PREMODERN EXPERIENCE OF THE NATURAL WORLD IN TRANSLATION

Edited by
Katja Krause, Maria Auxent, and Dror Weil

ROUTLEDGE

Premodern Experience of the Natural World in Translation

This innovative collection showcases the importance of the relationship between translation and experience in premodern science, bringing together an interdisciplinary group of scholars to offer a nuanced understanding of knowledge transfer across premodern time and space.

The volume considers experience as a tool and object of science in the premodern world, using this idea as a jumping-off point from which to view translation as a process of interaction between different epistemic domains. The book is structured around four dimensions of translation—between terms within and across languages; across sciences and scientific norms; between verbal and visual systems; and through the expertise of practitioners and translators—which raise key questions on what constituted experience of the natural world in the premodern area and the impact of translation processes and agents in shaping experience.

Providing a wide-ranging global account of historical studies on the travel and translation of experience in the premodern world, this book will be of interest to scholars in history, the history of translation, and the history and philosophy of science.

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Prologue

Experiencing *Wissenstransfer* in the First Episteme: Mesopotamia

Markham Geller

It can occasionally be useful to take a long view of knowledge transfer and the experiences of those who participated in it, by tracing its origins back to the earliest records in the long history of philology, for which abundant data can be found from Mesopotamia in the form of myriads of extant cuneiform tablets. These durable sources on clay and occasionally on stone, the earliest dating from the third millennium BCE and remaining legible until at least the third century CE, provide the first examples of many different writing genres, beginning with rudimentary accounts but soon progressing into narratives (myths, legends, chronicles, legal codes, incantations), as well as technical literature (medicine, divination, mathematics, astronomy, etc.). The same cuneiform script was used by students, scribes, scholars, and laymen for different, non-cognate languages such as Sumerian, Akkadian, Hittite, and Hurrian, which meant that knowledge transfer through translation was a key feature of this ancient episteme. There are some specific features of early writing that offer useful perspectives on ways in which the ability to record knowledge transformed society permanently and indelibly.

By approximately 3,000 BCE, mankind in the Fertile Crescent had discovered the art of record keeping, first with pictographic accounts but soon progressing into highly stylized cuneiform that soon became easily adaptable to expressing myths, incantations, and quasi-historical narratives. While on one hand we admire this emerging life-changing technology, it is comforting to fall back on the Eurocentric assurance that any writing system prior to the alphabet was too complex and cumbersome to become widely integrated into the lives of ordinary untrained individuals.

By the mid-second millennium BCE, a new and extremely concise writing scheme appeared on clay tablets, with some thirty modified cuneiform characters replacing the several hundred signs or characters used for Sumerian, Akkadian, and Hittite. Nevertheless, for the next two millennia, priests, bureaucrats, scribes, schoolboys, traders, merchants, and even kings kept using the original cuneiform script for letters,

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documents, and literature, and presumably could read these tablets as well, to some appropriate extent. As in China and elsewhere, the alphabet did not replace other scripts, despite its fewer characters. In fact, the overwhelming majority of cuneiform literature was non-alphabetic, and for good reasons. For native speakers of a language, cuneiform writing offered numerous advantages since, unlike the rather sparse alphabet, it offered the possibility of fully vocalized orthographies, with consonants, vowels, and even vowel length clearly delineated.[1] Second, the writing materials, consisting of wet clay and a reed stylus, were both durable and readily available, which facilitated the spread of literacy throughout urban populations.[2] Third, the durability of tablets meant that written records could survive over very long periods in the dry climate of Mesopotamia, so that first-millennium BCE schoolmasters could inherit and interpret older literature from the second or even third millennium BCE, because it was still available and legible. Fourth, the writing system itself helped scholars create a complex episteme and school curriculum, since it was based upon an inherent multilingualism. Soon after the invention of writing, speakers of Akkadian were already adapting the original Sumerian cuneiform syllabary to writing their Semitic language (Akkadian) and later using it for an Indo-European language (Hittite), so that engagement with translation and interpreting other languages developed to a high level.

One of the significant features of multilingualism was the built-in polyvalence of the cuneiform script, which very early on departed from single phonemic values for signs. Once the sign /sag/ for "head" in Sumerian could be read as /rēš/ for "head" in Akkadian, the sign soon acquired both phonetic readings. Eventually, after Sumerian was no longer a spoken language, numerous Sumerian sign values were used in Akkadian as "logograms," representing a concept rather than a sound, and were probably normalized or read as Akkadian.[3] The same process adopted Akkadian words as logograms into Hittite and Aramaic words as logograms into Middle Persian. These complexities opened up numerous new avenues for hermeneutics, as we will see shortly, but at the same time created a new form of discipline-based genres not meant for laymen or a casual readership, which relied upon logograms in a similar way to that in which Latin was used in legal and medical jargon. Professional diviners, magical experts, physicians, priests, and astronomers, among others, developed their own peculiar writing styles, which no longer resembled the syllabic orthographies of an earlier era or of literary masterpieces such as the Gilgamesh Epic.

Translators of the extensive literature from Sumerian into Akkadian required tools and aids. Of these, the most important were lexical lists, which were extensive and virtually comprehensive lists of vocabulary and technical terminology, as well as grammatical paradigms and legal formulae. Together, these represented a system of lexicography known from the earliest down to the latest phases of cuneiform writing.[4] Many of these lists were bilingual, providing Akkadian translations of Sumerian words for material objects, gods, professions, flora and fauna, diseases, anatomy, and numerous other kinds of equations, not all of which can be easily categorized.

One of the key problems facing compilers of these extensive lists was determining the logical order and sequence of entries, since cuneiform had no ready means of taxonomy similar to the alphabet. Moreover, these same ancient compilers and lexicographers felt no particular need to compose memoranda for our benefit, with explanatory keys to their classification and ordering systems. For much of this material, we remain in the dark as to why seemingly unrelated data are listed in sequence. The other difficulty associated with these lists regards how and why they were constructed. The perennial question is posed whether compilers extracted vocabulary from texts and documents and collected it into glossaries, or created arbitrary lists of words that could be useful for literary reference, or some combination of both. It is clear that authors of highly learned Sumerian compositions closely associated with a school curriculum often employed rare or even obscure words, which they must have borrowed from lexical lists. These schoolboy dialogues lampooning academic life show an impressive mastery of the wide-ranging vocabularies, which the authors used to advantage in composing their texts.[5]

The use of tables is a crucial tool for experiencing knowledge transfer, and another easily recognizable characteristic of Sumerian and Akkadian lexical lists is their tabular layout, with Sumerian in the left-hand column and explanatory Akkadian on the right.[6] The tabular format is often highlighted by both vertical and horizontal rulings, to mark off columns as well as dividing entries into discrete sections. Data presented in this kind of table layout remained one of the primary means of conveying information, allowing the user to scan visually large amounts of cuneiform data quickly. The tabular format was not limited to lexical lists and glossaries; it was also one of the characteristic formats for hemerologies and astronomical tables, and generally any data set that provided information in a condensed form, with either numbers or short entries. Tables were also, however, widely used by scholar-commentators, who entered a word in the left-hand column and explained it by a word in the right-hand column, a format that resembled the lexical texts in many respects.[7]

More than nine hundred commentary tablets have been found in Mesopotamian archives, often esoteric and difficult to understand, particularly since it is not always possible to identify the proof-text being commented upon.[8] Nevertheless, the patterns of hermeneutics are well elaborated, based on studies of technical hermeneutical terminology and on methods of hermeneutics developed by Babylonian scribe-scholars.[9] At the heart of this system of hermeneutics is Sumerian-Akkadian bilingualism, which allowed for word-play, puns, and multiple meanings derived from the polyvalent cuneiform writing.

What is most remarkable about this system, apart from its complexity, is that the written record of commentaries attributes hermeneutics to oral teachings. Colophons of commentary texts regularly state that the contents of the tablet are *ša pî ummâni*, "from the mouth of the expert" (i.e., professor), or alternatively simply *šut pî*, "oral explanation."[10] According to Frahm, the *ummânu*—master-scholar—is usually anonymous,[11] but this is a misunderstanding of school culture. Like other titles, such as "Pope," it is hardly necessary to mention this person by name, since every student would know immediately who "The Prof" was. The commentary tablets themselves are mostly meant for internal school consumption, possibly even representing the notes taken in lectures by students. More generally, it is a hallmark of such commentary texts to be attributed to oral teachings from a master-scholar.

It is not only commentaries that are attributed to the *pî ummâni*, or oral tradition. Many other texts which could be considered esoteric, in fields such as medicine or astrology, are also noted as such in colophons, with the added injunction that the contents are not to be shown to the uninitiated or those not knowledgeable (*la mūdû*). This emphasis on the importance of orality is not exclusively Babylonian—Plato's Phaedrus comments on the same topic, insisting that teachings in written form are unreliable, since they diminish the memory and one cannot argue with the written word. Socrates adds:

> You have invented an elixir not of memory, but of reminding; and you offer your pupils the appearance of wisdom, not true wisdom, for they will read many things without instruction and will therefore seem to know many things, when they are for the most part ignorant and hard to get along with, since they are not wise, but only appear wise.[12]

Mistrust of written teachings indicates preference for oral ones. This is the same tendency we find in Late Antiquity in rabbinic Jewish tradition, which recognizes two separate compendia, the Written Law (the Torah) and the Oral Law (the Talmud). The irony of this scheme, however, is that the Oral Law was also committed to writing in separate phases, while still maintaining its association with orality. The Talmud is functionally a commentary on biblical law, although in fact it is an encyclopedia of collected opinion on all social and religious topics, formulated as doxologies or quotations from numerous scholars and rabbis from Palestine and Babylonia. The orality of the text is almost entirely artificial, since the seventh-century CE redactors purposely edited quotations and statements as if they derived from direct discourse between two or more scholars at the same time, when in reality the cited speakers often never met. Nevertheless, the prestige and authority of the text rested on its orality, its being composed of opinions and direct speech attributed to noted scholars over the expanse of several centuries, and these statements represented collective wisdom of the rabbinic schools.

All of these aspects of Mesopotamian scribal culture, stemming from its writing system, inherent multilingualism, interest in lexicography and hermeneutics, and preference for orality, remained at the core of curricula and of philology long after Mesopotamian culture itself was forgotten. It is good to recollect that this first episteme was in existence continuously for more than three millennia, outliving successive cultures in Western Asia and Europe, and hence merits our retrospective attention and scrutiny.

Notes

1 The original Semitic alphabet only preserved vowel sounds under exceptional circumstances.

2 The usual assumption that fewer characters in the alphabet encouraged the spread of literacy is likely to be incorrect or at least exaggerated. The original alphabet was not easily adaptable to writing a foreign language unfamiliar to the reader, since the system of writing only approximates language. Moreover, writing materials (such as leather or parchment) were expensive and hence not always available to the general population, and this would impede literacy.

3 Sumerian continued to be read and translated in Akkadian schools after its demise as a spoken language, but the system of Sumerian "logograms" used within Akkadian texts (e.g., É instead of *bi-tu* for "house") often developed special meanings of their own, no longer corresponding to the original Sumerian meanings of the signs.

4 The fullest discussion of the lexical system can be found in Veldhuis, *History*.

5 For an example of a school composition relying heavily upon lexical texts, see Johnson and Geller, *Class Reunion*, 11.

6 This is a general scheme, with variations such as in Ugarit, c. 1300 BCE, from which one lexical list was found in four languages: Sumerian, Akkadian, Hurrian, and Ugaritic. Veldhuis, *History of the Cuneiform Lexical Tradition*, 232.

7 One lexical text in particular, called *Malku-šarru*, was a list of synonyms, a precursor of the modern thesaurus. The difference between this "lexical" text and a commentary is that a commentary drew its words to be explained from some other primary source, while the lexical list is simply a lengthy list of synonyms. See Hrůša, *Die akkadische Synonymenliste*.

8 Frahm, *Babylonian and Assyrian Text Commentaries*, is the best (and only) up-to-date survey of Mesopotamian commentaries.

9 See Gabbay, *Exegetical Terminology*, for a useful overview of the technical terminology of commentaries, which explains much of the logic of hermeneutics.

10 Frahm, *Babylonian and Assyrian Text Commentaries*, 43–44, 55–56.

11 Ibid., 86.

12 Plato, *Phaedrus*, trans. Fowler, 562–67.

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Introduction

Making Sense of Nature in the Premodern World

Katja Krause with Maria Auxent and Dror Weil

When, every year for six years, we watch a pair of eagles hatch one young despite having laid two eggs,[1] how do we make this natural phenomenon part of scientific knowledge? How do we share with others across space and time what we have experienced of nature? Aristotle offered one answer:

> So from perception there comes memory, as we call it, and from memory (when it occurs often in connection with the same thing), experience; for memories that are many in number form a single experience.
>
> (Aristotle, *Posterior Analytics* II.19, 100a3–5, trans. Barnes)

For Aristotle, perceptions, memories, experiences, and scientific knowledge were all captured in the soul of a single, perhaps ideal scientist. For those who came after him, perceptions, memories, experiences, and scientific knowledge were captured in the souls of many scientists. Equally, they were captured in the voices of many teachers, on the parchment of manuscripts and on printed paper, in the visual imagery of works on cosmology, elements, minerals, plants, animals, and human beings. In short, experience in the premodern world—*empeiria*, *experientia*, *tajriba*, *nissayon*—made its home in many media.[2] The history of that experience and its translations is the history our book will tell.

In the premodern stories related here, experience was a way of encountering, structuring, and probing into nature. But it did that in very different forms—by means of very different mediations between human subjects and artifacts. As our historical actors worked on and with experience, they subjected direct perceptions of nature in the moment, what we call here "live experiences," to a kind of domestication or cognitive assimilation.[3] Assimilation of this kind was part of premodern science no less than modern science,[4] but scientific knowledge in the premodern era was not subject to the exclusive rule of rationally processed sense perceptions. It was free to domesticate live experiences according to a range of epistemic norms, addressing different objectives and audiences.

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Such processes of domestication have momentous consequences. Direct sense perceptions of nature—live experiences—are ephemeral events, if events at all. Only when recorded in a more enduring medium do they lose this ephemerality, and they may lose even more: through attention, even hyper-attention, to just one or some of the qualities present in the event. Some qualities become more visible, others fade.[5] The cognizing scientist did not simply collect live experiences, but correlated, organized, and refined them into the processed products that have come down to us. That internal processing was inextricable from acts of externalizing, as experience was put down on parchment or paper. It was made to endure and to communicate through media that could extend it beyond a human lifespan or even many lifespans.[6]

When our actors externalized experience in this way, they often did so with the aim of enabling it to be internalized again by audiences in their classrooms, at their desks, or wherever scientists sought to share experience. In their acts of listening and reading,[7] the premodern scientists of the next generation repurposed their predecessors' experiences by performing their own acts of cognition on them. In some (though not all) cases, they added their own, domesticated, live experiences to form a new, combined type of experience that was often more certain and assured. The second, third, fourth, and subsequent generations each began the act of externalization again, initiating yet other cycles of the epistemic translation of experience.

These cycles did not remain within the boundaries of a single language or a locale. No less than the scientists, interlingual translators—who were often scientists themselves—domesticated and repurposed experience. Just like the second-generation scientists, translators took recorded, externalized experience and internalized it, subjecting it to translation between different languages, codifications, and media. Externalizing it again, along with all other scientific knowledge within which recorded experience was embedded, they repurposed it for the third, fourth, fifth, and subsequent generations of audiences across linguistic space.

For our actors, then, interlingual and intermedial translations of experience were not sharply separated, but part of a continuum of epistemic acts and processes.[8] For this reason, we propose the broad analytic category of "epistemic translation," which usefully embraces the many different acts of translation, with their multiple purposes, that emerge in this book.[9]

Beginning with ancient researchers into nature, most of the premodern actors we present domesticated and repurposed experience without elevating it to a universal concept. They seem to have tacitly agreed that the realm of the mind is separated from the realm of the senses by an invisible ontological line. Curiously perhaps to our modern eyes, this division extended to all the media by means of which experience could be externalized. Whether in terms, arguments, tables, diagrams, or images, experience (direct or indirect) and universal concepts were regarded as playing in separate leagues. During the many processes of translation that premodern experience underwent, it maintained its core epistemic character: as a kind of knowledge that did not immediately fulfill the highest epistemic ideals of truth and certainty, but remained tied to the conditions of time and space. This is not to say that experience could not overturn universal judgments, if they were wrong—but it is to say that the epistemic relationship between experience and the universal was such that in most cases, and in different ways, the universal ranked above experience.

This hierarchy did not prevent experience from taking a central place in the study of natural phenomena. Our volume investigates processes of translation that elicited and extricated certain qualities of experience, mentally fixing or ontologizing them (or certain of their properties) as a way to approach the natural world.[10] We thus ask: What kinds of acts were available for translating live experiences into the experience captured on parchment and paper? How did these acts of translating, in their own configurations, impact upon what was attended to in experience and what was lost?[11]

This approach is partly inspired by discussions on the ontology of scientific objects, described by Annemarie Mol: "It is possible to refrain from understanding objects as the central points of focus of different people's perspectives. It is possible to understand them instead as things manipulated in practices. If we do this—if instead of bracketing the practices we foreground them—this has far-reaching effects. Reality multiplies."[12]

The multiplication of reality is key to our broad analytic conception of translation. Rather than on objects manipulated in practices, however, we focus on experience manipulated in epistemic translation. In the premodern sciences of nature as in other scientific settings, experience is manipulated both as object of knowledge and as instrument for knowledge-making.[13] That accords ample space to types of experience that are empirical in the Baconian and post-Baconian sense of the word: direct access to nature, embodied practices of systematic observation, new sense-enhancing instruments and record-keeping technologies, induction from collected observations, work in the laboratory or the field, and many more.

But at the same time—and this is crucial—it opens up a space to integrate other types of experience, ones that that are empirical beyond the methodological practices usually associated with early modern science and natural philosophy in Western Europe. For instance, it includes sense perceptions of spoken words: hearing the voice of the teacher in the classroom is a perceptual act giving rise to mediated cognitions in the student that might cover the entire epistemic spectrum of perceptions, images, memories, experiences, and universals. This conception of experience gives rise to the two new questions that this collection raises: What is experience in the premodern sciences of the natural world? and How, and to what ends, was experience used in them? By responding to these questions, the chapters and section introductions aim to contribute to a new field in the history of experience in premodern science.

We focus on four media in which experience was domesticated and repurposed through translation in the broad sense we set out above: terms, arguments, pictorial formats, and expertise—a list by no means intended to exhaust the possible places where premodern experience found an intellectual home.[14] How experience endured as a way to probe nature in these various forms is a common thread running through the studies collected here. They reveal that experience's instrumentality sometimes meant a direct relationship between the natural object under investigation and the scientist pursuing that investigation. At other times, and perhaps more often, experience played a part in more indirect relations between the object of nature and the scientist. Such indirect relationships included the scientist's acts of imagination and memories in the absence of the object, acts of reading or listening to witnessed experiences, and acts of passing on and sharing experiences along with wider corpora of scientific knowledge. In these cases, experience was crystallized—even ontologized—into an empirical impression and expression, but not into an empirical method that was deliberately shared qua method, with its own epistemic standards of constituted facts, induction founded on collection and comparison, and so on.

These indirect relationships between nature and the scientist have long been subsumed under what some prominent sixteenth- and seventeenth-century thinkers, endeavoring to break from the past, denigrated as "bookish knowledge."[15] But this was, and is, a constructed divide between what is empirical about experience (most evidently the visual: what we sense before us) and what is not empirical about it (most evidently the oral: what others have told us that they sensed). Criticism of indirect, bookish knowledge—or rather "inscribed experience," as we might more appropriately call it—promoted certain empirical practices and demoted others, in order to establish particular methods of investigating and cognizing the natural world. It was a handy device to concentrate the experience relevant to science into a tighter definition (the empirical method) than its previously multifarious meanings. When the methodological approaches to experience were poured into this form, as Lorraine Daston and Elisabeth Lunbeck have eloquently put it, experience was "shaped and sharpened to scientific ends."[16] It was honed down to particular epistemic norms, chief among them respect for direct sense perception and objective verification. This is doubtlessly true for the period we have come to know as "early modern."

There was a price to pay for the empirical bent that insists on a direct sensory relationship with the object as the precondition for making scientific knowledge: the sidelining of other types of experience, that mediated between scientist and object in other ways. Following the early modern proponents of the empirical method who defined scientifically relevant experience in this way, present-day historians of science, too, have often insisted in one way or another on the lasting epistemic hegemony of early modern empirical practices of science such as direct sense observation, systematic recording, induction, and verification.[17]

The practical turn in the history of science has complicated that picture, particularly with respect to the many roles and types of direct experience at work in investigating, sensing, and observing nature and in communicating and verifying natural knowledge.[18] Nevertheless, there is more to be said about the range of possible relationships between scientist and object through the medium of experience, for both the premodern world and contemporary science. Three examples must suffice to make this point. First, experience as live experience of an object (sensory perception), as event, practice, routine, aesthetic act, and work, remains part and parcel of the various ontologies of experience—yet many of these ontologies have been somewhat downplayed in discussions of scientific experience, because we tend to focus on the epistemic features in scientific practices that resemble empirical methods.[19] Second, the personal and professional experiences that we use without theorizing them remain key to the making of science in the twenty-first century—but still await more attention from historians to note, collate, and assess them.[20] Third, inscribed experience undergoes significant, and epistemically functional, transformations during its rewriting—but the work of tracking those changes has only just begun.[21] The present collection takes up that challenge, opening the field to problems that still intrigue the history of science *tout court*.

Our history of premodern experience in translation studies those epistemic acts of domestication and repurposing that are related to the evidently empirical, but also those that may seem unempirical to our modern eyes. Precisely in those spaces where our perception differs from that of our historical actors', we find experience being put to use and rendered epistemically functional for scientific knowledge of nature. To perform that function, experience was carefully selected, positioned, framed, and shaped by our historical actors—even though, or perhaps because, it was only gradually structured systematically into methodological practices.

Perhaps one reason for this was premodern science's trust in the ideal scientist or expert. Well trained in logical reasoning, often also as physicians, scientists knew how to internalize experience from any given source, integrate it into the science they already possessed inside themselves, and repurpose it to fulfill a panoply of epistemic functions. Scientists acted as epistemic translators of experience, and so did interlingual translators in their own distinctive ways. What we see today on parchment and paper are the externalizations of these acts of trust, testifying to their stability even at a time when premodern epistemic norms of certainty and truth were already undergoing a profound reevaluation. But when trust in the epistemic powers of the scientist faltered to a large degree, new mechanisms and reorientations of experience arose, creating an experience that was more sharply delimited, actively regulated by norms of reason, and increasingly standardized in form and function.[22]

The issue of trust recurs throughout the book, but we focus on the scope of premodern experience in translation in four different media across time and space. These ontologizations of experience are chosen to highlight the similarities and differences in the preservation and transformation that each medium brings forth, on its own account and through the experiences it inscribes into science.[23] They mean that our book can be neither chronological in its structure nor comprehensively global in its coverage.

To narrow down the immense field of premodern experience in translation, we take as our starting point scientific practices around the *corpus Aristotelicum* and the sciences that twined about it. The science of medicine centering on the works of Galen and Avicenna arose in dialogue with Aristotle's writings, as did the evolving early modern sciences of nature. By focusing on closely related "epistemic cultures," to apply Karin Knorr Cetina's term to our own inquiry,[24] we are able to overcome the boundaries of periodization and localization that are still commonly applied to the premodern world.[25] What once was divided by the labels "ancient," "medieval," "early modern," and various "area studies" here comes together under the two prisms of the premodern world and the epistemic cultures clustering about the *corpus Aristotelicum*.

Given this focus, our book does not and cannot aim to be comprehensive. Quite the contrary. The four case studies in each part, addressing the translation of experience across terms, arguments, pictorial formats, and expertise, range over many languages, centuries, and continents. They will give only glimpses into the acts and processes of experience in translation. Yet those glimpses can contribute to global histories of science. Looking at translations within and between closely related epistemic cultures, we do not aim to retell older histories of the diffusion of Western science,[26] but neither do we adopt the frameworks of science, empire, and postcolonial studies with their interest in asymmetries between metropolis and colony, indigenous peoples, and hybrid cultural objects. Those dichotomies are not our analytic categories, because they highlight contact zones between epistemic cultures that were worlds apart.[27] Our own interest is in the history of an identifiable set of filiated epistemic cultures as it moves through different linguistic and temporal terrains. We ask how a shared set of epistemic norms—for instance, that science should aim to define and demonstrate things in nature; that science should rely on the scientist and the natural workings of his faculties—guided and framed the epistemic acts performed upon experience, and the epistemic uses and functions that experience was granted in return.[28]

Such a history may also suit other cases where particular scientific corpora were nodes about which epistemic cultures took shape. Our book on the *corpus Aristotelicum* and the works that conversed with it may thus offer a methodological framework for other parts of the world and other historical periods. The transregional expansions of the Confucian or Vedic corpora, along with their related epistemic cultures and scientific practices, are just two examples. In this sense, we hope that our volume will contribute indirectly to the study of other epistemic cultures that do not touch upon European lands at all.[29]

The emphasis on media in this volume may also be favorable for histories after the era of Eurocentric macrohistories and periodizations. As Bernhard Jussen has recently put it, "the new, mediological orientation in historiography that is currently taking shape looks set to be the most natural and productive path toward a realignment of our material, categories, and questions."[30] To be sure, only the externalized media of experience have been preserved over time. The subjective media—the sensory and intellectual actions of the scientists—are transmitted only (if at all) indirectly, in the objective media. Whether in terminology, in arguments, in pictorial formats, or in personal expertise, the translations we study are set about with the constraints that we face as historians of science whose scientists are long dead.

That temporal distance comes to center stage with the opening essay of the book, where Markham Geller looks at the role of orality through the lens of Mesopotamian science. In the next piece, Michael Chase introduces key strands in the work of Aristotle and his successors with regard to the status of experience, in a survey that will be particularly relevant to the volume's studies on terms and arguments. Chase tracks the conflict between reason and experience in Greek thought, from the Presocratics, through the Greek rationalists (Plato, Aristotle and his Peripatetic successors, and the Stoics), to the Roman physician Galen and his reception in the Arabic tradition. Problems of translation, the limits of language and the ineffability of individuals, and the complementary tension between different types of "knowing" turn out to be closely linked throughout the epistemological history he presents.

Following Chase's chapter chronologically, Part II asks how experience is expressed in scientific language, specifically in terms. Chapters in this section study the formation, negotiation, and domestication of some key experience terms as they are translated within and across languages. The authors analyze how experience terms altered and preserved their ontologies during such processes, and investigate the impact of cognitive and intellectual practices.

Turning to a larger purview of inscribed experience, Part III addresses the translation of experience into scientific arguments. The four chapters present essential features, status, and functions of experience in arguments, and show how these were affected by premodern epistemic translations, whether intralingual or interlingual. They ask how scientific translations of experience changed scientific norms and how, in turn, scientific norms facilitated or limited the possibilities of scientific translations of experience in arguments.

Part IV moves away from experience in letters to experience in pictorial systems. The chapters investigate how experience was translated into symbols, tables, and images, and how visual formats of this kind offered different ways of articulating, framing, and standardizing experience than did the verbal systems discussed in the previous two sections. As we will see, pictorial formats followed modes of expression that intertwined imagination with reason, and these different modes of expression generated new experiences and new scientific norms.

The book's most ephemeral and hard-to-access object comes to the fore in Part V: the expertise of the translators. The chapters in this section investigate how translations of scientific experience were shaped by the cognitive and intellectual practices, habits, and authority of the translators and their sources. They show that such expertise was inseparable from its agents' social and cultural environments, and that, in turn, these environments shaped and reshaped the transmission of experience in the sciences.

How does experience take shape in premodern scientific terms and their translations? How is it expressed in scientific arguments? How is it articulated and arranged in pictorial formats? And how are translations of scientific experience molded by the expertise of the translators? In her epilogue, Lorraine Daston completes the volume's historical arc by tracing these themes around the translocation, transformation, and assimilation of experience up to the science and scholarship of the present day.

Notes

1 On this example from Albert the Great's *De animalibus*, see Harvey in this volume.
2 Our use of the term "media" starts from the classical Aristotelian sense, of vehicles that carry certain properties of impressions to the senses, but extends it to the linguistic and physical vehicles that carry these properties on to other people. This usage interlocks with some media scholarship (e.g., Kittler, *Discourse Networks*) and history of science that applies insights from media studies (e.g., Schmidgen, *Hirn und Zeit*).
3 Though our notion of "domestication" is affiliated to that debated in translation studies, for example in the work of Paul Ricœur, Antoine Berman, and Lawrence Venuti (e.g., Venuti, *Translator's Invisibility*), we use it to describe not interlingual acts, but the epistemic acts in which experience moves from the event of live experience into the cognitive field of the scientist.
4 "Science" is used here not in the modern sense, but as a variety of practices for organizing and systematizing knowledge of nature. See Gieryn, "Boundary Work."
5 Recently, historians of philosophy have addressed theories of sense perception in the Aristotelian tradition. See, e.g., Glenney and Silva, *Senses*; Baltuta, *Medieval Perceptual Puzzles*; Bennett and Toivanen, *Philosophical Problems*.
6 On the role of writing in the transmission of scientific knowledge, see, e.g., Derrida, *Edmund Husserl's Origin of Geometry*.

7 Classics on this matter are Ong, *Orality and Literacy*; Clanchy, *From Memory to Written Record*; Yates, *Art of Memory*.

8 Recent work in translation studies has likewise blurred the conventional orders between different types of translation, though without our focus on experience. For an overview, see the Forum on "cultural translation" in *Translation Studies* 2, no. 2 (2009) and 3, nos. 1 and 3 (2010); also Burke and Hsia, *Cultural Translation*; Dupré, "Introduction."

9 Writing on the thirteenth-century Latin West, Katja Krause and Henryk Anzulewicz ("Albert the Great's *Interpretatio*") show that the Latin term *interpretatio* unified epistemic practices of interlingual translation and commentary on the *corpus Aristotelicum*. Similarly, Daniela Bleichmar ("Pictorial Knowledge") describes two different meanings of translation in the early modern period, physical movement of things and linguistic movement between languages, and adds a third type, "acts of interpretive translation." This last category comes closest to our own discussion, but it moves on the textual and material level rather than examining the roles of subjects and their experiential and cognitive inputs.

10 Work on translation in the history of science has mainly applied hermeneutic or semantic approaches to the epistemic acts performed on knowledge. See, for instance, Brentjes and Fidora, *Premodern Translation*; Fransen, Hodson, and Enenkel, *Translating Early Modern Science*; Cook, *Translation at Work*; Manning and Owen, *Knowledge in Translation*.

11 Empiricism is one example of loss through attention, as Bruno Latour indicates (alluding to Whitehead): "Empiricism, conceived as a clear-cut distinction between sensory impressions on the one hand and mental judgment on the other, cannot certainly claim to be a complete description of what 'we should be attentive to in experience.' " Latour, *Reassembling the Social*, 110.

12 Mol, *Body Multiple*, 4, also quoted by Lloyd, "Clash of Ontologies." See also Daston, "What Can Be a Scientific Object?"

13 We dispute the conventional exclusion of premodern science from such wider currents, often made on the basis that premodern scientific experience is not an empirical method. See, e.g., Hossfeld, *Albertus Magnus*; Jacquart, "Die Medizin"; Dear, "Meanings of Experience."

14 Other media, at different levels of resolution, could also be studied in this way—for instance, particular theories (as media on the meso level) or even entire systems of sciences (on the macro level).

15 Francis Bacon famously declared that natural knowledge needed new methods of direct perception, observation, recording, and verification: "We can't do without experience; but so far we haven't had any foundations for experience, or only very weak ones." *New Organon* I, aph. 98. On Bacon's method, see Jardine, *Francis Bacon*; Jalobeanu, "Francis Bacon"; on "bookish knowledge" more generally, Blair, "Humanist Methods."

16 Daston and Lunbeck, *Histories of Scientific Observation*, 2.

17 This critique is voiced by Ben-Chaim, *Experimental Philosophy*; Dear, "Meanings of Experience"; Grant, *Foundations of Modern Science*, 159–60.

18 Examples are Eamon, *Science*; Pomata and Siraisi, *Historia*; Kusukawa and Maclean, *Transmitting Knowledge*; Young, "Experimentalist as Spectator."

19 For instance, Rankin, *Poison Trials*; Werrett, *Thrifty Science*; Krause, "Source Mining."

20 Many biographical studies of scientists do address their personal and professional experiences (e.g., Daston and Sibum, "Scientific Personae"), but a more inclusive history of reading and writing practices in the modern sciences is still required. See Landecker, "Matter of Practice," 259–60. Some of Landecker's desiderata have already been applied, e.g., Kaiser, *Pedagogy and the Practice of Science*.
21 See, e.g., Krause, "Source Mining"; Leong, *Recipes*.
22 See, e.g., Daston and Lunbeck, *Histories of Scientific Observation*, 2; Wolfe and Gal, *Body as Object*; Allen, *Empiricisms*.
23 This approach also brings some recent trends in the history of science—visual studies and global history—into conversation with the more traditional approaches of textual study and the history of ideas.
24 Knorr Cetina, *Epistemic Cultures*. Her view of "culture" differs from that in most other studies on translation in the history of science, such as Burke and Hsia, *Cultural Translation*.
25 One paper where this common practice is usefully problematized, but nevertheless applied for lack of a better solution, is Shank and Lindberg "Introduction."
26 Basalla, "Spread of Western Science."
27 Valuable historical studies on such contact zones can be found in Marroquín Arredondo and Bauer, *Translating Nature*. See also Lloyd, "Clash of Ontologies."
28 For an insightful discussion on norms and normativity in history and how they evolve, see Daston and Gallison, *Objectivity*.
29 On localizing Europe, see MacLeod, "Nature and Empire"; Pimentel, "Sighting and Haunting."
30 Jussen, "Kohärenzinseln," 232.

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Part I

Contextualizing Premodern Experience in Translation

Part I Experience and Knowledge among the Greeks

From the Presocratics to Avicenna

Michael Chase

Do things gradually lose their names in your mouth?
Where once were words, flow discoveries,
Freed, with surprise, from the flesh of the fruit.
Dare to say what you call "apple."
This sweetness, that starts by thickening; in order
lightly raised to the status of taste,
To become clear, awake and transparent,
Ambiguous, sunny, earthy, local,
O experience, feeling, joy: immense!
(Rilke, *Sonnets to Orpheus* 1. 13, translation Michael Chase)

Introduction: Translation and Experience

Both "experience" and "translation" are what Aristotle called *pollachōs legomena*, terms with many meanings, the underlying unity of which may be hard to discern. In the present contribution, taking the notion of experience as formulated and utilized in ancient Greek thought as my focus, I will investigate the extent to which our current linguistically determined concepts of knowledge and experience help us, or hinder us, in understanding analogous concepts as used in the premodern culture of ancient Greece and Rome. To what extent does our language condition our thought?[1] Are there aspects of experience that cannot be adequately formulated in a natural language?

However we may wish to define "experience," we usually assume it has something to do with knowledge. But the English word "knowledge" is itself a *pollachōs legomenon*, and in this case the relative poverty of English may inhibit our understanding. Romance languages have two very different verbs corresponding to the English "to know": *savoir* and *connaître*, *saber* and *conocer*, *sapere* and *conoscere*. In all these cases, the former verb generally denotes a kind of propositional knowledge, "*knowledge-that* x is the case," while the latter tends to denote a kind of "*knowledge of* x" or "*knowledge of* what x is like," to express which English is constrained to fall back on paraphrases, such as "knowledge

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by acquaintance or familiarity." Ancient Greek also possesses at least two nouns that correspond to English "knowledge," *epistēmē* and *gnōsis*, as does Arabic (*ʿilm* and *maʿrifa*—often translated as "experiential knowledge"—respectively), and I would argue that their meaning broadly corresponds to the Romance language distinction between *savoir/saber/sapere* and *connaître/conocer/conoscere*.[2]

Since English lacks these conceptual nuances, in this chapter I will use the term knowledge$_1$ to designate *epistēmē* as certain, objective, propositional "knowledge-that,"[3] and knowledge$_2$ to denote *gnōsis* qua personal knowledge by familiarity or acquaintance. As we will see, this distinction is crucial in Greek epistemological discussion, not least because, according to the Aristotelian tradition, *epistēmē*, knowledge$_1$ characterized by certainty, is reserved for universal and necessary truths. There can be no *epistēmē* of the sensible, perceptible individual things that constitute our *Lebenswelt*, nor can there be any definition of them. In short, in this tradition, there can be no knowledge$_1$ (*epistēmē*) of experience; only knowledge$_2$ (*gnōsis*). Nevertheless, for the Aristotelian tradition it is experience, *qua* knowledge$_2$ of individuals, that provides the raw material out of which knowledge$_1$ derives, in the form of technique (*technē*) or certain, demonstrative, disciplinary knowledge (*epistēmē*). Yet how can certain knowledge$_1$ arise out of individual experiences, each one of which is an instance of knowledge$_2$?[4]

However we translate them, *technē* and *epistēmē* were generally held to be quite different notions, but both were distinct from mere experience (*empeiria*). For Aristotle, following Plato, technique, unlike incoherent experience, necessarily presupposes a knowledge of causes and an ability to teach what one knows. Yet while this Aristotelian doctrine remained dominant down to the end of Greco-Roman Antiquity and into the Middle Ages, it was not quite the only game in town. There were rival views, which questioned the complete epistemological and sociological superiority of knowledge$_1$, maintaining that experience itself, when suitably organized and preserved in memory, is quite sufficient for the constitution of a technique (*technē*) such as medicine.

Although a minority view, this revaluation of "technical" knowhow persisted throughout Antiquity as an underground current, and was influential on some exponents of Islamic thought, especially Avicenna. This may have been due to the realization that the Aristotelian edifice of theoretical, certain, demonstrative knowledge$_1$, precisely because it declares itself incapable of providing knowledge of individuals, was inadequate for practice-oriented techniques such as medicine. In what follows, therefore, I will trace the history and development of this conflict between reason and experience from its origins in Greco-Roman Antiquity, as an instance of intercultural translation that can be studied "as a method of revealing difference and similarity."[5]

Some Presocratic Exponents of Epistemic Modesty

I will limit myself to a few examples from the Presocratic philosophers, beginning with a text that may derive from the physician and physiologist Alcmaeon of Croton, active sometime between 500 and 470 BCE.[6] In Plato's *Phaedo*, when Socrates, while recounting his intellectual autobiography, is describing the doctrines of "natural science" (Gk. *phusiologia*) that fascinated him in his youth, he mentions one of the questions such "physiologists" discussed:

> Is it the brain that gives us the sense of hearing, seeing and smell, and from these come memory and opinion, and from memory and opinion remaining fixed we get knowledge$_1$ [*epistēmē*]?[7]

Here we have the following epistemological scheme:

> brain → senses → memory/opinion → knowledge$_1$

Note, for the moment, two aspects that will be prove to be important later: the presence of memory as a key faculty in the cognitive process, and the absence of any separate intellectual faculty that could be identified as reason or intellect. This last feature makes our text perhaps the earliest testimony to the doctrine that Michael Frede has dubbed "memorism": the ancient tradition in Greek thought that did not posit the existence of a separate faculty of reason, but believed that memory alone was sufficient to explain the acquisition of knowledge.[8] It is not certain that this text can actually be attributed to Alcmaeon,[9] but if it can, then its interest is even greater, since Alcmaeon was a late-sixth- or early-fifth-century BCE thinker who came from southern Italy, just like Acron and Polos, whom we will meet later.

Alcmaeon was also an exponent of proto-Skeptical and/or Empirist views,[10] such as the following: "About invisible and about mortal things, the gods have clear knowledge [*saphēneia*], while humans can only form conjectures [*tekmairesthai*]."[11] Alcmaeon thus seems to have been an exponent of what has been called epistemic modesty:[12] the stance, prevalent in archaic Greek thought, that set limits on what human beings can know about nature, the gods, and reality. Another proponent of this stance was Alcmaeon's near-contemporary and countryman Philolaus (c. 470–385 BCE), who, although he admitted the legitimacy of "nature in the cosmos" as an object of study,[13] claims that "nature in itself"—that is, the sector of reality that is beyond direct experience—is inaccessible to the human mind, and reserved for the gods.[14] Summing up this archaic tradition of epistemic modesty, Jonathan Barnes remarks that "belief and verisimilitude, not knowledge and truth, mark the goal of man's cognitive journey."[15] It is this attitude that, as we shall see later in the chapter, best characterizes the theory and practice of the Empirist medical school.

Plato on Experience and Technique

Traces of what one might call an empiricist attitude toward medical treatment are already found in the Hippocratic Corpus, a disparate assemblage of works written at different periods.[16] Clear evidence of a developed empiricist viewpoint, however, first emerges in Plato, especially in the *Gorgias* and the *Laws*.

At *Gorgias* 448C–D, the rhetorician Polos, praising his teacher Gorgias, points out that many of the techniques (*technai*) have been discovered by means of experience. It is experience that "makes our life proceed in accordance with technique,"[17] says Polos, while inexperience (*apeiria*) makes our lives be governed by chance or fortune (*tuchē*). Polos thus appears as a champion of experience, which, as the source of the discovery of the techniques, frees us from the randomness of chance.

We know little about Polos of Acragas (the modern Agrigento in Sicily), who may have been born around 440 BCE.[18] However, if, with Aristotle (discussed in the next section), we take seriously the attribution to him of the doctrine that experience is the origin of *technē*, this may suggest that Polos was associated in some way with the very beginnings of the medical school of the Empirists. As we shall see, Acron, the semi-legendary founder of the Empirist school of medicine, also came from Acragas and was a contemporary of Polos.[19]

Later in the *Gorgias* (500A–501B), Socrates points out that cooking, since it deals only with what is pleasant and does not know what is good or evil, is not a *technē* but mere experience (*empeiria)*. In this, it differs from medicine, which, since it has investigated the nature of the patients it treats and the causes of the remedies it prescribes and is therefore capable of providing an account (*logos*) of its methods,[20] does qualify as a *technē*.[21] Cooking proceeds in a completely non-technical (*atechnōs*) and irrational (*alogōs*) way, relying on mere routine and experience (*tribēi kai empeiriai*) to preserve the memory of what usually happens.[22]

We have here, *in nuce*, the key points of difference between the two later medical schools of the Rationalists or Dogmatists (*logikoi*), on the one hand, and the Empirics (*empeirikoi*) on the other. Like Plato, the former insisted on the need to start out from a rational understanding of the nature and function of the human organism and the causes of illnesses, from which they then deduced the appropriate treatments. In contrast, "relying on routine and experience to preserve the memory of what usually happened" could have served as a perfect formulation of the Empiric credo: they did indeed rely on frequentation (*tribē*) and experience (*empeiria*), and their technique (*technē*) did consist primarily in observing which phenomena occur previously, concomitantly, or subsequently to which other phenomena. As we shall see, however, if the

Empirics largely minimized the importance of reason for defining the nature of the human body and seeking the causes of illness, this was because they thought such intellectual activities were largely irrelevant.[23] For Plato, in contrast, as for the Rationalist physicians, the defining feature of both knowledge$_1$ (*epistēmē*) and technique is that one knows, and can explain, the causes and reasons for what one is doing.

Aristotle on Experience, Technique, and Knowledge$_1$

As he often does, Aristotle picks up where Plato left off, elaborating upon and transforming Plato's ideas.[24] At *Posterior Analytics* (2.19, 100a3–9), Aristotle presents his famous account of the origins of technique and knowledge$_1$. From sensation derives memory,[25] and repeated memories of the same thing amount to one experience (*empeiria*). Experience, which is equivalent to the establishment of a universal in the soul, then gives rise to a technique (*technē*) if it concerns the world of generation or becoming, but to knowledge (*epistēmē*) if concerns what (truly) exists. Aristotle presents a very similar scheme in the opening chapter of the *Metaphysics* (A, 980a20 ff.). In humans, memory leads to experience (*empeiria*), for many memories of the same thing "produce the power of one experience" (ibid., 981a1). Experience almost seems to be similar to knowledge$_1$ (*epistēmē*) and to technique, the difference being that experience is the *means* through which human beings acquire technique and knowledge$_1$; the role of experience is thus purely instrumental. Aristotle then quotes Polos to the effect that experience produced technique, while lack of experience produces chance.[26]

For Aristotle, then, technique results when, from many thoughts of experience, one universal judgment about similar things comes into being.[27] He illustrates this process with examples taken from medicine. Instances of judgments arising from experience include "remedy x helped Callias when he was suffering from illness y," "remedy x also helped Socrates when he was suffering from illness y," and so on. Technique comes into play when those who have been benefited by remedy x are identified as belonging to a single class—for instance, phlegmatics, bilious people, or those suffering from bilious remittent fever.[28] Technique thus seems consist in the power to make inferential generalizations, or at least to identify universal classes, presumably by means of reason.

Aristotle goes on to point out that we often see experienced people succeed where those who possess an account (*logos*), but no experience, fail.[29] This is because *experience is knowledge$_2$ of individuals, while technique is the knowledge of universals*,[30] but all actions and comings-into-being concern individuals. The example he cites comes once again from medical practice: rather than curing "man" as an abstract universal, what a doctor cures are individuals such as Callias and Socrates. More than experience (*empeiria*), Aristotle continues, technique is characterized by knowing$_1$ (*to eidenai*) and understanding (*to epaïein*),[31] and this is why we consider technicians (*technitai*) to be wiser (*sophōterous*) than experienced persons. This is because technicians know the reason *why* the means they employ actually work, whereas persons with mere experience know only the *that* (*to hoti*), not the why (*to hoti kai to dioti*).[32] Accordingly, master craftsmen are considered more honorable and wiser than manual laborers, who are analogous to inanimate things such as fire, insofar as they act as they do without knowing the reason why.

Here, in what reads very much like a development of ideas set forth in Plato's *Gorgias*, we have a clear distinction between experience as pre- or subrational knowhow that arises on the basis of memory, and technique as rational knowledge that is aware of the causes involved in a given practical activity and can articulate them. This view is accompanied by a devaluation of manual labor and those who practice it. If technique is considered to be more of a certain knowledge$_1$ (*epistēmē*) than mere experience,[33] it is because those who possess technique are able to teach what they know, whereas those who have experience alone are unable to do so.[34] In addition to this Platonico-Aristotelian devaluation of the epistemic value and status of technical, artisanal knowledge, what is important to retain here is Aristotle's principle, mentioned almost *en passant*, that experience is the knowledge$_2$ (*gnōsis*) of individuals, while *technē* deals with universals.

Aristotle's epistemological scheme in both *Metaphysics* A 1 and in *Posterior Analytics* B 19 can be roughly schematized as follows:

sensation → memory → experience → technique/knowledge$_1$

This scheme contains an innovation as compared to the analogous scheme we saw above in Alcmaeon: the appearance of the stage of experience. However, Aristotle is by no means clear about the nature or function of this new stage. In the passage of *Posterior Analytics*, he seems to envisage experience as equivalent, on the one hand, to a *logos*,[35] a notoriously ambiguous Greek term; and on the other to a universal concept.[36] Yet the reader remains puzzled as to exactly how, in this schema, such universals come into being. Subsequent generations of Peripatetics were to devote themselves to clarifying this point.

Alexander of Aphrodisias on *Metaphysics* A 1: Experience and the Formation of Universal Notions

The commentary on our passage from Aristotle's *Metaphysics* offered by the great Peripatetic philosopher Alexander of Aphrodisias (late second–early third century CE) is complex. Writing half a millennium after Aristotle, Alexander tries to elucidate what the Stagirite meant by his account of the formation of universals and the role of experience in the cognitive process. One reason for the complexity of his undertaking is that Alexander seems to be integrating conceptual schemes from at least two post-Aristotelian philosophical orientations: Peripatetic epistemology as elaborated by Aristotle's successor Theophrastus (c. 371–287 BCE), and the methodology of the medical school of the Empirics. Alexander begins his commentary as follows:

> He [Aristotle] clearly states how experience comes about from memory. For experience is already a kind of rational knowledge$_2$ [*logikē tis gnōsis*], but it is inferior to technique [*technē*], because experience is a kind of universal knowledge$_2$ of what has been remembered several times, which was the individual, whereas technique is not only knowledge$_2$ of this, but also of everything that similar to this insofar as it is one thing.[37]

Here, Alexander sketches an initial distinction between experience and technique. Experience is a set of memories of individual things, persons, or events; but even more explicitly than in Aristotle's account, it is also a kind of *rational knowledge*: knowledge$_2$, or knowledge in the sense of acquaintance or familiarity (*gnōsis*), rather than the certain, demonstrative, and propositional kind I have designated as knowledge$_1$ (*epistēmē*).[38] It is important to note Alexander's innovation here: Aristotle never speaks of a *logikē gnōsis*.[39] According to Alexander, technique knows everything that experience knows, but it goes one step farther, achieving cognition of what is *similar* to the individual things that have been remembered and processed by experience.[40] Alexander continues: "And as experience is to memory, which is of something that is one …, so technique and knowledge$_1$ [*epistēmē*] are to experience."[41]

Here, Alexander establishes a relation of analogy or proportion: experience is to memory as technique and knowledge$_1$ are to experience. In both cases, the analogy consists in the following point: just as experience is a knowledge$_2$ (*gnōsis*) that is the result of processing or elaborating memories, so technique and knowledge$_1$ (*epistēmē*) result from the processing of experience. Thus we have the following developmental scheme:

memories → experience/knowledge$_2$ → knowledge$_1$

Very roughly, then, we can say that according to Alexander, Aristotle's epistemological scheme is an account of how knowledge by acquaintance or familiarity (*gnōsis* = knowledge$_2$) is transformed into certain knowledge (*epistēmē* = knowledge$_2$).[42]

Alexander continues his explanation of *Metaphysics* A 1 as follows:

> For from experience comes the fact of knowing$_1$ [*eidenai*] that this medication is useful for those whose are suffering from this illness, but from technique [comes the knowledge that] making use of such [medications] benefits those who are suffering from such an illness, whence it is able to see the things that are similar [*homoia*] to the

> things that have been grasped by experience [*ek peiras*]. For it is to technique [*technē*] that the transition from the similar [*hē tou homoiou metabasis*] pertains, as he clearly showed from his examples … for the transition by technique according to similarity [*hē kata to homoion tēi technēi metabasis*] does not apply to medications alone, but also to illnesses.[43]

Perhaps influenced by Aristotle's liberal use of medical examples in *Metaphysics* A 1, Alexander here mobilizes technical concepts (*peira*, *tou homoiou metabasis*) deriving from Greco-Roman medical theory, and particularly the school of the Empirics. Let us see whether any light can be shed on these notions by what we know about the doctrines and practices of the Empiric school of medicine.

The Empiric School of Greek Medicine and Its Epistemology

Followers of the philosophical school known as Skepticism traced their origin back to Pyrrho of Elis (c. 365–c. 270 BCE).[44] When accompanying Alexander the Great to India,[45] Pyrrho had been impressed by the "gymnosophists" or "naked philosophers,"[46] who may well have included Buddhists. One basic feature of Pyrrho's doctrine was that the nature of reality is unknowable, a view that has parallels in some Buddhist schools of thought.[47] A key difference between the Skeptics and their main opponents, the Stoics, whom they characterized as "rationalists" or "dogmatists" (*logikoi*), concerned their attitude toward the epistemic status of techniques (*technai*), and the corresponding axiological status of their practitioners. For the Stoics, as for the Platonico-Aristotelian tradition, technical knowledge—knowledge that is exhibited in such techniques as small-scale manufacturing, craftsmanship, sculpture, farming, sailing, medicine, and so on—was inferior to theoretical knowledge$_1$ (*epistēmē*).[48] The Skeptics, perhaps following in the footsteps of the Academic philosopher Speusippus,[49] tended to regard technical knowledge as a heuristic instrument intended to assist the human senses, which, unlike the Stoics, the Skeptics held are always fallible. We may thus speak of a Skeptic rehabilitation of artisanal knowledge, which may have played a key role in the elaboration of the epistemology of the Empiric medical school.

The Empiric school was, along with the Rationalists and the Methodists, one of the three main schools of ancient Greco-Roman medicine during the Hellenistic period (c. 323–31 BCE).[50] Some Empirists claimed the fifth-century BCE physician Acron of Acragas as their founder.[51] Throughout the history of their movement, many Empirist doctors were associated with the philosophical "school" of the Skeptics.[52] Contrary to the Rationalists, the Empirists denied the value of seeking for hidden causes in medical diagnosis and treatment,[53] focusing instead on analyzing the patient's syndromes of symptoms and on determining which cures were effective in any given case. This focus on therapeutics and on discovering cures, rather than searching for their causes, is one of several points in which Empiric theory and practice are reminiscent of Buddhism.[54]

Eclipsed by rival medical schools, and especially by the overwhelming influence of Galen,[55] the writings of the medical Empirists were soon lost.[56] Despite this limited circulation, however, Galen's account of Empirist ideas in his *De sectis* (On the sects) was highly influential. When, in the medical schools of sixth- to eighth-century CE Alexandria, a canon of sixteen Galenic works was established as a curriculum for medical students,[57] the *De sectis* was placed first, as a kind of introduction to the study of medicine,[58] thus occupying a position similar to Porphyry's *Isagoge* in the contemporary philosophical curriculum. As a result, the *De sectis*, like the *Isagoge*, was the object of intense study and teaching, as is reflected in the large number of surviving commentaries, summaries, and paraphrases of the work, written in Greek, Latin, and Arabic, all of which are remarkably similar in structure, form, and content. Thus, at least the outlines of Empirist thought were well known to every Islamicate philosopher who had medical training, including Avicenna.

The methodology of the Empiric school of medicine was based on three pillars: (1) first-person observation (Gk. *autopsia*[59]), (2) *historia*, the "history" of first-person observations that previous doctors had recorded in the form of case histories; and (3) "transition from the similar" (*metabasis ek tou homoiou*), a method that allowed extrapolation from one case, illness, part of the body, or remedy to another one perceived as similar. Of these three aspects, it is (1) and (3), *autopsia* and "transition from the similar," that are most relevant to this chapter.

Autopsia was, for the Empirics, the most reliable source of knowledge. As first-person witnessing or observation, it is sometimes equated with experience (*empeiria*) itself.[60] According to Galen, *autopsia* is acquired by experience, trial, or testing (*peira*).[61] The Empirics' methodological-epistemological scheme distinguishes successive, increasingly refined stages of *peira*, which can be roughly summarized in the following schema:

> natural or accidental experience (*peira*) → imitative experience → expert experience (*tribikē peira*) → theorematic experience → state of being experienced (*empeiria*) → art, craft, or technique of medicine.

Let us compare this Empiric schema with those we have encountered previously in Alcmaeon, Aristotle, and Theophrastus (Table I.1). We note both striking similarities and important differences among these schemes. The apparent absence of memory in the Empiric scheme is misleading, insofar as the entire Empiric epistemology is based on careful observation and memorization of which phenomena precede, accompany, and follow which other phenomena.[62] The most striking contrast is with the Theophrastean scheme. Whereas Theophrastus and Aristotle's other Peripatetic successors seem to have bypassed the role

Table I.1 The Role of Experience in the Formation of Knowledge

Alcmaeon, Test. A 11 Diels-Kranz	*Aristotle,* Metaph. *A 1;* Anal. Post. *B 19*	*Theophrastus fr. 301a Fortenbaugh et al.*	*Empirics*
brain → senses → memory/ opinion → knowledge$_1$	sensation → memory → **experience** → formation of universals → *tekhnē*/ *epistēmē*	sensation → memory/ representation → **intellect** → **concept** (*ennoia*) → *tekhnē* / *epistēmē*	natural or accidental **experience** (*peira)* → imitative **experience** → expert (*tribikē*) **experience** → theorematic **experience** → state of being experienced (*empeiria)* → *tekhnē* of medicine

of experience, emphasizing and further articulating the role of intellect in the formation of universals as a necessary prerequisite for the development of both technique (*technē*) and knowledge$_1$ (*epistēmē*), the Empiric tradition, like Alcmaeon, sees no need to postulate the existence of a separate faculty of intellect. Instead, it rehabilitates the notion of experience, concentrating on a careful elaboration of the information it transmits and its role in the emergence of technique. As Frede saw, the Empirics thus represent a prolongation and/or a revival of the archaic Greek tendency of memorism.[63]

Another aspect of Empiric theory and practice, which is probably echoed in Alexander's exegesis of *Metaphysics* A 1, is the third pillar of the Empiric "tripod" of principles, "transition according the similar."[64] Like *historia*, this was conceived as a supplement to the problem that the individual Empiric practitioner's personal, firsthand experience (*autopsia*) is necessarily limited. He must therefore expand his knowledge base by studying case histories from the past (*historia*), but also has to provide himself with a heuristic tool in the form of transition to the similar or by similarity,[65] which will allow him to extrapolate from what he has experienced and apply it to previously unfamiliar cases.[66] Here again, as with the emphasis on experience (*peira*), we seem to have a close correspondence with Alexander's *Commentary on the Metaphysics*. The question of the extent to which Aristotle himself, who uses abundant medical examples in *Metaphysics* A 1, already had in mind Empiric or proto-Empiric doctrines, must remain open.

Our results so far seem to bear out Frede's contention that medical Empirism represents not a late Hellenistic development, but a revival of an ancient tendency of memorism and epistemic modesty, which, unlike the Rationalist tradition embodied by Plato, Aristotle, and the Stoics, rehabilitated the importance of artisanal-technical knowledge. To explain such knowledge, the early Empirists—like other representatives of the memorist tradition—saw no need to postulate the existence of a separate faculty of reason responsible for the process of abstraction and inference involved in the formation of universals.[67] Instead, they believed that observation and the faculty of memory, with its tendency to associate phenomena, were all that was needed. The Empirics' cautious attitude of sticking to the phenomena, which they share with the Skeptics, and their admission that the results of their application of the principle of "transition by similarity" can never aspire to certitude, but only to a probability that awaits confirmation by proto-experimental experience, all seem to place them in the camp of what has been called "the epistemic modesty characteristic of Archaic thought."[68] This tradition may thus be one important ancestor of Empiric thought. Another source may be Buddhism, which may have influenced the thought of Pyrrho, founder of the Skeptic school, a philosophy closely associated with Empiric thought and practice.

Aristotle on the Ineffability of Individuals

As Rilke pointed out in the epigraph to this contribution, it is one thing to utter the words "apple, pear, banana," but something quite different happens when we taste the actual fruit. Now, the words that designate them—names and definitions—suddenly become irrelevant, compared to the rich experience of the taste of the fruit, which alone can convey its connotations of sun, earth, and presence or "hereness," giving rise to feelings of wakefulness, transparency, and joy. At least one of Rilke's points thus seems to be that words fall short of conveying the infinite, concrete wealth of perceptual experience.

As we have seen, Aristotle mentions in passing that experience (*empeiria*) is the knowledge$_2$ (*gnōsis*) of particulars.[69] This remark may hold the key to understanding the need later felt by some thinkers for a revival and development of aspects of the Empirist reappraisal of artisanal or technical knowledge. We have also seen that later Greco-Roman philosophers saw difficulties entailed by the Aristotelian doctrine of epistemology and scientific demonstration. One particularly problematic point was that for Aristotle, there can be no definition, demonstration, or, consequently, knowledge$_1$ (*epistēmē*) of individuals or particulars.[70] Knowledge$_1$ is based on definitions, and definitions take place by genus and differentiae. Yet the highest reality of all, the divine First Principle, has no genus, and so cannot be defined. Likewise, the lowest realities in the hierarchical scale of being, such as individuals and matter, have no differentiae, and consequently no definition either. Both the highest and lowest levels of the Scale of Being are thus insusceptible of knowledge$_1$, and hence, at least to this extent, ineffable.

As Aristotle explains in *Metaphysics* Z 15, using arguments that show affinities with the thought of Gorgias,[71] when we seek to define an individual entity, language forces us to use universal terms ("white," "thin") if we wish to be understood. Every definition of an individual is hence inherently ambiguous: the (necessarily universal) terms we use to pick out such an entity could just as well apply to some other entity.[72] Thus, whatever words we choose to describe such entities necessarily fail to grasp the uniquely characteristic essence of the individual persons, things, and events that constitute our experience. It follows that certain aspects of our experience—some of them among the most important for us in our daily lives—are ineffable. If this is so, however, then language, and hence rational, discursive thought, falls short of achieving and communicating a completely adequate grasp of sensible particulars or individuals. Yet, as Aristotle himself underlines,[73] techniques such as medicine deal first and foremost with individuals. Whatever form of knowing is most appropriate for the practical techniques in general must, therefore, be something other than demonstrative, certain knowledge$_1$ (*epistēmē*).

From the Ineffability of Individuals to *mushāhada*

These may be some of the reasons why the great physician and philosopher Avicenna (Ibn Sīnā, c. 980–1037), who appears as an enthusiastic proponent of the Aristotelian theory of cognition and demonstration in his magnum opus *The Healing* (*al-Shifāʾ*), seems to question its adequacy in several passages from his less-studied works.[74] In these texts,[75] he points out that some domains of human experience, including sexual and intellectual pleasure, but also the experience of the Divine Light and Beauty, are inaccessible to reason or to syllogistic or rational thought (Ar. *qiyās*): one can only know them through taste (*dhawq*) and witnessing (*mushāhada*).[76] The pleasure proper to the human intellectual faculty, for instance, cannot be known by those who have not experienced it,[77] any more than an impotent man can know or desire the pleasures of sex, or a blind person can know the beauties of colors.[78]

One example Avicenna adduces is that of the sweetness of a cake: in a sense, one "knows" that the cake is sweet, even if one has never tasted a cake, because one has heard or read that cakes are sweet. This, however, is an inferior and inadequate kind of knowledge of the cake's sweetness. One cannot really *know* that the cake is sweet until one tastes it, and this is an instance of first-person witnessing (Ar. *mushāhada*). Similarly, the experience of the Divine Light, writes Avicenna, is

> a splendor, a light that comes from God through the intermediary of the Intellect. Discursive and rational thought only lead to it as far as affirmation <is concerned>. From the perspective of the proper character of its quiddity and its quality, the path to it is indicated only by witnessing [*mushāhada*]. This witnessing is only obtained by one who is disposed toward it by a healthy complexion of his soul, as when a person who has not tasted[79] something sweet agrees that it is

> pleasant by a kind of reasoning or by testimony: he will not acquire the proper character of pleasure unless by tasting it.
>
> All sensible and intellectual matters have aspects that can be known through reason [*bi-l-qiyās*] and properties of states that are known [only] by experience [*bi-l-tajriba*]. Just as neither flavor nor the ultimate nature of sensory pleasures can be captured by reason—for at most, reason can apprehend the affirmation of their [existence] devoid of specific details—so in the case of intellectual pleasure and the ultimate aspects of the witnessing [*al-mushāhada*] of supreme beauty, reason can only inform you *that* they are superior in splendor. As for their specific characteristic, however, it can only be known through direct appreciation [*mubāshara*], to which not everyone is guided.[80]

The precise interpretation of these texts, and others like them, is controversial,[81] yet they certainly seem to present a coherent doctrine. For Avicenna, there are aspects of experience that syllogistic reasoning cannot grasp: the specificity or proper character of things. Syllogistic or demonstrative reasoning, as theorized by Aristotle, can conclude that such phenomena as the Divine Light, pleasure, or sensory qualities such a flavor, *exist*. What it cannot grasp, however, but direct, first-person perceptual observation can, is the unique essence or *individuality* of such phenomena. Reason, in other words, can conclude *that experiential phenomena exist*, but it has nothing to say about *what experiential phenomena are like*:[82] this function is reserved for knowledge by acquaintance (*gnōsis* = knowledge$_2$). Genuine knowledge$_2$ of qualia such as taste and intellectual or sexual pleasure, or of divine truth and beauty, can thus be acquired only by experience.

The modality by which, according to Avicenna, such direct, first-person, experiential knowledge can be achieved is witnessing (*mushāhada*). At least two things are interesting about this term. First, in addition to its common meaning of personal witnessing or knowledge by acquaintance,[83] it is an important technical term in Sufi thought, where it often appears as one of the last stations or states (*aḥwāl*) along the mystic path.[84]

Second: when, sometime between 850 and 870, the great translator Ḥunain ibn Isḥāq came to render Galen's *De sectis* into Arabic, he translated the key Greek term *autopsia*—which, as we have seen, the medical Empirics coined as a technical term to designate their principle of first-person personal observation—by that same Arabic term, *mushāhada*.[85] As a physician, Avicenna will certainly have read the Arabic translation of *De sectis*;[86] but he will also have been familiar with the abundant Sufi literature which, by his time, had been using *mushāhada* as a technical term for well over a century.

We do not need to evaluate precisely the relative contributions to Avicenna's thought of these two currents: Greek Empirist medical theory and practice on the one hand; Islamic Sufism on the other. What is perhaps a more promising pointer for future research is the fact that both these intellectual orientations exhibit affinities with Buddhist thought. As we have seen, medical Empirism was associated with philosophical Skepticism, whose founder Pyrrho of Elis may have been influenced by Buddhists. As far as Iranian Sufism is concerned, the region of Tirmīdh had been covered with Buddhist temples prior to the Islamic conquest.[87]

Avicenna may be drawing on all these traditions to express a similar doctrine of the way the human cognitive apparatus can become aware of domains of reality which, because of their particularity and individuality, fall outside Aristotelian demonstrative/propositional thought (knowledge$_1$ = Greek *epistēmē* = Arabic *ʿilm*) and call instead for knowledge by acquaintance or familiarity (knowledge$_2$ = Greek *gnōsis* = Arabic *maʿrifa*). Like the Empirics and the Sufis, moreover, Avicenna seems sometimes to entertain the idea that this cognitive modality of first-person observation or perceptual experience (Greek *autopsia* = Arabic *mushāhada*) is not just an *alternative* way of knowing, but a *superior* way: direct, first-person observance or experience can grasp aspects of reality that rational and logical knowledge cannot. Might Avicenna have come to feel, late in life, that while Aristotelian doctrines of cognition and demonstration are well suited to deal with fields of logic, physics, and ethics, they may be less than completely adequate for the domains at both extremes of the hierarchical scale of being: the sublime, transcendent First Principle above, and the individual things, persons, and processes in this world below that constitute our everyday experience?

Conclusion

> There is indeed the inexpressible.
> This shows itself; it is the mystical.
> (Wittgenstein, *Tractatus Logico-Philosophicus*, 6.522)

In the long development we have surveyed, we have repeatedly encountered what seems to be basically the same conflict, between the rival cognitive claims of reason and experience. This conflict may date back to the late sixth or early fifth century BCE, when doctors, rhetoricians, and empirically minded philosophers, echoing a fundamental tendency of Archaic Greek thought, recommended—against the more ambitious claims for the powers of reason advanced by the early Ionian natural philosophers—a kind of epistemic modesty that acknowledged limits on reason's domain of validity. On this view, human beings can truly know only that of which they have experience; knowledge of the rest of reality is reserved for the gods. Similarly, Empirist doctors and Skeptic philosophers reacted against what they saw as the exaggeratedly speculative claims for reason made by Platonists, Aristotelians, and Stoics. In the process, they reasserted the validity and value of the kind of embodied wisdom inherent in the practices of artisans, skilled craftspeople, navigators, farmers, and doctors. Despite

Galen's ambiguous attitude in this regard, the triumph of his overall pro-Rationalist viewpoint led to the eclipse of the Empirist stance in medical science and contributed to the disappearance of their writings. In philosophy, the triumph first of Aristotelianism and then of Neoplatonism led to the overshadowing of rival schools such as Skepticism and the triumph of Rationalism. That legacy was bequeathed to the Islamic, Hebrew, and Latin Middle Ages.

Throughout this period, however, the ancient Skeptical and Empirist ideas and attitudes persisted, underground as it were, surfacing occasionally among scientists but also, unexpectedly, even in such predominantly rationalistic thinkers as Avicenna, who seems at times to have sensed the shortcomings of the rationalist-Aristotelian approach when it came to accounting for the incommunicable splendors of empirical, perceptual, particular existence. Some basic features of this Empirist attitude are also reflected in Sufi exponents of mystical experience: they, too, advocate an epistemic modesty that reserves for God the knowledge of that which is beyond the realm of human experience. Unlike the ancient medical Empirists and Skeptics, however, Sufi thinkers allowed for certain privileged moments in which, by a combination of spiritual exercises and divine grace, the seeker could hope to attain direct, first-person witnessing (*mushāhada*) of divine truth. As a foretaste of post-mortem bliss, this could lead to a kind of knowledge and "certitude" that, in their view, far exceeded the certainty the philosophers claimed as the exclusive domain of rational philosophy.

If we had access to more of the writings of the earliest Greek exponents of epistemic modesty, such as those of Alcmaeon of Croton and the earliest medical Empirists, might we find that their attitude of epistemic modesty (limiting the validity of reason to the field of human experience), far from being contradictory to "mysticism," is in fact perfectly compatible with it? Wittgenstein famously maintained that "the mystical" *just is* the fact that certain aspects of reality—from perceptual experience of individual beings and processes, to whatever suprasensible, divine realities may transcend human rational capacities—cannot be expressed by language, nor, consequently, grasped by rational, discursive thought.[88] If so, then perhaps "empiricism" and "mysticism" are, contrary to what is usually maintained, not so much polar opposites as cognitive approaches that can be complementary in a Bohrian sense,[89] as long as we are aware of, and respect, the domains of validity proper to reason and to experience.

Notes

1 I will not expressly address this question here. It would require, at a minimum, an account of the contrasting perspectives the Chomskyan tradition and defenders of the linguistic relativism of Sapir and Whorf. See Steiner, *After Babel*, 88–94; Lloyd, *Cognitive Variations*, 5–29.
2 See Lobel, *Between Mysticism and Philosophy*, 101 n. 51.

3 The Greek word *epistēmē* is often translated by "science," yet this connotes a range of ideas that are arguably lacking in the Greek. Today, the English word "science" connotes "experimental," but scholars debate whether the notion of a scientific "experiment" existed in Greco-Roman Antiquity. See Lloyd, *Magic, Reason, and Experience*; Lloyd, *Science, Folklore, and Ideology*; Lloyd, *Revolutions of Wisdom*; Lloyd, *Methods and Problems*. *Technē* is equally hard to translate: it is often rendered by "art," but the aesthetic connotations of the term as we currently use it are lacking in the Greek word, so I have rendered it here as "technique."
4 See, e.g., Simplicius, *In Physicorum*, ed. Diels, 1075.10–11.
5 Hanks, "Space of Translation," 18.
6 Centrone, "Acron d'Agrigente," 116, places Alcmaeon's floruit at c. 500 BCE. See Lebedev, "Alcmaeon," 241–47. For a survey of the widely varying scholarly opinions on Alcmaeon's dating, see Huffman, "Alcmaeon."
7 Plato, *Phaedo* 96b = Alcmaeon, Test. 24. 11 Diels-Kranz. On this text, see Frede, "Empiricist View," 238.
8 Frede, "Empiricist View."
9 It is omitted in Laks et al., *Early Greek Philosophy*. Perilli, "Alcmeone," 66–69, emphatically accepts the attribution; Huffman, "Alcmaeon," is slightly more cautious.
10 Perilli, "Alcmeone."
11 Alcmaeon, fr. 24 B 1 Diels-Kranz (= fr. D4 in Laks et al., *Early Greek Philosophy*). See Barnes, *Presocratic Philosophers*, 136–37; Hadot, *Veil of Isis*, 29; Lebedev, "Alcmaeon" (who proposes a modified text).
12 See Philolaus, *Pythagorean and Presocratic*, ed. Huffman, 125–26, citing Kahn, "Pythagorean Philosophy," 173, on the "epistemic modesty characteristic of Archaic thought." Huffman considers the emblematic representatives of such epistemic modesty to be Homer (*Iliad* 2.484 ff.); Barnes, *Presocratic Philosophers*, 137–38, lists Xenophanes, *Fragments*, 161–86, Alcmaeon, and the Hippocratic *On Ancient Medicine* (cf. Hankinson, "Art and Experience," 8–9). Lebedev, "Alcmaeon," 246, rightly adds Heraclitus (fr. 55 Diels-Kranz). On epistemic modesty in early modern English thought, inspired in part by the revival of Greek Skepticism in the sixteenth century, see Corneanu, *Regimens of the Mind*, who defines it as "an attitude of opting for prudent enquiry rather than positive assertion, for the probable rather than for the infallibly certain" (99). For the possible relevance of such an attitude of epistemic modesty in the "Age of Covid," see Chase, "Which School."
13 Philolaus, *Pythagorean and Presocratic*, fr. 1, ed. Huffman, 93.
14 Ibid., fr. 6, 123: "the being of things, which is eternal, and nature in itself admit of divine and not human knowledge."
15 Barnes, *Presocratic Philosophers*, 140.
16 Philodemus, *On Methods of Inference*, ed. De Lacy, 120–24; Edelstein, "Empiricism"; Perilli, "Alcmeone," 62, 73.
17 Plato, *Gorgias* 448c5–6. See also 462C–B.
18 See Chiron, "Pôlos d'Agrigente." The first collection (without translation) of the fragments of Polos was not published until Fowler, "Polos of Akragas."
19 Chiron, "Pôlos d'Agrigente," 1220; Renehan, "Polus, Plato, and Aristotle." On Acron, see Deichgräber, *Griechische Empirikerschule*, 270–71; Edelstein, "Empiricism," 195–96; Perilli, "Alcmeone," 68; Nutton, "Acron."
20 Plato, *Gorgias*, 501a.

21 See Hankinson, "Art and Experience," 4.

22 On the hendiadys *empeiriai kai tribē* in Plato, see *Phaedrus* 269d ff.; *Philebus* 55d ff. Cf. *Laws*, IV, 720a ff., where a distinction is made between free and slave doctors. The former have learned their trade "in accordance with nature" (*kata phusin*), possess and practice medicine as a technique (*technē*), start out from the causes of illness, take into account the nature of human body, know the reasons (*aitia*) for their actions, and can therefore give an account of them. Slave doctors, in contrast, have obtained their knowledge either by orders from the genuine doctors or by experience and technique (*kat' empeirian kai technēn*). See Plato, *Nomoi*, ed. Schöpsdau, 238–39.

23 See Frede, "Empiricist View."

24 On what follows, see Hankinson, "Art and Experience"; Krause in this volume.

25 Sensation is defined here as an innate faculty of judgment (99b34); memory as the persistence or remaining of a sense-impression (99b35–36.

26 Aristotle may have been quoting from a now-lost treatise by Polos; see Renehan, "Polus, Plato, and Aristotle."

27 Aristotle, *Metaph*. A, 981a4–6. Note that Aristotle does not say *how* this occurs.

28 This is presumably an instance of what Aristotle describes as identifying "the one apart from the many, whatever is one and the same in all those things." *Metaph*. A, 981a10–11.

29 *Metaph*. A, 981a13–14.

30 Ibid., 981a14–15.

31 Ibid., 981a24–25.

32 Ibid., 981a27–29. On the distinction between knowledge of the *hoti* and of the *dioti*, see Aristotle, *Posterior Analytics* I, 13.

33 *Metaph*. A, 981b7–8.

34 A Platonic notion, as we have seen; see *Alcibiades* 118c–d and the texts cited above.

35 "And when many such things come about, then a difference comes about, so that some come to have an account [*logos*] from the retention of such things." *Posterior Analytics*, 100a1–3, trans. Barnes.

36 "experience, or … the whole universal that has come to rest in the soul (the one apart from the many, whatever is one and the same in all those things)." Ibid., 100a3–6, trans. Barnes.

37 Alexander, *In Aristotelis Metaphysica commentaria*, ed. Hayduck, 4.21–25.

38 See Aristotle's key statement that experience is knowledge$_2$ (*gnōsis*) of individuals (*Metaph*. A, 981a16).

39 Nor does any other Greek author prior to Poseidonius (second–first century BCE).

40 Alexander's comment here is probably inspired by Aristotle's definition of *tekhnē* as a "judgment about similar things" (*Metaph*. A, 981a6). On experience as "extensive accessible memory knowledge of similarity classes," see Bolton, "*Techne* and *empeiria*," 140–41.

41 Alexander, *In Aristotelis Metaphysica commentaria*, ed. Hayduck, 4.25–5.2.

42 See the fragment of Alexander's lost *Commentary on the Physics*, preserved by Simplicius, *In Physicorum*, ed. Diels, 1074.27–1075.2. In the continuation of his text, Alexander gives a highly condensed account of the formation of

universals, probably based on the theories of Theophrastus, on which see Chase, "Porphyry on the Cognitive Process."

43 Alexander, *In Aristotelis Metaphysica commentaria*, ed. Hayduck, 5.2–8.

44 For more detail on what follows, see Chase, "Which School."

45 See now especially Halkias, "When the Greeks," 75–78; Beckwith, *Greek Buddha*, 10, 14–21, 48–49.

46 Diogenes Laertius, *Lives of the Ancient Philosophers*, 9, 61.

47 Long, *Hellenistic Philosophy*, 81–82. See Pyrrho, Testimony 53 Decleva Caizzi. For parallels with Buddhist thought, see Beckwith, *Greek Buddha*, 25–34; Chase, "Which School."

48 See Aristotle, *Metaph.* A 1, 981a23–28. The Stoics, in contrast, held that only the Sage knows why and how even the most skillful and successful technicians—great sculptors such as Polycleitus, for instance—do the things they do (Cicero, *Lucullus*, §§ 144–45).

49 Speusippus developed a theory of a "scientific sensation" (*ēpistēmonikē aisthēsis*) that participates in "scientific practice"; see Sextus Empiricus, *Adv. math*. 7. 145 (= fr. 75 Tarán). Compare Speusippus's "scientific sensation" with the notion of "rational experience" (*rationabilis experientia*), which was how the Empiric doctor Theodas of Laodicea (early second century CE?) classified the Empiric method of "transition from the similar." See Galen, *Subfiguratio*, 4, ed. Deichgräber, 50.2–4; Stok, "La scuola medica," 606.

50 For a more detailed presentation of the epistemology and scientific methodology of the Empiric physicians, see Chase, "Which School."

51 On Acron, see n. 19 above. However, current scholarship usually considers the Empiric school to have been founded around 250 BCE by Philinos of Cos. "Philinos 9"; Deichgräber, *Griechische Empirikerschule*, 254–55; Boudon-Millet, "Philinos de Cos."

52 Allen, "Pyrrhonism," 232.

53 As early as the first half of the third century BCE, the Empirics were called *anaitiologētoi*, "those who refrain from talking about causes"; see Erasistratus, fr. 35 ed. Garofalo (= fr. 25, 106–7 ed. Deichgräber). See Edelstein, "Empiricism," 197.

54 Compare the parable of the poisoned arrow in *The Shorter Exhortation to Māluṅkya/Cūḷa Māluṅkyovāda Sutta* (MN63), www.dhammatalks.org/suttas/MN/MN63.html, and see Frede, "Empiricist View," 229, on the Empirist view that "the task of a doctor is not to provide patients with a theoretical account of their disease and its cure, but to cure them." See also Celsus, *On Medicine*, I pr. 38; Chase, "Which School."

55 In general, Galen believed that medicine required a combination of both reason and experience; see Frede's introduction in Galen, *Three Treatises on the Nature of Science*, ed. Frede, xi–xxxiv; Van der Eijk, "Galen's Use"; Hankinson, "Art and Experience." Galen objected that the Empirists' allegedly unsystematic approach led them to results that were insufficiently "scientific and certain" (Galen, *De simplicium medicamentorum*, ed. Kühn, 231.2; see Van der Eijk, "Galen's Use," 49).

56 Galen was almost the only source, for the subsequent Greek, Latin, Hebrew, and Arabic traditions, of all information about Empirist theories and practice. The three main works in which Galen transmits Empirist doctrine are a good example of the importance of intercultural translation. Only one, the *De sectis*, survives in the original Greek, while the other two, *On Medical*

Experience and *Empirical Sketches*, are preserved in an Arabic and a late medieval Latin translation respectively. For modern translations of all three works, see Galen, *Three Treatises on the Nature of Science*, ed. Frede; Galen, *Traités philosophiques et logiques*, ed. Pellegrin and Dalmier.

57 On this canon, see Boudon-Millet's introduction to her edition of Galen, cxviii–cxxvi, 29–33; Bürgel, *Ärztliches Leben*, 140–62.

58 On this prominent position of the *De sectis*, see Pormann, "Jean le grammairien"; Pormann, "Alexandrian Summary"; Overwien, *Medizinische Lehrwerke*, 26–34. Ibn Hindū (d. 1029–1032) explains why the medical curriculum began with the *De sectis* as follows: "for it was necessary that it introduce the curriculum, in order to expel from the student's mind the doubts and sophistries of the Empirists [*aṣḥāb al-tajriba*] and the Methodists." *Keys to Medicine*, cited by Overwien, *Medizinische Lehrwerke*, 32.

59 A term which, as Galen observes, they seem to have coined. *Subfiguratio*, ed. Deichgräber, 47.8–11.

60 Ibid., 44.6–8; see also 47.23–26. The Empirics were known not only as *tērētikoi*, "the observant ones," but also as *mnēmoneutikoi*, "the memorious ones" (Galen, *De sectis*, 1, ed. Helmreich, 2.8).

61 See Liddell-Scott-Jones, *Greek-English Lexicon*, I.1. According to Galen (*De sectis*, 1, ed. Helmreich, 2.2–3), the Empiric school is that which "proceeds to the discovery of cures by means of experience" (*dia peiras*). See Alexander, *In Aristotelis Metaphysica commentaria*, ed. Hayduck, 5.4. On the succession of types of experience, see Deichgräber, *Griechische Empirikerschule*, 297.

62 Indeed, for the Empirics, such observation and memorization are precisely what knowledge consists in; see fr. 45 Deichgräber. See Sextus Empiricus, *Adv. math.*, 8. 288 (I thank Emidio Spinelli for this reference).

63 Frede, "Empiricist View," 227.

64 This method is designated by various forms: *hē kata to homoion metabasis*, *hē tou homoiou metabasis*, etc.; see Deichgräber, *Griechische Empirikerschule*, 301 ff. See Alexander, *In Aristotelis Metaphysica commentaria*, ed. Hayduck, 5.6–9.

65 *Hodos epi tēn heuresin* in Galen, *De sectis*, 3, ed. Helmreich, 4.7; *via ad experientiam* in Galen, *Subfiguratio*, ed. Deichgräber, 70.6.

66 Such "transition to/from the similar," or extrapolation on the basis of similarity, could be applied to similar illnesses, similar body parts, or similar diseases. See Chase, "Which School."

67 In a personal communication, Emidio Spinelli suggests a comparison with Sextus Empiricus, *Adv. math.*, 11. 160–65.

68 Kahn, "Pythagorean Philosophy," 173.

69 *Metaph.* A 1, 981a14–15.

70 See *Posterior Analytics* I. 8, 75b24–5. On this problem, and the Neoplatonic attempts to palliate it by means of the doctrine of the description (*hupographē*), see Chase, "Individus et descriptions."

71 Mazzara, *Gorgia ontologo e metafisico*, 179.

72 This implication of Aristotelian thought plays a key role in Avicenna's approach to the problem of the divine knowledge of individuals, with its crucial implications for the doctrine of divine providence; see Chase, "Individus et descriptions," 3–6.

73 See *Metaph.* A 1, 981b19–20: "the physician does not cure a man … but Callias or Socrates or some other called by some individual name."

74 For other reasons, see Sebti, "La notion de mušāhada," especially her discussion of Avicenna's *Taʿliqāt*, ed. Badawī, 34–35, a melancholy lament over the fact that human beings know only the properties and accidents of things, never their essence or reality (Ar. *ḥaqīqa*).

75 In addition to the two passages from Avicenna's *Notes on the Theology of Aristotle*, discussed below, Gutas, "Intellect without Limits," cites Avicenna's *Al-Mabdaʾ wa-l-maʿād*, *Ishārāt*, and *Al-Mubāḥaṯāt*. See the additional texts cited and discussed by Sebti, "La notion de mušāhada."

76 Treiger, *Inspired Knowledge*, 60.

77 Avicenna, *Al-Mabdaʾ wa-l-maʿād*, ed. Nūrānī, 112.10–15, cited by Treiger, *Inspired Knowledge*, 61.

78 Avicenna, *Metaphysics of The Healing*, 9. 6, ed. Marmura, 349. Similarly, the Andalusian mystic Ibn Ṭufayl (1105–1185) writes in *Ḥayy ibn Yaqẓān* that his vision of the Absolute Being cannot be acquired through syllogistic reasoning, but only through tasting (*dhawq*, ed. Gauthier, 7–8), just as a blind person could know (*yaʿrifu*) colors only by explanations of their names and ostensive definitions.

79 The verb here is *yadhuq*, formed from the Arabic root *dh-w-q*, source of the noun *dhawq*, "taste," sometimes translated as "experience." This is a key concept in descriptions of Sufi mystical experience; see Lobel, *Between Mysticism and Philosophy*, index; Frank, *Philosophy, Theology, and Mysticism*, 216–17; Sebti, "La notion de mušāhada," 166–67. Avicenna described his *Ishārāt* as intended for those who possess "gustatory wisdom" (*al-ḥikma al-dhawqiyya*); see Michot, *La destinée*, 3–4. Like *mushāhada*, *dhawq* is one of the stages on the Sufi path (no. 70 of the hundred stages enumerated by al-Anṣarī, c. 1006–1088 CE); see Tabbara, *L'itinéraire spirituel*, 298.

80 Avicenna, *Notes on the Theology of Aristotle*, ed. Badawī, 56.8 ff.; ibid., 44.12–16; I follow the text of Treiger, *Inspired Knowledge*, 61, 142 n. 52; translation Treiger slightly modified.

81 follow the interpretation of Lobel, *Between Mysticism and Philosophy*, 89 ff.; Treiger, *Inspired Knowledge*, 60 ff.; Sebti, "La notion de mušāhada." For a fierce denial that there is anything "mystical" about such passages, and the assertion that they are fully concordant with Avicenna's purely rational empiricism, see Gutas, "Intellect without Limits"; Adamson, "Non-Discursive Thought."

82 See Sebti, "La notion de mušāhada," 165.

83 In Arabic, one way to say "I did not know X personally" is *lam aʿrifuhū mushāhadatan*.

84 Gutas, "Intellect without Limits," is silent on the Sufi resonances of the term, but see Treiger, *Inspired Knowledge*, for a list of ten characteristics of *mushāhada* in al-Ġazālī. On the way in which knowledge$_2$ (*maʿrifa*), accompanied by divine illumination, leads to *yaqīn* according to the Khorasanian Sufi al-Ḥakīm al-Tirmiḏī (c. 830–910 CE), see Radtke, *Drei Schriften*, 2:60. For Tirmiḏī on *mushāhada*, see, e.g., al-Tirmidhī, *Bayān al-farq*, ed. Herr, 39, 62, 64–65. *Mushāhada* also plays a key role in the thought of al-Tirmidhī's contemporary Sahl al-Tustarī of Khuzestan (c. 818–896 CE); see Sahl al-Tustarī, *Tafsīr al-Tustarī*, 384 (index, s.v. *mushāhada*). Thus, in his use of the concept of *mushāhada*, Avicenna may be following a current that dates back to ninth-century Iranian Sufism. On al-Tirmidhī as a transmitter of "Hellenistic philosophical ideas," see Schimmel, *Mystical Dimensions*,

56–57; for the suggestion that this may imply the existence in Balkẖ and Tirmīdh of "eine Schule neuplatonischer Mystiker" dating back to the second half of the eighth century, Radtke, "Theologen," 552.

85 Galen, *Kitāb Ǧālīnūs*, ed. Salīm Sālim: "wa-sammū al-mujtamiʿ ayḍan al-**mushāhada**, wa-huwa ḥifẓ mā li-ashyāʾ qad shūhidat marāran kathīratan ʿalā ḥāl wāḥid" (Galen, *De sectis*, ed. Helmreich, 3.15–17: *eklēthē de hup' autōn autopsia*).

86 And, in all probability, the Alexandrian epitomes of Galen's sixteen canonical works as well. At *Notes on the Theology of Aristotle*, ed. Badawī, 44.12–16, as we saw, Avicenna speaks of *mubāshara* alongside *mushāhada*: *mubāshara* is the term used to render the Greek *autopsia* by the anonymous author of the Alexandrian epitomes of Galen's works. See Galen, *On the Medical Sects*, §13, ed. Walbridge, 16: "According to the Empiricists, there are two ways in which things are apprehended and understood: by vision, which is called **autopsy**" (*immā bi-l-baṣar wa-yuqāl la-hū al-**mubāshara***).

87 See the references in Crone, "Al-Jāḥiẓ," 220 n. 22. Tirmīdh was also the site of the teaching activity of Jahm ibn Ṣafwān, the early heretical thinker (d. 746) whom some scholars have considered a Neoplatonist.

88 On the limits of language, see Wittgenstein, *Philosophical Investigations*, 119; Wittgenstein, *Tractatus Logico-Philosophicus*, 5.6. This theme was dear to Pierre Hadot. See Hadot, *Philosophy*, 155, 163; Hadot, *What Is Ancient Philosophy?*, 88 ff.; Hadot, *Selected Writings*, 86. Faced with the enigma of existence, Hadot concludes, "language reaches its impassable limits" (Hadot, *Exercices spirituels*, 192–93). According to George Steiner: "Paralysed by the vacuum of words, by the chasm which has opened between individual perception and the generalities of speech, the writer falls silent." Steiner goes on to speak of "the limits of language, the necessary defeat of language by the privacy and radiance of the inexpressible." Steiner, *After Babel*, 83.

89 On the notion of complementarity as elaborated by the Danish physicist Niels Bohr (1885–1962), see ch. 10, "Complementarity Is Mind-Expanding," of Wilczek, *Ten Keys*, 206–22.

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Part II

Experience Terms

Part II Introduction

Experience Terms in Translation

Steven Harvey

> We do not, however, have the full mind of Aristotle in Latin; for Aristotle's book and the commentary on it were first translated from Greek into Arabic, and then from Arabic to Latin, and, besides, the translator told me that he did not know logic. … Still, a studious person can catch a faint scent of his views, even though he cannot taste them; for a wine that is decanted from a third vase retains little of its vigor.
>
> Roger Bacon, *Opus maius: Moral Philosophy*, trans. McCarthy, 389

The four rich and very different chapters in this Part illustrate, each in its own way, how premodern actors' terms relating to experience of the natural world were conveyed and transformed through translation. The terms "experience" and "translation" in the section title are taken analytically, with "translation" understood by the volume's editors in the "broad analytic category of epistemic translation."[1] Within this broad understanding of translation, there is also the sense of interlingual translation. Here we often find an expectation that something significant is lost in translation, either intentionally or inevitably. Indeed, we will see good examples of such loss in the studies in this section, but was this always an assumption of our actors themselves?

Al-Fārābī (870–950 CE), the founder of the school of Islamic Aristotelianism, presented his view of the contemporary task of philosophy and science in a section on the origin of the syllogistic arts in his *Book of Letters*. For him, philosophy was perfected in the days of Aristotle; after Aristotle, "philosophy [became] an art that is only learned and taught. … The instruction for the elect will be by demonstrative methods only, while the common instruction, which is for everyone, will be by dialectical, rhetorical, or poetical methods."[2] Firsthand experience was no longer needed. Significantly, al-Fārābī's concern was not with the problem of studying or teaching Aristotle in Arabic, but rather with the different methods of instruction suitable for the elite and for the many.

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Similarly, Averroes (Ibn Rushd, 1126–1198 CE), the great commentator on Aristotle, famously proclaimed:

> [Aristotle] is the one who originated … the art of logic, natural science, and divine science, and it is he who completed them. … No one who has come after him to this our time—and this is close to fifteen hundred years later—has been able to add a thing worthy of attention to what he said.[3]

Philosophy having been "completed," the activity of philosophy for Averroes was one that could best be performed through the careful study and explication of the writings of Aristotle. Although he occasionally speaks of mistakes by the translator, his main perceived problem was with the inherent difficulty of the subject matter, not with the Arabic translation; in other words, with the same kinds of problems encountered by the great Greek commentators with whom he was familiar.

Today we know better. Scholars have shown that many of Averroes's misunderstandings of Aristotle were a direct result of inaccurate translations. Yet what is remarkable is his uncanny ability to understand and explain the gist of an Aristotelian text even when the translation was garbled. Over four decades ago, the distinguished Harvard historian of ancient and medieval science John E. Murdoch made an astonishing claim: Averroes's "view of the proper analysis of a passage was often accepted even when, strictly speaking, it only made sense relative to the Arabic-to-Latin text of Aristotle on which it was based."[4]

Even the *falāsifa*, however, despite their fervent belief that Aristotelian science could be mastered through the Arabic translations, recognized at times that a particular translation was hopelessly poor. An example is Yaḥyā ibn al-Biṭrīq's early-ninth-century Arabic translation of Aristotle's *Meteorology*. When Samuel Ibn Tibbon, the translator of Maimonides's *Guide of the Perplexed*, undertook to translate the Arabic *Meteorology* into Hebrew in the first decade of the twelfth century, he soon realized the abundant difficulties that faced him.[5] In order to prepare a useful Hebrew translation, Ibn Tibbon first edited the Arabic text, then turned to Alexander's commentary, Averroes's *Short Commentary*, and Avicenna's *Shifāʾ* to elucidate obscure passages. The result of his considerable efforts—far beyond what one might expect from a translator—was a translation superior to its Arabic source.[6]

The present Introduction opens with a quotation from Roger Bacon's *Opus maius*. Clearly, to use Bacon's words, "we do not have the full mind of Aristotle" in Ibn al-Biṭrīq's translation of the *Meteorology*, but does this necessarily mean that a "wine that is decanted from a third vase retains little of its vigor"? Was this how the translators understood their art?

Ibn Tibbon certainly did not. Naḥum ha-Maʿaravi, the translator of Maimonides's *Epistle of Yemen* into Hebrew, also did not see his task this way. He wrote in the preface to his translation:

> I have seen fit to translate it from Arabic to Hebrew and to preserve its [the Arabic's] taste in it [the Hebrew], even though *it is emptied from vessel to vessel* [Jer. 48:11]. *And it is a hidden wonder* [Jud. 13:18] … From *a fruitful grapevine* [Psalms 128:3] …. If *it is emptied from vessel to vessel*, it will not be diluted. *Therefore, its taste remains in it and its scent does not change* [Jer. 48:11].[7]

In short, the wine in the second vessel retains the same taste and bouquet as that in the first. While this may be possible for Arabic to Hebrew, where word-for-word translations were often quite successful, the situation is different for Greek-to-(Syriac-to)-Arabic translations, as in the case of the Arabic translation of the *Meteorology*.

Part II of this volume is primarily concerned not with the general question of translations' reliability, but with how experience or an experience is conveyed in language or translated from one language to another or within the same language; in particular, inquiring into terms denoting experience. But can experience be conveyed in language? And if so, can what is learned of this experience be conveyed equally well in translation? It seems so, and I will give just one example.

Among the medieval philosophers of the three Abrahamic traditions, few could compare with Albert the Great for sheer indefatigable scientific curiosity. For example, he acquired knowledge of the number of eggs and chicks in the eagle's nest through firsthand experience "by visiting the nest of a certain eagle for six straight years" and "only by being lowered from the cliff on a rope of very great length."[8] Here, it seems, Albert was able to articulate his experience in language and that experience is now conveyed to us in Latin-to-English translation.

Chapter 1, by Katja Krause, engages us at once in the issues of the section, and indeed with different aspects of it: that of the actual translation from one language to another ("interlingual translation") and, of far greater interest for her, the translation of scientific teachings in the sense of reframing and repurposing them ("epistemic translation"). Her concern is with experience as an object of scientific inquiry, and thus goes directly to the heart of this volume.

Krause's chapter begins by pointing to a decisive difference between the two complete Latin translations of Aristotle's *Metaphysics* as regards their versions of the well-known discussion of experience in Book A 1, a chapter omitted in the Arabic translation. Krause explains that the two Latin translations, the early *translatio media* and the revised *translatio Moerbekana*, identically translate Aristotle's Greek in the sentence that "conveys the route from memory to experience," but diverge significantly in their versions of the "route from experience to the universal." As may be expected, the epistemic translation of this discussion of experience of a particular actor is directly related to the actual Greek-to-Latin translation the thinker had at his disposal, but, as Krause shows, this is only part of the story. The interlingual translations of this passage cried out for explanation. The differing approaches of Krause's three actors to the Latin text in front of them color their epistemic translations and ultimately their understanding of experience and its role in the acquisition of *scientia*.

Thus, Albert the Great, relying and building upon the *translatio media*'s version of this passage, parts from Aristotle's understanding of e*mpeiria* as found in the Greek text. His interesting and important discussion leads him yet further away from the text and directly into his classroom, where it was intended to affect the lives of his students. Thomas Aquinas, in contrast, relying and commenting upon the correction in the *translatio Moerbekana*, is closer to the Greek text and Aristotle's understanding of *empeiria*. Krause makes it clear that this is due, in part, to their ideals and practices, the different ways they saw their tasks as commentators (translators). Of course, their differences also stem from the Latin translation they had before them. What, for example, would Albert's account of *empeiria* have looked like if he had had access only to the *translatio Moerbekana*?

The third of Krause's actors, John Buridan, not constrained to a strict commentary, presents a third understanding of experience that could fit either translation. Krause shows that he turns more to medical practices for his interpretation of experience. His argument is made through illustration, with the example of the rhubarb that purges the bile. Experience, or what he calls "experiential cognition" or "knowledge," is not the sense perception or the memory of something sensed, but the knowledge that comes from very many sense perceptions and memories and that leads us to assent that a proposition is true in all cases.

In Chapter 2, Marilena Panarelli discusses the classifications of flavor and traces the way flavor was understood and categorized over a period of a millennium and a half, from Aristotle to Albert the Great, as it traversed linguistic, historical, geographical, and scientific boundaries.

At the outset, Panarelli pinpoints a potential problem in the translation of flavor from Greek. Whereas the ancient Greek term *chymós* can signify either flavor or humor, this is not so for the terms for flavor in Arabic, *taʿm*, and Latin, *sapor*. Thus translators of Galen's *On the Natural Faculties*, for example, needed to attend to the context in order to know that in I. 2 the discussion is of flavors, and in II. 8 it is of the genesis of humors. Does having separate words for flavor and humor help us to understand the source concepts as well as, if not better than, readers of the original Greek texts? In Panarelli's view, something may be "lost in translation" because the sameness of the word suggests the close relation between flavor and humor. Still, one could argue that the ambiguity of having one term for two concepts could be confusing.

Panarelli delineates several of the meanings of flavor in the authors she studies, such as "an epistemic object of theories of sense perception" and "an epistemic tool" in knowledge acquisition and application.[9] Flavor is a term "of both sense perception and experience" insofar as we can learn about certain plants and their properties and usefulness from tasting their flavors. This point is reinforced through a reference to Galen's *On the Properties of Foodstuffs*. In the full passage, Galen tells us he wishes he could simply accept the physician Mnēsitheus's persuasive-sounding account of the parts of plants, but as one may judge from experience, it is false. The problem was that Mnēsitheus failed to examine each plant first by taste and smell. Galen warns the reader not to be fooled by Mnēsitheus; to truly know a plant one must experience each part of the plant for oneself.

The medievals rooted their knowledge of flavor in the translated ancient Greek accounts and adapted, enriched, and applied them—in Panarelli's words, "translated them"—to different disciplines. Thus, Isaac Israeli studied flavor with a focus on determining which foods were best for different human temperaments, and Avicenna was primarily concerned with their benefits for medicinal purposes. Similarly to Galen, Albert, the botanist, held that the best way to know the substance of plants is to experience them by tasting their flavors.

Albert's sophisticated and carefully thought-out discussion of flavor is indebted to his readings of Greek and Arabic sources in Latin translation. There seems to be little evidence that he felt his understanding of flavor in these texts was compromised by having read them in translation.

Chapter 3, by Jonathan Morton, concerns interlingual and intralingual translations of technical terms; in particular, the very diverse meanings in twelfth-century Western Europe of the Latin *ingenium* (ingenuity), a term used inter alia to refer to a mental power "by which a person arrives at a solution to a problem or intuits a theoretical truth."[10] It "describes a mental process by which non-empirical experience and learning can occur independently of the external senses." Morton agrees with those who hold that a perfectly faithful interlingual translation is not possible, for in any translation slippage inevitably occurs. Such slippages, Morton reasons, are "especially pronounced in texts that discuss processes of cognition." In his fascinating study, Morton shows the ambiguity that arises when a term—in this case, *ingenium*—is used to denote or translate different processes of the mind.

Morton's story begins in the ninth century with a gloss by John Scotus Eriugena that employs the words *naturale ingenium* in the sense of some power, possessed by all humans, to know things so "they would not be completely deprived of knowledge of their Creator and of their natural dignity." Morton suggests that this use might explain the eleventh-century translation of *phusika ennoia* by *naturale ingenium* in Alfanus's translation of Nemesius's fourth-century account of cognition: "The receiving of intelligibles does not come from the preceding *phantasia*, but from teaching or from natural *ingenium*." Slippage occurs in the very next line of Alfanus's translation, with a mistaken translation of the term. Alfanus's uses of *ingenium* were influential and the term's meaning became more and more ambiguous. Morton traces very different and, at times, confusing meanings (and slippages) of the term in twelfth-century actors such as Adelard of Bath, William of Conches, John of Salisbury, Isaac of Stella, and Alcher of Clairvaux. Justifiably frustrated, he asks after citing Alcher: "What exactly does *ingenium* mean here? What exactly does it mean anywhere? The term's simultaneous vagueness and overdetermination means that it needs redefining, retranslating more or less each time it is used." As Morton notes, the problems that beset the term *ingenium* were present also for other Latin terms of cognition in the twelfth century, revealing the need for a more unified terminology.

Chapter 4, the last chapter in Part II, by Shixiang Jin, takes us from Western Europe in the twelfth and thirteenth centuries to China over three centuries later. Jin's story focuses on the learned Jesuit missionary Matteo Ricci and his almost incredible ability to memorize numerous random Chinese characters at a glance. In his 1596 Chinese book *The Western Art of Memory*, Ricci revealed the secrets of his personal memorizing experience to the Ming dynasty elite, apparently hoping he might pick up some converts to Christianity along the way. Jin's chapter is significant for us because it offers an important, if not radical, illustration of how things can go terribly wrong in translation.

Ricci had an interesting theory on how we memorize objects. Human memory is like a storehouse for objects we wish to remember, a teaching vaguely reminiscent of Socrates's aviary.[11] For Ricci, these objects worthy of memory can be reduced to images (*xiang*). The way to memorize Chinese characters is thus to reduce them to images and store them. Jin explains that Ricci split the Chinese characters into two pictorial constituents, each a character with a meaning of its own, which could tell a story and be put in the storehouse for easy recall. While all this may make sense to the Western mind, it flew in the face of the widely accepted Chinese principles of character formation. Ricci tried to reinterpret these principles, but, as Jin explains, his transformations seemed too alien for his contemporary Chinese reader. The distinction between contemporary Chinese scholars' understanding of Chinese character formation, reported by Jin, and that of Ricci was informed by the radical difference between Confucian and Aristotelian epistemologies. Moreover, Ricci's understanding of *xiang* itself made little sense within the context of Chinese tradition and culture. His attempts to explain his methods to his Chinese readers through his novel presentation of *xiang* and his reinterpretation of the principles of character formation were thus doomed to failure. The problem was not one of translating terms and concepts. Here, the translation was ultimately a cultural one. The Chinese who turned to Ricci's guidebook could understand its literal meaning—what needed translation were the foreign cultural concepts that threatened their own cultural legacy.

Notes

1 On the meaning of this expression and how "translation" and "experience" are understood in this volume, see the editors' Introduction.

2 Al-Fārābī, *Kitāb al-ḥurūf*, ed. Mahdi, 151–52, trans. Charles Butterworth (forthcoming, Cornell University Press).
3 Averroes, *Long Commentary on Aristotle's Physics*, in Harvey, "Hebrew Translation," 83.
4 Murdoch, "Transmission and Figuration," 415.
5 Samuel Ibn Tibbon, *Otot Ha-Shamayim*, ed. and trans. Fontaine, 2–5. This, as Ibn Tibbon knew, was Maimonides's view as well; see translator's introduction, x.
6 See ibid., translator's introduction, ix–xiii.
7 Maimonides, *Epistle to Yemen*, ed. Halkin, xxxv.
8 See Albert the Great, *De animalibus*, VI. I. 6. 50, in *Albertus Magnus on Animals*, trans. Kitchell and Resnick, 1:547. Albert uses the present infinitive, *experiri*, twice in two lines in this passage. On the grave dangers of Albert's undertaking, see also ibid., 1:549.
9 This fits nicely with Krause's statement in her chapter (58) that "experience was at once an object of *scientia* and … an instrument for acquiring it."
10 As Morton shows, the term is also used to translate *ḥads* in the mid-twelfth-century translation of Avicenna's *Liber de anima*.
11 Plato, *Theaetetus*, 197c ff.

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1 The Epistemic Authority of Translations

Albert the Great, Thomas Aquinas, and John Buridan on Aristotle's *empeiria*

Katja Krause

During the high Scholastic period, the practice of *scientia* (understood here as the practice aimed at producing true and certain knowledge) consisted in commenting upon a given set of source texts. At the newly founded universities and the study houses of the mendicant orders, this overwhelmingly oral practice followed the rules of logic in its approach, thus emulating what the texts propounded. Ideally, therefore, the practice of *scientia* coincided with the practice of defining and demonstrating, at least when it came to the philosophical curriculum, the foundation of all high Scholastic scholarship and erudition. But what exactly was the role that the source texts—most of them Latin translations of the *corpus Aristotelicum* and accompanying works from Greek and Arabic—played for the particular practices of commenting by means of definitions and demonstrations? More concretely: What kind of epistemic authority did the Latin audience grant to the words of the translations when they practiced philosophical *scientia*?

In one sense, this question may seem trivial, at least if we assume that the words of the Latin translations delineated what was being defined and demonstrated. In Aristotle's *Physics*, for instance, what required definition and demonstration was the subject matter, the physical body subject to change and motion. That, certainly, was most thirteenth-century historical actors' approach to the translations. But the question begins to take on more weight if we turn to a seeming split between what is linguistic and what is logical, what is philological and what is methodological, what is semantics and what is subject matter. In short, there seem to be two different authorities in the words of the translations: the authority of language and the authority of *scientia*.

This split authority is particularly pertinent to the matter of experience (*experientia*, *experimentum*). Unlike many other issues in the period, experience was at once an object of *scientia* and, at least in some areas of natural philosophy, an instrument for acquiring it. As an object of *scientia*, experience was subject to definition and demonstration, just like any other universal. But as an instrument for acquiring *scientia*,

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experience seemed to escape the hegemonic approaches of definition and demonstration, potentially opening up an approach complementary to them, as Michael Chase has shown for Antiquity.[1] This was usually a complex matter, too complex for this brief chapter. Among other things, in both cases the experience contained in the sources had already undergone interlingual translation, from Greek and Arabic into Latin, before it became part of the Scholastic practice of *scientia*. In turn, Latin commentators wove yet another layer of experience into the fabric of definitions and demonstrations. This layer, too, came in different shades: as an object of definition and demonstration, it added the Scholastics' own epistemic norms and convictions about experience; as an instrument for *scientia*, it added new experiential evidence, mostly in support of the premises of arguments.

If we wish to learn about the epistemic authority that the Latin audience granted the words in the translations of Aristotelian texts, then, we would ideally need a comprehensive investigation of all those passages that convey experience as an object of *scientia* and that use it as an instrument for *scientia*, in both the source texts and the Latin commentaries upon them. But "life is short, the art is long," as Hippocrates once said, and this chapter is shorter still, so I will confine myself to looking at one particular passage of the *Metaphysics* that discusses experience as an object of *scientia*.[2]

This passage is particularly well suited to my purpose for two reasons. First, *Metaphysics* was the work by Aristotle that was available to the Latin audience in the greatest diversity of interlingual translations. As well as two incomplete translations, not discussed here, two complete translations from the Greek reached Latin readers,[3] the *translatio media* by an anonymous translator in the twelfth century, and the *translationis mediae revisio* by William of Moerbeke (composed c. 1265–72).[4]

Second, these Latin translations were divergent in their wording. In the opening passages, which convey the route from memory to experience, both Latin translations—the *translatio media* and the *revisio Moerbekana*—follow the Greek original to the letter. Both render the Greek *gignetai d'ek tēs mnēmēs empeiria* (from memory, experience arises, 980b27) and *ai gar pollai mnēmai tou autou pragmatos mias empeirias dynamin apotelousin* (for many memories of the same thing produce the power of one experience, 980b28–981a1) as "fit autem ex memoria experimentum" (but from memory experience arises) and "eiusdem namque rei multe memorie unius experientie potentiam faciunt" (for many memories of the same thing produce the power of one experience). In both the Greek and the Latin versions, *mnēmai / memorie* are given the active role of producing *mias empeirias dynamin / potentia experientie*.

When they convey the route from experience to the universal, however, the two Latin translations diverge rather strongly. The anonymous translator of the *translatio media* rendered the Greek *ek pollōn tēs empeirias ennoēmatōn mia katholou genētai peri tōn homoiōn hypolēpsis* (from many thoughts of experience one judgment is gained concerning similar things, 981a5–7) as "ex multis experimento intellectis una fit universalis de similibus acceptio" (from many things understood through experience there arises one universal apprehension of similar things). Moerbeke set his red pencil to this Latin rendering. His revision translated the Greek instead as "ex multis experimentalibus conceptionibus una fit universalis de similibus acceptio" (from many experiential conceptions there arises one universal apprehension of similar things).[5]

These Latin translations of the Greek *ek pollōn tēs empeirias ennoēmatōn* seem to suggest a lack of unanimity about the role of intellection for experience.[6] But how did the Latin readers of the different translations build their philosophical *scientia* of experience upon the different formulations chosen by the translators? And what kind of epistemic authority did they grant to the translated words in that process, reframing and repurposing them in their very own acts of epistemic translation?

My aim in this essay is to show, first of all, that the Latin audience generally endowed the words of the Latin translations on experience with a *scientia*-centered authority as opposed to a language-centered authority. Having said that, this *scientia*-centered authority embraced quite different specificities in the commentaries of three of the most influential Scholastic commentators on Aristotle's *Metaphysics*, Albert the Great (1200–1280), Thomas Aquinas (1225–1274), and John Buridan (1300–1361).

Albert the Great gave what I will call a "demonstrative" authority to the words on experience in front of him. His *scientia*, as will become clear, took the words of the Latin *translatio media* upon which he commented to convey quite literally true and certain knowledge of experience's characteristics and epistemic role. Thomas Aquinas, in contrast, assigned an "authoritative" value to the words of the *translatio Moerbekana*. Aquinas's *scientia* of experience was thus, as I show, an exegetical exercise, explaining what Aristotle meant by experience and its epistemic role. John Buridan probably used the *translatio Moerbekana* as his template, but strayed more significantly from the Latin translation in his *Lectura Erfordiensis*, a question commentary. Buridan did not grant primary epistemic authority to the words of the translation, which he used as a thematic framework. Rather, he introduced epistemic criteria derived from medical practice in order to account for what experience is and how it works. Having shown that Albert, Aquinas, and Buridan accorded divergent types of epistemic authority to the Latin translations, thus reframing and repurposing the words in significantly different ways, I close with a brief discussion on the value of reading these and similar commentaries as philosophical *scientia* in practice.

Albert the Great on Experience in the *translatio media*

The diverse epistemic functions and meanings that the Latin translations and the ensuing Latin tradition poured into the conceptual pair *experientia*

/ *experimentum* may be discerned from the short passage at the beginning of the *Metaphysics* that I outlined above. In the Greek original and the two Latin translations, *mnēmai* / *memorie* (memories) are interpreted as performing the active role of producing *mias empeirias dynamin* / *potentia experientie* (the power of one experience). But this *dynamis* or *potentia* does not yet seem to be perfected. This may be one reason why Albert reads the *translatio media* of Aristotle's *Metaphysics* through an act-potency lens: he explains that the apprehension of universals, inasmuch as it is taken directly from singulars (including singulars in memory and experience), is an imperfect act or a second potency. The act is imperfect because it is still in motion and has not yet reached its goal; this much is clear from Aristotle. But for Albert, it is also imperfect because it is disordered and mixed, presumably with particularity. In contrast to the *potentia experimenti*, Albert explains, *scientia* and *ars* are the noetic actualities or the goals to which experience is to lead, and, in contrast to experience, they are ordered and unmixed, unwavering and pure.[7]

In Albert's eyes, *ars* does not arise from experience alone—or from many experiences, for that matter—but rather from the simultaneous involvement of experience and a prior universal in the intellect. In his views on the emergence of *ars*, Albert was deeply influenced by the *translatio media*'s rendering of Aristotle's *ek pollōn tēs empeirias ennoēmatōn mia katholou genētai peri tōn homoiōn hypolēpsis* (from many notions gained by experience, one universal judgment about similar objects is produced) as "ex multis experimento intellectis una fit universalis de similibus acceptio" (from many things understood from experience, one universal apprehension arises about similar things). In his exposition commentary, he writes:

> *But art arises* and is generated and perfected in us, when *from many things*, not confused—to be sure no longer [confused]—*through experience* by the purification of a universal *concept* by true and certain reason, *one universal apprehension arises*, abstracted *of all similar things* in an essential way, [an apprehension] for which it is proven that there are no exceptions.[8]

In this passage, Albert's "universal concept" (*universalis intellectus*) surrenders experience to an intellectual grasp. I here read *universalis intellectus* with MS family β, instead of *universalis intellectis* with MS family α. Read in this way, the status of experience is now elevated from a sensitive type of cognition to a mixed type of cognition; any newly acquired experience is informed simultaneously by the sensitive and the intellectual realms.

Albert here accepts the *translatio media*'s reading, with the probable change of *intellectis* to *intellectus*, thus highlighting the role of the prior universal whose role it is to purify, order, and essentialize the newly acquired experience. The concept has been generated "by true and certain reason," in reliance on the cognitive faculties that Albert considered the human soul to possess. Crucial among them is the agent intellect, for without this intellectual faculty to abstract the universal from the particular, there would be no universal concept in the first place. But the prior concept already present in the intellect matters too, as it immediately determines and specifies the new universal abstracted from experience. We are left, then, with a similar picture to the one Albert painted in his *Posterior Analytics* commentary, according to which every *ars* is achieved by a preexistent intellectual cognition.[9]

What Albert meant exactly by this preexistent intellectual cognition can be gleaned from his *Physics* commentary, a work he wrote at the very beginning of his commentary project in 1251. There, Albert distinguishes between confused and distinct universals of all things physical, similarly to the long commentary tradition on this passage, especially the works of Avicenna and Averroes, who exerted considerable influence on his view.[10] He explains that the "physical universal" (*universale physicum*) may be acquired by means of three different types of perception: perception through the external senses alone; perception through common sense and the external senses; and perception through "reason mixed in sense or in cognition" (*confusae rationis in sensu vel cognitionis*), common sense, and the external senses.[11] The last of these three types of perception is most relevant here, for it is this type of perception that does not concern the accidental properties of physical things, such as colors and shapes, but "extends over the common nature in the extended underlying subject,"[12] namely being (*esse*) and, as we learn later, substance (*substantia*). Albert here situates his discussion of perception through mixed reason, common sense, and the external senses solidly within a hierarchy of the soul's sensitive and rational faculties.[13]

The cognitive process that Albert takes to be involved in knowledge acquisition of physical things—things that are "in their totality conceived with matter in their being and their definition"[14]—starts from a confused universal as their common factor, for instance, from "animal."[15] Only afterwards does it proceed to an ever more specified universal, by increasingly determining and specifying the most general universal "animal" until it is finally defined through the proximate genus and specific difference, resulting in the most specific species (for instance, the six different species of eagles that Albert knew).[16] Albert identifies this cognitive process as a process of resolution (*resolutio*)—the "breaking down" of a vague universal into its different components—which he distinguishes from its opposite cognitive process, that of composition (*compositio*).[17]

Resolutio involves the intellect right from the start; the natural scientist uses it to acquire specific, essential knowledge about things in the world. *Compositio*, in contrast, requires the sensitive soul—the external senses and common sense—to be involved first, before the intellect enters the picture. But these senses together can only give rise to an overly general universal—a universal whose coming-to-be has not been regulated by the prior involvement of the scientist's intellect in allocating the newly abstracted universal to the correct genus and species.[18] Precisely this kind of prior involvement of the intellect is required in order to reach the proper definition of any given thing.

In the *Metaphysics*, sense perception, just like experience, thus has a subordinate, mediating role, yet it is integral to the intellectual processes. Neither the product ultimately sought nor the perfect capacity and activity of the scientist, sense perception is nonetheless critical for facilitating the products of *ars* and *scientia* as a perfection of the scientist's soul through the structured study of physics, mathematics, and metaphysics.[19] The perfection of the soul through *ars* and *scientia* is ultimately achieved through the removal of disorder, instability, and the possibility of opposites, which are still present in the objects of sense perception and experience.[20]

Albert's considerations here focus on the epistemic content of these objects. He argues that their essential properties yield a true and certain universal because they are ordered, stable, and without exceptions. His thinking on the analytic process of cognition, as elaborated in his *Physics*, is clearly in conversation with the *translatio media* of the *Metaphysics*, which he took to imply the priority of the universal concept *before* any new perception and experience. For Albert, *ars* and *scientia* are therefore unthinkable without perception and *experientia*. These are required at the beginning of cognition (a point I could only touch on here), in assenting to first principles (which I have had to leave undiscussed), and in specifying those universals that are already present but are too general to be useful (the point addressed here).

Albert's exposition commentary on the *translatio media* of the *Metaphysics*, read in conjunction with his *Physics* commentary, thus reveals how he practiced his *scientia* of experience in its relation to universals, not to things in the world. It was the precise wording of the *translatio media* that conveyed to him, in an instrumental way, the *scientia* of experience. Yet those words required more precise explanation if they were to constitute true and certain knowledge in a comprehensive fashion. This is why I argue that for Albert, the authority of the *translatio media* of the *Metaphysics* was epistemic rather than linguistic.

But there is more. Albert's discussion discloses how much he tailored the *scientia* of experience contained in the *translatio media* to *doctrina*, his practice of *scientia* as in the classroom. Albert insists on the embeddedness of experience into prior, but too generic, universals and posterior, now specifically refined, universals, and he is committed to the intellectual process of *resolutio*. In both of these stances, experience is maximally conducive to theorizing—for the type of experience theorized here maps perfectly onto Albert's pedagogical conception of the order of natural *scientia*: from the generic universals, as contained in the *Physics*, to the most specific universals, as contained most prominently in the *De animalibus*.[21]

The *translatio media* of the *Metaphysics* thus possessed crucial epistemic authority for Albert, since its cautious phrasing "ex multis experimento intellectis" (from many things understood through experience) confirmed to him the exact order and approach required for acquiring *ars* and *scientia* through *experientia* in dependence on universals. In contrast, the phrasing of the *revisio Moerbekana*, "ex multis experimentalibus conceptionibus" (from many experiential conceptions), no longer left that option open—leading its most prominent reader, Thomas Aquinas, in a strikingly different direction.

Thomas Aquinas on Experience in the *revisio Moerbekana*

Unlike Albert the Great, Thomas Aquinas read Aristotle's *Metaphysics* as positing grades of human cognition. Rather than the different cognitive processes of *resolutio* and *compositio* that Albert endorsed, and rather than the order in which *compositio* and *resolutio* yield *ars* and *scientia*, Aquinas advocated the cognitive process of *collatio*, naturally in his own peculiar reading of it.[22] *Collatio* was a view of sense perception and experience that Albert regarded as unsuited for philosophical *scientia* (though suited for rhetoric), as it could not yield ordered and distinctive universals.[23] But for Aquinas, in his commentary on the *revisio Moerbekana*, the corrected version of the *translatio media*, *collatio* was the solution, simply because there were no textual grounds to invoke the priority of a universal concept before experience.

What Aquinas found in the *revisio Moerbekana* was nothing but a straight path from memory, to experience, to the universal: "ex multis experimentalibus conceptionibus una fit uniuersalis de similibus acceptio" (from many experiential conceptions, one universal meaning arises about similar things).[24] These "experiential conceptions," however, left little room for combining experience and the intellectual activities into an ordered process of *resolutio*, as had been the case with the *multis intellectis* prior to *experimentum* in the old translation. Without such an ordered process, Aquinas suggested, experience

> derives from a *collatio* of many singulars that have been received into memory. But in this way, *collatio* belongs to humans alone, and pertains to the cogitative power, which is called "particular reason": the collective [power] of individual intentions, just as universal reason is [a power] of universal intentions.[25]

The reference to cogitative power is Aquinas's implicit tribute to Averroes. Much more relevant than the source or definition of this power, however, is Aquinas's construal of its function as analogous to that of the intellect. *Collatio* applies analogously to both grades of cognition—to particular reason in causing experience, and to universal reason in causing universals—but there is no account of the involvement of universal reason in the activities of particular reason.

Whether by *collatio* Aquinas meant a cumulative or a combinatory activity of the cogitative and intellectual powers can be gleaned from his account of the causation involved: "For he [i.e., Aristotle] says first that, in humans, experience is caused from memory. But the kind of causation is the following: because from many memories of one thing humans receive an experience of something."[26] The starting point for the many memories that give rise to one experience is one thing in the world, and not similar things. Whether this one thing is one in number or one in kind remains unsaid. The memories derived from it, though, seem to have established sufficient grounds for sameness in quality. The *collatio* of experience from many memories therefore equates to a quantitative accumulation of like qualities, and the analogous case holds true for the intellect.[27]

The sharp distinction between experience, with its focus on singulars, and art, with its focus on universals, resonates in the types of knowledge that Aquinas assigns to each grade of cognition. Experience equals knowledge of the fact (*quia*), art equals knowledge of the cause (*propter quid*), because "the artists know the cause."[28] In contrast to Aquinas's gradation, Albert's solution included *quia* and *propter quid* knowledge for all *scientiae* and *artes*, and it did so because more general universals were involved in ordering the kind of experience that made possible more specific universals.

A further explanation of these divergences can be found in the different commentary practices the two men used to promote the norms of truth and certainty. Albert's commentary practices relied on demonstration within a system of *scientia*. They followed the system's peculiar didactic and natural orders, and they pursued nothing less than the perfection of the scientist as *homo solus intellectus*.[29] These practices entailed the systematic integration of all demonstrative knowledge available, which Albert believed could be found in the Aristotelian tradition. But they also required supplementation by new demonstrations: in Albert's eyes, they lacked comprehensive authority, since the *scientiae* had not come down in full to the Latin world.

In contrast, Aquinas's commentary practices used demonstration as an exegetical enterprise, selecting works from the *corpus Aristotelicum* and signposting the Philosopher's authority in almost every section: "Aristotle says first," "Then, when he says," "Therefore, he says," and so on. For Aquinas, Aristotle's authority lay in the demonstrations presented in his works, and only when incomplete did these have to be expanded and explained (tweaked, too, especially when they apparently conflicted with the Christian faith). A comprehensive and literal system of *scientia* by means of *doctrina* versus textual exegesis is thus what marks out the particular takes on demonstration in Albert and Aquinas.[30] What did that mean for the Scholastic audience when neither a system nor exegesis were the main means to promote the norms of truth and certainty?

John Buridan on Experience in His *Lectura Erfordiensis*

The epistemic function of experience, described by Albert earlier as the analytic process of *resolutio*, took center stage once again in the work of the fourteenth-century philosopher John Buridan. Buridan's *Lectura Erfordiensis* was a question-commentary taught at Erfurt and thus, as Lambert de Rijk aptly remarks, was not a classic commentary but "a course of metaphysical questions inspired by the subject matter of the first books of *Metaphysics*."[31] Quite independently of any direct link to the *translatio media* and Albert's commentary on it, or to the *revisio Moerbekana*, Buridan pursued his very own interpretation of experiential cognition (*cognitio experimentalis*) as a case of quasi-intellectual cognition. He did not conceive of it as something sensed, but connected it to prior sense perceptions by way of correspondence, checking similar properties against prior sense perceptions:

> Sensible cognition [*cognitio sensitiva*] takes place in the presence of the sensible object itself: for it is just as you cognize this fire to be hot if you touch it. But memorative knowledge [*notitia memorativa*] is had of something that has previously been sensed through a preserved species in the memorative power: and thus, you cognize in this way that *this* fire which you sensed yesterday, was hot. But experiential cognition [*cognitio experimentalis*] is said of things that have never been sensed by you except through similar things that have been sensed by you. For instance, I say: You have never touched *this* fire, and nonetheless you cognize it to be hot. Even a dog that does not have an intellect would judge it from afar to be hot, because he has cognized many other, similar cases through touch to be hot, of which the memory has remained for him. For this knowledge [*notitia*] is called proper experiential knowledge, according to which experiential knowledge [*notitia experimentalis*] is distinguished from sensible and memorative knowledge.[32]

Buridan here exemplifies rather than explains how judgment about similar properties is possible, even for a dog: singling out the property of the heat of a fire without sensing its heat, the dog must rely on previous sense perceptions of other fires' heat. For humans, Buridan specifies the path of reasoning between similar properties even further as a path of syllogistic reasoning. Against what he considers a bad habit among some of his colleagues, their incorrectly identifying sense perceptions as experiences, Buridan suggests that a universal judgment is built by means of a proper inductive method. Only the repetition of many sense perceptions *without exceptions* gives rise to intellectual assent that something is always the case, even if it remains unsensed:

> It is true that we often call sensitive cognition "experiential." Thus, if you have touched *this* fire, you sometimes say you know from

> experience that it is hot. But this is improper [use] of [the term] experience, according to which experience is distinguished from actual sensation. And in this way, it is manifestly the case that experience is properly said to come to us from many sensations and memories. Consequently, if someone sees one time that *this* rhubarb purges the bile, he does not, after this, immediately judge with certainty that this other rhubarb purges the bile too. But if he sees it many times without exception, then he assents to the other case in a similar way. After this, you need to know from the power of the aforementioned types of cognition, the intellect arises to give approval to a universal proposition, both that all fire is hot and that rhubarb purges the bile. And this universal proposition is taken as a principle, so to speak, in art or in science.[33]

Unlike Aquinas's quantitative accumulations of memories to produce one experience, and of experiences to give rise to one universal, Buridan defines experience as a particular assent under new and strict epistemic conditions: invariability, recurrence, and similarity. This is an astonishing integration of epistemic criteria that, given the examples he chooses, Buridan surely borrowed from medical epistemology (the reference to the medical commonplace of rhubarb purging the bile makes this even more noticeable). For Albert and Aquinas, such conditions were only explicitly applicable on the level of intellect, but Buridan insisted on them for experience as well. His use of syllogisms and analogies—as Buridan knew well, excellent logician that he was—could also be applied to cognition of the particulars relevant for experiential cognition. Buridan also applied epistemic norms from the medical tradition for his natural philosophy,[34] but the fact that he integrates this medical rationality into his fundamental epistemological reflections on the *Metaphysics* is remarkable, setting new epistemic standards from a regulatory rather than an applied perspective.[35]

Both here and in his *Posterior Analytics*,[36] Buridan failed to specify what exactly identifies two properties as being sufficiently similar to one another. The two examples of the quality of heat in fire and the healing quality in rhubarb only allude to what Francis Bacon later specified in the lists of his *Novum Organon*.[37] Nonetheless, Buridan's view on *cognitio experimentalis* or even *notitia experimentalis* marks the beginning of the application of method on the level of the sensitive soul rather than on the level of the intellect, applying intellectual criteria of reflection, circumstances, and evidence to sense perceptions, as was a long-standing practice in medicine:

> Experiential knowledge [*notitia*] is certain and infallible, if it is confirmed on the basis of exceedingly many sense perceptions and memories together with a reflection on the memories, circumstances, evidence of the art [*apparentia artis*], etc. Otherwise, experiences are fallacious.[38]

Sense perceptions, in Buridan's eyes, still directly affect the building and accumulation of memory, but memory only indirectly affects experiential cognition. Its role is to prepare the scientist to evaluate a new case in front of him as being something similarly applicable to the prior sense perceptions that are retained in his memory, and to assent to its similarity only if the other two criteria, invariability and recurrence, have been met. Unlike Albert, then, who brought experience and intellection close to one another by intertwining the two processes, Buridan extended epistemic criteria originally reserved for intellectual cognition to cover experiential cognition as well, a move that was most certainly inspired by his acquaintance with medieval medicine and its practice. At least nominally, Buridan took seriously and elaborated upon the seeds of induction that he found in Aristotle's *Posterior Analytics* II.19. This elaboration also made it possible to uncouple experiential knowledge from the scientist currently exercising it, for it is in the specification of its epistemic criteria that experience becomes an objectified process of reasoning about particulars.

For Buridan's conception of experience, unlike for Albert's or Aquinas's, the Latin translation of Aristotle's source text carried little epistemic authority. Even though Buridan's classroom commentary loosely followed Aristotle's *Metaphysics* in its general epistemic make-up of experience for any given cognitive process, he inserted epistemic criteria from a different discourse into the very core of experience. These he most certainly derived from his acquaintance with medical practice, a practice that appears to him to explain the usefulness of experience more accurately than do the remarks in the translations of Aristotle's *Metaphysics*.

Buridan's turn to an external practice, seemingly unrelated to that of philosophical *scientia*, marked a striking reorientation in his conception of the relationship between experience and *scientia*. It was no longer the translated text, nor the intellectual endeavors related to the translation, namely *doctrina* and exegesis, that conveyed *scientia* about experience. The necessary and sufficient criteria for experience to count as experience conducive to *scientia* were no longer determined by *scientia* itself, but rather by medical practice. Buridan may, then, perhaps have been one of the first medieval philosophers to dissolve the interpretive hegemony of *scientia* over experience.

Conclusion

This essay has studied the epistemic authority that the *translatio media* and the *revisio Moerbekana* of Aristotle's *Metaphysics* were granted by Albert the Great, Thomas Aquinas, and John Buridan in their commentaries on the meaning and role of experience. The authority of the template differed substantially, in line with the strategies of epistemic translations the three commentators employed and the ends to which they did so.

Albert granted demonstrative authority to the *translatio media* in its power to convey a *scientia* of experience, which he elaborated upon by determining the precise relationship between the universals and experience.[39] Thomas Aquinas granted authoritative value to Aristotle's words as he found them in the *revisio Moerbekana*, and exegetically determined their epistemic value for the *scientia* that Aristotle propounded. John Buridan, finally, strayed away from the authority of the *revisio Moerbekana* in his question commentary *Lectura Erfordiensis*, and turned instead to the epistemic authority of medical practice. It was this practice, in his eyes, that disclosed the proper conditions under which experience is conducive to *scientia*.

In contrast to his two predecessors, Buridan thus gave the oral practices of lecturing and listening to the Latin translation of Aristotle's *Metaphysics*, and the textual practices of reading and writing commentaries upon it, much less epistemic authority to shape the subject matter of experience. Instead, he granted authority to those practices where experience was itself the approach of choice—thus translating the epistemic authority of experience into a practice outside the classroom. This is not to say that he embraced an empirical method for his *scientia*, quite the contrary. Indeed, Buridan followed a path of epistemic translation that his thirteenth-century predecessors had already walked—he commented on Aristotle's *Metaphysics* in the classroom just as Albert and Aquinas had done. But this path also enabled him to build his own, distinctive epistemic edifice out of a few highly canonized sentences. Contrary to Albert and Aquinas, he filtered the epistemic questions contained in these sentences through a different discourse, medicine, rather than through orality and exegesis. In his explicit use of this external discourse, Buridan acknowledged the importance of an empirical practice outside of philosophical *scientia* for determining the epistemic meaning and role of experience within it. Whether this particular type of epistemic translation was commonly continued by Buridan's school or other Scholastic thinkers of the fourteenth and fifteenth centuries remains to be studied. But it certainly set up a much more pronounced opposition between the epistemic practices of the classroom and those outside the classroom, thus opening up the cognitive possibility of identifying the classroom practices as "bookish" and those outside as "empirical."

Notes

1 See Chase in this volume.

2 Parallel passages are found in Aristotle's *Posterior Analytics* II. 19, 100a5–b5; *Nicomachean Ethics* VI. 7–8, 1141b8–1142a21; *Metaphysics* I. 1, 980b26–982a3.

3 As Gudrun Vuillemin-Diem explains, the two incomplete translations were the *translatio Iacobi* ("vetustissima"), made by James of Venice in the middle of the twelfth century, and the *translatio composita* ("vetus"), which revised the

translatio Iacobi and was made before 1236. Both translations translate the *Metaphysics* up to 1007a31, whereas the revision of the *translatio composita* breaks off at 998b23. Vuillemin-Diem, "Die *Metaphysica media*," 7–8.

4 Vuillemin-Diem, "Die *Metaphysica media*," 8–12. In addition, the Latin audience had access to at least one Latin translation of the *Metaphysics* from the Arabic (before 1237), which was transmitted together with Averroes's *Long Commentary on the Metaphysics*. However, as is well known, Averroes bases his commentary on the Arabic translation by Eustathius (c. 850) from the Greek that starts with 987a9 rather than 980a21, but he also cites "another translation," probably by Ishaq ibn Ḥunain (d. 910). In general, the transmission history of the *Metaphysics* from Greek to Arabic is extremely complex. See, e.g., Martin, "La Métaphysique." I thank Michael Chase for pointing out this complexity and reference.

5 Aristoteles Latinus, *Metaphysica, lib. I–X, XII–XIV, translatio anonyma sive 'media'*, ed. Vuillemin-Diem, 7.21–22; Aristoteles Latinus, *Metaphysica, lib. I–X, XII–XIII.2, translationis mediae recensio*, ed. Vuillemin-Diem, 12.24.

6 The two incomplete Latin translations provide yet other renderings. Aristoteles Latinus, *Metaphysica, lib. I–IV.4, translatio Iacobi sive 'vetustissima' cum scholis et translatio composita sive 'vetus'* I. 1. 1 vetustissima, ed. Vuillemin-Diem, 5.18–19 and 23–24; ibid. vetus, ed. Vuillemin-Diem, 89.16–18.

7 See Albertus Magnus, *Metaphysica*, I. 1. 7, ed. Geyer, 10.71–11.18.

8 Ibid., I. 1. 7, 11.36–41. The italicized passages in my translation are the source text that Albert glossed.

9 See Albertus Magnus, *Analytica Posteriora*, I. 1. 3, ed. Borgnet, 8a.

10 For a very helpful and detailed overview, see Lammer, *Elements*, ch. 2.

11 See Albertus Magnus, *Physica*, I. 1. 6, ed. Hossfeld 11.51–71.

12 Ibid., 12.1–4.

13 This could be understood to coincide with the estimative faculty, but Albert distinguishes it from *experientia*. See Albertus Magnus, *De anima*, II. 1. 2, ed. Stroick, 168.15–24.

14 Albertus Magnus, *Physica*, I. 1. 1, ed. Hossfeld, 2.31–33.

15 See ibid., I. 1. 6, 11.93–12.19.

16 See Albertus Magnus, *Metaphysica*, I. 1. 10, ed. Geyer, 14.84–15.10. On the eagles, Albertus Magnus, *De animalibus*, XXIII, tr. un., ed. Stadler, 1436.34–1437.17.

17 See Albertus Magnus, *Physica*, I. 1. 6, ed. Hossfeld, 12.41–66. For the ancient background, see Chase, "*Quod est primum*."

18 See the passage cited in the previous note and also Albert's very similar discussion on rhetoric in the *Posterior Analytics* above.

19 Albert describes the connection between natural philosophy, mathematics, and physics in *Metaphysica*, I. 2. 10, ed. Geyer, 28.1–6.

20 See ibid., I. 1. 7, 11.41–48.

21 See Albertus Magnus, *Physica*, I. 1. 4, ed. Hossfeld, 6.34–8.13.

22 Two excellent papers have explained in much greater detail than space permits me to do here Aquinas's take on experience in Aristotle's *Metaphysics*: Lutz-Bachmann, "'Experientia'"; King, "Two Concepts."

23 Albertus Magnus, *Analytica Posteriora*, I. 1. 3, ed. Borgnet, 11a. Albert defines cogitation earlier in his *De homine* (ed. Anzulewicz and Söder, 481.3–4). The Augustine reference here is probably to *Confessions*, XI. 18.

24 Aristoteles Latinus, *Metaphysica, lib. I–X, XII–XIII.2, translationis mediae recensio*, I. 1, ed. Vuillemin-Diem, 11.9–12.25.
25 Thomas Aquinas, *In duodecim libros Metaphysicorum Aristotelis expositio*, I. lect. 1, ed. Marietti, 8, par. 15.
26 Ibid., 9, par. 17.
27 See ibid., 9, par. 18.
28 See ibid., 10, par. 24. It should be noted that in his commentary on the *Posterior Analytics*, Aquinas provides a rather different interpretation of how experience and reason relate. See Thomas Aquinas, *Expositio libri Posteriorum* II, lect. 20, ed. Leonina, 244.144–246.287.
29 For instance, Albertus Magnus, *De anima* I. 1. 1, ed. Stroick, 2.32–33; *Ethica* IX. 3. 1, ed. Borgnet, 585a; *Super Iohannem* VIII:32, ed. Borgnet, 352a. Albert develops the implications of this formula concisely in his *De natura et origine animae*, 2. 13, ed. Geyer, 38.85–39.8. See, e.g., Anzulewicz, "Anthropology"; Krause and Anzulewicz, "Albert the Great's *Interpretatio*."
30 Albert's commentary on the *Metaphysics* can be identified as a proper *expositio* commentary. Not unlike Aristotle's template, it is divided into *tractatus* and *capitula*. Its main mode of commenting consists in long paraphrases of the template, expanding upon it by extending sentences, adding paragraphs or even entire chapters. However, unlike Aquinas's *expositio* commentary, Albert's commentary is not divided into *lectiones*. These reflect the oral lectures of the university or *studium generale* classroom. Markedly absent from Albert's commentary are also the *divisiones textus*, which typically stand at the beginning of a *lectio*, as is the case in Aquinas's commentary. Unlike later *expositio* commentaries, neither Albert's nor Aquinas's contain *dubia* or appended *questiones*. As such, Albert's and Aquinas's commentaries differ strongly in form from Buridan's *questio* commentary, which does not explain the base text in detail, but rather focuses on select themes in the text.
31 De Rijk, "Introduction," lxxiv.
32 John Buridan, *Lectura Erfordiensis*, q. Iva, ed. De Rijk, 26.29–27.14.
33 Ibid., 27.14–28.
34 This has recently been observed by Chiara Beneduce in her comprehensive study on Buridan's acquaintance with ancient and medieval medicine, "Natural Philosophy." See especially 187–89, on the epistemological relation between the two disciplines. For those who wonder about the precise medical sources of Buridan, Beneduce writes: "It is not easy, given our present state of knowledge, to determine how exactly Buridan got acquainted with those doctrines, whether his medical sources were second-hand or first-hand, and precisely to what extent he knew theoretical medicine" (182).
35 Galen's *De sectis* II reports similar epistemic values held by the Empirics, but these are not his own. On this possible background of John Buridan, see Chase in this volume, especially 31. The medieval Latin translation of *De sectis* was made by Burgundio of Pisa from the Greek original. See McVaugh, "Galen."
36 See, e.g., John Buridan, *Analytica Posterior*, I, q. 2a, ad 9, ed. King (http://individual.utoronto.ca/pking/resources/buridan/QQ_in_Post_An.txt), where he connects the criterion of repetition with Averroes's take on induction at the beginning of his *Physics*.
37 See, e.g., the discussion of heat and its reliance on fire in book II, aph. 11–22.

38 John Buridan, *Lectura Erfordiensis*, q. Iva, ed. De Rijk, 29.1–5.

39 The most likely reason why Albert commented on the *translatio media* instead of the *revisio Moerbekana* is simply a matter of availability and common practice. Albert wrote his commentary around 1264 (for the dating, see Albertus-Magnus Institut, "Albertus Magnus," 30); Moerbeke's translation was probably made between 1265 and 1272 (for the dating, see Vuillemin-Diem, "Die *Metaphysica media*," 11). Common practice is discussed at length in Vuillemin-Diem, "Praefatio."

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2 Scientific Tasting

Flavors in the Investigation of Plants and Medicines from Aristotle to Albert the Great

Marilena Panarelli

Among the most controversial terms that were translated in the context of medical pharmacology during the twelfth and thirteenth centuries are, without doubt, those related to the classification of flavors. This is especially true from the perspective of the history of knowledge transmission. Although initial attempts to categorize flavors were made during Antiquity by Aristotle and Galen, a thorough categorization was completed only during the Middle Ages, in the field of Arabic medicine.[1] This categorization was then translated into Latin and transmitted to the Latin West.[2]

The transmission of knowledge regarding sensory data—such as flavors—faces some particular linguistic and epistemic obstacles, since such data are closely linked to direct experience. In addition, a precise categorization of flavors required a systematic approach to the experience of natural elements such as plants. I investigate the development of the doctrine of flavors during the Middle Ages, in terms of two questions: What role did the doctrine of flavors play in the development of medical and philosophical knowledge in the period? And how did the translation of terms for flavor from Greek to Arabic to Latin and the classification of flavors facilitate the transmission of scientific teachings on flavor across linguistic borders?

The most important value that flavors carried for the premodern natural philosopher was not their phenomenology, but their expressive properties. For different scientists, the different flavors could express anything from the substantial qualities of plants, to the pharmacological properties of simple medicines (*simplicia*), to the states of maturation of food, to the operations of drugs. How could the same flavors, with the same phenomenological properties, be expressive of such a wide range of different scientific ideas?

To answer these complex questions, I will turn first to the disciplines within which the flavors were put to use in shaping scientific ideas. It is well known that flavors played a key role in the discipline of botany and in practical medicine, both dietetics and *materia medica*. These disciplines had different ends—knowledge for the sake of knowledge (botany) and knowledge for the sake of use (practical medicine); knowledge for the sake of use in food (dietetics) and knowledge for the sake of use in

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drugs (*materia medica*). This meant that the flavors were translated into disciplines that overlapped, but were not identical. In each, the flavors took on different epistemic values, even though in the experiences of their phenomenological properties, they remained the same.

These epistemic translations of the phenomenologies of the flavors between different disciplines are the focus of this chapter. Specifically, I ask how, against the background of Aristotle and Galen, three medieval scientists translated the phenomenology of the flavors into dietetics (Isaac Israeli), *materia medica* (Avicenna), and botany (Albert the Great). I look at the scientific translations in Latin only, even though Aristotle and Galen composed their works in Greek, Isaac Israeli and Avicenna in Arabic. This is because I aim to show, first, the scientific ideas with which Albert the Great, the main focus of my chapter, was acquainted and, second, that he decided to pursue his own scientific goals by integrating flavors into the science of botany.

Interlingual and Interscientific Aspects of Flavor

In ancient Greek, there was an implicit relationship between the doctrine of flavors and the doctrine of humors, though this was lost in the Latin translations. The ancient Greek term *chumós* refers to flavors and humors at the same time.[3] Thus, in ancient Greek, there is a kind of assimilation between flavor and the object to which it refers: the Greek term does not denote the perceptive state of the one who tastes, but the physical state of the object of taste, its liquidity.[4] However, in Arabic and subsequently in Latin, *chumós* was translated using two different terms, separating the notion of flavor from the object of perception and instead linking it to the subject by indicating the perceived sensation of the one who is tasting. In Arabic, the notion of *chumós* was split into the words *khilṭ* (pl. *akhlāṭ*), translated into Latin as *humor*, and *ṭaʿm* (pl. *ṭuʿūm*), translated into Latin as *sapor*.[5]

The Latin epistemic viewpoint arising from the Greek *chumós* classifies flavors by systematizing humoral theory: to acknowledge a certain kind of flavor, one must identify the dominant humors or, more specifically, the complexion, which is thought of as the dominant quality resulting from the humors present in a body. This relation between *sapor* and *complexio* requires investigation, as the notion of *complexio* indicates a kind of pharmacological identity of a natural living being. As such, identifying the complexion is the primary goal of sensorial analysis. A certain complexion is also associated with certain medicinal properties of a drug or plant, which can be deduced from perceptible features such as form, color, smell, and, especially, flavor.

An epistemic analysis of *sapor* in its relationship to *complexio* is highly significant for the history of medicine, as it may help to reveal the nature of *simplicia*, medicines made of single ingredients taken from a plant. Among the different meanings assumed by the Latin term for flavor, *sapor*, the first to consider is thus its meaning as an epistemic tool of *materia medica*, pharmacology. There, flavor is the quality that, through *experientia*, makes the complexion of a natural object and its humors epistemically accessible.

To investigate the term *sapor* from this perspective, we must also analyze it as an epistemic object of theories of sense perception, looking at systematic approaches to sensible knowledge that led to the idea of reiterated experiences, *experimenta*. In fact, *sapor* is a term of both sense perception and experience, as the recognition of different flavors is the first step in a cognitive process that leads to the identification of a drug as useful for a certain kind of disease. In other words, the recognition of the differences between flavors enabled scientists to acquire a fundamental part of medical knowledge, the attribution of particular operations to particular drugs. In other discourses as well, flavor became an instrument to investigate plants as natural beings per se and the differences between them. In these discourses, too, flavor was one of the most fundamental epistemic tools, since it could provide clues to the maturity of foodstuffs and the substances of plants.

Aside from its relationship to *complexio*, another aspect of the term *sapor* is key to its history. In Latin, the semantic root shared by humor and flavor in Greek was lost, and a new etymological similarity came into focus. *Sapor* was declared to be the etymological root of *sapientia*, as in the well-known Latin saying *sapientia a sapore dicitur* (wisdom is said [to come] from flavor).[6] This etymological association of *sapor* and *sapientia* was common, but it connects two semantic fields that are actually very distant: *sapor* belongs to the senses and corporeity, *sapientia* to the field of intellectual knowledge and spirituality. Still, in the early seventh century, Isidor of Seville, in his *Etymologiae*, already acknowledged the connection between the two terms: in the same way that the sense of taste discerns flavors, the wise man discerns the causes of things, having access to the truth.[7] The activity of the wise and the activity of taste both presuppose a kind of discernment. The link between flavor and wisdom prompts the assumption that—at least in Latin culture—knowing something means recognizing its specific flavor. Thus, the sense of taste is the sense that leads to a deep knowledge of its object, implying an assimilation of the object.

In Latin, *sapor* also bore an allegorical meaning derived from biblical sources. Biblically speaking, tasting the fruit of the tree of knowledge is the origin of sin itself: by experiencing this taste of knowledge, the first man sinned. In the eyes of medieval Christians, taste, more than any other sense, determined the destiny of humankind. What remedied this original sin, depicted as tasting the forbidden fruit, was the sacrament of the Eucharist, through which humans could regain grace.[8] For the thirteenth-century Dominican friar Albert the Great, the fruit of sin is thus contrasted with the sacramental bread. Both foods are charged with meaning, but they have opposite flavors. Among the five senses, then, taste is the one that may cause sin or grace.[9]

Similarly, *sapor/sapientia* included two opposites of the cognitive process: taste, as one of the five senses, is the beginning of the process of knowledge, whereas *sapientia* is the highest degree of knowledge. In a passage of his *Super Iob*, Albert assigns an allegorical value to the sense of taste, linked to exercising judgment.[10] Taste implicitly involves the capacity of judgment, which imitates *sapientia* as such.

The extent to which this new etymological approximation influenced Albert's botany and his use of flavor there will be discussed below. For now, I shall turn to his scientific and medical sources—first Aristotle and Galen, then Isaac Israeli and Avicenna—in order to investigate their scientific translations of flavor.

Aristotle (384–322 BCE)

During Antiquity, Aristotle was one of the first to attempt a categorization of initially seven and later eight flavors, mainly in his *De anima* and *De sensu et sensibilibus*. As part of an investigation of the sensitive soul, Aristotle provided a general treatise on each sense in the *De anima*, where he connects the sense of taste to the sense of touch.[11] Aristotle states that the object of taste is tangible because it does not need any medium to be perceived. The tangible substance that is the object of taste is a moist substance, and moisture is a necessary condition for taste to be perceived.[12]

In *De sensu et sensibilibus*, Aristotle gives a more extended definition of flavor. Having claimed that water is tasteless, he observes that flavors appear when nature transforms water by adding a dry substance through the action of heat. Flavor originates when the dry substance ages into a moist one,[13] and thus results from its own opposite. In the same passage of the *De sensu*, Aristotle explains that flavors are most evident in plants precisely because they have a dry temperament, so that the contrast between moisture and dryness is stronger in them.[14] Flavor can therefore be defined as the property resulting from the dry solid (*xēros)* acting on moisture (*ugrós*). As such, flavor occurs only in food, which is a mixture composed of solid and liquid substances.

To support his thesis that the fundamental prerequisite for the perception (*aísthesis*) of flavor (*chumós*) is moisture, as the Greek term itself already expresses, Aristotle observes that the tongue is unable to perceive taste when it is completely dry, but also when it is too moist: the moisture present in the tasty substance has a solvent power on the tongue. This is why taste is a sense that perceives without a medium. By explaining the term in this way, Aristotle laid the foundation for a close connection between the doctrine of flavors and the doctrine of humors.

In *De sensu* 442a, Aristotle proposes that there are original flavors: just as all colors derive from black and white, all flavors derive from sweet and bitter.[15] These are the strongest flavors, as sweetness implies an excess of moisture, bitterness a lack of moisture. In both *De anima* and *De sensu et sensibilibus*, he lists the same kinds of flavors: sweet, bitter, oily, salty, pungent, grating, sour, and sharp.[16] The main difference between the two works is that in *De sensu* he claims they are seven in number, defining oily as a species of sweet, whereas in *De anima* the number increases from seven to eight, as oily is considered a distinct flavor. *De anima* gives a full classification of flavors and establishes three categories: simple flavors, intermediate flavors, and derived flavors. A precise quality of the substance is assigned to each flavor and there is a precise causal relationship between them. Each state of the moist substance has its own corresponding flavor. This Aristotelian approach constitutes the starting point for the translation of the eight flavors into other discourses, Galen's medical discourse being the first I turn to here.

Galen (129–c. 216 CE)

Aristotle's classification of the flavors and their connection to the sensation of taste was loosely related to a specific object, foodstuffs, but Galen translates it into his medical corpus with a clear focus on one specific object carrying those flavors: simple drugs, whose virtues, he suggests, can be discerned by means of an elaborate experiential regime. In Book IV of his *On Simple Drugs* (*De simplicium medicamentorum temperamentis ac facultatibus*), Galen offers a very detailed discussion of flavors, which proved to be crucial for the medical traditions in Greek, Byzantine, Arabic, and Latin lands.

The Latin translation made from the Arabic translation of *On Simple Drugs* is attributed to Gerard of Cremona (though this attribution remains controversial).[17] After describing the properties and effects of plants in the first books of the work, Galen dedicates the fourth book to the study of flavors, on the assumption that flavors are expressions of those properties and effects. In other words, the analysis of flavors in general is translated here into an analysis of the flavors of drugs. The pharmacological properties of the simple drugs become possible to grasp through a sensorial analysis of what is tasted. I will now explore how Galen manages this work of translation.

Galen devotes the first chapter of Book IV to the organ of taste, the tongue.[18] In contrast to the other sense organs, Galen defines the tongue as the "purity of sense" (*puritas sensus*); it is able to transform itself into that with which it comes into contact, as the saliva collects the juice of what is being tasted. He then compares the exercise of the senses to that of reason: just as dialectic leads human reason to recognize the truth, avoiding *sophismata*, so the correct exercise of the senses leads the physician to recognize the nature of the drug. The careful investigation of the flavors of drugs thus leads to a deep knowledge of them—making such investigation indispensable for the student physician.

The student of medicine, Galen argues, must memorize the precise phenomenology of the flavors of specifically expressive plants and drugs, so that each flavor may be easily recognized during the practice of medicine and not mistaken for another. For instance, in order to recognize the phenomenology of a pungent flavor, Galen insists on student physicians practicing their sense of taste by repeatedly consuming garlic, chewing it and holding it in the mouth for a long time. Learning to recognize the phenomenology of an astringent flavor, the student should consume new wine, and for the phenomenology of bitterness, the ideal substances are borax, nitrate, and myrrh.[19]

In this Galenic exercise, Aristotle's eight flavors provide the conceptual basis for the sense experience: they enable the student physician to recognize the particular phenomenologies of flavors in the foodstuff or drug. Once the student's senses have been sufficiently trained and stabilized in their exact recognition, he can move on to the second step, associating the stabilized sensorial qualities with particular virtues of drugs. This step involves a translation of phenomenologies of flavors into the operative properties of plants and, in medical practice, back from the operative properties into the phenomenologies.

For Galen, then, the discernment of flavors is already a kind of technical knowledge, attainable through a precise methodology. Training the senses under the guidance of a conceptual apparatus that distinguishes between eight different phenomenologies of flavors—inherited from Aristotle—helped Galen to scientifically translate flavors into useful knowledge for the accurate discernment of virtues in plants and drugs.

As these remarks on Galen's experiential method show, the phenomenology of flavors is here already connected with the study of botany. If one wants to determine the properties of vegetables and fruits, one must investigate their flavors, as these give some indication as to ripening, for instance.[20] Moreover, when he discusses the flavors of plants, Galen also attends to notions of botany. Flavor being the most reliable expression of the nature of a plant, it is necessary to recognize flavors so as to prepare a drug correctly, but also to be familiar with plants and fruits in other respects.[21] The Aristotelian doctrine of flavors is thus both a fundamental epistemic instrument for the Galenic physician and useful with regard to the knowledge of plants and fruits that is needed for understanding botany as such.[22] This theoretical framework, set out by Aristotle and Galen, formed the core of medieval reiterations of the topic, although the medieval thinkers I shall discuss systematized it more thoroughly.

Isaac Israeli (c. 832–c. 932 CE)

As in so many aspects of the transmission of knowledge, Arabic writers played a special part here. They not only reconsidered the number of existing flavors, but also translated the epistemic role of flavors into new classifications of foodstuffs. Most importantly, although the semantic connection between humor and flavor implied in ancient Greek was lost in Arabic, the dependence of flavors on the different kinds of humors was systematized in detail in some Arabic medical sources. One of the works where we find this translation into a full-blown theory is Isaac Israeli's *De diaetis universalibus*. Translated into Latin by Constantinus Africanus, this was one of the most important sources of Constantine's *De gradibus*, a fundamental text of the Salernitan Medical School.[23] The section on flavors in Isaac's *De diaetis* is a long and well-structured piece of theorization. It begins with a statement that identifies the cause of the diversity of flavors as the different *complexiones* of food: the preeminence of one of the active qualities (heat or cold) over one of the passive qualities (moisture and dryness) generates different kinds of flavors.[24]

According to Isaac, there are two causes for the diversity of flavors: differences in the *complexiones* of foodstuffs, and differences in the actions of the active qualities on the passive ones. Isaac offers a kind of genealogy of flavors, stating that the beginning (*initium saporis*) is twofold—a flavor needs both the dry and the moist substance to be perceived, which is in line with Aristotle's explanation.[25] This means that the mutation of flavors corresponds to a change in the balance of dried and moist components. Here, Isaac clearly relies on the idea, already present in Galen, that a different flavor can be associated with each step of a fruit's maturation. This idea would become central some centuries later: in Albert's *De vegetabilibus*, for instance, we find the notion that the growth of fruits and plants can be considered a kind of cooking.

For Isaac, the different degrees of flavors represent the different degrees of the process of the perfection of the fruit, as the maturation of a fruit is always a passage from tartness (*ponticitas*) to sweetness (*dulcedo*). This example helps him to explain how one flavor changes into another. The passage from one flavor to another can be gradual or immediate: grapes, for instance, become *dulces* only after before having been *acetosae* (sour) and *stipticae* (astringent), while dates do not pass through such intermediate stages, their taste changing immediately from tart to sweet. However, a nongradual transformation from tartness (*ponticitas*) into sweetness (*dulcedo*) may happen in two ways, depending on the modification of the tangible qualities of the substance itself: it may be due to the substance of the fruit being hard from the beginning or becoming hard while becoming sweet.[26] Once again, the cause of different processes of fruit mutation is sought in the composition of the nourishment.

Unlike Aristotle and Galen, Isaac thus considers the phenomenology of flavors to reflect the state of the substance, namely the kinds of moistures present especially in vegetal foods. Isaac translates the phenomenology of flavors into a context that is directed not only at the exercise of the sense of taste as such, but at an interpretation of the general state of the substance—at the ability to recognize the kinds of moisture present in the substance and, consequently, their specific actions.

A key piece of theory underpinning Isaac's phenomenology of flavors is that the balance between heat and moisture generates different kinds of *sapores*. This interpretive scheme translates every type of moisture into a certain type of flavor, which may be further distinguished. For instance, the flavor-type tartness (*ponticitas*) may be modified into two different kinds of flavors, astringency (*stipticus*) and sourness (*acetosus*). But the description of the transition from one flavor to another also implies that there is a causal relationship between them, one that testifies to different states of transformation of the same substance. This transformation is regarded as the perfection of a fruit, leading to its maturation. Sweetness is the flavor that indicates the highest edibility, as Galen also noted several times, because it corresponds to the last step of maturation.

It is not by chance that Isaac considered the *complexio* of sweetness to be the one closest to that of human beings; this explains why sweet foods are the most nourishing and most easily digested. At the same time, the translation of flavors into a theory about *complexiones* carries significant implications: the epistemic value of flavors, conceived of as phenomenological information derived from sense perception, is no longer universally valid, but always valid only relatively to the tasting subject. A certain kind of flavor may indicate that a substance is good for humans, but that might not hold true for every other animal as well. Isaac's categorization served as a way of determining what kind of foodstuff was most suitable for the different human temperaments, in a text that became one of the most authoritative sources on this doctrine not only for dietetics, but also for pharmacology and botany.

Avicenna (Ibn Sīnā, c. 980–1037 CE)

Whereas Isaac translated the phenomenology of flavors into a theoretical categorization concerning food and dietetics, Avicenna went a step further by establishing a clear connection between flavors and the virtues of drugs. This type of scientific translation from the perceivable properties of plants to their unperceivable virtues was complex, and Avicenna reflected carefully on the investigation of the effects and operations of drugs.[27] He suggested that in general such an investigation may proceed in two ways, through experiments (*semita experimenti*) and through rational analysis (*semita rationationis*);[28] the particular study of flavors was part of the second method, rational analysis. Avicenna understood this to imply a kind of reasoning that moved from recognizing the sensory features of the substance to understanding its medical uses. Accordingly, he translated the thinking of Aristotle, Galen, and Isaac into a profound system of *materia medica*, clearly indicating how specific qualities of the substance of each drug may be deduced from its sensorial qualities, such as color, smell and, most importantly, flavor. For instance, bitterness indicates that a thick, earthy substance is warm (*substantia spissa ac terrea calida*), tartness (*ponticitas*) that it is cold.

Especially interesting in this account is Avicenna's assumption that a specific operation of a drug corresponds to a particular kind of flavor. The operations are understood as the direct effects of the substance of the drug, to be expected on the basis of an analysis of the drug's physical qualities. Recognizing the flavor is therefore one way to deduce the drug's utility. Indeed, each flavor corresponds to a certain *operatio* of the drug, so that a proper understanding of the sensorial data enables the validation of the practical aspect of medical science. The ultimate goal of this investigation is to heal, but a prerequisite for that is profound knowledge of the individual drug, which implies being well acquainted with the plant. The categorization at the base of the Avicennian doctrine may be summarized as follows:

Sapor	*Operatio*
Sweetness (*Dulcedo*)	Smoothing and increasing nourishment (*Lenificatio et multiplicatio nutrimenti*)
Bitterness (*Amaritudo*)	Wiping (*Abstersio*)
Tartness (*Ponticitas*)	Contracting when it is weak, squeezing when it is strong (*Contractio si est debilis, expressio si est fortis*)
Sharpness (*Acuitas*)	Contracting, hardening, holding back (*Contractio et induratio et retentio*)
Saltness (*Salsedo*)	Wiping and drying up (*Abstersio et exsiccatio*)
Astringency (*Stipticitas*)	Contracting and thickening (*Contractio et inspissatio*)
Oiliness (*Unctuositas*)	Lubricating and low burning (*Lubrificatio et coctio parva*)
Sourness (*Acetosus*)	Putrefaction (*Putrefactio*)

Each operation pursues a particular medical goal, being useful to heal a certain disease. Avicenna divides them into three groups. The first group includes universal and the second group particular operations; the third group comprises those operations that are similar to the universal. Avicenna's categorization of the operations is so elaborate that he eventually lists forty-nine different types of operations.[29]

It is impossible to analyze this aspect of Avicenna's medical account here, but it should be mentioned that each operation may be deduced from certain sensory qualities of the drug, following a sensory analysis that is even more precise and complex. This is especially true for drugs composed of more than one flavor. For those cases, Avicenna provides an interpretive schema encompassing the various possible combinations of two or more simple flavors.[30] Bitterness and astringency (*amaritudo et stipticitas*), for instance, produce a flavor called *horribilitas*, while the combination of bitterness and saltiness yields a flavor called *turpido*. If two different flavors are present in the same substance, a wider range of operations is ascribable to it, which may enhance each other, acting synergistically. Thus, in a composed flavor, the recognition of the simple flavor component is a step of the *semita ratiocinationis* designed to delineate the virtues and the operations of the medicine. The correct sensorial analysis, which presupposes a proper training of the sense of taste much like that I have described for the case of Galen, also has a specific goal: to discern the drug's *complexio*.

By translating the phenomenology of the flavors into a precise pharmacological interpretation intended to determine the compatibility between the *complexio* of those who ingest the drug and the *complexio* of the drug itself, Avicenna corroborates and systematizes the idea that the *complexio* of the drug corrects the faulty *complexio* of the sick person. Based upon an analysis of the phenomenology of flavors, the aim of studying drugs is thus to discern their different complexions in order to establish how to heal the varying degrees of a disease. In this way, Avicenna builds upon the phenomenology of flavor to contribute to medical pharmacology.

Albert the Great (c. 1200–1280 CE)

Albert the Great's treatment of flavor in his *De vegetabilibus* is unique among the ancient and medieval thinkers discussed here. Although it is not a medical work, the main aspects of the medical tradition just outlined appear in it: Galen's experiential method, Isaac Israeli's dietetics, and Avicenna's *materia medica*. Albert's work thus translates the phenomenology of flavors into the philosophical investigation of the vegetal world, detaching it partially from medical usefulness. In Albert's account, flavor is no longer the means of knowing the drug, but of knowing the plant as such, the object under investigation in natural science. With regard to plants, Albert mainly revisits elements I described for Galen's *On Simple Drugs*, connecting the term *sapor* to the term *experimentum*. In this context, too, Albert translates *experimentum* from the purely operative science of medicine into an inquiry into substances, as prevalent in the *scientia de plantis*.

More specifically, in the sixth book of *De vegetabilibus*, Albert declares a change in course: from now on, the philosophical consideration of the universals of plants is replaced by an investigation of the particular.[31] The whole sixth book is dedicated to a kind of argumentation assuming that the particular can be known. Yet if the universal truth is known due to the employment of logic, specifically syllogisms, how can the truth of the particular be known? Albert answers this question at the beginning of the book: "For it is experiment [*experimentum*] alone that certifies with regard to such things [i.e., particulars], since syllogisms cannot be made use of with regard to the natures of such particular particulars."[32]

Here, the definition of the word *experimentum* matters. Chiara Crisciani and Joel Agrimi show that the medieval *experimentum* is a *collatio* of regular and stored sensible impressions and memories.[33] This terminology of *experimentum* developed mostly at the faculties of arts and medicine during the thirteenth century, where Albert also played a major role. Thus, Albert's statement that in order to know a plant, or rather in order to know its virtue, one must experience it through its flavors—which accords with the Galenic-Avicennian tradition—is highly relevant: "Flavor is what gives the most certain experience of the virtues of plants."[34]

In this Albert partially contradicts Avicenna, who considered the analysis of flavors to pertain to the path of reason (*semita ratiocinationis*) rather than to experience. The term *experimentum*, which Albert translates from the medical tradition into his philosophical investigation, thus acquires a slightly different meaning. In a philosophical treatise like *De vegetabilibus*, the *via experimenti* coincides with the analysis of sense perceptions, and flavor is the most phenomenologically explicative of a plant's experienceable qualities.

Following his predecessors, especially Avicenna, Albert lists eight plus one different types of *sapores*, adding *insipidus* (the tasteless) to the classical eight. Because he considers flavor the most reliable epistemic instrument to study the vegetal world, Albert says that those who want to gain knowledge of plants should very carefully (*intentissime*) get to know their flavors.[35] Albert defines flavor as the *proxima sequela complexionis*,[36] the most immediate effect of the *complexio*. Identifying the *complexio* is the aim of this investigation, exactly as it was for Avicenna. However, the operation of a drug is not absolute, but related to the *complexio* of the drug itself and to that of the sick person—the action of a plant changes depending on the body on which it acts. If the two *complexiones* are similar, the action of its virtue will be feeble; if they are dissimilar, the action will be *vehementior* (more vigorous).

On the basis of this theoretical framework, it can be explained why certain plants are edible for certain animals but not for humans. As an example, Albert cites henbane, *jusquiamus*, a herb toxic for humans but much loved by sparrows. The explanation lies in the "similarity and difference of complexion" (*similitudo et dissimilitudo complexionis*): it is toxic for humans because of the powerful action of its heat, which is too strong for and quite unlike the human *complexio*. Another aspect is of note here: Albert no longer limits the meaning of the term *complexio* to the field of medicine and the operations of drugs, but translates it into the much wider semantic field of botany.

For Albert, just as for Aristotle, the sense of taste can connect to its object without an external medium. The contact between taste and its object is direct, because the only medium taste needs to perceive flavor is the *medium humidum salivale*, which coincides with the investigated object itself—in plants, the sap or *succus*. This closeness between the perceiving subject and the perceived object enables knowledge of the "intimate and first virtues" (*virtutes intimae et primae*).[37] The close connection between flavors, saliva, and plant juices is strongly emphasized here. Albert was also aware that the two terms *sapor* and *humor* were expressed by the same ancient Greek word,[38] which is why he adds that the connection is not explicitly expressed in the Latin.

Of all the senses, taste is the most reliable one, being closest to the substance of the plant. Albert warns against the error of other senses. Color can often be misleading (white, for instance, is a sign of a warm substance if it is earthy, but a sign of a cold substance if it is watery), and even taste must be analyzed carefully, as the perceived flavor is always a composition of different flavors, only one of which is dominant. In fact, the epistemic goal of "knowledge of flavors" (*scientia de saporibus*) is probability (*probabilitas*) and not necessity (*necessitas*). Taste has to be interpreted in its phenomenology and as such is prone to error. Taste does identify a certain quality of the substance, but among the qualities there are some—for example, the cold qualities (*qualitates frigidae*)—that might be confused with others. In this case, Albert again translates the information from Avicenna's *Canon* faithfully. Knowing a plant means tasting it, subjecting it to a careful sensory analysis that prevents one from being deceived by fallacious sensitive appearances.

In Albert's *De vegetabilibus*, the nine flavors are listed hierarchically, from the *sapor insipidus* at the top to *amarus*, *acutus*, *salsus*, *acetosus*, *ponticus*, *stypticus*, and *pinguis sive unctuosus* and *dulcis*. The substance that bears flavor (*substantia ferens saporem*) can be of three kinds—*grossa*, *intermedia*, and *subtilis*—and its quality can be of three kinds as well, namely *calida*, *intermedia*, and *frigida*. Each substance and quality corresponds to a certain kind of flavor:

Substantia	1. *grossa*	2. *intermedia*	3. *subtilis*
a. *calida*	amara	salsa	acuta
b. *intermedia*	dulcis	insipida	pinguis
c. *frigida*	pontica	styptica	acetosa

The flavor *acutus*, for instance, is indicative of a substance that is both warm and subtle, whereas the flavor *amarus* indicates one that is thick and warm (*grossa et calida*). The precise sensorial analysis of a plant in this scheme permits the natural philosopher to determine an exact correspondence between qualities and flavors. Looking at this method of analysis, we see that Albert employs several terms drawn from the field of medicine, such as *experimentum* and *complexio*. Rather than translating texts from one language into another, Albert—like his medieval Arabic predecessors—ventures into the epistemic translation of material from one field of knowledge into another.

The theoretical apparatus of his predecessors aided Albert in that enterprise, as he could translate much of their theorization into his botany. But Albert promotes the intersection between philosophy and medicine in a very significantly new way. Although the precise doctrine of flavors emerged in the context of medicine, Albert clearly recognizes its epistemic value for *scientia* as well. Through the analysis of flavors, he aspires not only to know the pharmacological operations of plants, but to know their substance as such, which is knowable through its effects. In Albert's view, the philosopher should know the operations of a plant not in order to heal, but in order to recognize them as effects of a certain substance and thus to become able to describe their qualities. In this way, Albert successfully translated the phenomenology of flavors into his very own system of natural philosophy.

Conclusion

It is time now to narrow down the broad meaning of the couplet *sapor/sapientia* discussed at the outset of my chapter, specifying it for the context of Albert's botany.

Since *sapor* was not just blind sense perception but followed a distinctive experiential method, it was conceived of as something that creates knowledge—that, if interpreted correctly, reveals deeper knowledge about the substance of plants. The history of Albert's knowledge of flavors as revealing the substance of plants is rather complex, undergoing several stages of epistemic translation. Aristotle translated the sense perception of flavor into a phenomenology of eight distinctive flavors. Galen translated these into the medical corpus, by addressing the training of the student physician's senses that was required in order to master the transition from sense perception of flavors to a clear phenomenology of flavors. The medieval physician Isaac Israeli took advantage of this insight of Galen's and translated it into dietetics, where the phenomenology of flavor reveals the different states of maturation of plants. Avicenna then used both developments to translate the phenomenology of flavor into his *materia medica*. There, it constituted the accessible epistemic grounds to reveal, by means of experience, the inaccessible operational virtues of simple and complex medicines. In Albert's work, finally, the phenomenology of flavor was granted an even greater epistemic power. Translated into the science of botany, flavor could now indicate the substance of a plant as such.

Except for the case of Aristotle, the phenomenology of flavors was an epistemic tool that was able to produce different types of knowledge by experience. Behind the simple recognition of flavors, there stood a broad implicit theoretical apparatus, which made certain medical or scientific judgments possible. The phenomenology of flavors, as I have shown, promoted a kind of knowledge that can be defined as experiential, since it always implied a certain comparison and correlation of phenomena, mastery, and the application of a type of sensory methodology. This opens up a previously almost unexplored perspective that will enable us to reconstruct scientific method in the premodern era.

Notes

1 Jacquart, *L'épopée*.
2 Burnett, "Sapores sunt octo."
3 Dilg and Keil, "Humoralpathologie"; Schöner, "Das Viererschema."
4 Stabile, "Sapor-Sapientia," 310.
5 I would like to thank Tommaso Alpina for helping me with the analysis of the Arabic. However, a detailed analysis of the terminology is beyond the scope of this chapter. See Ullmann, "Wörterbuch."
6 See Stabile, "Sapor-Sapientia."
7 Isidorus Hispalensis, *Etymologiae*, X, ed. Lindsay, n. 240.
8 See Albert, *De mysterio missae*, III. 4, ed. Borgnet, 86b.
9 See Albert, *De corpore domini*, I. 2, ed. Borgnet, 195a.
10 Albert, *Super Iob*, XXXIV. 3, ed. Weiß, 394.
11 See Aristotle, *De anima* II. 10, 422a8, trans. Miller, 237.
12 Ibid., 422a11, trans. Miller, 237–38.
13 Aristotle, *De sensu et sensato* IV, 441b21–24, trans. Ross, 67.
14 Ibid., 441b25–442a3, 67–69.
15 Ibid., 442a13–15, 67–69.
16 Aristotle, *De anima* II. 10, 422b5–15, trans. Miller, 237–38.
17 Most of the translations attributed to Gerard of Cremona are a matter of debate. The case of *On Simple Drugs* is particularly complex, because almost the entire manuscript tradition is incomplete, ending with Book V. However, an Arabic–Latin translation of Book VI also exists, despite being transmitted by only few manuscripts. Three possibilities are mooted: attributing the entire translation to Gerard, only Books I–V, or neither. The well-known Pincius edition, printed in Venice in 1490, transmits the translation attributed to Gerard up to Book VI, the remaining five books being transmitted in the translation of Niccolò da Reggio. See Ventura, "Simple Drugs"; Jacquart, "Les traductions"; Petit, "La tradition latine," 1069.
18 Galen, *De simplicium medicamentorum temperamentis ac facultatibus*, IV. 1, ed. Pincius, 57b; ed. Kühn, 619–20.
19 Ibid., IV. 2. 2, ed. Pincius, 58b–59ra; IV. 4, ed. Kühn, 632.
20 Ibid., IV. 8, ed. Kühn, 648.
21 See Galen, *On the Properties of Foodstuffs*, II. 59. 648, trans. Powell, 109.
22 See Stabile, "Sapor-sapientia," 319.
23 See Ventura, "Lo sviluppo," 643.
24 Isaac Israeli, *De diaetis universalibus*, XIV, ed. Lyon 1515, 34b–35ra.
25 Ibid.
26 Ibid., 36ra.
27 Avicenna, *Canon*, II. 1. 4, Venice 1507, 82va.
28 See Chandelier, "L'expérience."
29 Avicenna, *Canon*, II. 1. 4, Venice 1507, 82va.
30 Ibid., 67r.
31 Albert, *De vegetabilibus*, VI. 1. 1. n. 1, ed. Meyer and Jessen, 341. See Wöllmer, "Albert the Great."
32 Albert, *De vegetabilibus*, VI. 1. 1. n. 1, ed. Meyer and Jessen, 341.
33 See Agrimi and Crisciani, "Per una ricerca"; Draelants, "Expérience et autorités"; Friedman, "Albert the Great's Topoi."
34 Albert, *De vegetabilibus*, III. 2. 1. n. 68–69, ed. Meyer and Jessen, 191.

35 Ibid., n. 69, 191.
36 Ibid., n. 66, 190.
37 Ibid., n. 69, 191.
38 Albert, *De anima*, II. 1. 10, ed. Stroick, 79.31–33.

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3 Making Sense of *ingenium*

Translating Thought in Twelfth-Century Latin Texts on Cognition

Jonathan Morton

To think about how translation works and what it entails is to think about language's limits and about how, or even whether, it can adequately convey meaning. When the material being translated comprises writing about experience, another level of complexity is added. The texts translated have themselves already translated the non-linguistic into language. As testified by the oft-cited Italian dictum *traduttore, traditore* (translator, traitor), any translation necessarily involves a certain slippage from the source text to which it claims loyalty, through distortion, subtraction, or addition. A perfectly faithful translation between different linguistic systems and cultural contexts is simply not possible, even as translation more broadly is nonetheless both possible and necessary for the transfer of knowledge and ideas.[1]

Attention to translation can, in fact, make us sensitive to the slippages in meaning that take place within the same language, between texts or different language users as they attempt to make sense of technical or scientific terminology. Expanding "translation" to encompass acts of semantic transfer not only between different languages—interlingual translation—but also within what is ostensibly the same language—intralingual translation—brings to light changes in meaning that occur when trying to make sense of unfamiliar terms, a problem that necessarily besets human communication. That phenomenon is especially pronounced in texts that discuss processes of cognition.

Other pieces in this collection deal with the concept of experience as something rooted in the evidence of the senses, from which inferences can be drawn. When discussing internal mental processes, however, the experience in question comes not from empirical data but from the internal phenomena of thought. This cannot be faithfully replicated for confirmation in laboratory conditions or elsewhere, nor can it be understood or analyzed by an external observer, except once it has been translated into language. Finding the language (and, especially, finding a common language) for such unobservable experience is not easy.

I will be considering the specifics of attempts to build a scientific language to discuss cognition in texts written in Latin, principally in twelfth-century Italy, France, and England. My case study is the term

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ingenium—meaning "ingenuity," "intelligence," "craftiness"—as it is used to refer to a mental faculty, power, or act by which a person arrives at a solution to a problem or intuits a theoretical truth.[2] The term describes a mental process by which non-empirical experience and learning can occur independently of the external senses. It is impossible to make a judgment about how much the authors and translators I discuss draw on their own experience of thought when attempting to translate its terminology, except to say that attempts to make sense of an account of the processes of thinking necessitate acts of comparison between the account and what goes on in one's own head. Reading and interpreting explanations of cognition, then, entail another kind of translation: one between accounts of mental activities and one's experience of them.

By and large, the twelfth-century Western European accounts of mental activities that I discuss were overshadowed by the subsequent translation into Latin of the eleventh-century *Liber de anima* of Avicenna (Ibn Sīnā) and Aristotle's *De anima*. The more systematic models of perception and cognition in those texts came to dominate psychology from the early thirteenth century onwards, as part of a wider intellectual movement involving the rise both of universities as institutions and of Aristotelian philosophy. In the twelfth century, however, different clusters of thinkers—around the medical schools at Salerno, the church school of Chartres with its interest in natural philosophy, and the more theologically minded Cistercian and Victorine monastic circles—still taught from different textual authorities with different terminologies.

Concepts and terms transferred between local academic spheres can at times be traced to individual moments of reading or translation.[3] The incredibly small number of actors in this earlier, twelfth-century context, more isolated from each other than in later periods, makes them a good case study for examining the kinds of translative and hermeneutic activities that are just as present, if harder to detect, in more networked and systematized communities of knowledge-making. This is not to say that in the thirteenth century the terminology of cognition suddenly becomes wholly stable and transparent—far from it. Rather, the inherent instability in scientific terms across periods and in different cultures is revealed especially clearly in the study of twelfth-century translation, through the attention to semantic change that translation demands at a time when authors themselves are so clearly wrestling to understand the terms they use.[4] This essay will consider several specific moments of translation to see what the choices made by individual actors reveal about their negotiations between different languages and different epistemological discourses.

This period saw a huge increase in translations from Greek and Arabic into Latin, and different translators often reached for the same terms to render concepts from quite different languages that cannot be mapped precisely onto each other. The material under discussion here exemplifies that: the same term in Latin replaces terms from Greek and Arabic contexts that are non-identical in meaning. Such linguistic overlap counts as its own subgenre of the kind of semantic betrayal one might expect in translation, a phenomenon of linguistic slippage proper to the activity. I want, though, to stress the importance of another, secondary but intimately related phenomenon: not just interlingual translation, between languages, but intralingual translation, between the same language—what we might call *rewording*.[5]

For Jacques Derrida, certain phrases silently announce such rewording, such as *en d'autres mots* (in other words) or *autrement dit* (put differently), auto-deictic acts that signal an attempt to translate the sense of one sentence into another sentence in the same language.[6] The need for translation *within* a language demonstrates a real or potential failure of communication, which the rephrasing seeks to remedy, due to an uncertainty in the meaning of terms or phrases themselves. If a term were transparent, it would not need glossing, and such glossing amongst authors' giving accounts of the different powers of the mind or soul indicates that they lack a fixed set of terms that can be understood in the same way to talk precisely about the processes of cognition. The words themselves then must be remade or redefined almost every time they are used if they are to be meaningful. Individual words themselves must be repeatedly reworded. Because words needed to be found in Latin to translate terms from Greek and Arabic that entailed different accounts of cognition and perception, existing Latin terms themselves became even more opaque, contradictory, or equivocal than they had already been.

The twelfth-century philosopher John of Salisbury studied with some of the most influential philosophers and theologians of his time, Robert of Melun, Peter Abelard, William of Conches, and Gilbert of Poitiers, and was well placed to give a view on competing versions of the powers of soul. While in some of these versions the soul is one substance carrying out different actions in thought (memory, judgment, etc.), in others it has different qualities:

> But there are many who, in contrast, assert that the soul is indeed one substance in quantity but that it is formed of different qualities and, just as it is subject to different passions, so it can use many powers. And I indeed might believe there to be more of them than are expressed in books, since the soul, while it strays from the Lord, most ignorant of its origin, hardly recognizes its own powers.[7]

Not only does John note scholarly debate over how thinking happens, he asserts, in the theological language of his time, the limits of the soul (which we moderns might translate imperfectly as 'mind') that prevent it from grasping its own powers. The debate arises in no small part because we have so little understanding of how we understand. In premodernity and even in modernity, evidence for how thinking works is for the most part experiential but not empirical—that is, not available to external sense-perception—and thus very hard to describe factually, which undercuts Roman Jakobson's certainty that "all cognitive experience and its classification is conveyable in any existing language. Whenever there is deficiency, terminology may be qualified and amplified by loanwords or loan-translation, neologisms or semantic shifts, and finally, by circumlocutions."[8]

Although it is possible to find terms and circumlocutions to translate words for tools or objects, for example, texts on cognition and the models and terms they put forward cannot themselves adequately transport the experience of cognition into a discursive domain of verbal articulation and reasoning. We have all, I assume, experienced that "eureka" moment, finding a solution to a problem, that lightbulb moment (and the metaphor of electric illumination is a good example of the figurative language needed to account for an experience that is literally indescribable). Attempting to describe how that solution was found, what it felt like, or what happened in our mind to arrive at it demands imperfect translation, translation that both succeeds and fails to put it into words. This uncertainty in understanding and in description gives rise to a host of competing models and terms for mental acts, faculties, powers, processes, activities (we moderns are not short of such terms)—all of them incomplete, labile, and equivocal. The result is that, in this context especially, talking about thinking requires continual acts of intralingual translation, rephrasing, definition, or explanation to make sense of it. That making sense, that translation, that putting things into our own words or into different words, is an epistemic activity: attention to translation, between languages or within a language, brings out the active, world-making nature of interpreting scientific texts and making them meaningful. As Lydia Davis puts it: "To read is to translate, and to translate is to write, to write to read, to read to write."[9] The necessary/impossible task of the translator and the necessary/impossible task of the theorist or of the premodern scientist can be mutually illuminating.

With these considerations in mind, I would like to turn to the word *ingenium*, often translated into modern English as "wit" or "ingenuity."[10] It is not possible to give an account of all the different models of cognition written or circulating in this period, and I will keep to a restricted number of case studies to follow the fortune of this one word in specific acts of translation, as it is used in mediating between Latin, Greek, and Arabic.

Ingenium's etymology hints at its status as a something innate or inborn (*in* + *genitum*, from *gigno*: I beget, give birth to) and in Classical Latin means either something like talent, natural personality, or character, or intelligence in a fairly general sense.[11] In the early Middle Ages, it becomes used by Neoplatonist writers to mean a more specific mental capacity, an activity of the rational mind for seeking out truth. John Scotus Eriugena, in his gloss on Martianus Capella's *De nuptiis Philologiae et Mercurii*, describes the *naturale ingenium* as follows:

> Just as fire invisibly penetrates every corporeal creature, so natural *ingenium*, which is common to everything with a rational nature, is distributed individually to each mortal person born in this world, so that they would not be completely deprived of knowledge of their creator and of their natural dignity but, always illuminated by an interior light, they seek out themselves and their God through the assiduous search for the truth.[12]

Ingenium is some kind of power, activity, or function that leads to the discovery of new things. This explains why, when the Salernitan theologian and medical doctor Alfanus translated Nemesius of Emesus's turn-of-the-fifth-century *Peri physeōs anthrōpou* (*On Human Nature*) from Greek into Latin as *De natura hominis* in the late eleventh century, he chose to render the Greek concept *physikē ennoia* (natural thought) as *naturale ingenium*.[13] Nemesius's account of cognition, which Alfanus rendered accessible to medieval students of medicine, put forward a Galenic model of the brain in which the imagination (*imaginatio*) or fantasy (*phantastica/phantasia*) is in the first of three ventricles; it processes sense-images to be judged by the reason or intellect in the brain's middle ventricle (*ratio* or reason),[14] and these are finally stored in memory (*memoria*) in the rear ventricle. However, Nemesius invokes Plato as an authority for a process of understanding intelligibles or abstract conceptions, which do not come from the external senses and are stored by and recalled using a different function: not *memoria* but *rememoratio*. And these intelligible principles or truth are not processed by imaginative faculty located in the front of the brain:

> Non enim ex praecedente phantasia est intellegibilium receptio, sed ex disciplina vel naturali ingenio.
>
> The receiving of intelligibles does not come from the preceding *phantasia*, but from teaching or from natural *ingenium*.[15]

Nemesius holds that intelligible, abstract concepts are present inside us naturally, so that—in Alfanus's version at least—the *ingenium* is a power by which Platonic ideas are recalled (i.e., learned) absent any perception.[16] As Harry Austryn Wolfson has noted, this distinction between memory—*memoria* in its Latin translations—from sense-data and the recollection of ideas, *rememoratio*, is not original to Nemesius. It can be found in Plotinus's *Enneads*, 4.3.29 and Aristotle's *De memoria et reminiscentia*, 1, 450a.[17] In these accounts, transmitted by Nemesius, abstract intelligibles are acquired (or recollected in a specifically Platonic sense) through teaching (*mathēsis*) or natural thought (*physikē ennoia*), rather than through sensory experience processed through the imagination and the intellect. The Greek version that Alfanus translated reads:

> ou gar ech proēgēsamenēs phantasias ē tōn noē tōn anagēpsis, all'ech mathēseōs ē physikēs ennoias.
>
> The receiving of intelligibles does not come from the preceding *phantasia*, but from teaching or from natural thought.[18]

Ingenium, then, is what allows us to understand principles *without* the experience of sensory things. There is a difference, however, the next time that Alfanus translates *physikē ennoia*:

> Naturali vero ingenio adinventa dicimus, quae firmiter omnibus insunt, ut esse deum. Hanc autem Plato rememorationem esse dicit ideae.
>
> We say things to be discovered through natural *ingenium* when they are things firmly implanted in all of us, for example the principle that God exists. Plato calls this the recollection of ideas.[19]

For comparison, here is Nemesius's Greek version, which clarifies that he is referring not to a mental power but to something known innately:

> physichas de legomen ennoias tas adidachtōs pasi prosousas hōs to einai theon.
>
> We call natural thoughts those things present to all without teaching, such as that God exists.[20]

Whether deliberately or accidentally, Alfanus gives a new version. Whereas in the first instance, *physikēs ennoias* was a genitive singular—"of natural thought"—in the second, *physichas ennoias* is an accusative plural—"natural thoughts." Alfanus has rendered both as the singular faculty of *naturale ingenium*. In this second case, Nemesius is saying that the natural thoughts are in us, whereas Alfanus says that these principles are *recognized by* the power of *ingenium* that is in us. It is not hard to understand why Mark D. Jordan categorizes Alfanus's translation as "partial and defective."[21] For the matter at hand, however, the question of the correctness of the translation may be less interesting than the work Alfanus is doing as he tries to make sense of a potentially ambiguous account of the learning or recollection of ideas that do not come from any previous sense-perception processed through the imagination. He has made Nemesius's account fit with earlier Latin models of intuition through an act or a power called *ingenium*, an act of discovery by the rational mind. This implies a model of cognition distinct from the Galenic one increasingly available to his colleagues in Salerno through the translations of Constantinus Africanus, especially the latter's *Pantegni*. As Alfanus's problems show, haunting the problem of the translation of psychological terms is the underlying difficulty of giving any kind of secure account or model of how we grasp intellectual principles.

It is notable that when Nemesius's text was translated into Latin a second time, by Burgundius of Pisa in the 1160s, the translator more accurately rendered the first instance in the genitive singular *physikēs ennoias* as *naturale intentio* and the second in the accusative plural *physichas ennoias* likewise as the accusative plural in Latin: *naturales intentiones*. In his first mention of the reception of intelligibles, Burgundius translates Nemesius as follows:

> non enim ex praecedenti phantasia intelligibilium resumptio, sed ex disciplina vel **ex naturali intentione**.
>
> for the recovery of intelligibles does not come from the aforementioned *phantasia* but from teaching or from natural *intentio*.[22]

"Ex naturali intentione" means something like "from a natural [i.e., innate] concept," which holds also for his second translation of *ennoia*:

> **naturales** autem dicimus **intentiones** quae sine doctrina omnibus adsunt, ut esse Deum.
>
> we call them natural concepts because they are present to all people without teaching, for example, the existence of God.[23]

Intentiones continued to mean mental concepts throughout the Middle Ages, as it did for Roger Bacon in the thirteenth and Jean Buridan in the fourteenth century, but all the terms involved are polysemous, slippery, and ambiguous.[24] *Ennoia*, for example, can mean an act of thinking, a concept or conception, an intent, or the meaning of a word.[25] *Ingenium* and *intentio* themselves have multiple meanings, and all three words are being used to convey a process that cannot be perceived by the senses and is hard to pin down in language.[26] Burgundius's and Alfanus's problem is the problem of every translator of models of cognition in this period (and every philosopher, theologian, or medical doctor who wrote a model of cognition is a translator in the intralingual sense proposed above): How can one make sense of different, ambiguous textual accounts of thinking in the absence of any empirical evidence beyond one's own opaque experience of thought? Attention to the problems of trying to capture precise meanings in new language brings the epistemological and discursive uncertainties of psychological writing into clearer focus.

Alfanus's translation choice was to prove influential, and the various attempts to make sense of it are illuminating, for example that of the English natural philosopher Adelard of Bath (c. 1080–c. 1152), grappling with the Galenic model of the human brain and its relation to thinking that he found in Alfanus's Latin rendering of Nemesius. In his *Quaestiones naturales*, Adelard combines the imagination (the capacity to create images) and the *ingenium* (the capacity to intuit or perceive an idea):

> In cerebro enim [anima] utitur **fantastico** motu, id est **ingeniali**; rationali etiam, id est iudicio; set et memoriali, id est recordatione.
>
> In the brain [the soul] uses the movement of **imagination**, that is of the ***ingenium***; rational movement, namely, judgment; and also the memorizing movement, namely, recollection.[27]

Adelard's account is confused, or confusing, from the point of view of the Galenic model, in which the imagination is situated in the front cell of the brain, its role being to process the sense data brought to it by the senses. Adelard himself seems to follow this model in a shorter work, *De eodem et diverso* (*Of the Same and the Different*).[28] In Alfanus's version, Nemesius defines the *phantastica* as a power of the irrational soul whose operation is caused by the senses ("virtus irrationalis animae per sensus operativa").[29] Where Alfanus's translation distinguishes *ingenium* as a power that, unlike the imagination, does not deal with sense-data, Adelard has brought them together. He has done something similar in the case of memory, bringing memory and recollection (as *recordatio*) together as one power.

What prompted this decision? What does fantasy or imagination mean now that it has been merged with *ingenium*?[30] Is there something about imagining—picturing non-existent objects—that is similar to the conceptual or intuitive leap carried out in or by *ingenium*? I raise these questions not to resolve them, but to suggest that they are at stake for writers and readers, medieval and modern, trying to make sense of what thought is and how it works to adjudicate between ambiguous terms and their own experience of thought.

William of Conches (c. 1090–post-1154), one of the most influential figures of the twelfth-century Platonizing movement often referred to as the Chartrian School, is an even more revealing example of the problems of making sense of ambiguous terms and descriptions. Like Adelard, he shows the entanglement of imagination and ingenuity or, more specifically, between *phantastica* and *ingenium*. Up to this point I have been writing under the assumption that Latin writers saw no difference between the Latin *imaginatio* and the Greek *phantastica*, but William makes his own translation choices when dealing with this point, both in proposing a different understanding of the Greek loan-word and in engaging in a series of intralingual acts of rewording within his own text. We can see from one paragraph to the next how he attempts to find a terminology to make sense of the processes of cognition. In several of his works William mentions a tripartite structure of the mind, which has *ingenium*, *ratio* (reason), and *memoria* (memory). For example, in his commentary on Boethius's *De consolatione Philosophiae* (*Consolation of Philosophy*), he writes:

> Three things make someone perfectly wise: *ingenium*, which is the natural power to understand something quickly; reason [*ratio*], which is the judgment of the things grasped; and memory [*memoria*] of past things.[31]

The definition of *ingenium* recurs elsewhere in William's work in a more or less identical formulation, and he also correlates the difference in people's speed of understanding with the speed of their *ingenium*.[32] Another indication of how William intends the term can be found in a different formulation of the trio of powers that cause wisdom. In his *Dragmaticon*, they are *intelligentia* (intelligence), *ratio*, and *memoria*. Either William has changed his mind about the different powers of the mind in this later work or he considers *ingenium* and *intelligentia* to be interchangeable. *Ingenium* here is not given the associations with the imagination that Adelard introduces. William defines the imagination quite differently in his gloss on Boethius immediately after his definition of *ingenium*, quoted just above. The *imaginatio* is "a power of the soul [*vis animae*] by which a person perceives the form of a thing not present," related not to intellection and understanding, but to the forming of images.[33]

Since William does not think *ingenium* and imagination are the same, his use of the term *phantastica* is baffling at first. William locates *ingenium* in the front ventricle of the brain, using it interchangeably with *phantastica*:

> In the first part of the head there is a cell of the brain in which is found the power of understanding that is called the *phantastica*. It is proved that this is so by doctors having seen someone of good *ingenium* to have lost their *ingenium* when wounded in that part of their head.[34]

The term *phantastica* is now defined to mean something in complete opposition to Nemesius's definition. Maybe William, following Adelard, did not realize that *imaginatio* and *phantastica* are Latin and Greek terms for the same power; maybe he was introducing his own scheme of mental powers; or maybe both. Instead of the production of images, William has made the term mean the grasping of principles.[35] He gives two interlingual translations for his idea of the *phantastica*, most directly as a *vis intelligendi* but also, slightly more indirectly, as *ingenium*. As in Adelard, the need for these terms to be defined or reworded in order to make sense is evidence of the ambiguity that marks the discussion of cognition in this period and beyond.

William's *Dragmaticon philosophiae* exhibits a similar pattern of interlingual translation. Here he justifies his tripartite model of the mind by discussing head wounds in a passage that echoes similar material in Adelard's *Quaestiones naturales* and ultimately derives from a passage in the *De natura hominis*, immediately following Nemesius's distinction between the memory of things from the *phantastica* and the memory of things from the *naturale ingenium*:[36]

> Concerning someone of sound *ingenium*, reason [*ratio*], and memory [*memoria*], doctors have recorded that such a person, receiving a blow to the first cell [of the brain], had lost the power to understand [*vis intelligendi*], but retained reason [*ratio*] and memory [*memoria*].[37]

Though he does not feel the need to gloss "reason" and "memory," William takes the trouble to rephrase *ingenium*, testifying to the term's ambiguity. In fact, in the next passage his terminology slips, so that he first renames *ingenium* as *intelligentia*, then makes it *vis phantastica*, and then *intelligentia* again:

> Again it was seen [*visum est*] that whenever someone is wounded in the rear cell, keeping intelligence [*intelligentia*] and reason [*ratio*], they lose memory [*memoria*]. For Solinus recounts in his *Collectanea* that when someone received a wound there they became so forgetful that they did not know they have a name. Another was seen [*visus est*] to lose their reason when wounded in the middle cell, while still keeping memory and the phantastical power [*vis phantastica*]. Therefore the ancients rightly said that wisdom [*sapientia*] had its seat in the head, or that Minerva was born from the brain [*cerebrum*]: for these things, which make wisdom, namely intelligence, reason, and memory, have their seat in the head.[38]

It is significant that William, like Adelard, justifies his psychological propositions through the use of witnessed empirical experiences, real or hypothetical.[39] In the passage just cited, he twice signals the visual nature of the phenomena (*visum est/visus est*). The fact that he returns repeatedly to such empirical evidence—secondhand as it is—to justify his account of the processes of cognition suggests the value of experience, even (or especially) for an area of study in which sense-experience is almost impossible to come by. If experience is something that has to be narrated, that is, put into language, in order to be meaningful, the disjunction between the uncertain experience of thinking and the relative clarity of observed and narratable phenomena is illustrative. A comparison between the two throws into relief the instability of terms used to describe the invisible, yet nonetheless experiential aspects of mental powers and processes.

Danielle Jacquart has noted William's departure from medical orthodoxy and his innovation in associating the *ingenium* with *intelligentia* in the passage just cited.[40] Making these two terms equivalent to the *phantastica vis* is, here, an even more radical departure from the norm than the introduction of *intelligentia*. The term *phantastica vis* is one I myself struggle to translate. It should really mean the "imaginative power" but cannot do so here, given William's own intralingual translations in the passage. This difficulty, crucially, puts me in the same situation as a twelfth-century cleric or doctor attempting to decode treatises on cognition. William appears to be using the term interchangeably with intelligence, a power of understanding, so does this mean he has misunderstood the loan-word *phantastica*, taken from the Greek?

Alfanus's translation is absolutely clear that "phantasia vero, id est imaginatio" (the *phantasia* is the imagination), and Thierry of Chartres, writing his *Librum hunc*, a commentary on Boethius's *De trinitate*, in the 1140s, more or less contemporaneously with William, had no problem identifying the power located in the *phantastica cellula* of the brain as the imagination of earlier authorities.[41] Thierry and William were both influential teachers of the School of Chartres and their students would have had to negotiate these competing models.

William himself negotiates between different textual authorities translated from Greek and Arabic, not to mention works in Latin that themselves require interpretation. Especially when considering intralingual translation, it is not necessarily possible to separate out the functions of the translator, the teacher, and the author. To write is to teach, to teach is to translate, and each requires complex interventions on the part of the actor. It would be a simple thing to dismiss William by saying he is confused as to what the terms meant in earlier works, but, as with Adelard, this confusion, inadvertent or deliberate, is symptomatic of attempts to talk about thinking and to negotiate between different models of thought. In the twelfth century, authors had to contend with the different models of the soul and its powers found in Augustine's *De trinitate*, 10 (*memoria*, *intelligentia*, *voluntas*), Boethius's *De consolatione Philosophiae*, 5, pr. 4 (*sensus*, *imaginatio*, *ratio*, *intelligentia*), Aristotle's *De anima* (*vegetabilis*, *sensibilis*, *rationalis*), and Galen (*imaginatio*, *ratio*, *memoria*). More broadly, such uncertainty is a fundamental problem for attempts to find a common language with which to discuss the tricky phenomena of thought.

In his *Dragmaticon*, William articulates his own tripartite model (*ingenium/intelligentia, ratio, memoria*), drawing on the Galenic model inherited through Constantinus Africanus and Nemesius while departing significantly from it. Just when we might be beginning to understand this model, however, he introduces a separate tripartite model of the soul, bringing *ingenium* back but this time as part of a different trio:

> Beyond these faculties, there are others that serve reason and the intellect, such as *ingenium*, memory [*memoria*], and opinion [*opinio*]. *Ingenium* is the natural power to perceive something quickly .... Memory, for its part, is the power of firmly retaining things known. Opinion truly is the perception of the thing with some doubt.[42]

I want to flag up how symptomatic of twelfth-century psychology this inconsistency is. It is a consequence of bringing together incompatible terminology and models of thought, although perhaps the idea of a "model" of thought implies an account of cognition more detailed than what is actually on offer. Instead, we can observe attempts to fix in language an act or experience, in the case of *ingenium* the experience of suddenly "getting" an idea without being able to give an account of it that could be called scientific. The recourse to textual authority, the backbone of medieval knowledge production, is of limited use given the proliferation of different models and the shifting nature of the terms used in each of them. What remains are repeated attempts at translation within and between languages and, always subtending the discussion of internal mental processes, translation from the subjective experience of thought to the shared space of spoken or written discourse.

John of Salisbury (1115/20–1180) would have been exposed to the theories of William of Conches. Writing in the middle of the twelfth century, he gives an account of cognition in which *ingenium* has replaced imagination in the Galenic tripartite system, so that nature first drives the *ingenium* to perceive certain things,[43] which it places in the storehouse of memory, while reason judges the things perceived. Taking a definition from Hugh of St. Victor's *Didascalicon* (and misattributing it to Isidore), John defines *ingenium* as "a certain power, placed naturally in the spirit, that functions by itself."[44] Something similar can be seen in *De anima* of the Cistercian monk Isaac of Stella (c. 1100–c. 1170):

> *Ingenium* is truly said to be a power of the soul [*vis animae*], or an intent [*intentio*], which extends itself and spurs itself towards the discovery of unknown things. *Ingenium* therefore seeks out unknown things, reason [*ratio*] judges the things that are found, memory [*memoria*] stores the things judged and furthermore offers things to be judged.[45]

It might seem that there is a stabilization in the model of cognition here, but things are not that simple. What is a *vis animae*, exactly, and how does it compare to an *intentio* (the latter term chiming with Burgundius of Pisa's contemporaneous translation of *ennoia*)? To say that the precise term does not matter—*ingenium*'s perception of ideas is just something that somehow happens: ideas are instantaneously grasped and then judged—is to accept the impossibility of adequately fixing the phenomenon it attempts to convey within a scientific taxonomy. This ambiguity, this inability to say what has happened, this need for additional terms—power, intention, and so on—to reword what is being discussed, is, though, precisely the point. For Isaac, the term *ingenium* needs redefinition or intralingual translation for it to make sense; even then, it runs up against the chasm between how thinking works, or is experienced, and how it can be described in a scientific or analytic way. Isaac continues his presentation by offering an analogy of ingestion, mastication, and rumination:

> The ingenium therefore brings what it finds to the reason, the memory recalls what it hides away, the reason truly is, so to speak, placed above present things, and as it either chews up in the mouth of the heart, so to speak, what the teeth of the *ingenium* gather in or else chews over what the stomach of memory brings back.[46]

To complicate matters, Isaac goes on to make the point that all three powers are activities but share the same *essentia* (essence), and he immediately puts forward a separate fivefold schema of cognition, along the lines of the Boethian fourfold model, so that the soul apprehends things through *sensus* (sense/s), *imaginatio* (imagination), *ratio* (reason), *intellectus* (intellect), and *intelligentia* (intelligence).

Isaac's *De anima* was addressed to another Cistercian, Alcher of Clairvaux, who incorporated much of it into his own text (misattributed in the Middle Ages to Augustine), *De spiritu et anima*, which circulated widely in monastic circles. *De spiritu et anima* is notable for its astonishing gallimaufry of models of cognition and three-, four-, and fivefold models of passions, virtues, powers, and activities of the mind, spirit, or soul. Its account of the workings of the spirit, the mind, the imagination, the intelligence, and the reason is anything but systematic. The fourth chapter repeats Isaac's claim of the unicity of the rational soul and advances his five-part scheme of mental activity running from sense up to intelligence.[47] Then, in the eleventh chapter, Alcher repeats Isaac's definition of *ingenium* after attempting to put the powers of the mind in order:

> And whatever sense perceives, imagination represents, cogitation forms, *ingenium* seeks out [or discovers], reason [*ratio*] judges, memory [*memoria*] preserves, intellect [*intellectus*] separates, intelligence [*intelligentia*] comprehends and brings it to meditation or contemplation.[48]

What exactly does *ingenium* mean here? What exactly does it mean anywhere? The term's simultaneous vagueness and overdetermination means that it needs retranslating, redefining, retranslating more or less each time it is used.

It is in this context that I wish to consider my final example of translation: the reworking from Arabic into Latin of Avicenna's *Liber de anima*, made in Toledo at some point between 1152 and 1166.[49] This case recalls another aspect of translation, that a translator's choice to select a given word as a translation sheds light on that word's meaning in the target language. Here the use of the term *ingenium* not as a faculty in the brain but as an intellective act is significant. *Ingenium* is found as a term in the Latin version of Avicenna, but in a more specific and limited sense than that used by the European authors we have seen. Avicenna uses the Arabic *ḥads* (guessing correctly, hitting on the right answer) to translate Aristotle's *eustochia* (skill at shooting at a mark).[50]

In the *Posterior Analytics*, *eustochia* is a particular kind of *agchinoia* (ready wit, sagacity, shrewdness) that enables a person to intuit the middle term of a syllogism.[51] Aristotle's examples include someone who observes that the moon's bright side always faces the sun and concludes that it draws its brightness from it, or who sees someone talking to a rich man and concludes that it is to borrow money from him. In the Latin Avicenna, *ḥads* is translated as *ingenium*, which is glossed as an "actus rationis, cuius propria vi invenitur medius terminus" (act of the rational faculty which finds the middle term [of a syllogism] using its own power). It is through finding the syllogism's middle term that intelligible or abstract things can be intuited. This act can come about through one's own *ingenium* or through teaching, which ultimately derives from the ingenious act of the first person to work it out.[52] The Latin Avicenna goes on to say that some people are endowed with such *ingenium* that they can find the middle term—reach an understanding of causes and principles—without teaching, and those people can be regarded as prophets, arriving at spiritual truths directly.[53]

Here the translation choice actually clarifies something about the term *ingenium*. Not only is it important as an authoritative model for later readers, writers, teachers, and students to follow, but the material in the source text (here *ḥads*) shows us something about what the Latin *ingenium* meant to the translator/s at the moment they put it into Latin. There is, though, an added and familiar complication. When Avicenna's *Liber de anima* came to be translated into Latin, his translator/s rendered the term *ḥads* first as *subtilitas* and later as *ingenium*.[54] Does this variation indicate hesitation or uncertainty? The moment of translation is one of both clarity and confusion.

In fact, the translation and circulation of Avicenna's *Liber de anima* and Aristotle's *De anima* transformed the discussions of cognition that were possible in the Latin West by offering a far more detailed and systematic account of how thinking happens, one in which there was no place for any part of the brain equivalent to the *ingenium*. Avicenna replaces the Galenic tripartite model of the internal senses with a fivefold model: common sense, imagination, *imaginativa*, *estimativa*, and memory.[55] *Ingenium* is absent here as a mental power or *virtus*, but it survived as a term in the context of medical theory and practice, the most obvious example being Gerard of Cremona's Latin translation of the Arabic version of Galen's *Peri Therapeutikēs methodon* (*On the Therapeutic Method*), which Gerard entitled *De ingenio sanitatis*.[56]

Ingenium did not thrive as a term in discussions of the powers of the mind after the twelfth century, although it did continue to be used as term for intelligence. In the mid-thirteenth century, Albert the Great saw it as a natural ability that allows leaps of conjecture (as opposed to more thorough rational inquiry) or else as a natural mental capacity in a more general sense, allowing for it to be fast or slow.[57] Importantly, Albert does not include *ingenium* as a power worthy of scientific discussion and explanation, in stark contrast to the mental powers laid out by Avicenna, such as the common sense, *estimativa*, or memory, which Albert discusses in turn in his *De homine*.[58] The Aristotelian-Avicennian paradigm shift in the science of the mind, and in *scientia* more generally, left no place for *ingenium* as a term with a specific meaning that would make it susceptible to scientific analysis and system-building. While still in use, it went from being a technical term, capable of being incorporated within a reasoned account of how thinking works, to being more like a normal part of language, albeit one whose ambiguous meaning betrays its complex history of translation. (It is interesting here to speculate whether a characteristic of such "normal" or "non-scientific" language is that its ambiguities are allowed to be remain in suspension, its competing meanings still entangled.)

The success or failure of a particular term or a particular account of the mind may not, though, be what is of chief interest in this study. Instead, the struggles for meaning pursued in and through translation in the case of *ingenium* are of broader relevance to the history of science, in particular the history of cognitive science. The problems that beset the term *ingenium* are present also for the terminology of cognition in general, and in particular for words such as imagination, fantasy, common sense, and intelligence. These may present as transparent in their meaning to the casual observer, but those trying to discuss them analytically must perform continual acts of intralingual translation to make sense of them as they attempt to map the opaque processes of thought in language. This is even more the case when the terms themselves mask overlapping and competing theories and conceptual frameworks.

These problems of clarity are due in no small part to the translation shifts that occur during its interlingual translation, but this more obvious form of translation should not blind us to the universal practice of intralingual translation in the search for a shared analytic language, in which terms' meaning can change subtly among different users of what is ostensibly the same language. What is more, as new scientific accounts emerge with their own terminology, older terms lose their technical salience while still remaining in use. Such slippages and struggles are not historical phenomena particular to European premodernity but happen across cultures and times. Ana Rojo has recently stressed the mental experience—cognitive and emotional—of a translator who starts from a source text and, in translating, must construct a meaning from the "mental simulation" that is "central in the comprehension of language" while negotiating between cultures, ideologies, and their own personal idiosyncrasies.[59] Translation entails complex mental activity, hard to fix in words, and its complexity is only compounded in the translation of texts that are themselves *about* mental activity. Adapting Lydia Davis's dictum: to translate is to write; to write is to think; to think is to translate. Paying close attention to the historical work of translators, to the multitude of individual acts of interlingual and intralingual translation of scientific works, sheds light on the nature of translation, and each kind of translation sheds light on the other. More than that, though, such a methodology is necessary for the history of science in its task of explaining how concepts and frameworks of knowledge develop, change, and decline over time.

Notes

1 Jacques Derrida brings out some of this tension in his paradoxical assertion not only that nothing is translatable, properly speaking, but that, simultaneously, nothing is untranslatable. See Derrida, *Qu'est-ce qu'une traduction 'relevante'?*, 19–20.
2 I will give a more thorough account of *ingenium* in a monograph-in-progress entitled *Engines of Invention: Thinking Machines in the High Middle Ages*.
3 For Svenja Gröne, for example, the Cistercian William of Saint-Thierry's *De natura corporis et animae* introduced ideas about physiology from Constantinus Africanus into his monastic circles that he almost certainly found in his reading the "Chartrian" natural philosopher William of Conches. Gröne, "Le premier écrit," 127–29. See also William of Saint-Thierry, *De natura corporis et animae*, ed. Lemoine, 30; Lemoine and Picard-Parra, *Théologie*, 181–82; Jordan, "Construction," 47.
4 For a useful introduction to different twelfth-century theological and philosophical accounts of psychology, see Michaud-Quantin, "La classification."
5 Jakobson, "Linguistic Aspects of Translation," 233: "Intralingual translation or *rewording* is an interpretation of verbal signs by means of other signs of the same language."
6 Derrida, *Qu'est-ce qu'une traduction 'relevante'?*, 29.
7 Iohannes Sarisberiensis, *Metalogicon*, 4. 9, ed. Hall and Keats-Rohan (unless stated otherwise, all translations are mine). See Künzle, *Das Verhältnis der Seele*, 89. This is taken up in a very different and more sustained way in Avicenna, *Liber de anima*, 5. 7, ed. Van Riet, 154–74.
8 Jakobson, "On Linguistic Aspects of Translation," 234.
9 Davis, "To Reiterate," 215.
10 Lewis, "Francis Bacon and Ingenuity."
11 Vallini, "*Genius/ingenium*," 6–7.
12 Eriugena, *Annotationes in Marcianum*, 8. 4, ed. Lutz, 13. For a twelfth-century equivalent, see Richard of Saint-Victor, *Benjamin major*, 3. 21, *Patrologia Latina*, 196:130BD.
13 For discussion on Nemesius, see Chase, "Némésius d'Émèse." For background on Alfanus, see Jacquart, "Les traducteurs du XI[e] siècle."
14 Wolfson, "Internal Senses," 72–73 and *passim*.
15 Nemesius, *Premnon physicon*, 11, ed. Burkhard, 88.8–10.
16 The continuing influence of the idea of the inborn nature of abstract concepts continues into the early modern period, as can be seen in John Locke's rejection of it in his *An Essay Concerning Human Understanding* (1689), 1. 2.
17 Wolfson, "Internal Senses," 74–75.
18 Nemesius, *De natura hominis*, 13, ed. Morani, 69.3–4; see Wolfson, "Internal Senses," 74–76.
19 Nemesius, *Premnon physicon*, 11, ed. Burkhard, 88.24–26.

20 Nemesius, *De natura hominis*, 13, ed. Morani, 14–15.
21 Jordan, "Construction," 45, n.10.
22 Nemesius of Emesa, *De natura hominis*, 12, ed. Verbeke and Moncho, 87.82–84.
23 Ibid., 88.95–96.
24 Roger Bacon, *Questiones super undecimum*, 20; Zupko, "On the Several Senses," 260–61.
25 See *Online Liddell-Scott-Jones Greek-English Lexicon*, s.v. ἐννοίας.
26 Boethius, for example, uses *naturalis intentio* to mean the inclination that impels the human being towards the good in *De consolatione Philosophiae*, 3, pr. 2, trans. Stewart, Rand, and Tester, 240–41. On the multiple meanings of *intentio*, see *Dictionary of Medieval Latin from British Sources*, s.v. intentio.
27 Adelard of Bath, *Questiones naturales*, 17, ed. and trans. Burnett, 124–25. I have emended Burnett's translation, which rendered *ingeniali* as "of the intelligence."
28 Adelard of Bath, *De eodem et diverso*, ed. and trans. Burnett, 70–71.
29 Nemesius, *Premnon physicon*, 11, ed. Burkhard, 72.17–18.
30 Winthrop Wetherbee has, incorrectly in my view, taken the term *ingenium* to be more or less synonymous with imagination in writing about the mind in the twelfth century. Wetherbee, "Theme of Imagination."
31 William of Conches, *Glosae super Boetium*, 1, pr. 1, ed. Nauta, 19, and cf. ibid., 4, m. 7, ed. Nauta, 282. William of Conches, *Dragmaticon*, 6. 18. 18, ed. Ronca and Badia, 242–43.
32 *Glosae super Platonem*, proemium, ed. Jeauneau, 65; ibid., 34, 102; *Dragmaticon*, 6. 26. 1, ed. Ronca and Badia, 266.
33 William of Conches, *Glosae super Boetium*, 1, pr. 1, ed. Nauta, 22.
34 Ibid., 1, pr. 1, 19. Cf. ibid., 4, m. 7, 282.
35 Nemesius says (through Alfanus), in *Premnon physicon*, trans. Alfanus, c. 13, ed. Burkhard, 89, that the "phantasticum igitur tradit dinoscibili apparentia" (the *phantasticum* passes things perceived to the recognizing faculty, also called the *rationale* or "rational faculty" immediately afterwards). The relation between the *phantastica* and the *phantasticum* is not especially clear in Alfanus.
36 Adelard of Bath, *Questiones naturales*, 18, ed. Burnett, 126–27. Analyzing William's specific vocabulary choices in this passage, Danielle Jacquart concludes that neither Nemesius nor Constantinus was the immediate source (Jacquart, "Les emprunts," 324) but nonetheless, see Nemesius, *Premnon physicon*, 13, ed. Burkhard, 89.11–90.21; Pigeaud, "La psychopathologie de Galien."
37 William of Conches, *Dragmaticon*, 6. 18. 7, ed. Ronca and Badia, 242.
38 Ibid., 6. 18. 18, 242–43.
39 Adelard, *Quaestiones naturales*, 18, ed. and trans. Burnett, 126–27: "Whoever first treated these three cells separately, I guess, learnt this very thing by experiencing it with his senses."
40 Jacquart, "Les emprunts," 343–44.
41 Nemesius, *Premnon physicon*, 6, ed. Burkhard, 72.20; Thierry of Chartres, *Librum hunc*, 2. 4, ed. Haring, 91–92.
42 William of Conches, *Glosae super Platonem*, c. 34, ed. Jeauneau, 102.
43 There is a certain amount of ambiguity about the term *percipio*, which can mean either sensory perception or mental apprehension. While it means the

latter here, "perception" cannot help but recall the sensory mode of knowledge, which is, in fact, its opposite.

44 Iohannes Sarisberiensis, *Metalogicon*, 1. 11, ed. Hall and Keats-Rohan. Cf. Hugh of St. Victor, *Didascalicon*, 3. 8, *Patrologia Latina*, 176:771B.
45 Isaac of Stella, *Epistola de anima*, *Patrologia Latina*, 194:1879BC.
46 Ibid., *Patrologia Latina*, 194:1879C.
47 *De spiritu et anima*, 4, *Patrologia Latina,* 40:782.
48 Ibid., 11, *Patrologia Latina*, 40:787.
49 For an in-depth discussion of translation choices made by the Latin translators of Avicenna, see Bertolacci in this volume.
50 For the centrality of *ḥads* in Avicenna's epistemology see Gutas, "Intuition and Thinking."
51 *Posterior Analytics*, 1.34, 89b10. See Gutas, "Ibn Sina [Avicenna]"; Jacquart, "La notion d'*ingenium*," 65; Goichon, *Lexique*, §140; Rahman, *Avicenna's Psychology*, 36–37. *Eustokhia* is rendered by both James of Venice and Gerard of Cremona as *subtilitas*, a form of *sollertia*, in their Latin translations of the *Posterior Analytics*. See Aristotle, *Analytica Posteriora*, 1.34, ed. Minio-Paluello and Dod, 67.20 and 246.20.
52 Avicenna, *Liber de anima*, 5. 7, ed. Van Riet, 152.94–99. The Latin of this passage includes the curious assertion that "subtilitas autem est supra ingenium" (subtlety is above ingenuity). The Arabic actually has *al-dhakāʾ* (acumen, which the Latin *subtilitas* translates here) as a power (*quwwa*) of *ḥads* rather than being *above* it as in the Latin version, which may come from reading *quwwa* as *fawqa*. I am grateful to Michael Chase for generously sharing his insight and knowledge on this point.
53 Avicenna, *Liber de anima*, 5. 7, ed. Van Riet, 153.100–18.
54 The Latin translators of Avicenna render *ḥads* by *subtilitas* at Avicenna, *Liber de anima*, 5. 6, ed. Van Riet, 151.79 (equivalent to the Arabic at *Avicenna's "De anima,"* ed. Rahman, 248.15). At *Liber de anima*, 5. 7, ed. Van Riet, 152.94–99 (equivalent to the Arabic at *Avicenna's "De anima,"* ed. Rahman, 249.6ff.) it is rendered as *ingenium*. I am, again, grateful to Michael Chase for his invaluable advice. See also Jacquart, "La notion de l'*ingenium*," 65.
55 Avicenna, *Liber de anima*, 5, ed. Van Riet, 1–67.
56 Jacquart, "La notion d'*ingenium*," 67–68. The popularity of this title is shown in its survival in later manuscripts for the later translation of Burgundius of Pisa and Pietro d'Abano, despite their preference for *terapeutica methodos*. See Jacquart, "De l'arabe au latin," 173.
57 Albert the Great, *Super Ethica*, 6. 9, ed. Kübel, 470.548; 6. 14, 479.557 and 483.561. See also Albert the Great, *Metaphyisca*, 2. 12, ed. Geyer, 103.
58 Albert the Great, *Summa de homine*, 35–41, ed. Borgnet, 306–56.
59 Rojo, "Translation," 723.

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4 The Encounter of Image and *xiang* (象) in Matteo Ricci's *Western Art of Memory* (*Xiguo Jifa*, 1596)

Shixiang Jin

On August 29, 1595, Matteo Ricci (1552–1610) wrote Edouard de Sande (1547–1599), the Jesuit superior of the China mission in Macao, to report that the literati in Nanchang city marveled at his amazing memory. They even regarded it as a miracle, he boasted. How, asked his admirers, could Ricci possibly remember random Chinese characters just at a glance, no matter how many were presented to him on one page?[1] Ricci's reaction was to wonder if this would not be a good opportunity "to convert more local people to Christianity" by imparting his system of mnemonics to them—or at least to those Chinese literati who yearned to pass the civil service examinations—in an apparently Sinicized form.[2] As Peter Burke has noted, the Jesuits were "specialists in cultural translation" who aimed "to be 'all things to all people.' " In that sense, "Ricci's strategy of dressing as a Chinese scholar was typical of his order."[3] The result of Ricci's deliberations was a short book in Chinese entitled *Xiguo Jifa* (西國記法 *The Western Art of Memory*, hereafter *Jifa*), which was published in 1596 and circulated among members of the Ming dynasty elite.

Jifa is a six-chapter treatise divided into three parts. In the first two chapters, Ricci treats of "Principles" (*Yuanben* 原本) and "Application" (*Mingyong* 明用), narrating the Aristotelian epistemological process of recall based on images (象記法). In the next three chapters, he explains carefully the activity of mnemonics. Initially, in chapter 3, "Setting of Position" (*Shewei* 設位), he shows how to establish appropriate places in the mind to situate or deposit already formed images. In the fourth chapter, "Building of Images" (*Lixiang* 立象), which works on the assumption that Chinese characters are images, Ricci gives specific instructions for forming images from Chinese script. In the fifth chapter, "Determining of the Material of Knowing" (*Dingshi* 定識), he turns to more practical questions and presents a series of cases in which places and images are combined into a dynamic activity of memorizing. In the last part, chapter 6, "Extension of this Material" (*Guangzi* 廣資), Ricci supplies further examples of image formation out of 120 Chinese characters.

This little treatise has attracted the attention of scholars since the 1980s, particularly because it is believed to have been the first text to introduce European rhetoric to China. The scholarship has investigated *Jifa*'s

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occidental heritage, its vernacular modifications, its basic characteristics, its writing aims, and its historical reception in China. Just recently, Jaewon Ahn found that *Jifa* was strongly influenced by Johann Host von Romberch's *Congestorium articifiose memorium* (1520).[4] Three decades before Ahn, Michael Lackner translated *Jifa* into German and provided a useful introduction. There and in a 1993 paper, Lackner explained that despite Ricci's high hopes, the influence of *Jifa* on Chinese literati turned out to be almost negligible. The reason, Lackner argued, was that "the way in which Chinese characters are transformed into *imagines* is an essentially tautological one, because all Chinese characters work as images, even though not all of them are images."[5] This, it seems to me, is a rather narrow reading of a more complex problem. I suggest instead that Ricci's cultural and epistemic translation failed to bridge the gap between his Western concept of *imagine* and his audience's long-standing philosophical traditions around the notion of image.

In 2018, Ana Carolina Hosne's paper on "Untranslatable Images of a Classical Art of Memory in Ming China" countered Lackner's argument that, in the Chinese Jesuit version of Scholastic memory, the image is closely related to the contemporary Chinese notion of "the abstract."[6] Instead, she finds that

> as a man of the Renaissance, Matteo Ricci's mind was a mass of associations, things that "stood for" other things. So images could stand for words, arguments and concepts; but when he merged words and images by exclusively resorting to Chinese characters to condense visuality, the images in Ricci's treatise did not stand for something else, at least not for the Chinese.[7]

Against the background of Hosne's work, I will respond to Lackner's assertion by clarifying major differences between what Ricci intended by the term 象 (*xiang*, the Chinese translation of the "image" in mnemonics) in *Jifa* and what contemporary Chinese literati understood by the term. I suggest that due to his personal memorizing experience, academic training, and missionary strategies, Ricci uprooted the Chinese characters from their cultural tradition and treated them as physical images that could be perceived, memorized, and experienced using the inductive process that Aristotle outlines in *Metaphysics* I.1 and *Posterior Analytics* II.19. This distinction in the technical meaning of the term *xiang* exemplifies my argument that some basic terms are nourished by a cultural tradition and become virtually untranslatable when cross-cultural translation also involves the translation of philosophical and cosmological systems.

Chinese Characters as Images in Ricci's *Jifa*

Ricci introduced the method circulating among Jesuits for enhancing memory on the basis of two premises: first, human memory is like a storehouse with several loci (which Ricci translates as *wei* 位) in which people can store the objects they wish to remember. Second, the objects worthy of memorizing, in this instance Chinese characters, can be reduced to images (which Ricci translates as *xiang* 象). The essence of the method was to manipulate mnemonic images and deposit them in a fixed and appropriate imaginary locus. At the outset of chapter 2, "Application," Ricci explains the general rules for applying these principles by means of four examples:

> 假如記"武""要""利""好"四字，乃默置一室，室有四隅，爲安頓之所，卻以東南隅爲第一所，東北隅爲第二所，西北隅爲第三所，西南隅爲第四所。即以"武"字，取勇士戎服，執戈欲鬥，而一人扼腕以止之之象，合爲"武"字，安頓於東南隅。以"要"字，取西夏回回女子之象，合爲"要"字，安頓於東北隅。以"利"字，取一農夫執鍊刀，向田間割禾之象，合爲"利"字，安頓西北陳。以"好"字，取一丫髻女子，抱一嬰兒戲耍之象，合爲"好"字，安頓西南隅。四字既安頓四所，後欲記憶，則默念其室，及各隅而尋之，自得其象，因象而憶其字矣。此蓋心記法之大都也。
>
> For instance, to remember the four characters 武 [*wu*, War], 要 [*yao*, Importance], 利 [*li*, Benefit], and 好 [*hao*, Good], one could improvise an internal image of a room with four corners to place the four characters. The southeastern corner is the first, the northeastern corner the second, the northwestern the third, the southwestern the fourth. To memorize the character 武, one can first imagine such a scene in which an armed warrior holding a "halberd" [戈] in his hand desires to fight while another man tries to "halt" [止] him by holding his wrist. Then the image can be deposited in the southeastern corner. In order to memorize the character 要, one can combine the image of "an Islamic woman" [女] with the image of her coming from the "Western Xia" [西], then put it in the northeastern corner. For the character 利, one can imagine that a peasant holding a long "knife" [刀] in his hand cuts "grain stalks" [禾] on the field, and then save it in the northwestern concern. For the character 好, we can imagine that "a woman with a servant hairstyle" [丫] plays with "a child" [子] on her arms and then store the image in the southwestern corner. If the four characters assigned to four places are to be recollected later, one could recall the hall by heart and look for these images in the corners, thereby also the characters. This is the essence of mnemonics by heart.[8]

In this discussion, Ricci constructs an ingenious solution to the problem of how to set up a close association between the Chinese characters and the images required by his mnemonics in a manner that will be accessible to Chinese literati. He begins by building an imaginary mental architecture for storing mnemonic images of the Chinese characters. Then he splits each of the Chinese characters to be remembered into several, seemingly constitutive parts, and contrives a vivid image for each part. He then combines these different parts into one striking image that is easier to memorize than the original character. This is akin to the visual alphabet he learned from European memory treatises, fashionable at the time, in which an image stood for the initial letter of its name, enabling words to be spelled out as a row of objects.[9] Ricci's own imaginary method follows this model by combining the meanings of two pictorial constituents of one Chinese character to form a single striking story that can subsequently be deposited in a particular place of the mental palace. For instance, he breaks down the character 武, meaning "war" in Chinese, into two simple elements: the right side (戈) and the left side (止). The two sides of 武 are not, however, just simpler elements of one character, but characters in themselves, carrying their own meanings in Chinese. 戈 means a weapon named halberd, and 止 expresses the action of halting—hence Ricci's suggestion of imagining a scene where a man tries to halt a warrior holding a halberd. This complex imaginary story, containing such vivid and action-related representations of a war-like scene, subsequently has to be located in a particular room of the mental palace by the learner. In order to recall the character 武, the learner simply reenters his memory palace, returns to the place where the image was originally stored, and retrieves it. Ricci's method of memorization and recalling is thus based firmly on the dissociation and recombination of images within mental arrangements. Without the orderly arrangement of the images in an appropriate place or against an appropriate background, retrieval is deemed impossible.

Having clarified the basic rules of his mnemotechnics in chapter 2, Ricci explains its methodology in much greater detail in the next three chapters. Chapter 3, "Setting of Position," discusses the properties that a place for the images must possess:

> 凡記法，須預定處所，以安頓所記之象。… 處所既定，爰自入門爲始，循右而行，如臨書然，通前達後，魚貫鱗次，羅列胸中，以待記頓諸象也。… 夫安象於處所，猶書字於漆板，其字有時洗去，而漆板用之無窮。故處所非象可比，最宜堅固穩妥，然後利終身之用。
>
> It is important in mnemotechnics to determine the place that has the capacity for images …. Once the place is determined, you can enter into it from the door and go along the right side through it, as if you are reading a book from the beginning to the end. These places are neatly lined up in your heart like the scales of fish where the images are stored and memorized. … Assigning the images to the places is just like writing on a lacquer board: after a certain time, the scripts are washed out, but the lacquer board can be used repeatedly. Therefore, compared with places, the images are not as useful at all.

> The places can be used for a lifetime, the firmer and more stable, the better.[10]

In the remainder of the chapter, Ricci lists thirteen qualities of eligible places—magnificence, leisure, neatness, brightness, and so on. These qualities are of utmost importance, not least because Ricci is convinced that a firm and stable memory palace must be constructed in order to master mnemotechnics.

The claim that "there is no character in this world that could not be conceived as an image" (天下無不可象之之字) marks all of Ricci's efforts in chapter 4, "Building of Images." To realize this claim in practice, Ricci substantially reinterprets the six Chinese principles of character formation—widely accepted by all Chinese literati at the time—on the basis of his belief that "the transition from image to writing was immanent in the history of the script."[11] The six principles were explained by Xu Shen (許慎, c. 55–c. 149) in his *Shuowen jiezi* (說文解字, *Explanation of Graphs and Analysis of Characters*), which accounted for the development of the script and for relationships between characters.[12]

Ricci takes these principles on board, but he amends them to elucidate five methods of dissociating and combining characters, following the practices he presented in chapter 2. His whole project starts from the claim that the principle of the pictograph is primary in character formation:

> 蓋聞中國文字，祖於六書，古之六書，以象形爲首，其次指事，次會意，次諧聲，次假借，終以轉注，皆以補象形之不足，然後事物之理備焉。但今之字，由大篆而小篆，小篆而隸，隸而楷，且雜以俗書，去古愈遠，原形遞變，視昔日自然之文，反以爲怪。而時俗所尚，在古所謂謬譌無取者，咸安用無疑。故茲法取象，一以時尚習見之字爲本，特略及古書耳。
>
> I have heard that Chinese writing is the progeny of six principles of character formation [*liushu* 六書]. The six old principles began with "pictographs" [*xiangxing*象形], next "simple indicatives" [*zhishi* 指事], then "compound ideographs" [*huiyi* 會意] then "phonetic compounds" [*xingshen* 形聲], then "loan characters" [*jiajie* 假借] and lastly "related pairs" [*zhuangzhu* 轉注]. All the other principles made up for the insufficiencies of pictography. The principles of everything were then complete. Present-day characters [have evolved] from Greater Seal Script to Lesser Seal, from Lesser Seal to Clerical, from Clerical to Regular, with vulgar characters mixed in as well. As the distance from antiquity increases, characters mutate from their original forms. The original natural writing of old times is now instead perceived to be strange and unnatural. What is currently considered to be popular would have been considered unbearably strange in antiquity, yet it is widely used without questioning. Therefore, the

> choosing of images for the [memory] technique will be based on the characters preferred by current fashion, with only occasional reference to ancient writing.[13]

Ricci takes the pictograph to be the basic principle of character formation, all subsequent principles being there largely to alleviate "the insufficiencies of pictography." He traces the history of Chinese scripts accordingly, and sets up a map of connections between pictographs, old script, and natural writing in order ultimately to justify building images for mnemonics based on current script fashion. He does not, however, provide a distinct substantiation of his views. His thinking seems to be that although there is a decline in the use of ancient Chinese writing, and the current characters would have seemed strange to the ancients, the old and current scripts both share the same universal principles of character formation, and especially the first one: the pictography of real things.

Based on the relationship between characters and physical reality, Ricci next distinguishes three kinds of images, in preparation for reinterpreting the six principles:

> 凡字實有其形者，則象以實有之物。但字之實有其物者甚少，無實物者，可借象，可作象，亦以虛象記實字，蓋用象迺助記，使易而不忘。然正象與借象、作象，在我活法以通之 …
>
> In general, such characters that take forms out of reality are images of real things. In fact, however, there are only few characters that come from real things. If those things do not exist in the concrete, one can borrow or create images for them, and also use unreal images for memorizing those characters that refer to a real thing. The use of the image can help to memorize easily and is hardly forgotten. In our living method, however, there are real images in association with borrowed images and created images.[14]

This division into three categories, the real, created, and borrowed image, is crucial for Ricci's reinterpretation of the theoretical foundations of Chinese character formation. By subsuming the six Chinese principles under these three categories, Ricci completes his reinterpretation of character formation based on images. He suggests that only those Chinese characters that mirror forms of real things are remembered by virtue of their "real images," and he therefore considers them to be co-extensive with the category of "pictograph." He subsumes those characters remembered by adding imaginary images to the real images, or by deducing them from the real images, under the category of "created images." This category he sometimes also calls "simple indicatives" or "compound ideographs." Finally, those characters that are remembered by "borrowing" images from other characters because they share certain similarities (such as phonetics, meaning, or shape) are categorized as "loan characters," "phonetic compounds," or "related pairs." Ricci finds three simple categories of his own making to reduce the traditional six principles of character formation to his theory of building images. Ultimately, he believes, no matter how complicated Chinese writing is, it can always be attributed to the imaginative modification of some real image.

In the rest of chapter 4, Ricci proceeds to set out five perspectives by means of which characters can be dissociated and combined:

> 至若因實具之物兼形質以成象，或壘本象以成象，或合數象以成象，或參象意而成象，復有難於作象，乃因有形之物，稍損益之以成其象，則知天下無不可象之之字，亦在乎善權巧變也歟！
>
> In the case of a real and concrete thing, one combines the form and material as its image; or one can double the original image to make an image; or can unite several images as one image; or construct an image according to the meaning of the image. If it is still difficult to build an image, one can subtract or add images to the image of corporeal things to attain it. It is therefore obvious that there is no character in this world that could not be conceived as an image, once one has flexibly mastered the rules of the building of images.[15]

Chapter 4 constitutes the core text of *Jifa*, because it is here that Ricci treats thousands of Chinese characters as images and argues that, as such, they can be assigned to a particular place in a person's mind. By combining and dissociating the real images of things and states of affairs, he believes, one can obtain an image of any Chinese character.

In chapter 5, based on various combinations of images of single characters, Ricci promises that a whole paragraph or a text can be memorized in the memory palace. He shows how to apply the art of memory in order to remember typical ancient Chinese sentences, extracted from Chinese classics such as *Analects* (論語) or *Classic of Poetry* (詩經). All the treatises he cites are set texts for the Ming dynasty imperial civil service exams—clearly, Ricci intended to catch the eye of Chinese literati who were hoping to pass the notoriously demanding exams.

In the last chapter, Ricci picks almost 120 different kinds of characters to show his skills and strategies in building images from different perspectives. His procedure reduces the complicated to the simple and replaces difficult-to-remember words with easy-to-remember images. This makes it possible to memorize a whole sentence with the help of the combinations of the images of characters without having to understand the meaning of the sentences exactly.

It is worth noting that in all Ricci's treatments, the real images of things have absolute priority, and the created and borrowed images are of secondary importance. No matter how freely created and borrowed the images used in mnemonics, constructed by imagination, they all have a solid grounding in the real, outer world. As we saw, Ricci repeatedly insists that the pictograph is the basic principle of character formation, and that "all the other [images] made up for the insufficiencies of pictography."

To understand the reasons for this insistence and Ricci's ontological hierarchy between real and borrowed images, we need to return to chapter 1, "Principles," in which he lays a Scholastic theological and epistemological foundation for his mnemonics that explains the heritage of the particular properties Ricci assigned to "image" and the ways he used the concept in his *Jifa*:

> 人受造物主所賦之神魂，視萬物最爲靈悟，故遇萬類悉能記識，而區別以蔵之，若庫藏之貯財貨然。及欲用時，則萬類各隨機而出，條理井井，絕無混雜。……記含有所，在腦囊，蓋顱頭後，枕骨下，爲記含之室。故人追憶所記之事，驟不可得，其手不覺搔腦後，若索物令之出者，雖兒童亦如是。……蓋凡記識，必自目耳口鼻四體而入。當其入也，物必有物之象，事必有事之象，均似以印印腦。
>
> The Creator has endowed human beings with the soul, which is subtly perceptive of all things. It is therefore able to perceive all kinds of things encountered, distinguish them, and preserve them as if they were stored in a warehouse. When someone wishes to use them, every item will come into sight in order and without any confusion … . The place of memory is located in the brain. Behind the skull bone, below the occipital bone, there resides the room of memory. Therefore, people tend to unconsciously scratch themselves on the back of their head when they try to recall what they once memorized, but cannot recall right now. It is as if they try to pull [these memories] out. The phenomenon [of scratching] is observed even in children. … Perceptions necessarily come through the eye, ear, mouth, and nose as well as the body. When they enter [the internal senses], the images of things and the images of states of affairs must come into being. It happens as if the brain is stamped by a seal.[16]

This paragraph is crucial to the epistemological foundation of Ricci's concept of the image. Although his whole mnemonic treatise is reminiscent of Pseudo-Cicero's *Rhetorica ad Herennium*, its theoretical foundation seems to derive from Aristotle's *De anima*, especially concerning the role that the image plays in the process of cognition. Indeed, as a member of the Society of Jesus, Ricci had undergone rigorous academic training at the Collegio Romano, and was familiar with the Aristotelian and Scholastic traditions. His understanding of the term "image," which he used to rewrite the six principles of Chinese character formation, may be seen as deriving from the Aristotelian epistemological context, and especially from *De anima*. As Francis Yates has noted: "For the scholastics, and for the memory tradition which followed them, there was a point of contact between mnemonic theory and the Aristotelian theory of knowledge in the importance assigned by both to the imagination. Aristotle's statement that it is impossible to think without a mental picture is constantly brought in to support the use of images in mnemonics."[17]

This is borne out by the work of another Chinese Jesuit, Giulio Aleni (1582–1649). In 1623, Aleni wrote a pamphlet, *Xingxue Cushu* (性學觕述, *A Brief Outline of the Science of Human Nature*), which was adapted from the Coimbra commentaries on *De anima* and *Parva naturalia*. After introducing Aristotle's four internal senses of the soul, Aleni wrote a chapter "on mnemonics" that cites Ricci's art of memory.[18] The case shows that Jesuits in China, following the Scholastic tradition, regarded the Aristotelian theory of knowledge as the basis of their mnemonics. In short, the concept of image in *Jifa* had a rich Aristotelian epistemological background, especially the theory of perception.

Considering the medieval and post-medieval transformations and developments of Aristotelian theory, the image in Ricci refers to a "sensible species," an image that is directly abstracted from the sensible thing in the world. Images thus represent an object's physical attributes, abstracted by the intellect to form a pure conceptual image, the "intelligible species." The latter represents the thing in the world in its truly essential form. Behind the single notion of the image in the Jesuit art of memory, then, there was a tremendous web of concepts related to the theory of abstraction in Scholastic epistemology. On the deepest level, the images in Ricci's mind might even be signs of the Creator, because in Scholasticism "the theory of abstraction was rooted in two basic principles: that there is a necessary correspondence between objective reality and our conception of it, and that objective reality itself is subject to an inexorable, God-given, logical order."[19]

Character and *xiang* in Wei Jiao's *Liushu jingyun*

Jifa is typical of the appropriation of Chinese traditional views by the Jesuits: Ricci put new Chinese wine into old bottles—bottles made up of Aristotelian philosophical theory, pseudo-Ciceronian rhetoric, and religious concern. But his transformations seemed too alien to Chinese people in the Ming dynasty, and a Confucian scholar at the time probably read something very different in Ricci's writings. That is illuminated by a contemporary Chinese scholar who discussed the topic of character formation from a Chinese point of view, Wei Jiao 魏校 (1483–1543) and his *Liushu jingyun* (六书精蕴, *Essentials of the Six Principles of Character Formation*, hereafter *Jingyun*).

Wei Jiao was the chief of education examinations at the provincial level and the chief executive of national ritual activities, and was a vigorous advocate of the Neo-Confucian School of Bodyheartminding (*xinxue* 心學).[20] His book *Jingyun* was published in 1540 with the purpose of linking Chinese etymology to *xinxue*, which by the early sixteenth century had become the most influential alternative to the "Cheng-Zhu" Neo-Confucian orthodoxy associated with the brothers Cheng Hao 程顥 (1032–1085) and Cheng Yi 程頤 (1033–1107) and with Zhu Xi 朱熹 (1130–1200).

The dictionary *Jingyun* is clearly embedded in Confucian thought and epistemology. Composed in an encyclopedic style, it presents the world that Chinese people inhabited and cultivated at the time. Wei Jiao selects and explains over six hundred characters in six categories: heaven and earth (the first and second *juan*), human affairs and the human body (the third and fourth *juan*), and artifacts and living beings (the last two *juan*). Each *juan* contains about one hundred closely related characters. In *juan* 3, for instance, Wei traces the etymology and meaning of 字, which is the "character" (字) written in Lesser Seal style that was prevalent in the Qin dynasty (before 221 BCE) and explains the relationship between the six principles of character formation on the basis of the Chinese understanding of "xiang and xing" (象形), as image and shape. Ricci interprets *xiang* as referring to a *real* image of a thing or state of affairs. When perception enters the internal senses, according to the Jesuit, the images of things and the images of states of affairs come into being in the human mind. The mind is metaphorically "stamped by a seal."

There is an enormous gap between Ricci's understanding of *xiang* and its Confucian understanding as presented by Wei Jiao. It should be noted first of all that *xiang*, a term that can be translated as "image," "figure," or "pattern," has a long history in China, on which I cannot dwell here.[21] I will limit myself to a few indications of what orthodox Confucian teachings say about it in the Confucian commentaries on the *Yijing* (易經, *Book of Changes*) and its transformations in the Ming dynasty.

In Confucianism, the realm of experience is limited to what lies between heaven and earth. *Xiang* is first referred to in the sixty-four basic situations of the *Yijing*, whose sequences—never static—express the relations between humans and their life-world. In *Xici* (繫辭, *Commentary on the Attached Verbalizations*), part of the *Yijing* and said to have been written by Confucius, the term *xiang* is explained as follows:

> The holy sages were able to survey all the confused diversities under heaven. They observed forms and phenomena, and made presentations of things and their attributes. These were called the Images [*Xiang*] … . The holy sages were able to survey all the movements under heaven. They contemplated the way in which these movements met and became interrelated, to take their course according to eternal laws. Then they appended judgments, to distinguish between the good fortune and misfortune indicated. These were called the Judgments.[22]

In Neo-Confucianism in the Song dynasty, heaven is the image of the *Qian* hexagram 乾卦, which, by virtue of its eternal motion, unremitting and endless generation, means "the highest sincerity does not cease." Earth is the image of the *Kun* hexagram 坤卦, which is the symbol of docility and completion. The principle of the motion of eternal generation and completion equates to *Qian* and *Kun* as the way of heaven and earth. The former belongs to the category of *Yang* 陽, the latter to the category *Yin* 陰. Neo-Confucianism emphasized that "the successive movement of *yin* and *yang* constitutes what is called 'the course (of things)' [*Dao* 道]. That which ensues at the result of their movement is goodness; that which shows it in its completeness is the natures (of men and things)."[23] In Confucianism, *Dao* is recognized as the coherence between cosmological and moral orders. This coherence is also called *Ziran* 自然 (lit. "so of itself"), which became a standard translation for "nature" in Modern Chinese. There, the term refers to the natural environment, but before the nineteenth century, it just meant acting according to the self without prevention or letting things be as they are.[24] This "self" is not a tabula rasa, but emerges out of the *Li* 理 (principle) of movement of *yin* and *yang*. Zhu Xi therefore crystallized the notion of "the investigations of things and the fathoming of principles" as Confucian basic training.

In the Ming dynasty, Wang Yangming 王陽明 (1472–1529), a dissenter concerning Cheng-Zhu orthodox learning, proposed that human conscience, or innate knowing of the good (*Liangzhi* 良知), is the metaphysical foundation of heaven and earth:

> When I say the investigations of things and the fathoming of principles, it means directing the conscience everywhere and to everything. The conscience of my bodyheartminding is the principle of Heaven. By directing the principle of conscience into things, they also acquire their presence. Directing the conscience of my bodyheartminding is extending knowledge [*zhizhi* 致知]. Everything that acquires principles is the investigations of things [*gewu* 格物], which is *Xin* [心 bodyheartminding] and *Li* [理 principle] are combined as one.[25]

Wei Jiao was just a follower of this new trend, as can be seen in his comments on the issue in *Jingyun*:

> 象形，文也，字之母也，一造化之自然也。形難虧象。有事則象其事，亦曰處事，物各付物也。或謂之指事。有意則象其意，亦曰會意。不足也而諧聲，亦曰形聲。未有字也，先有其聲，以聲合形，字以之成。因此生彼，是謂轉注。建首一類，字之原也。以同意相受，或轉其文，或轉其聲，觸類而長，字之委也。又不足也，緣類而假借焉，無不足矣！萬物與我同體，不必其在己，凡此皆字也，文若氣化矣。母生子而子又為母，字所以無窮也。

> "Xiang and Xing" [Image and Shape] is the Script [*wen* 文], the mother of characters, and lets all things be themselves as they are. Shapes hardly miss the Xiang. Where there happens an affair, there is a Xiang of the affair, which also called "doing an affair," that is, a thing presents itself adequately. This is also referred to as "simple indicative." Where there is a meaning, there is a Xiang of the meaning, which also called "compound ideograph." If there is still not enough for generating all characters, there is the "phonetic compound," also called *xingsheng*. The phonetic pronunciation is prior to characters; then by combining figure and phonetic element, a character can be generated. And, the generation from "this" to "that" is called "related pairs." The setting of a classification by "radicals" [*shou* 首] is the origin of character formation. And then, the species of characters are broadened by resorting to similar meaning, related figure, or shared phonetic element. This is the generation of character formation. If there is still not enough, then a "loan character" covers by analogy. Thus, there is enough! [Because] there is no gap between I and All things, it is not necessary that all things are in us. All above mentioned are characters. The Script seems like a phase of the transformation of Qi [*qihua* 氣化]. The mother gives birth to sons, and the sons grow up into mothers again. This is the reason that characters are endless.[26]

This paragraph is crucial for understanding the relationship between characters and *xiang* in Confucian thought. Wei Jiao here elucidates the six principles of character formation in four steps. First, he defines what "Xiang and Xing," the first principle of character formation, is on the ontological level: a script allowing the self-revelation of things. Then he discusses the relationship between *xiang* and the second (simple indicative) and third principle (compound ideograph), and lists three additional principles, all of which seem to lack a Neo-Confucian explanation. He claims the unity of the six principles by giving them a Neo-Confucian foundation.

In the first sentence cited, Wei follows the orthodox Confucian understanding of "Xiang and Xing" as developed in the *Yijing*. There, following the explanations in *Xici*, *xiang* means "to give shape or bring into shape."[27] One of the key characteristics of *xiang* in the *Yijing* is its independence of any human observer. Whether or not we look at it, it is "out there," expressed in all things but in a variety of modes, such as the shape of a thing, the omen of an affair, the orientation of meaning, or a corporeal symbol, etc. This is why Wei Jiao wrote that "Xiang and Xing" is identical to Script in its very ontology. Script is simply the pattern of natural things in their original senses, or, to use his words, "the mother of characters" that "lets all things be themselves as they are."

Once this first principle is clarified on the ontological level, Wei Jiao adds that *xiang* can express itself adequately in yet more shapes or models.

Besides being the very shape of things, *xiang* also runs through all the processes of performing activities and giving them meaning. Hence, he identifies the happening of a thing and its meaning with *xiang*: "Where a thing happens, there is a Xiang of the thing" and "Where a meaning, there is a Xiang of the meaning." *Xiang* thus clearly unifies the nature of all things with human performances and activities of understanding. Yet engaging in activities according to the nature of all things also has at its root a self-revelatory component, according to which "a thing presents itself adequately" (物各付物). In short, Wei Jiao takes the principles of character formation to be identical with the principles of practice and knowing in every sense, and, as a consequence, *xiang* allows all things to show themselves as they are.

Wei Jiao goes on to discuss the remaining principles of character formation, which are related to human intervention, such as artificial combination (phonetic compound), making a connection of similarity by related pronunciation and meaning (related pairs), or giving an extant character new meaning in a specific context (loan character). Although any Chinese character can be formed on the basis of all six principles taken together, Wei seems to worry that the latter three principles are too invasive of the self-revelatory process of *xiang* to match the ontological entailments of this first principle of self-revelation. This is why he also posits an identity between the I and all other things: "there is no gap between I and All things, it is not necessary that all things are in us."

This claim explains a tenet of the doctrine of Bodyheartminding—my Bodyheartminding is the cosmos (吾心即宇宙)—put forward by Lu Jiuyuan 陸九淵 (1139–92), the founder of the teaching of Bodyheartminding. Wei Jiao seems to argue that because all men and things belong to unremitting and endless generation and change, there is no distinction between I and Thing. Hence there is no absolute difference between what is made by humans, even in their minds, and what is made by nature; by extension, there is no real, outer, physical, and objective world which I need to perceive and whence I need to derive my knowledge.

In contrast to the analogy of seal and imprint from the Aristotelian tradition, then, Wei Jiao insists that "it is not necessary that all things are in us" because there is no such world that could be divided into the inner and the outer. All characters created through the six principles are characters identical to *xiang*, although some of them are characters produced by the human mind. At the end of the passage, Wei Jiao reclaims his Confucian standpoint once more by suggesting that as "a phase of the becoming of Qi," scripts and characters, like the other things, are always in change and regenerating.

Wei Jiao's entire discussion gives no inkling that he treats the Chinese characters as pictures, or as images that take on mental existence on the basis of being perceived from the outer physical world. The difference between Wei's understanding of "image" and Ricci's is thus not arbitrary but informed by the radical disparity between Confucian and Aristotelian ontologies and epistemologies. As Roger Ames put it:

> in our [Western] tradition, image in the vernacular combines the notions of perception and imagination, where the mimetic, representative, figurative, and fictive connotations of image are derived from the ontological disparity between a transcendentally "real" world and the concrete world of experience. The absence of such ontological disparity in the Confucian model will mean that image is the presentation rather than the representation of a configured world at concrete, literal, and historical level.[28]

Accordingly, in Wei Jiao's tradition, *xiang*, being both substance and function, presents itself in the patterns of all things, the practices of human affairs, and the performances of reason and affection. Sages such as Confucius, who had the means to perceive the mysteries and movements in the sublunary world, made models for what is suitable to particular things and put forth rules and rituals for human society. The words bearing the sages' comprehension of various modes of *xiang* were inscribed in the Chinese classics, which were then passed down from generation to generation. The ancient classics already contained all possible wisdom; their continued cultivation through an education of the next generation prepared the initiated to comprehend their depths, embodying the patterns so that "the spontaneous responsiveness and conscientious action of the sage took over."[29]

In this tradition, contrary to Ricci's art of memory based on image, the recitation of the sages' teachings was taken to be the primary step of education. As Zhu Xi said: "Children's learning is non-stop reciting based on previous words, which could cultivate their intuitive knowledge and ability."[30] Thus, it is hard to say there is anything that is totally new, because all things have already revealed themselves in a previous recitation of the sages' teachings.

An Untranslatable Term?

In *Jifa*, based on his reinterpretation of 象形, the first of the six principles of character formation, Ricci transformed Chinese characters into various kinds of images made of lines or strokes and related to physical reality. This vital transformation made, he could work with the term in the Chinese language but using a conceptual framework of Aristotelian provenance. More particularly, he integrated *xiang* into an Aristotelian cognitive theory of image, memory, and experience. His success in theory, however, failed to exert the expected influence on Chinese literati in practice. Ricci's pamphlet did not survive in China, although millions of people were eager to find shortcuts to pass the imperial examinations. Nevertheless, the transient encounter of "image" and *xiang* in *Jifa* opened the curtain of intercultural communication between the Occident and the Orient that has survived until today.

Seventy-eight years after the death of Ricci, a French Jesuit named Joachim Bouvet (1656–1730) arrived in Beijing to inherit Ricci's enterprise. This time, he regarded Wei Jiao as his interlocutor and tried to rebuild the philosophical basis of *Jinyun* by laying a Christian foundation for the *Yijing*.[31] With the deepening of dialogue and communication, the apparently untranslatable basic concepts nourished by a cultural tradition were eventually relocated into a new place and endowed with new meanings, in a kind of "cultural transplantation" in Floris Cohen's sense. As Cohen argues, processes of transformation or cultural transplantation offer the most potent boost to novelty and creativity. An influx of foreign people, foreign ideas, and foreign practices may—under the right circumstances—greatly enhance the chance of novel things happening to ideas or habits that were worn out in their original setting.[32]

In short, the word "untranslatable" is not as negative as it may sound.[33] It is the untranslatable that makes differences and diversities possible. In the Confucian horizon, the two opposing principles in nature, *yin* and *yang*, are the origin of change and generation. "Harmony without uniformity" (和而不同) is the premise and condition for novelty and creativity in the future.

Notes

1 Ricci, *Lettere dalla Cina*, 163.
2 Ricci, *Commentari della Cina*, 250.
3 Burke, "Cultures of Translation," 15.
4 Ahn, "On *Xiguo Jifa*," 118.
5 Lackner, "Jesuit Memoria," 205.
6 Lackner, *Das vergessene Gedächtnis*, 16–17.
7 Hosne, "Matteo Ricci's *Occidental Method*," 154.
8 Ricci, *Xiguo Jifa*, 146.
9 Ricci's explanations inherited the basic pattern of the art of memory from the tradition of rhetoric, as becomes clear by comparison with a discussion in the *Rhetorica ad Herennium* (late 80s BCE): [Cicero], *Rhetorica ad Herennium*, III. 17, trans. Caplan, 209, 213, 217,
10 Ricci, *Xiguo Jifa*, 148–49.
11 Rusk, "Old Scripts," 76.
12 For the six principles of character formation, see Xu, *Chinese Words*, 39–40; Rusk, "Old Scripts," 77; Xu, *Shuowen jiezi*, 314–15.
13 Ricci, *Xiguo Jifa*, 151. Translation emended from Rusk, "Old Scripts," 76–78.
14 Ricci, *Xiguo Jifa*, 151.
15 Ibid., 154.
16 Ibid., 143.
17 Yates, *Art of Memory*, 32.
18 Aleni, *Xingxue Cushu*, 269–85, 293–97.
19 Smith, "Knowing Things," 731; see also Smith, "Perception."
20 Huang, *Mingru xue'an*, 46–62.

21 That history is examined at length for Daoist and Zenist Chinese by Robinet, *World Upside Down*, 26–32; Wang, *Returning to Primordially Creative Thinking*, 233–305.
22 *I Ching*, 596–97. Translation emended.
23 Ding, "Possibility of the Recommencement," 43, quoting and explicating the *I Ching*.
24 Lloyd and Sivin, *The Way and the Word*, 200.
25 Wang Yangming, *Quanji*, 44–45.
26 Wei Jiao, *Liushu jingyun*, vol. 3, 46a–b. Before Wei, Wang Anshi (1021–1086) in his *Zi Shuo* (字說 Explanations of Characters) also argued that "although characters are devised by man, they are in fact based on nature." See Mittag, "Becoming Acquainted with Nature," 324.
27 Peterson, "Making Connections," 81.
28 Ames, "Meaning as Imaging," 228.
29 Lloyd and Sivin, *The Way and the Word*, 193.
30 童稚之學，不止記誦，養其良知良能，當以先入之言為主。Zhang, *Xiaoxue jijie*, 94.
31 Chan, *Chinese Books*, 518–22.
32 Cohen, *Modern Science*, 45–46.
33 Quite independently of my conclusions here, I have been anticipated in this notion of "untranslatable" by Barbara Cassin. Cassin, "Introduction," xvii.

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Part III

Sciences and Scientific Norms

Part III Introduction

Experience, Translation, and the Norms of Science

Jamie Cohen-Cole

What were the rules, norms, and expectations by which people in the premodern world conducted themselves as they translated experience onto paper, generating and preserving experience within the bodies of scientific knowledge available to them? As this volume demonstrates, such translation was no simple matter. Aristotelian rules of method took experience to be mutable and therefore an unreliable a source of knowledge. They set a high bar, informing experience's relation to the governing rules, norms, and expectations of science. The norms demanded that, first, sense perceptions be collated and, second, these collated experiences be translated onto parchment and paper, before they could count as experience. Only through skilled practices—applying the proper types of reasoning to sense perceptions, inferring from perceptions, images, and memories, and associating different epistemic or even ontological realms—could experiences be constructed as *scientific*, and from there be made into potential candidates for true and certain knowledge. Such were the towering norms of Aristotelian science.

The norms of authentic scientific experience policed most strictly those topics that strayed farthest from what could be demonstrated by syllogisms or proven by mathematics. This means we moderns can find characteristic candidates for scientific knowledge not only in prototypical instances, but also, and even more clearly, in cases where our predecessors sought to negotiate which topics and methods were inside, which outside proper scientific knowledge. Those cases can be found especially at the fringes of the body of Aristotelian science.[1]

As Julia Reed shows (Chapter 8), normative conventions in early modern England become apparent when medical ontologies designed to help us understand sickness and health are translated into more than one language of mathematics: geometric (following the model of Newton) or numeric. Norms of translation from physical to textual or mathematical form shed light on the scientist's, physician's, and philosopher's personae.[2] The practice of careful measurement, for example, might be taken to indicate the scientist's moral and intellectual virtues.[3]

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But the practices of mathematics cannot simply be taken for granted. Far from expanding everywhere monotonically, numeric measurement and the method of its application to the sciences has depended on cultural contexts.[4] Even the choice of which kind of mathematics—numeric, algebraic, geometric—is most appropriate to use in print and to model the world is part of a system of cultural values that embed disciplinary practices and norms of personal conduct.[5] In both the cases Reed discusses, adopting mathematical forms involved a gain in prestige, through affiliation with either the high status of astronomy or the promise of becoming able to measure otherwise inaccessible indicators of bodily condition. At the same time, both gains involved a loss: the loss of reference to classical ontologies of the humors as transmitted from Galenic medicine. Medical practitioners could nevertheless gain by mathematical translation because each form offered to raise their epistemic status as physicians. Translating medical experiences into the language of mathematics thus marked a potential path to certain knowledge in early modern England, emulating the Aristotelian ideal of certainty.

Yehuda Halper focuses on medieval Hebrew and Arabic philosophy to show how within that same broad context of Aristotelian certainty, experience was filtered by norms of syllogistic reasoning (Chapter 7). Halper figures Moses Maimonides as translating Aristotle for his readers in both a linguistic and an epistemic sense. Four settings for the discussion of experience in Maimonides's *Treatise on the Art of Logic* illustrate a range of norms of evidence and reasoning (inductive, inferential, deductive, syllogistic) that would make observations taken from medicine into candidates for experience and possibly knowledge.[6] One context for the *Treatise* was Maimonides's own work, the *Medical Aphorisms*; the others emerge in three separate translations of the *Treatise* into Hebrew. Halper explains that medieval readers' familiarity with—and perhaps their experience of—very specific contexts, whether of a particular reading and interpretive tradition or of medical cases they had experienced themselves, would have invited specific interpretations of whether and how observations of bodies could achieve the status of certain knowledge.[7] These settings demonstrate that there was a mutable set of formal rules for collecting empirical evidence and translating it into certain knowledge, rules that were in flower well before Francis Bacon outlined his own rules for translating observations into knowledge in the *New Organon* of 1620.

Norms for making experience into knowledge extended beyond rules of inference or the application of geometry and measurement. Hannah Erlwein's and Tommaso Alpina's chapters consider the norms that regulated translation from a given observable instance to a similar unobservable case, at least unobservable to the naked eye. In formal terms, these would be the rules of inference and observation for establishing similarity sets, analogies, and models. Erlwein (Chapter 6) shows that *kalām* theologians debated which forms of analogy would establish a proper translation between the world of everyday experience and that of the eternal. These debates set norms that governed just how experiences of, for instance, writing could be translated into knowledge about that which is inaccessible to the senses, for instance whether and how the world is eternal.[8]

Alpina (Chapter 5) describes how Avicenna's norms for experience conditioned the making of knowledge about animal sensations. Avicenna spelled out which kinds of human observations could count as experiential knowledge about the sensory experiences of aquatic creatures. Direct observation of fish and dolphin anatomy being impossible, Avicenna set normative conditions for making observations of invisible morphology and drawing conclusions from it: when people had prolonged and repeated experience of animal behavior, they could draw valid scientific inferences about animals' sensory or cognitive capacities, in this case their faculty of hearing.

Together, the chapters in this section suggest that the use of experience and observation, even of those things not directly accessible by direct sense impression, did not need to wait for the sixteenth century, as has sometimes been assumed.[9] Centuries before, there were already both specified activities and precise norms governing the use of experience in the making of scientific knowledge—only there was yet not a unified scientific method. This lack of unity marks the premodern period not as unique, but as entirely continuous with scientific study ever since.[10] Further, the premodern scientific studies that made experience both a topic of investigation and a meta-scientific tool have echoes in the work of some twentieth-century cognitive psychologists, who took perception and observation to depend on memory, reason, judgment, inference, classification, and a range of social factors. The cognitive psychologist Jerome Bruner contended that

> the organism is always set or tuned or expectant; he is, in short, ready for certain classes of stimulus events to occur. The tuning of the organism, and we shall discuss its determinants presently, we shall call an hypothesis ... . The data of the scientist are not the raw cues of stimulation, but the perceptions of the scientist which occur when those cues confirm perceptual hypotheses which he has acquired. In this important sense, then, the scientist's data are not found, but created.[11]

As Lorraine Daston and Elisabeth Lunbeck have noted, until recently historians of science have missed the role of the intellect in observation because they read psychologists as being only interested in perception.[12] Perhaps this tradition of fashioning historiographic tools by reading psychologists selectively was a product of historians focusing their attention primarily on prototypical, paradigmatic sciences. If so, then broadening the history of science's scope to ask how non-canonical fields—medicine, theology, the human sciences—have studied perception, reason, observation, and experience offers us the chance to go beyond views of the premodern period as prescientific and take it on its own terms.

Notes

1 Parallels can be found with modern instances that question whether the social sciences are actually science. See Gieryn, "U.S. Congress"; Gieryn, "Boundary-Work."
2 Daston and Sibum, "Scientific Personae."
3 Schaffer, "Astronomers"; Schaffer, "Late Victorian Metrology."
4 Wise, "How Do Sums Count?"
5 For accounts that show dramatically different virtues attached to geometric representation, see Galison, "Suppressed Drawing"; Wise, "What's in a Line."
6 "Candidates for knowledge" is inspired by Ian Hacking's analysis of candidates for truth and falsehood in "Language, Truth and Reason."
7 The effects of different forms of reading on the interpretation of a single text are discussed in Warwick, "Cambridge Mathematics." Warwick drew on the field of reader response to underline his claim that texts are interpreted preconsciously according to the norms of specific reading communities. See especially Fish, *Is There a Text in This Class?*, 318.
8 This observation offers a useful corrective to previous studies of such rules, which suggest that analogical reasoning emerged in the early modern period and with a move away from the kind of thinking characteristic of alchemical study. See Gentner and Jeziorski, "Shift from Metaphor to Analogy."
9 For instance, Grant, *Nature of Natural Philosophy*, ch. 8; Cohen, *Scientific Revolution*.
10 Galison and Stump, *Disunity*.
11 "Cognition and the Limits of Scientific Inquiry." Paper read at the Institute for the Unity of Science at the American Academy of Arts and Sciences, 1951. Jerome S. Bruner Papers, Harvard University Archives, HUG 4242.28. This argument appeared in a number of places, including Bruner, "On Perceptual Readiness." For broader discussion of Bruner's work and the role of scientific reason in shaping observation, see Cohen-Cole, "Reflexivity."
12 Daston and Lunbeck, "Introduction," 5.

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5 Translating Method

Inference from Behavior to Anatomy in Avicenna's Zoology

Tommaso Alpina

The beginning of *Metaphysics* I. 1 contains one of Aristotle's scanty references to the concept of experience (*empeiria*). He claims that experience is the result of several memories of past perceptive acts concerning one and the same thing.[1] However, experience yields new knowledge with respect to that resulting from single perceptive acts, which is stored in memory and is the basis for experience.

It seems that, for Aristotle, experience, though related to particular things, can lead to higher levels of generalization, eventually resulting in universal judgments, which are the domain of art (*technē*). In *Metaph.* I. 1, Aristotle provides examples to explain the transition from the knowledge of particulars to the universal knowledge of principles through experience.[2] These are drawn from the medical field, where experience plays a crucial role—for medicine is a discipline dealing with particulars and based primarily on observation. Astronomy is another case in which experience is essential: there, experience is said to be the first stage to reach the level proper to science.[3] A similar description of experience can be found in *Posterior Analytics* II. 19, where Aristotle contrasts deduction with induction concerning the acquisition of the first principles of demonstration, and experience via sense-perception is the ultimate ground for knowledge.[4] At the beginning of the *Physics*, though not referring to the notions of experience (*empeiria*) or induction (*epagōgē*), Aristotle outlines a method of inquiry into the principles and causes of natural things that starts from what is more knowable and clearer *to us* and proceeds toward what is more knowable and clearer *by nature*. This method suggests an inductive process from the effects to the causes of natural phenomena.[5]

Avicenna has a similar, though refined, account of experience, which is a central concept in his epistemology.[6] In the *Kitāb al-Burhān* (*Book of Demonstration*),[7] I. 9 and III. 5, corresponding to Aristotle's *Post. An.* II. 19 and I. 18, he presents a concept of experience (or "methodic, regulated experience," *tajriba*) distinct from Aristotelian induction (*istiqrā'*). Avicenna's *tajriba* rests on repeated observations and produces valid knowledge under certain, stipulated conditions, on the basis of an observed regularity that cannot be ascribed to mere chance.

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Independently of such observations, a syllogism is connected with experience and hints at the underlying cause (the middle term) of the observed regular phenomenon. Therefore, experience yields new, conditionally—not syllogistic, absolutely—universal knowledge (*kullī bi-sharṭ*),[8] with no certainty deriving from it.[9] The concept of *istiqrāʾ*, by contrast, though also built on information acquired through sense-perception, produces only probable knowledge.[10] As a middle path between pure induction and deductive knowledge, experience thus makes it possible for applied sciences such as astronomy or medicine to be effectively practiced and to produce new, though limited, knowledge. It is no surprise that Avicenna, like Aristotle, uses medical (to be precise, pharmacological) examples to illustrate it.[11]

Unlike Aristotle, in the *Samāʿ ṭabīʿī* (*Physics*) and more generally in the natural philosophy of the *Shifāʾ*,[12] Avicenna usually privileges a "mode of instruction" over a "method of inquiry."[13] He starts from the *communia naturalia* (*al-umūr al-ʿāmma*), the general principles of natural things, passing then to specific issues based on those principles, without engaging (or even claiming to engage) in actual observation of the phenomena as effects whose cause he aims to discover.[14] Avicenna's *Kitāb al-Ḥayawān* (*Book of Animals*, hereafter *Ḥayawān*), however, at the crossroads of natural philosophy and medicine—of theoretical philosophy and a practical discipline—is a notable exception to this established methodology.

Written approximately in AH 418/1027 CE, the *Ḥayawān* is the eighth, longest, and final section of the *Shifāʾ*'s natural philosophy. Avicenna composed it by following Aristotle's three zoological writings available in Arabic translation: *Historia animalium*, *De partibus animalium*, and *De generatione animalium*,[15] which circulated as a unitary work of nineteen books under the title *Kitāb al-Ḥayawān* (*Book of Animals*), the same as Avicenna's title.[16] Avicenna supplements the Aristotelian source with the new medical findings in his *Kitāb al-Qānūn fī l-ṭibb* (*Canon of Medicine*), a formidable textbook of Galenic medicine whose composition started in approximately 1013 CE. This integration occurs primarily in *Ḥayawān* XI–XIV, where the rudimentary knowledge of anatomy and physiology that Aristotle displayed, especially in *De partibus animalium*, needed to be updated.[17]

Throughout the *Ḥayawān*, Avicenna uses the concept of *tajriba* several times to refer to the method by which he and other inquirers have arrived at certain conclusions on zoological issues.[18] Like Aristotle's, Avicenna's zoology is a science of animals from the perspective of their material constituents, that is, their bodily parts.[19] These parts—which, together with other criteria, reveal the genus and the species of the animal—are generally visible to the naked eye and can therefore be the object of direct observation. But Avicenna's zoology also includes, and seems even to favor, inferences as to bodily parts of animals that either remain invisible or cannot be established to perform the same physiological functions based on sufficiently similar anatomy. In the first case, invisibility precludes sense perception as a viable epistemic approach to zoological investigation. In the second, analogical reasoning is precluded as an alternative approach.

Bodily features of many animal species fall under these categories of difficulty for different reasons. Nonetheless, some of those features can still be said to have certain physiological functions based on a third epistemic approach: an inference from behavior to anatomy and, consequently, to physiology. The inference is based on sufficiently repeated observation of a specific behavior in similar circumstances, providing it with adequate epistemic grounds (visibility, comparable conditions of the observational process, and the combination of personal and testimonial experience).

This chapter explores the structure and use of the third epistemic approach in Avicenna's zoology. I focus on the beginning of *Ḥayawān* IV. 2, where Avicenna adopts it to infer from their behavior that fish (and dolphins) share in the sense of smell and hearing. As we shall see, this epistemic approach involves particular textual strategies for dealing with the Aristotelian source, including selection, paraphrase, and additions.[20] For despite having at his disposal a complete and almost faithful translation of the Aristotelian work, Avicenna incorporates only those passages that are useful for structuring his peculiar inferential approach to bodily parts—passages in which Aristotle reports his personal experience and secondhand experience concerning fish behavior. What is more, the Arabic translator's usage of particular terms like *tajriba* to render the original Greek may have prompted Avicenna to take the use of these terms in zoology and graft them onto his own concepts in order to flag up the method of inquiry proper to this discipline.

Introducing Zoology: Criteria for Animal Classification

Following *Hist. anim.* I. 1, 487a11–14, where Aristotle first maps in "broad outline" (*typōi*, *bi-qawl mukhtaṣar*) the fundamental criteria for distinguishing or grouping animals—manners of living (*bious*, *tadbīr al-maʿāsh*), activities (*praxeis*, *afʿāl*), characters (*ēthē*, in the Arabic translation substituted by *ghidhāʾ*, nourishment), and bodily parts (*moria*, *ajzāʾ*)[21]—Avicenna begins his *Ḥayawān* with a chapter whose title lists the criteria he will apply in the first part (treatises I–X) of his zoological investigation: "On the difference of animals in general concerning shelter, food, characters, activities, and bodily parts" (*Fī khtilāf al-ḥayawān jumlatan min jihat al-maʾwā wa-l-maṭʿam wa-l-akhlāq wa-l-afʿāl wa-l-aʿḍāʾ*).

The first part of Avicenna's *Ḥayawān* corresponds to Aristotle's *Historia animalium*. Following the Aristotelian source, Avicenna devotes treatises I–IV. 1 to comparative anatomy focusing on animals' bodily parts and organs, treatises IV. 2–VI to animals' activities broadly conceived (sensation, locomotion, sleep and wakefulness, male and female distinction, mating habits), treatises VII–VIII to shelter, food, characters, and diseases. Treatises IX–X are devoted to the thorny question of the male and female role in reproduction, aiming to settle the issue that set philosophers against physicians (IX), and issues related to conception and miscarriage (X).[22] As already mentioned, however, in the *Ḥayawān* Avicenna does not simply reproduce the contents of Aristotle's writings without originality, but approaches the Aristotelian material selectively.[23]

Ḥayawān IV. 2 covers the contents of *Hist. anim.* IV. 8–11 and, together with chapter IV. 1, encompasses all the contents of the fourth book of Aristotle's work. Avicenna noticeably streamlines the Aristotelian text, reducing it to a two-chapter treatise. In *Ḥayawān* IV. 2, after dealing with bloodless animals (aquatic animals and insects) as Aristotle does, Avicenna offers a more general discourse on the features shared by all animals, though in different degrees of complexity: sensation (limited to the five external senses), movement, calls, sleep and wakefulness, and sexual differentiation.

The discussion of animals' sensation at pages 61.5–62.17 of the 1970 edition of the *Ḥayawān* corresponds to *Hist. anim.* IV. 8. Again, Avicenna's discussion is much shorter than Aristotle's: a 158-line chapter in Bekker's edition is summarized in a two-page chapter. In this specific context, the reason for Avicenna's selection lies in his attempt, as set out in the introduction to this chapter, to apply the third epistemic approach to bodily features, as an inference from behavior to anatomy and physiology. To this end, Avicenna seems to consider it crucial to combine his personal experience of animals' behavior with secondhand, testimonial experience of the same phenomenon derived from Aristotle's *Historia animalium* so as to ground his conclusions on a more solid epistemic basis.

What's New about Animal Sensation? Textual Selection and Appropriation

After a brief outline of the topics the chapter will cover, Avicenna starts *in medias res* by paraphrasing *Hist. anim.* IV. 8, 532b33–533a3: "Every blooded animal that generates an animal [i.e., viviparous] has five external senses, except those that are damaged, like the mole [*khuld*]. For its eye is under the cover of its skin, although it has pupil, eyeball, and the white [of the eye, i.e., sclera]" (*Ḥayawān* 61.6–7).

Here Avicenna reproduces a general claim Aristotle makes almost at the beginning of *Hist. anim.* IV. 8: that the human being, land viviparous animals, and blooded oviparous animals, which include those endowed with lungs (reptiles and birds) and those endowed with gills (fish—thus excluding the non-blooded oviparous animals such as cephalopods and crustaceans), manifestly possess all the five external senses (*panta phainetai echonta tautas pasas*, 533a1–2), except the damaged ones, such as the mole, which is described in greater detail than in the Avicennian text. The Aristotelian remark thus concerns one of the two main classes into which animals are distinguished, that of blooded (coextensive with vertebrate) animals. Furthermore, by qualifying the viviparous animals as land animals, Aristotle is—at least for the moment—excluding aquatic and flying viviparous animals, the cetaceans and chiroptera.

Avicenna's version of this remark is narrower than Aristotle's. By mentioning the blooded viviparous animals ("blooded animal that generates an animal"), he points to a specific subclass (that of viviparous animals) of the higher class of blooded animals. This version may depend on the last sentence of the Arabic translation of Aristotle's Greek, which reads: "We ought to know that the human being, the land [*al-mashshāʾ*, lit. walking] animals that generate an animal like themselves, and all blooded animals that generate an animal have all the sense-organs."[24] However, given that the Arabic translation does not feature exactly the same phrasing as Avicenna's text, it seems plausible that Avicenna's different formulation of the Aristotelian sentence arises from the role he assigns to his source within the overall purpose of his exposition. In what follows, I present this claim in more detail.

The table of contents of his discussion on animals' sensation in this part of *Ḥayawān* IV. 2 shows that Avicenna devotes the most substantial part to fish and dolphins, limiting his treatment to the senses of taste (briefly), hearing, and smell (61.7–62.11), which Aristotle addresses at 533a30–534b12. Then there is a brief discussion on the sense of smell in insects, especially ants and bees, which corresponds roughly to *Hist. anim*. IV. 8, 534b18–25 and 534b30–535a5, and testaceous animals such as pearl oysters (62.11–17).

Two elements emerge from this: first, unlike Aristotle, Avicenna focuses almost exclusively on fish and dolphins, with cursory references to insects and testaceous animals; second, like Aristotle, he concentrates on the senses of taste, hearing, and smell, neglecting vision and touch.

Careful inspection of Avicenna's selection reveals that it serves a purpose already present in the Aristotelian text. Like Aristotle, Avicenna focuses on animals that are far removed from us either due to their anatomy, or because they are difficult to observe and their physical characteristics hard to grasp, or both. But unlike Aristotle, he devotes more space to fish and cetaceans than to non-blooded animals (cephalopods, crustaceans, insects, and testaceans) because, unlike the latter group, observation of the former promises to yield significantly new information.

Avicenna's primary focus on hearing and smell seems to arise from a similar epistemic promise. As Aristotle himself notes, all animals, inasmuch as they are animals, must possess at least the sense of touch, so it is superfluous to ask whether an animal possesses that sense or how it senses the tangible qualities.[25] Given that taste is considered a form of touch,[26] its treatment seems to be likewise superfluous. As for sight, considered the noblest sense in the philosophical tradition of Antiquity and Late Antiquity, the reason Avicenna does not deem it necessary to investigate whether an animal possesses it or not may lie in a passage of the Aristotelian text where eyes, the sense-organ of sight, are said to be very visible.[27] Whether or not an animal possesses eyes can be immediately grasped by the senses; and if an animal has them, one can be instantly sure that that animal can see. In *Ḥayawān* I. 3, devoted to instrumental bodily parts (organs) and their location, Avicenna writes: "Induction indicates [*wa-qad dalla l-istiqrāʾ*] that every marine animal has two eyes except some marine animals with earthen skin, and every animal generating an animal [= viviparous] has two eyes except the mole" (21.11–13). The fact that Avicenna here associates the immediate knowledge that an animal possesses eyes with induction (*istiqrāʾ*), which he elsewhere criticizes for yielding only probable knowledge and contrasts with experience (*tajriba*),[28] may help to explain why he seems to find it superfluous to investigate animals' sight: if induction can provide sufficiently solid knowledge about animals' sight, there is no need to linger on the issue.

The reasons for Avicenna's selective approach to the Aristotelian source, then, are extremely relevant in determining what the zoological investigation in the first part of his *Ḥayawān* is all about. As I have said, Avicenna seems to detect particular topics and/or animals that require special scientific investigation because they are below the threshold of what is immediately evident to the senses. This means that zoology seems to focus not (or not only) on animals' perceptible features, but on features that are not immediately perceptible through ordinary observation and therefore need to be subjected to a specific scientific investigation, the basis of which is always sense-perception. Let me now spell out the method and characteristics of this investigation proper to zoology.

From Behavior to Anatomy: Eyewitnessing and Repeated Observation

Avicenna's introduction to his exposition of the senses of fish supports my hypothesis that he primarily brings to the fore an argument implicitly present in his Greek source. Avicenna writes:

> [(a)] Fish also are endowed with taste, and because of it they incline toward some things having taste but not toward some others. [(b)] The organ of hearing and smelling of fish is *not evident* [*wa-laysa yaẓharu li-l-samak ālat al-samʿ wa-l-shamm*]. The nostrils of fish do not lead to their brain, but rather to their gills. [(c)] However, if they did not hear they would not flee from frightening sounds, and if they did not smell they would not come together to the trap [made for them] with the smell of milk and other things.
>
> (61.7–10)

This passage is an abridged version of *Hist. anim.* 533a30–b6. Each of its three parts contains an interesting remark for the present purpose. Like the blooded, viviparous animals, fish, which belong to the class of blooded, oviparous animals, are said to have the sense of taste. This is inferred not immediately from some anatomical feature they display, but from a particular behavior: their selective inclination for things having taste. That information could not be grasped from a mere glance, but seems to be derived from some more structured, prolonged experience. In all likelihood, this experience arises not from ethological interest, but from fishing techniques—just as with Aristotle, from whom the account may have been drawn. In *Hist. anim.* IV. 8, 533a30–33, Aristotle refers to tasty baits (*delear*) to attract fish; and in the Arabic translation, the desire of fish for tasty things is connected with *ṣayd* (hunting or, in this case, fishing).[29]

That fish possess the sense of hearing and smell is more difficult to establish than their having the sense of taste, and Avicenna acknowledges as much. The reason is that the sense-organs for hearing and smell are concealed in fish, whose peculiar anatomy prevents the inquirer from inferring a solid knowledge through analogy. Here two elements are noteworthy. The first is *a parte obiecti*. Mere observation does not allow the inquirer to establish whether fish share in the sense of hearing and smell, because the sense-organs through which those senses usually operate are hidden to the inquirer's sense-perception. The second element is *a parte subiecti*. The peculiar anatomy of fish hinders access to cognition on this matter, for the inquirer cannot establish an effective parallel between his own anatomical features, more familiar to him and thus used as a cornerstone for comparative anatomical investigation, and those of fish. Avicenna offers an example, derived from Aristotle:[30] even that which resembles human beings' (and other animals') nostrils, and ought thus to be used for the same purpose (smelling, together with inhaling), does not in fact perform the same function in fish. That is because the nostrils of fish, unlike those of other animals, are not connected with the brain, which Avicenna seems to take as the seat of sensation,[31] but with gills,[32] and therefore cannot be the sense-organ for smelling. Be that as it may, the example borrowed from Aristotle is probably based on some anatomical dissection. We do not have sufficient information to establish whether Avicenna (or even Aristotle) actually dissected a fish or simply adopted the results recorded by someone else who did.

Despite the difficulties arising from the fact that the sense-organs of hearing and smell in fish are hidden and cannot be easily compared with their cognates in human beings and other, more knowable animals, Avicenna concludes that fish must share those senses because they flee startling sounds and are trapped by bait. How does Avicenna reach this conclusion? And what kind of knowledge is it?

In the rest of the discussion, Avicenna gives the reader evidence substantiating his conclusion about hearing and smell in fish. That evidence is collected through sense experience, either firsthand or secondhand. The former is the result of Avicenna's direct acquaintance with a certain phenomenon and is introduced by the formula "I say," as is customary in the

Ḥayawān.[33] The latter is quoted from Aristotle and is either the narrative of Aristotle's own experience or his account of others' experiences.

> I say [*aqūlu*]: I myself have also witnessed them [*ḥattā annī shāhadtuhā*] diving into ponds[34] in which milky things are thrown, and being easily trapped. I have already seen with my own eyes [*qad ʿāyantu*] fish proceeding toward the singing and the playing of the lute and the cymbal. When they are close to the gathering [where instruments are being played], they remain quietly listening, without moving. When the [act of] hearing [the sound of those instruments] stops, they flee away; however, when it [i.e., the sound] resumes, they come back.
>
> (61.11–13)

Avicenna infers that fish possess the sense of smell and hearing from two distinct experiences. First, he *witnessed* that fish are attracted and caught by throwing milky things into the water. Consequently, he can claim that they distinguish between smells and incline toward their favorite ones. Second, he *saw with his own eyes* that fish are attracted by the sound of musical instruments at some gathering, since they come near to the place where instruments are played, go away when the sound ceases, and come back when it resumes. Therefore, he can conclude that they can hear.

Noteworthy in Avicenna's narrative of his own experiences is the terminology he uses to introduce them: *shāhada* (to witness, inspect, observe) and *ʿāyana* (to see with one's own eyes, examine). These verbs, used here in the first person singular for the first and only time, at least to my knowledge, in the *Ḥayawān*, seem not to have been randomly chosen. They convey a precise meaning: Avicenna was personally witnessing the behavior of fish, which made him conclude that they share those two external senses.

A second point of interest is the *kind* of experience he had. Although this is a sense experience accomplished through sight, it is not the result of a quick look at fish and their external appearance, but rather a prolonged observation that enables Avicenna to infer some cognition from fish behavior, as remarked above. I am assuming that in both cases, it takes a trial-and-error procedure to know the baits by which fish are particularly attracted and a suitable period of time to see the fish actually biting them, or, in the case of hearing, being attracted by the sound of some musical instruments (as indicated by the detailed description of musical performance with interruptions and resumptions).

In general, becoming acquainted with animals' behavior requires conditions that can be met only over a certain time. However, there is a difference between the two types of experiences Avicenna mentions. Although both seem to be accomplished according to the same pattern (an observer, an object of observation inspected over a certain period, the right conditions for observation), the first kind of experience is connected with fishing techniques, which may involve knowledge previously acquired not necessarily by Avicenna himself, but communicated to him and put to use at the moment of observation. The second experience seems to be less structured. The impression given by the text is of a casual circumstance—Avicenna taking part in a gathering where instruments were played close to a pond containing fish—that turns into a significant experience, bearing a certain cognition about fish, thanks to Avicenna's curiosity and attentive examination. It is worth emphasizing, though, that apparently in neither case did he introduce the stimulus specifically to see what fish would do. This is, then, not an "experiment" in the sense of intervening with the goal of making a scientific finding. Of course, we cannot be sure that Avicenna actually had those experiences, even though it is not uncommon to find similar, though more concise, accounts of his personal experiences in the *Ḥayawān*.[35]

Avicenna's report of his direct, visual experience is followed by a selection from the Aristotelian texts concerning the sense of hearing in fish, which consists of secondhand experiences:

> The First Teacher [i.e., Aristotle] said: [(i)] dolphins and some species of fish are dazed by the sound of pans and the sounds of thunder, and they flee toward the depth [of the sea], then they are trapped …, yet dolphins do not have a [visible] organ of hearing [*wa-inna l-dulfīn lā āla samʿ lahā*]. And [the First Teacher said]: [(ii)] when fishermen [*wa-inna l-mallāḥīna*] decide to go fishing, they stop from [using] oars, reduce the sounds in order not to make the fish flee, and loosen the sail so that no rustling sound may be heard. Then, when they surround the fish, they shout, make noises, and clank to gather the fish in the middle in one single place. [(iii)] And when a shoal of fish appears [on the surface of the sea] to graze in tranquility, they [i.e., fishermen] slowly approach the shoal in order to discern it [reading *li-yaʿrifūhu*]. If they are not friendly, the shoal flees. [(iv)] Among the river fish that seek shelter under rocks, there are those that are dazed and confused by [people's] beating on the rock under which they seek shelter. Then they come out, like someone who faints. So, fish [can] hear [*fa-l-samak yasmaʿu*]. Indeed, people of experience attest [*bal qad shahida ahl al-tajriba*] that their hearing is acute and sharp, especially in the case of the mullet [cf. *kestreus*, 534a8], *sarrī* [cf. *salpē*, 534a9], and *ḥrūmīs* [cf. *chromis*, 534a9].
>
> (61.14–62.5)

Here, Avicenna summarizes almost fully the contents of *Hist. anim.* IV. 8, 533b9–534a4. The passage is particularly relevant because Aristotle acknowledges that fish and dolphins possess the sense of hearing, although their anatomy should suggest otherwise—at first glance, they seem to lack ears, the sense-organ usually connected with hearing and, on that basis, one would incline not to ascribe hearing to them. Just as in Avicenna's report of his own experience, Aristotle seems to ground his claim on a specific kind of perception, a prolonged observation of the behavior of fish and dolphins, not on an occasional or even singular visual act, which would lead to the opposite conclusion.

However, in Aristotle's text it is clearer than in Avicenna's that in order to draw this conclusion about fish and dolphin hearing, the writer relies not on his personal experience but on fishermen's experience. The reason Aristotle does so may be that fishermen have an extensive acquaintance with fish and dolphins as a result of their constant and repeated interactions with them, aiming to find the most effective fishing techniques—ones that take advantage of the creatures' peculiar behavior, in this case their reaction to sounds. Considered reliable, fishermen's reports in the Greek text (which Avicenna summarizes) lead Aristotle to the conclusion that fish can hear (I no longer discuss dolphins, as they are not mentioned in Avicenna's account of his own experience).

These passages containing Avicenna's reports of his own experiences and his summary of the Aristotelian text seem to imply that although sense-perception is fundamental for zoological investigation, Avicenna does not believe every isolated sense experience to be conducive to a firm grasp of certain animal features. The concluding sentence of the excerpt quoted above is revealing. Avicenna claims there that "people of experience attest" (*bal qad shahida ahl al-tajriba*) that the hearing of fish is acute, and then provides some examples. The crucial words here are *shahida* (to attest, bear witness) and *ahl al-tajriba* (people of experience). "People of experience" lend corroborative evidence that fish have a sense of hearing.[36] By experience (*tajriba*), Avicenna here seems to mean something more structured than mere observation, and may be referring to the technical notion of *tajriba* (methodic or regulated experience) he sets out in the *Burhān*. This certainly echoes the Aristotelian text, as I pointed out in the introduction.

The corresponding passage in the *Hist. anim.* contains a similar claim. There, Aristotle says that "people living by the coast" (*diatribontas peri tēn thalattan*) argue that fish possess not only a sense of hearing, but an acute one. They come to this conclusion because of their iterated exposure to fish behavior in contexts similar to those in the report of fishermen's experiences.[37] Interestingly, it is the Arabic translation that introduces the word *tajriba* in this context, rendering *diatribontas peri tēn thalattan* as "some people of experience and possessing the knowledge of the nature of marine animals" (*baʿḍ ahl al-tajriba wa-l-maʿrifa bi-ṭibāʿ ḥayawān al-baḥr*, 207.6–7). The circumlocution used by the Arabic translator emphasizes that what makes coast-dwellers' claim about fish valuable and trustworthy is their experience (*tajriba*) of the creatures' behavior, from which they infer something about their nature.[38] Avicenna may have taken the use of the word *tajriba* by the Arabic translator and grafted on his own concept of experience as a more structured procedure than mere, occasional observation—something, probably based on repeated acts of perception, that results in a solid understanding of the phenomenon. Although the discussion about fish's sense of hearing is soon concluded, Avicenna makes a final remark on the topic: "In the case of some fish and dolphins, the sound arrives at their brain from a different organ [i.e., different from the ears], to which hearing is proper" (62.10–11).[39]

In sum, Avicenna's discussion of fish's sense of smell (62.5–10) is very concise and entirely based on the abridged version of the Aristotelian text found in the Arabic translation. There, Aristotle concludes that fish have a sense of smell on the basis of the experiences of fishermen, who use fishing techniques taking advantage of fish's capacity to distinguish smells.[40]

Similarly, in the passage on insects (ants and bees) and testaceous animals, Avicenna summarizes the corresponding text in the Aristotelian source, which is already very concise. Aristotle collects some evidence about ants having a sense of smell because they flee the smell of sulfur (Avicenna adds the smell of arsenic) and the smoke of storax and stag horn; about cephalopods and crustaceans having a sense of smell because they are attracted and caught using particular baits; about bees having the sense of taste because they prefer fragrant flowers over rotten-smelling ones; and about testaceans (among gastropods) having the sense of smell and taste, such as the purple-fish. Avicenna omits all reference to cephalopods and crustaceans and to bees' sense of taste, and makes only a general point about insects and testaceous animals having the sense of smell. However, the conclusion of that point is worth quoting: "We have no knowledge of sight and hearing in them" (*fa-lā ʿilm lanā bihī*) (62.17). This remark, which has a parallel in the Aristotelian text,[41] seems to suggest that nothing can be said about whether these animals do or do not have a sense of sight and hearing. This is the case either because it is difficult to observe them for a prolonged period or because even repeated observation supplies no clues since their behavior does not display as much internal likeness as in the case of fish.

Broadening the Perspective: Toward a Conclusion

Avicenna does not say anything explicit about the subject-matter or method of zoology at the beginning of the *Ḥayawān*. However, there are some indications of zoology's subject-matter in the dense prologue to the *Nafs*, which comes immediately before the botanical and zoological section of the *Shifāʾ*. In the prologue, Avicenna argues first that the investigation of the soul must take priority over that of the body because the soul is the formal cause of the organic composites, and their study should begin with the principle that determines what they are in actuality, that is, the form. He adds that the investigation of the soul pertaining to psychology might be supplemented by a specific discourse (*kalām mukhaṣṣaṣ*, 3.1) on plants and animals. That discourse will no longer have to do with their souls, but primarily with their "bodies and the properties of their bodily activities" (*muta'alliq bi-abdānihā wa-bi-khawāṣṣ min af'ālihā l-badaniyya*, 3.2).[42]

At first glance, what Avicenna means by "bodies and the properties of their bodily activities" seems to pertain to the domain of matter and material characteristics, which can account for those differences between animals (and between plants) that cannot be inferred from their having a certain soul. This interpretation is suggested by the immediately preceding passage, where Avicenna says that the investigation of the soul (and of what derives from it in terms of faculties and activities) must be an investigation of the common features shared by all instances of sublunary souls and their bearers. The specific features of each, though essential, must be left aside because it is too difficult for us to grasp them—or, at least, such an endeavor can only follow the investigation of what they share.[43] Avicenna seems to assign this task to zoology, which can accomplish it by looking at animals' specific external, material features. The method that would be required for that, however, remains unclear.

The section of *Ḥayawān* IV. 2 I have discussed sheds light on the question of zoology's method (at least in the context of comparative anatomy). Undoubtedly, zoology deals with the body, its parts, and its peculiar features that distinguish (or group) animal species. It offers a deeper understanding of different animal classes than that derived from their soul. To say that animals have an animal soul gives us only a formal, explanatory principle, which orients our inquiry into particular animal classes, preliminarily giving us general coordinates: we should expect to encounter organic, living beings capable of perceiving and moving, those abilities being less or more refined in the different instances of living beings endowed with an animal soul.

The investigation of animals' bodily features is conducted through the senses, which are capable of perceiving and recording their great variety.[44] However, such investigation cannot be based only on the single perceptive acts accomplished by the senses. Besides sensible features acknowledged by the senses either immediately (we see that an animal has two wings) or after dissection (we see that an animal has two lungs), there are animal features belonging to a sub-perceptible realm, not in that they are not perceivable at all, but in that they are not the object of a specific sense and thus cannot be grasped by a single, atomistic act of perception, but only through a combination of repeated perceptive acts. This combination brings about what Avicenna calls *tajriba*. Methodic experience (*tajriba*) is precisely what we saw in the case of animals' sensation, especially where animals' anatomy is far removed from ours and it is difficult (or even risky) to establish analogies. In the context of *Ḥayawān* IV. 2, "experience," both personal and testimonial, is what enables Avicenna to outline a peculiar epistemic approach to animal features. This approach can be called a "translation" in the sense that it is an inference or transfer of knowledge from behavior to anatomy and, consequently, to physiology.

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Notes

1 *Metaph*. I. 1, 980b28–981a1; Gregoric and Grgić, "Aristotle's Notion," 9, give an English translation with an in-depth analysis of the passage and of Aristotle's notion of *empeiria*. See also LaBarge, "Aristotle on *Empeiria*."
2 *Metaph*. I. 1, 981a1–12. The transition from particulars to universals on the basis of experience is a thorny issue in Aristotle. See Gregoric and Grgić, "Aristotle's Notion," 15–29.
3 *An. Pr*. I. 30, 46a17–22. On this passage, see Gregoric and Grgić, "Aristotle's Notion," 21–22.
4 *Post. An*. II. 19, 100a3–6.
5 *Phys*. I. 1, 184a16–21. On this passage and its interpretation by late Ancient commentators, see Alexander of Aphrodisias, *Commentaire perdu à la* Physique *d'Aristote*, 592–95; Morrison, "Philoponus and Simplicius," 9.
6 On Avicenna's notion of *tajriba*, see McGinnis, "Naturalized Epistemology"; Janssens, "'Experience.'" For the Aristotelian background, Gutas, "Empiricism," 399–400.
7 This is the fifth section of the logical part of Avicenna's *Kitāb al-Shifāʾ* (*Book of the Cure/Healing*, hereafter *Shifāʾ*), and corresponds to Aristotle's *Posterior Analytics*. The *Shifāʾ* is Avicenna's most comprehensive philosophical *summa*. Written between c. 1020 and 1027 CE, it covers a great deal of the philosophical legacy, especially Aristotelianism, inherited from Antiquity. The four main areas this massive work encompasses are logic, natural philosophy, mathematics, and metaphysics.
8 Avicenna, *Al-Shifāʾ*, *al-Manṭiq, al-Burhān* I. 9, ed. ʿAfīfī (hereafter *Burhān*), 96.4–7.
9 Ibid. I. 9, 98.1–2. On this passage, see Alpina, *Subject, Definition, Activity*, 154–55.
10 *Burhān* I. 9, 95.16–18.
11 The standard example is the knowledge of scammony's capacity for purging yellow bile, which is acquired from repeated observations of the same phenomenon. For the discussion of this example, see *Burhān* I. 9, 95.1–18. See McGinnis, "Naturalized Epistemology"; Janssens, "'Experience'"; Gutas, "Empiricism."
12 The *Samāʿ ṭabīʿī* is the first section of the part on natural philosophy, which corresponds to Aristotle's *Physics*.
13 On this distinction and its application to *Samāʿ ṭabīʿī*, see Lammer, *Elements*, 70, 75.
14 See ibid., 62–81. On Avicenna's method in psychology, see Alpina, *Subject, Definition, Activity*, 58–95.
15 In his Introduction to the *Shifāʾ*, in Avicenna, *The Healing*, ed. Di Vincenzo, 8.38–40, al-Jūzjānī gives insights into the composition of the *Ḥayawān*: "He [Avicenna] also composed the [*Book of*] *Animals* and the [*Book of*] *Plants*, and completed these books. Although in most of the *Book of Animals* he

followed a course parallel to the *Book* [*of Animals*] of the philosopher Aristotle [*wa-ḥādhā fī akthar kitāb al-Ḥayawān kitāb Arisṭūṭālīs al-faylasūf*], he made additions going beyond them [i.e., Aristotle's *Plants* and *Animals*] [*wa-zāda fīhā min dhālika ziyādāt*]" (all translations mine unless otherwise attributed).

16 No Arabic translation of *De motu animalium* and *De incessu animalium* is attested, though Averroes seems to refer to the first work in his commentary on Aristotle's *Parva naturalia*. For the ninth-century Arabic translation of Aristotle's *Historia animalium*, *De partibus animalium*, and *De generatione animalium* see, respectively, *The Arabic Version of Aristotle's* Historia Animalium (ed. Filius), *The Arabic Version of Aristotle's* Parts of Animals (ed. Kruk), and Aristotle, *Generation of Animals: The Arabic Translation Commonly Ascribed to Yaḥyā ibn al-Biṭrīq* (ed. Brugman and Drossaart Lulofs). The authorship of this translation is still debated. See the introductions to the editions.

17 See Musallam, "Avicenna."

18 See Avicenna, *Al-Shifāʾ, al-Ṭabīʿiyyāt VIII, al-Ḥayawān*, ed. Muntaṣir, Zāyid, and Ismāʿīl (hereafter *Ḥayawān*), IV. 2, 62.5; IX. 5, 172.9; XII. 4, 204.5, 8; XIII. 1, 271, 10; XIII. 7, 324, 3; XV. 1, 385.7; XVI. 1, 401.9; XVII. 1, 416.11.

19 See Lennox, *Philosophy of Biology*; Avicenna, *Avicenna's De anima* (*Kitāb al-Nafs*), prologue, ed. Rahman (hereafter *Nafs*), 2.18–3.2. I return to this passage below. The *Nafs* is the sixth section of the *Shifāʾ*'s natural philosophy.

20 See *Ḥayawān*, I. 1, 1.10–13: "Let us now talk about animals by following in all this book the first teaching as a model [*muḥtadhīna fī jamīʿ hādhā l-kitāb ḥadhwa l-taʿlīm al-awwal*], except in the case of the anatomy of the organs of the human being [*illā fī tashrīḥ aʿḍāʾ al-insān*]—actually, we prefer to put together anatomy [*al-tashrīḥ*] and [its] usefulness [*al-manfaʿa*] in one single place [*fī mawḍiʿ wāḥid*]—and in the case of few [other] things. Then we shall cut off in terms of information that which he [Aristotle] was prolix about. We shall mention of the theoretical discourse [*min al-kalām al-naẓarī*] what is appropriate for our opinion and our collection of these sections [*bi-raʾyinā wa-jamʿinā li-hādhihi l-funūn*]." See also the passage quoted in n. 15.

21 *Arabic Version of Aristotle's* Historia Animalium, 113.2–3.

22 Like the Arabic translation, Avicenna also covers the topics of *Hist. anim.* X, which is considered spurious.

23 See Alpina, "Exercising Impartiality," 145–47.

24 *Arabic Version of Aristotle's* Historia Animalium, 205.14–15.

25 *Hist. anim.* IV. 8, 533a16–17. This passage reads the same in Arabic translation. See *Arabic Version*, 206.3–4: "The fifth sense, which is the sense of touch [*ḥiss al-lams*], exists in all kinds of animals." Cf. *De an.* II. 2, 413b4–7; *Nafs* II. 3, 67.8–13.

26 Or, more precisely, the object of taste is also something that can be touched. See *De an.* II. 10, 422a8.

27 *Hist. anim.* IV. 8, 533a18–20: "In some animals the sense-organs are clearly visible; and this especially happens in the case of the eyes." This sentence (until line a30) is absent in Arabic. However, the preeminence of sight (harking back to Plato), its sense-organs, and its proper object emerges cumulatively from *De anima* II. 7 and *De sensu* 2–3, where sight is dealt with first.

28 See *Burhān* I. 9, 98.4–6.

29 See *Arabic Version*, 206.4–5.

30 *Hist. anim.* IV. 8, 533 b1–4; *Arabic Version*, 206.6–8. It should be noted that the Aristotelian text says some of fish's alleged nostrils are partly blind (*ta men typhla*) and partly lead to the gills (*ta de pherei mechri tōn branchiōn*), not to the brain. In the Arabic translation, "blind" is rendered as hidden, concealed (*takhfā*, from *khafiya*).

31 On Avicenna's view that the brain (not the heart) is the seat of sensation, see *Nafs* IV. 1, 163.4–165.8, where the common sense that gathers the forms (*ṣuwar*) impressed in the five external senses is located in the front part of the first cavity of the brain and is said to be "in reality what senses." See Alpina, "Retaining"; on Aristotle's position, see *Hist. anim.* I. 16, 495a11–17, where he maintains that three ducts connect the eye with the brain, and seems to confirm that the brain, not the heart, is the seat of sensation.

32 However, gills are the organ for respiration in fish, and therefore share at least one function with nostrils in other animals.

33 In the *Ḥayawān*, Avicenna introduces his own comments and observations with the formula "I say" (*aqūlu*), but Aristotle's position with the formula "The First Teacher said" (*qāla al-muʿallim al-awwal*), or simply "He said" (*qāla*). See Kruk, "Ibn Sina," 326–27.

34 Reading *jibāb* instead of *ḥabāb*.

35 See the introduction to *Ḥayawān*, 14–15, and Kruk, "Ibn Sina," 327, although I do not agree with Kruk's conclusion that the information "based on his own observations or on reports of 'trustworthy people' or 'hunting specialists,'" which Avicenna adds to the Aristotelian text, is often "of a fairly anecdotal nature." That does not seem to be the case in this chapter.

36 The expression *ahl al-tajriba* occurs at least once more in the *Ḥayawān*, at IX. 5, 172.9, where Avicenna discusses the stages of development of the embryo and the alleged differences between male and female fetuses. There, however, it differs slightly: *ahl al-tajriba wa-l-imtiḥān* (people of experience and examination). This passage has no correspondence in the Aristotelian text.

37 *Hist. anim.* 534a4–8.

38 This interpretation seems to be confirmed by the translation of *tines tōn empeirikōs alieōn* (some experienced fishermen, 532b19–20) as *baʿḍ ahl al-tajriba min al-ṣayyādīn* (some people of experience among fishermen, 205.7). See, in particular, the Arabic rendering of the adjective *empeirikos* (experienced) as *ahl al-tajriba*.

39 Avicenna's remark is not original; it is found in the Arabic translation of the Aristotelian writing (*The Arabic Translation*, 208.7–9). In the Greek, the remark concerns just dolphins, and is included in a longer consideration about dolphins having the sense of hearing and smell despite lacking an evident sense-organ for each of those senses. *Hist. anim.* IV. 8, 534b6–10.

40 *Hist. anim.* IV. 8, 534a11–b5. In Avicenna's text, there are four explicit references to fish being trapped (*yuṣādu*, being trapped, 62.6, 9^2; *miṣyada*, trap, 62.7) by using different smells.

41 *Hist. anim.* 535a13–14. The Arabic translation reads: *wa-laysa ʿindanā shayʾ thābit bayyin fī baṣar wa-samʿ* (209.4–5).

42 Shortly afterwards, Avicenna refers to the subject-matter of his exposition on plants and animals with the term *states* (*aḥwāl*, 3.10).

43 *Nafs*, prologue, 2.5–18: "The second [reason for a unitary account of the soul, the first being the necessity for accuracy of the science of the soul, 2.3–5] is that plants share with animals the soul to which the activity of

growth, nutrition, and reproduction belongs. It is unquestionably necessary that [animals] be separated from plants with respect to the psychic faculties that are proper to their genus and, then, proper to their species [*an yanfaṣila ʿanhu bi-quwā nafsāniyya takhuṣṣu jinsahū thumma takhuṣṣu anwāʿahū*]. And what we can deal with as regards the soul of plants is what is shared by animals, but we are not much aware of the *differentiae* that render this generic notion in plants specific [*wa-lasnā nashʿuru kathīr shuʿūr bi-l-fuṣūl al-munawwiʿa li-hādhā l-maʿnā l-jinsī fī l-nabāt*]. If this is the case, the relation of this part of the investigation to the fact of its being a discourse on plants has no greater claim than [its relation] to the fact of its being a discourse on animals, since the relation of animals to this [vegetative] soul is the [same] relation as that of plants to it. And the state of the animal soul stands in similar relation to the human being and to other animals. And since we want to deal with the vegetative and the animal soul only insofar as it is shared—for there is no science of what is particular except [that which comes] after the science of what is shared—and [since] we are little engaged in the essential *differentiae* of each soul, of each plant, and of each animal because that is difficult for us [*wa-kunnā qalīlī l-ishtighāl bi-l-fuṣūl al-dhātiyya li-nafs nafs wa-li-nabāt nabāt wa-li-ḥayawān ḥayawān*], it is better that we deal with the soul in one single book." The prologue to Avicenna's *Nafs* is analyzed in Alpina, *Subject, Definition, Activity*, 64–68. See also Alpina, "Knowing."

44 See Avicenna, *Qānūn*, I. i. i. 2, 36.15: "The organs and their use must be approached by means of sense [*bi-l-ḥiss*] and anatomy [*wa-bi-l-tashrīḥ*, the practice of anatomy, dissection]."

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6 Translating from One Domain to Another

Analogical Reasoning in Premodern Islamic Theology (*kalām*)

Hannah C. Erlwein

Premodern practitioners of the science of theology (*ʿilm al-kalām*) prided themselves on not falling into the pitfall of blind adherence to religious dogmas—a pitfall less enlightened groups had stumbled into—but subjecting these to rational investigation and proof.[1] Without that, they argued, one would remain on the level of mere presumption (*ẓann*), rather than actual knowledge (*ʿilm*).[2] With their minds firmly set on this task, they had recourse to a number of methods. The theologian Māturīdī (d. 944 CE), who will play a prominent role in this chapter, enumerates these "ways to knowledge" (*subul*) and divides them into three categories: the things (*aʿyān*) in this world, which are known by sense perception (*ḥawāss*); reasoning, speculation, and pondering (*istidlāl*, *naẓar*, *tafakkur*) in the case of entities that cannot be reached by sense perception; and finally authentic transmitted traditions (*akhbār*, such as the Quran or Prophetic sayings). These three categories have in common that they comprise "indications" or "signs" (*dalāla*) that, when deciphered correctly, make it possible to attain knowledge.[3]

In this chapter, I focus on only one of these categories, reasoning, and more specifically on one particular form of it: analogical reasoning. The early generations of theologians—at a time when *kalām* was consolidating itself as a branch of science—displayed an affinity for a particular form of analogical reasoning that involved using experienceable phenomena to gain knowledge about phenomena beyond experience. They employed such reasoning to solve a variety of theological problems. An often-cited example is the divine attributes. Some theologians argued that God's attributes (falling under phenomena beyond experience) should be conceptualized in analogy to human attributes (an experienceable phenomenon). Thus, if humans are described as knowing due to knowledge that they possess, God, whom the Quran describes as knowing, must in analogy have an attribute of knowledge as well. It is little surprising that not all theologians agreed with this particular analogy. Some of them, anxiously seeking to uphold God's absolute oneness, could not accept that the single divine essence should be contaminated by such hypostatic attributes (*maʿānin*) of knowledge, power, will, and the like. Instead, the

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truth was that God is knowing by Himself, by virtue of His essence (*bi-dhātihi*). They rejected the preposterous notion that there existed an analogy between humans and God in this regard.[4]

Theologians used technical terminology for this sort of analogy. They referred to experienceable phenomena using the term *al-shāhid*, unexperienceable ones as *al-ghāʾib*, and called analogical reasoning between these "using the *shāhid* as evidence for the *ghāʾib*" (*al-istishhād bi'l-shāhid ʿalā al-ghāʾib*) or "indications of the *shāhid* for the *ghāʾib*" (*dalālat al-shāhid ʿalā al-ghāʾib*). The *shāhid* and the *ghāʾib* could thus be labeled two distinct "epistemic domains," which could be connected by way of analogy because one domain contained evidence and indications that pointed beyond themselves to the other domain. The theologian Ibn Fūrak (d. 1015 CE) highlights the idea that analogy between the *shāhid* and the *ghāʾib* is between two different epistemic domains when he glosses them as "what is speculated about and what relates back to what is speculated about, as well as what is known and what one is in doubt about, but seeks to know based on what is known."[5]

Analogical reasoning between these two epistemic domains can be analyzed as a translation process. Just as in linguistic translation, meaning is translated from one language (the source language) in another (the target language), in analogical reasoning in *kalām*, theologians translated between two epistemic domains (the source domain and the target domain), although in their case it was descriptions or judgments about phenomena that were translated. Theologians also faced some of the same problems that translators do. Just as in interlingual translation there is always a "degree of interpretation by the translator,"[6] theologians were confronted with the very real challenge that in purely descriptive terms, there was no single way of translating between the two epistemic domains. Just as translators look for norms of translation that can regulate their activity,[7] these theologians sought to meet the challenge by subjecting their activity to norms of analogy. The sources indicate that they wrestled with each other about what we might call the "epistemic norms" associated with analogy. What sorts of experienceable phenomena could, or indeed should, be used as the starting point for analogical reasoning? What do these experiences have to involve in order to serve as an analogy for unexperienceable phenomena? And what is a valid analogy between experienceable phenomena and phenomena beyond experience?

The disagreement among theologians about the "epistemic norms" was only one of detail, however, and did not affect the general validity of analogy as a way to knowledge. A general critique of analogy as a mode of reasoning in *kalām* emerged only among later generations of theologians, who rejected it outright.

In this chapter, I discuss the three questions mentioned above, regarding theologians' conceptualization and use of analogies between experienceable phenomena and phenomena beyond experience, through the case of one particular problem: the origin of the world. This problem itself revolves around two questions: First, has the world always existed, or does it have a first beginning for its existence? And second, does the world (which, as theologians could prove, is originated) have a cause for its existence, or did it suddenly come into existence, uncaused and by mere chance, or did it actualize its own existence? For several reasons, this problem was prominent in the thought of premodern Islamic theologians, and it is traditionally investigated at the very beginning of a *kalām* work. It is in response to the problem of the origin of the world that the theologian Māturīdī, one of my study's protagonists, critically engages with different opinions about the norms of analogical reasoning. The theologian Juwaynī (d. 1085 CE), my other protagonist, also reports extensively on disputes among theologians over the way in which Ashʿarī (d. 936 CE), the namesake of a whole theological school, made use of analogical reasoning when considering the origin of the world.

Analogical Reasoning in Theology (*kalām*)

Debating Norms of Analogy: Juwaynī's Account

In his *Kitāb al-Shāmil*, Juwaynī grants an insight into the quarrels among theologians of two different schools over the norms governing analogy. These concerned the question of what the experiences to which both schools had recourse actually entail, or what they should entail in order to fulfill their purpose. Theologians also argued over how to perform the transfer between the two epistemic domains—what the theologian can learn about unexperienceable phenomena by drawing analogies with experienceable ones.

At stake in the disputes that Juwaynī recounts was Ashʿarī's use of analogical reasoning. In the manner of a good practitioner of *kalām* who scrutinizes religious dogmas, Ashʿarī opened one of his works, *Kitāb al-Lumaʿ*, with the question "What is the proof that there is a creator for creation?" To answer this question, Ashʿarī invoked the following experienceable phenomena:

> The proof is that the human being … was once merely a drop of sperm, then became a blood clot, then flesh. We all know [*qad ʿalimnā*] that the human being cannot transform himself from state to state …. We see [*raʾaynā*] that the human being is first a child, then a young adult, then an elderly person, and finally old, and we all know that he does not transform himself from state to state … but that there is one who transforms him from state to state.[8]

Ashʿarī then added other experienceable phenomena:

> What makes this clear is that cotton cannot change into spun thread, then a woven garment, without a weaver or maker. He who takes cotton and expects it to become spun thread and then a woven garment without a maker or weaver—he is out of his mind and in utter ignorance! Likewise, he who looks at a wasteland where there is no castle, and expects clay to turn into a different state and to pile itself up [as bricks], without a maker or builder—he is ignorant![9]

Ashʿarī is evidently using analogical reasoning of the sort that calls on experienceable phenomena to gain knowledge about a phenomenon that cannot be known by experience—in this case, the world's dependence on a cause. As his analogy appears to argue (and I say "appears" because he does not actually spell it out), the experience that all these phenomena depend on a cause for their transformation, and cannot actualize themselves, can be treated as an analogy for the problem under investigation: the whole world (literally, the whole of creation) likewise depends on a cause.

The particular way in which Ashʿarī has recourse to these experiences reveals something interesting: experienceable phenomena in the *shāhid*, such as the transformation of humans, lead to the attainment of an item of knowledge, namely the knowledge that this transformation has an external cause. Experiential phenomena involve sense data ("we see"), but these yield knowledge ("we all know"). The attainment of this knowledge is the prerequisite for analogical reasoning, which in turn leads to the attainment of the same item of knowledge about an unexperienceable phenomenon, such as that the world, too, has an external cause. Unfortunately for us, Ashʿarī is silent about his rationale in asserting that these experienceable phenomena and the world at large behave analogously. What justifies this analogy is not self-evident, and this is one of the objections later theologians made against the usefulness of analogy in theology.[10]

In his *Kitāb al-Shāmil*, Juwaynī offers a rather detailed account of the quarrels among later theologians about Ashʿarī's analogy. His account suggests that a number of points were at issue, some of which I will now set out.

Juwaynī notes that attacks on Ashʿarī's use of analogical reasoning came from the adherents of a rival theological school, the Muʿtazilīs. "One of their criticisms," he writes, was as follows:

> The most absurd thing [Ashʿarī] said was to declare him ignorant who expects a building [to come about] without a builder and a writing without a writer … . According to him, the writing and the building do not actually come about by humans … . There is no point in using as evidence something that contradicts one's own principle! … You [followers of Ashʿarī] are unable to prove the creator [i.e., the problem under investigation: Does the world have a cause?] since

> you deny that we humans in the *shāhid* actually bring about [our actions].[11]

The Muʿtazilīs remind the Ashʿarītes that their school's founder was committed to the theological position that rather than humans bringing about their actions, their actions are dependent on God's creative activity. The appearance of true human agency is essentially an illusion.[12] This position on causality had, in the estimation of Muʿtazilī theologians, detrimental consequences for Ashʿarī's analogy between experienceable phenomena and phenomena beyond experience, for if buildings and the like do not actually come into existence due to humans, then Ashʿarī's analogy simply fails. He cannot argue that the world depends on a cause, *in analogy* to the experience that buildings depend on human builders, if the latter is not actually the case for him. Yet "the way to affirm a judgment for the *ghāʾib* is by linking it to the *shāhid*"[13]—as both Ashʿarī and the Muʿtazilīs agreed.

The criticism expressed by the Muʿtazilīs can be regarded as relating to the norms governing analogical reasoning in theology. First, for theologians it is not enough to invoke a given experience, such as buildings and builders—they argue about what *precisely* a given experience involved, and whether this qualifies it to serve as an analogy in the first place. The disagreement between the Muʿtazilīs and Ashʿarī might best be conceptualized by means of the contemporary category of "theory" in relation to experience: what distinguishes the experience invoked by Ashʿarī, of the connection between building and builder, from the experience invoked by the Muʿtazilīs is their contradictory theories of human causality, which shaped the way they experienced the world.[14] As Ashʿarī had pointed out, experience starts off from sense data—but the Muʿtazilīs' critique highlights that in experience, sense data come together with theory and are interpreted within a given theoretical framework. The resultant difference in experience is not a triviality but has grave consequences for theology's claim to leave behind mere conviction and reach the lofty plains of knowledge.

Second, they dispute what *precisely* a given experienceable phenomenon reveals about a phenomenon beyond experience. This is essentially the question of the norms governing the process of translation between the two epistemic domains. Translating in the correct way means asking what it is about experienceable phenomena that tells us something about unexperienceable ones. Which known characteristic or attribute of an experienceable phenomenon should also be said of an unexperienceable phenomenon of which the theologian seeks to attain knowledge? The question was raised, Juwaynī reports, by the Muʿtazilīs: "It is your [i.e., followers of Ashʿarī] principle that we humans are connected to our actions by way of acquisition [*iktisāb*]—and that God is high above this and that He is characterized by [proper] creation! … How then can you use experienceable phenomena [*shāhid*] as testimony for unexperienceable phenomena [*ghāʾib*]?"[15]

The Muʿtazilīs' point was that since Ashʿarī used the experience of human actions, such as buildings, as an analogy to prove that the world has a cause, he should have made the *way* or *mode* in which humans are connected to their actions part of his analogy. Instead, Ashʿarī chose to focus only on the vague claim that there is *some sort of connection* between building and builder. In seeking to establish the world's dependence on God in analogy to a building's dependence on a human builder, Ashʿarī should—had he made correct use of his analogy—have said that God "acquires" His actions just as humans "acquire" theirs. ("Acquisition" was the term used by Ashʿarī and his followers to indicate that humans do not truly create their actions, God does; but still humans can be held responsible for these actions as they "acquire" them from God.[16]) This would, of course, have been an absurd and even sacrilegious conclusion for Ashʿarī, and equally for the Muʿtazilīs. The reason why Ashʿarī did not want to take the analogy as far as the Muʿtazilīs wanted to push him is that his theory of human causality did not allow it. And the reason why the Muʿtazilīs pushed Ashʿarī to go further in his analogy is that they wanted him to concede that his theory of human causality was flawed and that this undermined his whole theological enterprise.

Ashʿarī's later followers, unsurprisingly, refused to accept that their school's founder had been mistaken on so many counts. Juwaynī reports their attempts to "deflect this criticism":

> The writing does not come about unless from [*min*] a writer, for the writing is bound to [*urtubiṭat*] the writer. We therefore declare him ignorant who expects the writing and the building to come about without writer and builder. So, if something is bound to something else, and if the objective is simply to affirm the connection [*taʿalluq*] in general, but not its details, then it does not matter whether this being bound together is [in the mode of] acquisition or true creation. This is so because the reasonable person knows about the connection first, and then comes to know of its details through [further] speculation.[17]

Ashʿarī's followers, then, rejected the Muʿtazilīs' critique as unfounded. The experience that buildings and builders always occur together justifies the conclusion that they are "bound together"; to expect a building to occur without a builder would go against everything we know from experience. This is why Ashʿarī's analogy was valid. The precise nature of the connection between building and builder is a secondary matter, to be established by further pondering, and therefore has no bearing on the translation between the two relevant epistemic realms. Ashʿarī was vindicated.

Juwaynī's account is interesting not only in offering insight into theologians' disagreement about the norms of analogy in their science.

It also bears witness to a fundamental change in attitudes to analogy as a way to knowledge among later generations of theologians, including Juwaynī himself. These later theologians broke with their predecessors (even the then still venerated Ashʿarī) by not merely disagreeing on which norms would guarantee the correct use of analogy but casting doubt on the very validity of analogy in theology.[18]

This is apparent in Juwaynī's own position on analogical reasoning, which he added to his account of the previous generations' disputes. He remarks on the vindication of Ashʿarī's analogy cited above that "this way of going about it is not satisfactory."[19] Instead, he argues, theologians should assert that it is known *necessarily* (*al-ḍarūra*) that originated things come about due to a cause.[20] Without the assertion that "the connection between act and agent" is known by necessity, theologians will never be able to refute an opponent's claim that "originated things do *not* come about due to a cause." Reference to "experienceable phenomena" (*shawāhid*) and "examples" (*amthila*) may help to *clarify* (*awḍaḥa*) this item of knowledge, but unlike in analogical reasoning, these are not required to *establish*, nor *can* they establish, that the world at large actually has a cause.[21] This is why Juwaynī can conclude that

> the connection between originated thing and originator … is confirmed without consideration of experienceable phenomena [*shāhid*] and phenomena beyond experience [*ghāʾib*], for origination, which is possible in itself, depends—precisely because of its possibility—on a particularizer [*mukhaṣṣiṣ*], and it is not necessary to affirm an actual agent in the experienceable domain.[22]

Debating Norms of Analogy: Māturīdī's Account

Like Juwaynī's *Kitāb al-Shāmil*, Māturīdī's *Kitāb al-Tawḥīd* indicates that theologians had a propensity to employ analogical reasoning as a way to knowledge in the science of *kalām*, but also that they were not unanimous on the norms that should govern it. Māturīdī discusses such norms in a section of his work where he deals with differing positions on how knowledge of experienceable phenomena should be translated into knowledge of phenomena beyond experience. The same sort of analogical reasoning also features prominently in Māturīdī's battles on two major theological fronts: his attempt to establish that the world has a temporal beginning, and his attempt to prove that it has a creator. Māturīdī's arguments show how a premodern theologian actually used knowledge derived from experience or experiences in order to gain knowledge about unexperienceable phenomena, by way of analogy—but his use of such analogies can also be read as a prescriptive account of how this should be done.

Māturīdī frames his discussion of the norms of analogy in terms of disagreement among different groups: "People disagree about the way in which experienceable phenomena are indications of phenomena beyond experience [*wajh dalālat al-shāhid ʿalā al-ghāʾib*]."[23] As is often the case with works of *kalām*, Māturīdī says nothing about the identity of these "people," and only presents their position on a given problem. He simply introduces their disagreement with the words "there are some who say this" and "others who say this."[24]

The first group, Māturīdī explains, holds the following normative position regarding the connection between the two epistemic domains: "They are the same [*mithl*]—for experienceable phenomena are the root [*aṣl*] of what is beyond experience, and the root and its branch [*farʿ*] do not differ. Unexperienceable phenomena [*ghāʾib*] are known by way of experienceable ones [*shāhid*], and through analogy [*qiyās*] between one thing and another."

The second group agrees with the first group about the way in which analogical reasoning should connect the two domains, but evidently things are not quite that clear-cut, for they remark: "[Experienceable phenomena] point to the same [*mithl*]—and to something different [*khilāf*]. The indications found in experienceable phenomena, which point to a difference [with unexperienceable phenomena], are, however, more evident [*awḍaḥ*]."[25]

Māturīdī then gives examples of what the positions taken by these two groups entail. His enumeration shows a striking interest in the question of the origin of the world, indicating the importance of analogical reasoning for this particular issue. The first group's position, in which experienceable phenomena indicate that unexperienceable phenomena are the same, allows them to affirm that the world is past-eternal and has not entered existence. They argue that the *shāhid*, the domain we experience, presents itself as a "world" (*ʿālam*) to us. Since both epistemic domains must be the same, this means that "for every point in time in the past"—the past being the *ghāʾib*, the domain that is only knowable by analogy with experienceable phenomena—there must have been a "world." There was, then, no point in the past when the world did not exist.[26] It is worth highlighting something about the term *ghāʾib* at this point: as Māturīdī's example indicates, this epistemic domain embraces *all* phenomena, past, present, and future, that escape direct experience. Being removed from human experience may mean that an entity (e.g., God) cannot be fathomed by the senses as a matter of principle, but it may also mean that the phenomenon lies in the past (e.g., the existence of the world) and is therefore removed from human experience, while not in principle being beyond human experience.

Turning to the second group, Māturīdī introduces an example that aims to justify why, at times, the connection between the two epistemic domains is not one of similarity. This is evidently directed at the position taken by the first group, for Māturīdī will not accept their conclusion that the world is pre-eternal. The example takes the form of an *argumentum ad absurdum*: if the *shāhid* and the *ghāʾib* were in all cases the same, as the first group claims, then this would entail that "everyone who looks at himself should think that everything in the world [that is not directly experienced by him] is just like him—but this is absurd!"[27]

Interestingly, "similarity" seems to be understood here such that a given phenomenon in the domain of the *shāhid* must be the very same phenomenon in the domain of the *ghāʾib*. There does not seem to be room for the idea that it is only *some aspects* of an experienceable phenomenon that are translated into the domain of unexperienceable phenomena. This is at the heart of the dispute between the followers of Ashʿarī and Muʿtazilī theologians: How far should analogical translation between the two domains go? How much of what characterizes the "source domain" should be translated into the "target domain"? It is also what the second group criticizes when they object that experienceable phenomena may "point to the same—or to something different," and that the difference is often more evident than the sameness. Māturīdī goes on to explain:

> When someone experiences [*shāhada*] something in this world, he uses it to prove that the world is originated or that it is pre-eternal—but its eternity or its originatedness are not the same as the thing itself [which he experienced]. Then he goes on to prove that the world has an originator or that it exists due to itself—but both of these are something different than the thing itself.[28]

The argument here (which admittedly is not spelled out in the detail we might wish) is that concrete experienceable phenomena do indeed tell us something about the world at large, whether it is pre-eternal or has entered existence, and whether it has a cause or not. However, the second group stresses that knowledge about the world's pre-eternity or originatedness, and its having a cause or not, that is attained by way of a translation between the two epistemic domains is not *ontologically identical* with the experienceable phenomenon. To use the analogy between a building's dependence on a builder and the world's dependence on a creator (which Māturīdī himself also employs quite frequently), the experienceable phenomenon that is the building can be used to attain the knowledge that the world has a cause, but this insight is ontologically speaking not the *same* as the building, but different from it. It therefore involves a different translation process than the one advocated by the first group.

Māturīdī now ventures to put forward a "principle" (*aṣl*), as he calls it, for theologians to read experienceable phenomena correctly, so as to ensure that the translation process in analogical reasoning is valid. This "principle" corresponds to what I called "epistemic norms" of analogy. He explains that experienceable phenomena in the world contain different "aspects," which allow one to draw different conclusions about those phenomena: “The principle is that the indications found in the world vary in accordance with the difference of aspects [*jihāt*] found in the world.”[29] For example, one “aspect” to be considered in relation to a given experienceable phenomenon might be the combination of opposite natures in it (e.g., hot and cold, good and evil), and this particular aspect must be read as an indication of the thing’s originatedness. Another might be its ignorance of its own conditions and its inability to correct flaws in itself, and this particular aspect must be read as an indication of its dependence on a cause.[30] It is important, as Māturīdī’s explanations show, for theologians to read these aspects and what they indicate correctly when they make experienceable phenomena the basis for knowledge of phenomena beyond experience. The significance of this becomes clear when Māturīdī himself ventures to draw an analogy between human arts and the world: “The writing indicates [its dependence on] a writer. … In the same way, the world with everything in it indicates [its dependence on] an originator. … The same is the case with buildings, weaving, carpentry, and [all other] arts.”[31]

The first group discussed by Māturīdī fails to correctly read these “aspects” and their indications when, based on a flawed analogy between the epistemic domain of the *shāhid* and that of the *ghāʾib*, they claim to know that the world is pre-eternal. Māturīdī’s account of both flawed and correct ways of using experienceable phenomena as indications for unexperienceable ones may be seen as something of a practical guide, a normative instruction for theologians to disentangle the muddle of aspects in order then to read them correctly.

As well as discussing different positions on the epistemic norms relating to analogy, Māturīdī puts forward his own arguments relating to the concrete theological problem of the origin of the world. Like Juwaynī, he uses analogical reasoning to prove that the world depends for its existence on a creator, rather than having suddenly come into existence or having actualized its own existence. Before proving this central theological dogma, however, Māturīdī presents a number of proofs—once more making use of analogies between experienceable und unexperienceable phenomena—in refutation of the sacrilegious belief that the world might always have existed. Māturīdī’s own use of such arguments sheds further light on the norms associated with analogy in *kalām*.

Māturīdī lists a multitude of arguments in the section dealing with the temporal beginning of the world, introducing each new argument by the word “Also.” Not all of these take the form of analogical reasoning. For instance, his very first argument is that all material entities making up the world (in *kalām* parlance: “bodies,” *ajsām*) are necessarily in a state of either rest or motion. These alternating states come to be and are not eternal. The material entities must be originated, just as these states are that inhere in them.[32] In this line of argument, experienceable phenomena also play a role, but the experiences cited are not used as the starting point of an analogy.

Let us turn to those of Māturīdī's arguments that do invoke analogical reasoning. In the section discussing whether the world is eternal or originated in time, Māturīdī presents the following argument:

> Also, if something does not enter existence unless due to something else that precedes it, and if this is a condition [*sharṭ*] for all of them, then the whole [chain of things] would never enter existence .... Don't you see that he who says to another one "Don't eat this unless you have eaten that!"—and this condition applies to all of them—he will never eat?![33]

The bone of contention here is the argument, put forward by those of Māturīdī's opponents who uphold the pre-eternity of the world, that every single thing in this world originates from another thing preceding it. This, they argue, implies that there must always have existed something.[34] Māturīdī's strategy is to reduce his opponents' position to absurdity, and thus to affirm the only remaining alternative: the world is originated. He does so by introducing an analogy between a particular experience and the issue under discussion, which is not subject to human experience. The knowledge that the world is originated is gained by analogy to the experience of eating, and the analogical translation between the two epistemic domains is valid because they are connected by the impossibility of an infinite regress.[35] Māturīdī's argument implies a judgment that his opponents make use of experienceable phenomena in a flawed way. He would certainly not deny that experience tells us that all originated things are preceded by other things. Yet this is not relevant when drawing an analogy between the two realms—it is a different "aspect," to use his own terminology, that is significant for the theologian's inquiry.

Māturīdī then continues with another consideration: "He who says, 'It is not known [*yuʿlam*] that something could be made from nothing!' judges existents by way of the (external) senses [*ḥiss*], but the things that can be known may be beyond sense experience [*khārija ʿan al-ḥiss*]."[36] Māturīdī's opponents are here once more those who uphold the world's pre-eternal existence. They, too, display an affinity for analogies between the domain of experienceable phenomena and the domain of unexperienceable phenomena, and argue that the religious dogma of *creatio ex nihilo* is not part of human experience. Indeed, the opposite is true: humans know from experience that things derive from other things; this must by analogy also be true of the issue of the world's origin of the world, and it can thus be shown that the world is pre-eternal. Māturīdī considers this analogy flawed and consequently rejects the conclusion (or probably it is the other way round: he rejects the analogy because it leads to an undesired conclusion). He seems to stress that what is true of those existents which are accessible by the senses is not equally true of *all* existents. Once more, the opponents engage in a flawed translation process between the two epistemic domains. Though it may be true that all *experienced* existents are preceded by other existents, this judgment is not to be transferred to *all* existents.

As he presents the argument, Māturīdī does not explain why his opponents should be mistaken in transferring the judgment about experienceable existents to unexperienceable existents. He just asserts that the analogy is flawed. It may, however, be the case that we are supposed to read this argument alongside others, such as the previous argument invoking the impossibility of an infinite regress in the past—or that this is one of the instances where Māturīdī wants to draw attention to the fact, as he would have it, that the opponents are incorrectly reading the "aspects" found in experienceable phenomena.

Finally, Māturīdī sets out the following case of analogical reasoning:

> We do not know [*naʿlam*] of a writing without a writer, or of a disintegration without one who causes it, and the same is the case when it comes to composition, as well as to rest and movement. This then is necessarily the case for the whole world, for it consists of things that are composed and things that disintegrate .... It is absolutely true for the world that it does not get disintegrated and combined unless due to another [i.e., a cause]. All composition and every writing in the domain of experienceable phenomena [*fī al-shāhid*] come about due to the one with whom they occur, and in the same way [*mithl*] the whole world [which belongs to the domain of unexperienceable phenomena, i.e., the *ghāʾib*], for it is the way we mentioned.[37]

It is slightly perplexing that this argument appears in the section on whether the world is originated or pre-eternal; it seems that what the argument tries to establish is that the world is the product of a cause. With this focus, the argument fits much more neatly into the subsequent section of Māturīdī's work, which deals with the question of whether the world, in being originated, depends on a cause or not. This curious observation aside, the argument entails an intriguing instance of analogical reasoning: Māturīdī invokes the experience that every writing has a writer, every case of composition one who composes, and every state of rest or movement one who brought it about. Experience leads humans to the knowledge ("we ... know") that these states depend on a cause. Since theologians know that experienceable phenomena are "indications" (*dalāla*) of unexperienceable phenomena, Māturīdī transfers this judgment from one epistemic domain to the other. He even has good reasons for doing so, which relate to norms of valid analogical reasoning, for the analogical transfer is justified by the observation that both epistemic domains contain things characterized by composition and disintegration.

Now that Māturīdī has successfully refuted the preposterous notion that the world could have existed in pre-eternity, he takes it upon himself to eradicate any last doubts that the world is indeed God's product. The section on the proof that the world has a cause contains several arguments, two of which are of interest here as they contain an analogy. The first is this:

> If the world were due to itself, it would be necessary that it came to exist after it already existed [for its existence would be caused by itself]—but this means that it cannot be due to itself since it comes to exist due to another … . Also, evidence [*sh-h-d*] to what we said is found in buildings, writings, and ships: They do not exist unless due to an existent agent, and the same [*mithl*] is true in our present case.[38]

The second runs:

> Also, if it were possible that the world began to exist by itself at a point, then it would be possible that all of it came to exist in one way. But this is not the case, and it is rather the case that it contains all sorts of differences, and these differences, such as that it contains things that are living and dead, disintegrated and combined, small and big, evil and good, only change due to another. This is then true for the whole world, which exists due to another. If, however, [one were to say] that [the aforementioned hypothesis, i.e., that the world began to exist due to itself] is possible, then it would in consequence also be possible that the colors of a garment change by themselves, and not because of the dyer, or that a ship becomes what it is by itself. But since this is not the case, it is necessary that these things are brought about by someone …, and this is also the case with our present concern![39]

It is interesting to note that in both arguments, Māturīdī seems to treat the analogy between experienceable phenomena and phenomena beyond experience as an *addition* to a purely rational argument. That is to say, the crucial point both arguments intend to make—namely that one encounters an absurdity and contradiction when assuming that the world might have actualized its own existence—can stand without the additional reference to buildings, ships, and garments. This attests to Māturīdī's view that the problem can be solved successfully by reference to reason-based arguments, which do not necessarily have to take the form of analogical reasoning. At the same time, however, he does not seem to treat the analogy between the two epistemic domains as a purely rhetorical device, with a merely persuasive function. This is indicated by his emphasis that buildings, writings, ships, and the like contain actual "evidence" to the point he seeks to make—namely, that things enter existence due to a cause—and that this is an actual indication that the world, too, must depend on a cause. As noted above, the root of the Arabic word for "bearing evidence" (*yashhadu*) is the same as that of the term *shāhid*, which indicates the domain of experienceable phenomena. Analogy is one form of reasoning and rational argument, which like others can yield knowledge of the origin of the world.

Both arguments also bear witness to Māturīdī's affinity for the *argumentum ad absurdum*. His method of proving that the world owes its existence to a cause is to reduce to absurdity the notion that the world caused its own existence. Both the analogies he presents underscore this point, but their focus is slightly different. In the first analogy, which invokes such experienceable phenomena—commonplace ones, we might add—as buildings, writings, and ships, the focus is on the observation that they come to *exist* only due to a cause which must be existent prior to them; the second analogy, which invokes garments and ships, revolves around the notion that the actual *characteristics* they display, which could conceivably be different, depend on a cause. In both cases, whether entering existence or changing characteristics, the point is that this is not actualized by the thing itself, but requires a cause. The insight that this applies to the experienceable phenomena is then translated into the domain that is beyond experience, by way of analogy.

On the face of it, there is no particular reason why Māturīdī chose buildings, writings, ships, and garments as the starting point for his analogy between the *shāhid* and the *ghāʾib*. The feature that connects them is their—evident, as Māturīdī would have it—dependence on a cause. Yet if this was what Māturīdī sought, he could have chosen any one of a whole range of experienceable phenomena to make the same point. Seeing that his actual selection coincides with the experienceable phenomena invoked by other theologians, such as Ashʿarī and his followers, but also Muʿtazilī theologians, we must conclude that these human products had become something of a *topos* for analogical reasoning in *kalām*. This also tells us something about the norms associated with analogy: although from a purely logical perspective many analogies could work, it was only some that were actually used.

This in fact raises a much more fundamental question: What is it about human arts and products that informed theologians' clear preference for them as analogies, in particular since they served to make a point about something that is definitely not a human product, the world? Māturīdī and his fellow practitioners of *kalām* do not tell us, but it seems plausible that it has to do with theologians' goal of conceiving of God as a creator and agent endowed with such attributes as will, knowledge, and power.[40] The analogy between the world and human products lent itself to this goal, as theologians generally held that human products indicate the attributes of will, knowledge, and power in humans (despite differences in their theories of causality, as discussed above). This implies something interesting about the norms governing the use of analogy: human products as the starting point of an analogy allowed theologians to conclude that God is the agent and creator of the world—yet this particular analogy would not have been employed if it had not implied the desired conclusion. After all, *kalām* was an apologetic enterprise that sought to provide proofs for already accepted dogmas. In a way, this means that the conclusion of this sort of analogy prefigured and determined what experiences were selected for analogical reasoning.

Conclusion

This chapter has shed light on one facet of the significance of experience of the natural world in premodern Islamic theology. As I showed, theologians frequently invoked experienceable phenomena—some of which became theological *topoi*—to attain knowledge of phenomena that are beyond human experience, by way of drawing analogies between them. I suggested that this sort of analogical reasoning can usefully be viewed through the lens of translation: theologians engaged in translation between two epistemic domains, one accessible by experience, the other not. In my analysis, I used "translation" as analogous to interlingual translation, in order to make two points: first, that the concept of translation is applicable to a variety of contexts and goes beyond its arguably most frequent association with linguistics; and second, that the concept of translation gives us relevant tools to flesh out some of the intricate details of the conceptualization of analogical reasoning in *kalām*. Comparably to linguists' endeavors to define norms of translation, we have seen, theologians quarreled over what might be called the epistemic norms governing the correct use and conditions of analogy in theology. Regarding the origin of the world, for example, much of their disagreement concerned the question of what precisely experienceable phenomena have to entail in order to serve as analogies, and which characteristics of experienceable phenomena should be translated into the domain of unexperienceable phenomena. Despite dissent on the epistemic norms, the relevance of this sort of analogy as a way to knowledge in *kalām* remained unquestioned until later generations of theologians doubted its effectiveness altogether—but that story must wait to be told in another article.

Notes

1 I use the term "science" here as the actors' category *ʿilm*, which is a systematized form of knowledge-making. See Akasoy and Fidora, "Structure and Methods."
2 Al-Shawkānī, *Irshād*, 1:1085; see Frank, "Knowledge and *Taqlīd*," esp. 43–44.
3 Al-Māturīdī, *Kitāb al-Tawḥīd*, 69–74. At *subul*, the Arabic text reads *sabīl*, which seems wrong.
4 See Gimaret, *Les noms divins*.
5 Ibn Furak, *Maqālāt*, 302. Here and throughout, translations are my own.
6 Nida, "Principles of Correspondence," 126.
7 Toury, "Nature and Role of Norms."
8 Al-Ashʿarī, *Kitāb al-Lumaʿ*, 18.
9 Ibid., 18.

10 Ashʿarī's silence might have to do with the nature of his text, which is very concise and was probably accompanied by an oral commentary in a teaching context. It might also be that Ashʿarī simply treats the analogy between buildings and the world as common knowledge among theologians. Ghazālī raises this sort of critique in his *Miʿyār al-ʿilm*, 167.
11 Al-Juwaynī, *Al-Shāmil*, 276–77.
12 See Griffel, *Al-Ghazālī's Philosophical Theology*, ch. 5.
13 Al-Juwaynī, *Al-Shāmil*, 277.
14 Compare the contemporary debate on the theory-laden nature of observation: Brewer and Lambert, "Theory-Ladenness"; Kuhn, *Structure of Scientific Revolutions*; Hanson, *Patterns of Discovery*; Fodor, "Observation Reconsidered."
15 Al-Juwaynī, *Al-Shāmil*, 277.
16 See Frank, "Structure of Created Causality"; Frank, *Early Islamic Theology*; Frank, *Classical Islamic Theology*; Abrahamov, "Re-Examination."
17 Al-Juwaynī, *Al-Shāmil*, 283–84.
18 Though not of legal analogy, which remained an acknowledged "source of law." See Hasan, *Analogical Reasoning*; Hasan, "Principle of Qiyas"; Kamali, *Principles of Islamic Jurisprudence*.
19 Al-Juwaynī, *Al-Shāmil*, 284.
20 See Abrahamov, "Necessary Knowledge."
21 Al-Juwaynī, *Al-Shāmil*, 282–83.
22 Ibid., 285.
23 Al-Māturīdī, *Kitāb al-Tawḥīd*, 92. See Rudolph's detailed study of Māturīdī, especially Part Three on his theology, including the origin of the world and analogical reasoning: Rudolph, *Al-Māturīdī*, 219–348.
24 Al-Māturīdī, *Kitāb al-Tawḥīd*, 92.
25 Ibid.
26 Ibid.
27 Ibid., 93.
28 Ibid., 92–93.
29 Ibid., 94.
30 Ibid.
31 Ibid., 93.
32 Ibid., 78.
33 Ibid., 80.
34 This position is discussed in more detail in a later section ("Beliefs of Those Who Claim that the World Is Eternal"), which presents the various—evidently highly problematic—versions of the position that the world is pre-eternal. Al-Māturīdī, *Kitāb al-Tawḥīd*, 94–102.
35 It is important to bear in mind that Māturīdī subscribes to an occasionalist, atomist position of causality, according to which all occurrences are instances of "coming to be." This is why he can draw an analogy between things *entering existence* (the world) and things *happening* (eating). See Pines, *Studies in Islamic Atomism*; Sabra, "Simple Ontology"; Wolfson, *Philosophy of the Kalam*.
36 Al-Māturīdī, *Kitāb al-Tawḥīd*, 81.
37 Ibid., 81–82.
38 Ibid., 84.
39 Ibid., 84–85.

40 Theologians posed another kind of cause as well, one that causes necessarily by virtue of its essence. This kind of cause was called *ʿilla* or *sabab*, while the agent cause was called *fāʿil*. See, e.g., al-Bāqillānī, *Kitāb al-Tamhīd*, 53.

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7 Can the Results of Experience Be the Premises of Demonstrations? Four Hundred Years of Debate on a Single Line of Maimonides's *Treatise on the Art of Logic*

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This chapter shows how a single mention of the role of experience in building scientific arguments, in a single logical text, appears to have had different meanings in different contexts and translations according to the scientific norms of the readers. The text in question is the Arabic *Treatise on the Art of Logic* (hereafter *TAL*) most likely by Moses Maimonides (1138–1204).[1] If read on its own, this mention of experience would have a completely different meaning than if read in the context of Maimonides's medical writings. It seems that three medieval Hebrew translations of the *TAL* rendered this item in different ways, depending on their understanding of Hebrew logical terminology. The most popular translation was apparently the most limited in its terminology, contributing to the varied interpretations of this line among Hebrew commentators. They approached the text from divergent Aristotelian scientific backgrounds, all of which in turn differed from the Arabic logical, scientific, and medical norms inherent in the context in which Maimonides wrote.

In his lone mention of the results of experience in the *TAL*, Maimonides appears to include such results among things known with certainty, which can be used to form the premises of demonstrative syllogisms. That is, Maimonides classes the results of experience alongside "first" and "second intelligibles," which are known directly by the intellect or inferred directly from things known directly by the intellect, as things of which one can have not only knowledge but knowledge that one has such knowledge (i.e., certainty, second-order knowledge). For demonstrative syllogisms to reach conclusions that are certain, their premises must themselves be certain, and Maimonides's *TAL* would accordingly seem to admit the certainty of demonstrative syllogisms whose premises are, or are based on, not only first and second intelligibles, but also the results of experience.

Yet Maimonides never explains why the results of experience can be known with certainty; nor does he ever use such results to form syllogisms or any other kind of inference in the *TAL*. Moreover, Maimonides's Arabic medical writings present an antithetical view: experience is not

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comparable to, and indeed is much less reliable than, first intelligibles or scientific demonstrations. This view of experience as providing less-than-certain knowledge, explained in some detail in several works, is clearly Maimonides's more considered view and the one he recommends scientists keep in mind when making syllogisms or medical inferences. In contrast, the view that the results of experience are known with certainty, mentioned in a single line in the *TAL* and even there only tangentially, seems to have only a didactic function in the discussion of the structure of scientific demonstrations. There is no reason to think that Maimonides would have recommended that a fully educated scientist accept the results of experience as certain knowledge.

In the twelfth to thirteenth centuries, the *TAL* was translated into Hebrew three times and became one of the primary texts for teaching logic in medieval and Renaissance Hebrew throughout Spain, southern France, Italy, and the Byzantine and then Ottoman lands.[2] The Hebrew readers of the translated text would have accessed it against a background of Hebrew scientific, philosophical, and medical texts, of which many were translations from Arabic and Latin. The translated text of the *TAL* became a much copied and studied logical text in Hebrew and even gained a commentary tradition, one that begins as early as Moses of Narbonne in the fourteenth century and extends as late as Moses Mendelssohn of the eighteenth century. The writers of the extant Hebrew commentaries on the *TAL* were aware that the text was translated, but did not have recourse to the original Arabic, which in most cases remained beyond their reach both linguistically and indeed materially, since the Arabic manuscripts of the *TAL* were not distributed as widely. Accordingly, textual modifications made by the translators went undetected by the commentators. In fact, although the translations presented word-for-word renditions of the Arabic—a practice that helped form a distinctive scientific Hebrew of the Middle Ages—some Arabic words had no clear counterpart in Hebrew.

As we shall see, one consequence of this practice was that Moses ibn Tibbon, author of the most popular translation of the *TAL*, apparently did not believe there was a clear Hebrew counterpart for the Arabic word for certainty, *yaqīn*, and translated it using the Hebrew *ʾemet*, which he also used for "truth." This left an opening for Hebrew commentators to discuss how such experiences might be verified (that is, rendered certain) or might contribute to verifying knowledge of universals. The Hebrew commentators on the *TAL* sought to integrate the text into their understandings of Aristotelian science and medieval medicine and thereby also to integrate their accounts of experience with their views of how to verify true knowledge.

In this chapter, I follow the history of the line in Maimonides's *TAL* stating that the results of experience can be used as premises of demonstrations, first in its original Arabic context, then in the context of Maimonides's medical writings in Arabic, and subsequently in its context within the Hebrew translations. Finally, I examine how four Hebrew commentators on this line understood it: Joseph ibn Kaspi (1280–c. 1345),[3] Moses of Narbonne (d. after 1362),[4] Mordecai Comtino of Istanbul (fifteenth century),[5] and Abraham Farissol of Ferrara (fifteenth–sixteenth centuries).[6] Far from holding a unified view of the meaning of the *TAL* on this point, the Hebrew commentators exhibit a range of approaches to experience. Kaspi sees experience as a part of a process of attaining abstract knowledge of universal forms through repeated sensations of particular forms. Such universal abstract forms are, in Kaspi's view, certain, and as such they can form the premises of scientific demonstrations. Moses of Narbonne and Abraham Farissol seek to explain experiences as second intelligibles, thus allowing them to be the basis of certain demonstrative premises, while Mordecai Comtino argues that experience is an inductive process, which does not in itself contribute to demonstrations, but requires causal knowledge to verify those experiences and construct demonstrative syllogisms. All four approaches draw directly on Aristotelian ways of conceptualizing knowledge and verification, while at the same time differing significantly in their interpretations of how experience contributes to attaining and verifying knowledge. This single line of the *TAL*, then, is an example of how differently words can be understood in an original text, in the original context, in translation, and in various commentaries.

Experience in the Arabic *TAL*

The one mention of experience (Ar. *tajriba*) in the *TAL* occurs in a discussion about which propositions may be admitted as certain (Ar. *yaqīn*) for the purposes of forming demonstrative syllogisms. The Arabic text says:

> Now as to sensed things and intelligibles, there is no difference among those of the human species who are sound in their senses and thought, nor is there any contention for superiority among them with regard to the certainty that is [attained] through them. … Whatever is apprehended through sound sensation, that which comes from it is undoubtedly certain. Similarly, all of the first and second intelligibles are certain. By second intelligibles, I mean, for example, geometric theorems and astronomical calculations. For each of these is a certain intelligible because it is made clear through premises that are ultimately supported by first intelligibles. Similarly, all of the results of experience, for example, that scammony is a laxative and gall-nut causes constipation, and all the things like this are certain.[7]

In its context, the statement is important for determining the certainty of propositions that can be used as premises of demonstrations. The claim here seems to be that just as first and second intelligibles can be used to form certain premises of demonstrations, so too the results of experience (*kullamā akhrajtā al-tajriba*)[8] can also be used to form certain premises of demonstrations. The statement does not, however, define "experience." Moreover, it is far from providing obvious guidelines for obtaining the "results of experience." Most strikingly, it tells us nothing about why such results should be certain (*yaqīn*) or even true.

At the same time, the passage does tell us a little about what intelligibles (*al-maʿaqūlāt*) are, how one obtains them, and what makes them certain. First intelligibles are said to be those things that are known immediately and require no proof (*dalīl*) in order to be confirmed—for instance, that the whole is greater than the part and that things equal to the same thing are equal to each other. These are propositions that are somehow immediately apparent to the intellect, and their very immediacy would seem to guarantee their certainty. Second intelligibles, apparently, are propositions that are dependent on or inferred from first intelligibles, such as geometric theorems based on propositions such as that the whole is greater than the part. Sensed perceptions (*al-maḥsūsāt*) are also described as immediately known, or apparent and which similarly require no proof to be confirmed. That is, just as first intelligibles are immediately apparent to the intellect, so too sensed perceptions are immediately apparent to the senses. It is possible that the *TAL* sees the results of experience as analogous to the second intelligibles. That is, the results of experience (for instance, gall-nut causes constipation) are dependent on sensed perceptions (for instance, watching Zayyid after he eats gall-nut). Like second intelligibles, experience is not immediately apparent and requires some kind of inference. The passage does not, however, explain in what such inference consists. If second intelligibles are inferred via demonstrative syllogisms whose premises are first intelligibles, it is possible that the results of experience are inferred via demonstrative syllogisms whose premises are sensed perceptions. Yet this argument is not stated in the *TAL*, and it is not clear that such syllogisms would actually result in certainty. In fact, unlike first intelligibles, sensed perceptions are frequently mistaken. Inferences based on mistaken sensed perceptions would result in mistaken results of experience.

In sum, the account in the *TAL* focuses on the notion that one must choose premises that are certain in order to construct syllogisms with conclusions that are certain, but it leaves open many questions about what makes those premises certain, the inferences valid, and the conclusions certain. This is particularly apparent when it comes to premises, inferences, and syllogisms based on sensed perceptions and experience. Presumably, the *TAL* would have its readers look elsewhere to discover answers to these questions.

The Uncertainty of Experience in Maimonides's Medical Writings

However certain the results of experience may be in the *TAL*, in Maimonides's medical writings experience is often given to error. Thus, in his commentary on Hippocrates's first aphorism, the Arabic of which asserts that "experience is dangerous" (*al-tajriba khaṭir*),[9] Maimonides attributes the danger to an inability to explain how material and formal properties of various drugs produce different effects in different patients or even in different bodily organs of the same patient. Maimonides's focus appears to be on warning his reader, probably a beginning student of medicine, not to experiment on patients. Still, his words here call into question the extent to which experience is reliable enough for taking action, even as Maimonides acknowledges that the power of each nutrient and drug was learned only by way of experience. That is, although inferences based on experience are ultimately based on sensed perceptions, they are not reliable and so not logically certain. Accordingly, one should avoid making such inferences on one's own. The student of the Aphorisms, in short, would be better off relying on the experiences of others.[10]

Yet the experiences of others are also often far from yielding certainty. Indeed, in the *Medical Aphorisms* Maimonides warns of other influences on observations, some known to the observer and others what we might call subconscious.[11] At the end of his treatise *On Asthma*, Maimonides, again citing part of Hippocrates's first aphorism (*al-tajriba khaṭir*, "experience is dangerous"), denounces those who rely solely on experience as "quacks" who encourage people to believe things for which there is no demonstration (*burhān*).[12] Medicine requires experience, but cannot be practiced without science (*ʿilm*), which requires "speculation and reflection" (*naẓr wa-taʾammul*). Citing Galen, Maimonides asserts that experience requires syllogistic reasoning (*qiyās*) and that such reasoning can *demonstrate* (*yubarhinu*) "for you the existence of the things for which you search." That is, the proper approach for a medical doctor is science and logical reasoning combined with experience and trial—preferably, he goes on to say, trials already performed by others.[13]

Maimonides does *not* say here that one can actually use Aristotelian demonstrations to verify one's experiences, nor does he say that one can use the results of experience as premises of demonstrations. He says only that the doctor should make use of both methods: experiences and syllogistic demonstrations. That is, Maimonides differentiates between the demonstrated knowledge of the sciences and the experiential inferences made by medical practitioners, noting that the doctor should practice both. He frequently refers to results confirmed by experience (for example, in his book *On Poisons*) using the Arabic verb *ṣaḥḥa*. This verb can refer to something being firm, admissible, or true, but it can also refer to something being or becoming "healthy."[14] It is thus a fitting term for medical verification of observations. In general, Maimonides uses *barhana* ("demonstrate") and *yaqina* / *yaqīn* ("certain") to describe the results of scientific demonstrations. One of the challenges for the doctor, then, is to navigate between scientific knowledge and confirmed experiential results with regard to individual cases.

So while Maimonides seems to suggest that the results of experience can form the basis for demonstrative syllogisms in the *TAL*, this assertion plays no part in his actual medical writings and indeed is somewhat antithetical to his approach there.[15] It seems likely to me that in the *TAL* Maimonides was interested not in the precise use of the results of experience, but in outlining the logical structure of demonstrations. When experience and trial take on central importance in his medical writings and the stakes of applying experiences to medical actions are higher, Maimonides is more careful to distinguish them from demonstrated science. It is even possible that Maimonides wanted his better students to inquire into the relationship between experience and demonstration.[16]

Experience in the Hebrew Translations of the *TAL*

The *TAL* is extant in three Hebrew translations: that of Moses ibn Tibbon, dated 1254, that of Ahitub ben Isaac of Palermo from the latter half of the thirteenth century, and that of Joseph ben Joshua ibn Vivas Lorki, sometime in the fourteenth century. The first two were made independently, whereas the third is a revision of Moses ibn Tibbon's version on the basis of the Arabic text.[17] It was the first translation, by Moses ibn Tibbon, that was the most widely read; it exists in close to one hundred manuscripts and was used for all of the Hebrew commentaries.[18]

Moses ibn Tibbon, active in the 1240s through the 1270s, was one of the most prolific Arabic-to-Hebrew translators ever. His father, Samuel ibn Tibbon, translated Maimonides's *Guide of the Perplexed*, Aristotle's *Meteorology*, and some treatises on intellectual conjunction by Averroes. His brother-in-law, Jacob Anatoli, translated Averroes's Middle Commentaries on the core works of Aristotle's logical *Organon* as well as some astronomical works. To these, Moses ibn Tibbon added translations of Averroes's Short Commentaries on *De anima*, *Parva naturalia*, *De caelo*, *De generatione*, *Meteorologica*, *Physica*, and *Metaphysica*. He also translated numerous mathematical and astronomical works, along with at least eight medical works. His medical writings included a number of translations of Maimonides's medical works, among them the *Regimen of Health* (in 1244), *On Poisons*, and the commentary on Hippocrates's *Aphorisms* (in 1259).[19]

This is to say that, after Moses ibn Tibbon, Hebrew readers had access to a complete scientific curriculum in a fairly unified idiom, focusing especially on logic, physics in its numerous subfields, and medicine. The *TAL* would have a played a prominent role in this project since, in addition to being attributed to Maimonides, it was much shorter than Averroes's logical commentaries and could be referred to with relative ease. In fact, the *TAL* is too short to supplant Averroes's logical commentaries, and Moses ibn Tibbon probably felt that his readers would turn to these for in-depth questions raised by the *TAL*. Should questions of a medical nature arise, readers were likely expected to refer to the medical works that Moses ibn Tibbon had translated. Thus, Moses ibn Tibbon could expect that someone with questions about using the results of experience would turn to Averroes's commentaries on the *Organon*, Maimonides's medical writings, or the numerous writings on natural science that were then available. There would be no need to interrogate the lone mention of experience in the *TAL* on its own.

Still, Moses ibn Tibbon preserves the passage, keeping it quite close to the Arabic. All three translations in fact translate the Arabic *tajriba*, "experience," with the Hebrew *nissayon*.[20] Other key terms are also translated consistently, with one important exception: the Hebrew equivalent of "certain" (*yaqīn*). This word appears as *ʾamiti* in Moses ibn Tibbon, *hitʾamtut* in Ahitub, and *vadaʾi* in Vivas.[21] Whereas Vivas's *vadaʾi* later became standard for certainty and Ahitub's *hitʾamtut* usually refers to verification, though it could be intended to mean "certain" here, Moses ibn Tibbon's *ʾamiti* is the word for "true." This reflects the difficulty of differentiating truth from certainty (i.e., knowing that something is true) in medieval Hebrew. It could, though, also allow readers of Moses ibn Tibbon's translation to think that the results of experience are true, but not certain. That is, a reader of Moses ibn Tibbon's translation could understand that first and second intelligibles are true and that sensed perceptions and the results of experience are also true, without inferring anything about how they are verified in order to gain knowledge that they are true. That second intelligibles are verified via demonstrations could be inferred from context in the *TAL*, but this need not imply anything comparable about the results of experience. Even so, the context would seem to include the results of experience among truths to be used in building demonstrative syllogisms. Moses ibn Tibbon may have expected his readers to turn to other scientific and medical works to discover how the results of experience can be verified. The Hebrew commentators on Moses ibn Tibbon's translation of the *TAL* did not always do so, however, and even when they did, they looked at other works, not translated by Moses ibn Tibbon, leading to a range of different views about the certainty of experience and how it can be verified.

Experience in the Hebrew Commentaries on the *TAL*

The earliest known commentary on the *Treatise on Logic* is that of Joseph ibn Kaspi, who wrote at least thirty works, most of them commentaries on the Bible, Maimonides's *Guide*, and Averroes's commentaries on *Ethics* and the *Republic*. These commentaries focus on logic, philosophy, politics, ethics, and religion rather than on medicine. Similarly, his independent treatises deal largely with religious questions, treated in a scientific manner.[22] Kaspi's interest in natural science was slight, and there is no evidence of him having learned or practiced medicine. Still, he was educated in the Hebrew philosophical curriculum begun by the Ibn

Tibbon family, a curriculum that relied heavily on Averroes's commentaries on logic and ethics and on Maimonides's works.[23]

In his short commentary on the *TAL*, Kaspi notices that the author does not explain how to verify the truth of the results of experience, and says:

> Since the results of experience are similar in one way to the sensibles and in another to the intelligibles, [Maimonides] did not make them a fifth kind [of proposition]. For the individual [results] are sensed. Yet when the sense reduplicates its sensing of the individuals, the intellect grasps the universal, as we shall explain in the *Posterior Analytics*.[24]

Kaspi thus locates experience (*nissayon*) as part of the process of abstracting universals from sensed objects. As Aristotle describes in *Posterior Analytics*, repeated sensation by individuals somehow gives rise to an understanding of the universal. Universals abstracted in such a way become the basis for demonstrations in the physical sciences. Kaspi here says that experience is part (or all) of the repeated sensations by individuals that result in the apprehension of universals. As such, he gives a kind of logical basis for including the results of experience among certain premises that can form demonstrations. The results of experience are verified through repetition and abstraction of a universal.[25] However, he does not connect such experience to the kind of medical experience that the *TAL* suggests through the examples of scammony and gall-nut.[26]

Shortly after Kaspi, or perhaps around the same time, Moses of Narbonne—also known as Narboni and Maestro Vidal—commented on the *TAL*. Like Kaspi, Narboni was educated in the philosophical curriculum of the Ibn Tibbon family, and this is reflected especially in his philosophical writing on Maimonides's *Guide*. But his interests led him to seek out other, Muslim, philosophers and he wrote Hebrew commentaries on al-Ghazali's *Maqāṣid al-falāsifah*, Ibn Ṭufayl's *Ḥayy ibn Yaqẓan*, Ibn Bājja's *Tadbīr al-mutawaḥḥid*, and the early Jewish mystical work *Shi*ʿ*ur Qomah*. He also wrote a medical commentary on Avicenna's *Canon* and at least one original medical treatise, *ʾOraḥ ḥayyim*.[27] Narboni clearly has medical practice in mind when he explains the use of experience in his commentary on the *TAL*.

> Regarding the second intelligible: what difference is there between a first intelligible and a second intelligible? A first intelligible is apparent to anyone's senses, but its perfection remains [unsensed]. Thus, an example is a teacher's proof for a student that the angles of a triangle are equal to two right angles, but this is apparent to the senses. A second intelligible is not apparent to the senses. For example, scammony is a laxative and gall-nut causes constipation. Rather the second intelligible is tried through the path of experience. Therefore, it is true.[28]

Whereas Kaspi had placed experience between sensibles and intelligibles, Narboni connects "the path of experience" (*shevil ha-nissayon*) with the second intelligibles. Narboni seems to have in mind that first intelligibles are abstracted from sensibles. He also seems to see second intelligibles as derived from first intelligibles, perhaps through repetition of the act of sensation. The result is a second intelligible that is "not apparent to the senses" in that its *cause* is not apparent. That Zayyid is observably constipated each time he eats gall-nut is, it seems, a first intelligible. That gall-nut causes constipation is an unobservable inference from this first intelligible, and so a second intelligible. It is nevertheless true. For Narboni, then, the results of experience are also kinds of universal properties. Although it is not clear from this how the truth of the results of experience can be verified, it *is* clear that by identifying these results with second intelligibles, Narboni is able to include premises derived from experience in scientific demonstrations.

Over a hundred years later, Mordecai Comtino of Istanbul wrote a much longer and more detailed commentary on the *TAL*. Comtino also wrote commentaries on Maimonides's *Guide*, Euclid, numerous astronomical books, and the Bible.[29] In his religious works, he emphasized the necessity of studying science. Comtino's scientific background was likely largely drawn from the scientific translations begun by the Tibbonides and various Hebrew commentaries on those works. It is still not clear how much Arabic, Greek, or Jewish Qaraite scientific work he studied. In any case, his commentary on the *TAL* differs from those of Kaspi and Narboni in that he significantly limits the role of experience in forming demonstrative proofs. When explaining Moses ibn Tibbon's statement that the results of experience are true, he asks how they can be verified:

> Since that which is experienced is true, why did the Master [i.e., Maimonides] not count it among the propositions that are known and for which one need not bring a proof that they are true? … The answer is that experiences are composed of sensibles and intelligibles, as Abu Hamid Al-Ghazali stated. … [Maimonides] uses these two examples because that scammony is a laxative is known through experience alone. But that gall-nut causes constipation is also known through a syllogism. That scammony is a laxative is only known by experience because it is due to a property consequent on the form of scammony and properties consequent on form are only known through repeated perception of them, as has been explained in physics. However, that gall-nut causes constipation … is also known by syllogism, as Avicenna explained in *Canon* II.3.
>
> Induction is made on conditions … when, for example, we tell a patient, "Drink this drug because it will benefit you. For so-and-so drank it and it benefited him." Yet if he accepts this, it is a dialectical example. However, if he seeks to know and verify first of all that it

will benefit every other patient who takes it, this is a demonstrative induction.[30]

Comtino brings to the discussion a range of ways for explaining and verifying experienced results based on the interactions of formal and material properties of sensibles and intelligibles. He does not relate the results of experience to second intelligibles at all. In some cases, he notes, such results can also be attained by syllogisms, but in other cases they cannot. Arguments based only on experience, says Comtino, are inductive, not demonstrative. However, once one knows and can verify why the experience yields the result it does, then the experience becomes part of what Comtino calls a "demonstrative induction" (*ḥipus mofti*). It seems to me that what makes this induction demonstrative is that it can be supported by a verified, true reason—that there is a demonstration explaining why it is so. The fact that it repeatedly continues to be so is recognized by the induction.[31] Comtino then diverges from Kaspi, Narboni, and the *TAL* itself in arguing that the results of experience are not themselves sufficiently certain to form the premises of demonstrations. Repeated experiences can form inductions, but it seems that one would need to find a cause of the experience in order to make a scientific demonstration.

In contrast to Comtino, the 1474 commentary of the Italian Renaissance thinker Abraham Farissol clearly and simply includes the results of experience among the second intelligibles. Farissol is best known for his geographical work *Iggeret ʾOrḥot ʿOlam*, the first Hebrew work to discuss the New World.[32] This work, though, was written in 1524, considerably later than his *TAL* commentary. The latter is part of a compilation made together with students and probably reflects how he taught logic at the time. The commentary itself is, in general, a highly simplified and shortened version of the *TAL*, perhaps aiming for even greater accessibility than that provided by the Moses ibn Tibbon translation. Farissol's only comment on experience in the *TAL* is the following: "The definition of second intelligibles is the notions that are explained by premises that are close to first intelligibles or which experience has brought forth."[33]

In fact, Farissol is not interested in experiences, but merely includes them as part of his explanation of second intelligibles. Insofar as they are second intelligibles, what experiences have brought forth is certainly true and can be used as the basis of demonstrations. This view is more or less the one we find in Narboni's commentary, and Farissol may have adopted it in its simplest form for what we can assume are beginning students of logic. This format would be likely to deflect questions about how to verify the results of experience, or at the very least would allow the teacher to defer them to a later area of study.

Conclusion

The *TAL* included the results of experience as a somewhat inexplicable source for certain propositions that can be used for certain premises to form demonstrations. This may have been based on a kind of analogy: as first intelligibles are to second intelligibles, so sensibles are to the results of experience. Still, I do not think that Maimonides made too much of the use of experience here, since, as we saw, he treats the relationship between experience and demonstration quite differently in his medical writings. The Moses ibn Tibbon translation of this passage on experience in the *TAL* altered the source text to speak of the (first-order) truth of the results of experience, rather than the (second-order) certainty of those results. The Vivas translation corrected this, but it does not seem to have been much read. As a result, over the subsequent four hundred years of studying the *TAL*, commentators presented a range of explanations about the (second-order) verifications of the results of experience. Joseph ibn Kaspi apparently saw experience as part of the process of abstracting universals from sensed particulars, and thus as part of the process of discovering and verifying universals. Narboni and later Farissol took the results of experience to be the second intelligibles themselves, under the understanding that their certainty lies in their derivation from first intelligibles. Comtino, in contrast, took the results of experience to be true, but not universal or certain: by accumulating these results, one can argue inductively, but one would need a causal relationship to make a demonstratively certain scientific claim. In a way, Comtino follows Maimonides's medical approach when he seems to suggest that demonstrative reasoning should be used, where possible, to supplement gains from experience. Narboni, too, had been concerned with the medical applications, a concern that is absent from the *TAL* commentaries of Kaspi and Farissol.

What we see, then, is a diverse group of thinkers from all over the Mediterranean world, spanning the course of four centuries, who are struggling with different ways of incorporating experience into the Aristotelian syllogistic framework. It is clear that the more medically inclined, Narboni and Comtino, understand the value of knowledge gained by experience and seek to find ways to incorporate such knowledge into an Aristotelian framework. The less medically inclined, Kaspi and Farissol, seem to focus primarily on the role of experience in the process of abstracting universals. The diverse ways of interpreting this single passage of the short *TAL* are thus a window into larger debates on the role of experience in the very method of scientific argumentation.

Notes

1 Moses ibn Tibbon, the other translators of the work, and the tradition of commentaries on the *Treatise on the Art of Logic* all unquestioningly took the work to be authentically Maimonides's. Recently, however, Herbert Davidson ("Authenticity of Works Attributed"; "Ibn al-Qifṭī's Statement") has suggested that this attribution was erroneous. Davidson's arguments are conjectural and based primarily on the lack of Jewish content in the *Treatise* and considerations of whether the work fits in well with other books

by Maimonides. Such arguments cannot, of course, be refuted, but when weighed against the attribution of the work to Maimonides in numerous medieval sources, they seem rather weak.

2 The three Hebrew translations are edited in *Maimonides' Treatise on Logic*, ed. Efros. They were made by Ahitub (thirteenth century), Moses ibn Tibbon (1254), and Joseph ben Joshua ibn Vivas Lorki (fourteenth century). For the Arabic text in this volume Efros used only two incomplete and fragmentary manuscripts, but he reedited the text in 1966 in "Maimonides' Arabic Treatise," after another manuscript was discovered and then published by Mubahat Türker in Mūsā ibn-I Meymūnʾun, *Al-Makāla fī Sināʾat al-Manṭiḳ*. Note that although the Arabic text survives in Hebrew characters, there is nothing to indicate that it is Judeo-Arabic. Its propagation in Hebrew characters is likely due to the limitations of later Hebrew copyists. On the treatise's dissemination, see Dienstag, "Commentators, Translators and Editors."

3 Kaspi's commentary on the *TAL* exists in a single manuscript (Vatican Library, cod. Ebr. 429, fols. 123r–v). It has been edited with extensive notes in "Commentary of Joseph ibn Kaspi," ed. Kasher and Manekin.

4 The commentary of Moses of Narbonne, also known as Maestro Vidal, on *TAL* exists in a single manuscript (Munich, Bavarian State Library, MS Heb. 289) and is edited in "Commentary of Narboni," ed. Hayoun.

5 Comtino's commentary is edited in Maimonides, *Treatise on the Art of Logic with Commentaries*, ed. Qafiḥ.

6 Abraham Farissol's commentary (perhaps two commentaries, perhaps written with students) survives in a single manuscript in Parma, The Palatina Library, MS ebr. 1957. I hope to prepare an edition in the near future.

7 "Maimonides' Arabic Treatise on Logic," ed. Efros, 22 (Hebrew pagination). English translation is my own.

8 The Arabic phrase literally means "all that which experience has brought forth," which is too bulky to be rendered throughout this chapter. Accordingly, I translate it "results," but readers are advised to not to take it in the same sense in which we speak of "scientific results" today, but more along the lines of what, in general, is produced by experience. It will become clear that this notion is not entirely well defined among those who employ it.

9 Compare to the Greek, however: *hē de peira sphalerē*, which means experiment or trial is precarious or misleading. See Hippocrates, *Aphorismi*, ed. Littré, aph. 1.1. On the Arabic tradition of this phrase, see Rosenthal, " 'Life Is Short.' " For a list of other scholarly works on and editions, see Fichtner, *Corpus Hippocraticum*, 25–28.

10 See Maimonides, "First Aphorism of Hippocrates," ed. Bar-Sela and Hoff, 352–54.

11 Maimonides, *Medical Aphorisms*, trans. Bos, tr. 25, aph. 69. Thanks to Steven Harvey for alerting me to this.

12 Maimonides, *On Asthma*, trans. Bos, 96: "Hippocrates said: 'Experiment is dangerous.' But in our times, experience is claimed only by pseudo-physicians, who make people believe in something which has not been proven in order to cover up their lack."

13 Ibid., trans. Bos, 97–98 (translation modified): "For the art of medicine ... follows speculation and reflection .... One of [Galen's] statements about experimentation [*al-tajriba*] and the empiricist [*al-mujarrib*] is the following:

'Syllogistic demonstrates for you the existence of the things for which you search.'" Bos notes (98 n. 43) that the Arabic citation from Galen is not found in any of his extant works.

14 Maimonides, *On Poisons*, *passim*.

15 A reader asks whether Maimonides could have used the expression "the results of experience" (*kullamā akhrajtā al-tajriba*) in the *TAL* to mean experience combined with demonstrated proofs or logical argumentation, as recommended, in Maimonides's view, by Galen. In this case, experience would not be certain on its own; it would be the demonstration or the logical argumentation that provides certainty. This is a possibility, but then there would be no need for the *TAL* to mention experience at all—it could mention only the criteria for establishing certainty.

16 Other arguments could also be used to explain the different approaches to experience in different works. One is to say that Maimonides wrote the *TAL* in his youth and the *Medical Writings* at the end of his life. Over that period, he came to appreciate Hippocrates's cautionary words and so emphasized the differences in approach between theoretical science and experience. The problem here is that there is no positive evidence about when the *TAL* was written, and it may well have been when Maimonides was older and more experienced. Of course, one who believes that the *TAL* was not written by Maimonides would see no need to reconcile it with his medical works.

17 See "Maimonides' Arabic Treatise on Logic," ed. Efros, 12.

18 The Ahitub translation is extant in only four manuscripts, in three of which it appears as notes to the Moses ibn Tibbon translation, and the Vivas translation is extant in only one manuscript. Little is known about these figures or the context in which they produced their translations. On the manuscripts of the various translations, see Steinschneider, *Hebrew Translations*, 161–63.

19 On the translation activity, which is too great to list here, of Moses ibn Tibbon, see Kreisel, Sirat, and Israel, introduction to *Writings of R. Moshe Ibn Tibbon*, 9–13.

20 The use of *nissayon* for "experience" certainly predates Moses ibn Tibbon. Indeed, Moses ibn Tibbon's grandfather uses the term to translate Hippocrates's statement in his first aphorism, "Experience is dangerous," in his admonition to his son, Judah ibn Tibbon, "A Father's Admonition," 1:80. In contrast, Moses Maimonides and numerous Mishnaic and Gaonic sources used *nissayon* primarily to describe Biblical trials, especially that of Abraham in Genesis 22. See Halper, "Jewish Ritual as Trial." However, by Moses ibn Tibbon's time the scientific context of this term was sufficiently established that it is unlikely anyone would have confused the meaning. Indeed, no commentator even saw a need to clarify.

21 See *Maimonides' Treatise on Logic*, ed. Efros, 40, 81, 113–14 (Hebrew pagination). Note that the single manuscript containing the Vivas translation, Paris, Bibliothèque nationale de France, MS héb. 1201 (written sometime in the fifteenth or sixteenth century), contains an image at exactly this point in the text (fol. 67v) as an example of a geometric proof that is a second intelligible. Note, too, that in Hebrew and Arabic, proof (Hebrew: *temunah*, Arabic: *shakl*) can also mean image. Gadi Weber was able to identify the text in the image as from the Babylonian Talmud, Sukkah 8a: "Each cubit along a square has a diagonal of a cubit and two fifths." The Talmudic context is a discussion of how many people can fit in a *sukkah*, with the assumption that

each person takes up the space of a cubit (or a circle whose radius is a cubit). The passage also notes that exact accuracy is not needed for this calculation, though it does not say explicitly that $1\frac{2}{5} \neq \sqrt{2}$. Since this calculation is not completely accurate, one would not expect to find it as an example of a geometrical proof. Still, Vivas, or more likely Vivas's copyist, added it in here.

22 On Kaspi's massive literary production, including two commentaries on Maimonides's *Guide of the Perplexed,* commentaries on the Bible, and summaries of Averroes's commentaries on the *Organon*, Aristotle's *Ethics*, and Plato's *Republic*, see Sackson, *Joseph Ibn Kaspi*, 57–61.

23 On Kaspi's recommended philosophical curriculum, see Sackson, *Joseph Ibn Kaspi*, 92–102.

24 "Commentary of Joseph ibn Kaspi," ed. Kasher and Manekin, 395. My translation.

25 Kaspi's account of reduplicating sensation in order to draw out a universal almost certainly draws on Jacob Anatoli's Hebrew translation of Averroes's *Middle Commentary* on Aristotle's *Posterior Analytics* II.19. See Florence, Biblioteca Medicea Laurenziana, Plut. MS 88.32, fols. 214v–215r (https://dare.uni-koeln.de). Averroes, however, spoke of reduplicating forms (*she-yukhpelu ha-ṣurot*), while Kaspi speaks of reduplicating sensation of particulars (*kefilat ha-ḥush be-ʾishav*). Even so, the influence on Kaspi of Averroes in Anatoli's translation is clear.

26 Hannah Kasher and Charles Manekin have kindly shared with me the text of a correspondence between Joseph Kaspi and Qalonimos ben Qalonimos that they are editing. There, Kaspi identifies experience with the Avicennian notion of intuition, *ḥads* (Kaspi uses the Arabic term in Hebrew letters and explains it in Hebrew). In this letter, Kaspi, citing Avicenna's *Colliget*, clearly connects this understanding of intuitive experience with discovering the proper uses of drugs and surgery through trial and error. This view seems entirely unrelated to his *TAL* commentary.

27 Narboni's commentary on the *Guide of the Perplexed* appeared in *Der Commentar des Rabbi Moses Narbonensis*. Narboni's Hebrew summaries of Ibn Bajja's *Governance of the Solitary* and *Epistle of Farewell* were edited by Hayoun in "Hanhagat ha-Mitboded" and "Narboni and Ibn Bajja" respectively. See also the recent edition of Narboni, *Commentary on Risalāt Ḥayy Ibn Yaqdhān*, ed. Shiffman. Cf. Holzman, "Rabbi Moshe Narboni."

28 Narboni, "Commentary of Narboni," ed. Hayoun, 84. Hayoun's text is based on Munich, Bavarian State Library, MS Heb. 289, fols. 12v–13r, but has misread the manuscript in many places. Two significant misreadings occur in the passage I quote. In the second sentence, Hayoun has *nirʾeh la-ḥush aval huʾ nifqad ha-shelemut*; the manuscript has *nirʾeh le-ḥush kol aval huʾ nishʾar ha-shelemut*. In the final line, he has *min baḥan*, the manuscript has *muvḥan*. My English translation reflects the reading of the manuscript.

29 On Comtino as a mathematician, see Virac and Levy, "Hero of Alexandria." On Comtino as a commentator on Maimonides, see Eisenmann, "Scientific Aspects."

30 Maimonides, *Treatise on the Art of Logic with Commentaries*, ed. Qafiḥ, 112. English translation is my own.

31 Note that the Hebrew for "repeated perception" (*hekhpel haḥush*) is similar to Kaspi's Hebrew (*kefilat ha-ḥush*), which I translated "the sense reduplicates" above. Like Kaspi, Comtino is probably also drawing on Averroes's *Middle*

Commentary on Aristotle's *Posterior Analytics* II.19 in the translation of Jacob Anatoli (which spoke of *yukhpelu ha-ṣurot*). See n. 25 above. Comtino's expression is, in fact, closer to Kaspi's than to Averroes's. Note also that in the same section of the *Middle Commentary*, Averroes speaks of using induction to arrive at universals that can then be used for demonstrations, but he does not use the term "demonstrative induction." This term would seem rather to contradict Averroes's emphasis on distinguishing demonstrations and inductions. Kaspi and Comtino were apparently both influenced by Averroes's language in Anatoli's translation, though they applied the notions quite differently.

32 On Abraham Farissol's life and thought, see Ruderman, *World of a Renaissance Jew*.

33 Parma, Palatina Library, MS ebr. 1957, fol. 54r: *geder ha-muskalot ha-sheniyyot hem ha-ʿinyanim asher nitbaʾaru be-haqdamot qerovot la-muskalot ha-rishonot o sh-hoṣiʾam ha-nissayon*. MS 1957 bears a Provençal watermark and seems to have been brought by Farissol from Provence, where he was born in 1452, to Ferrara, where he immigrated in 1469. The texts and even chapters of the works in this manuscript are composed in different hands and seem to have been works made by Abraham Farissol together with his students, perhaps in some kind of school context. On the history of the manuscript and Farissol's method of writing and teaching, see Engel, "Man of the Renaissance."

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8 The Weight of Qualities

Quantifying Temperament in Early Modern British Mathematical Medicine

Julia Reed

In 1715, two years after his death, an English translation of the complete Latin works of the Scottish physician Archibald Pitcairne (1652–1713) appeared in London, furthering Pitcairne's role in the advancement of the new mathematical medicine.[1] "The Author of these *Dissertations* was one of the first, who leaving the *Old* Conjectural Method of Physical Writers, struck into a *New* and more Solid Way of Reasoning, grounded upon Observations and Mathematical Principles," the translator's preface proclaimed, noting Pitcairne's professorship in the practice of medicine at the University of Leiden, where at his inaugural lecture twenty-four years earlier he had called for a total reform of medicine on the model of Newtonian mathematical physics.[2]

Before taking up his professorship in April 1691, Pitcairne had read the first edition of Isaac Newton's *Principia Mathematica* and had resolved to mathematize medicine.[3] The need for this mathematization was obvious, Pitcairne declared in his lecture: only a mathematical method could secure certainty in medicine. Physicians needed to begin thinking, sensing, and reasoning like mathematicians and recover from their "addict[ion] to Philosophizing" about the essences or "physical causes" of material things.[4] On this point Pitcairne took his cue directly from Newton's *Principia:* there is an "unknown something" (*illud ignotum*) in a material body that accounts for all its observable actions in relation to other bodies.[5] The *Principia* had famously described the relations between bodies from a mathematical perspective based in observations of motions, and not, Newton warned the reader, as the causal explanations of those relations.[6] Such inner causes of material bodies are presently unknown, Pitcairne argued; what can be known about bodies is only what can be sensibly perceived in their motions in relation to one another. From this, the observer can induce the laws of governing these motions. For Pitcairne, physicians should thus observe and reason like astronomers:

> Physicians ought to propose the Method [*institutum*] of Astronomers as a Pattern for their Imitation [*imitandum*]: [astronomers] Never, in the Explication of the Motion of the Planets, call in the Assistance of a Romantic Hypothesis concerning the Structure of the World,

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> however pleasing and plausible, but by comparing the Observations which have been made at great Distances of Times and Places, and put together in a Method familiar to them, and useful to all the Phaenomena of the Celestial Motions, and to compute the Powers and Force which Bodies in Motion observe in their Tendency to other Bodies, either moveable or immoveable. Let us, if we are inclined to deserve well of the Republic of Physic ... follow this excellent Rule of Theirs.[7]

For too long medicine had sought unobservable, and therefore hypothetical, causes or essences in animal bodies. If, instead, the living body was observed as extended parts in motion, both medical theory and practice could attain the absolute certainty of mathematical demonstration. From observing bodily motions, physicians would be able to induce the forces or powers (*vires*) governing them, and then from these powers the laws of motion of the animal body, or the "animal economy," as it was called, which would serve as the principles of demonstration in medicine.[8]

Pitcairne's inaugural lecture at Leiden was apparently well received; G. A. Lindeboom reports that the Leiden board of governors enthusiastically voted to increase Pitcairne's salary that same day.[9] Pitcairne immediately began publishing and presenting a program of mathematical medicine, which began with a dissertation on William Harvey's discovery of blood circulation.[10] In Pitcairne's view, Harvey had made it possible to apply a Newtonian "model of mathematical precision" to medicine: theoretically, blood circulation was the principle of life—the most fundamental motion of the living body—and practically, maintaining circulation was the principle of health.[11] Harvey had thus made mathematical certainty in medicine possible by discovering the observable and, in principle, measurable motions of the animal economy: the forces and speeds of blood circulation and the secretion of fluids from the blood at different parts of the body.[12]

Pitcairne was a member of what Theodore Brown has termed the "Newton-struck" generation of mathematicians and physicians—including Pitcairne's disciple and popularizer William Cockburn (1669–1739), the brothers John Keill (1671–1721) and James Keill (1673–1719), and the apothecary John Quincy (d. 1722)—who attempted to reform medicine into a certain mathematical science. Mathematizing medicine according to the practice of Newtonian astronomers, however, raised difficult theoretical and practical questions about its scientific object: How should mathematical physicians observe and measure the animal economy? How are the motions inside living bodies like or unlike the external motions of bodies observed in the sky or the laboratory? How are these motions best observed, measured, recorded, and communicated?

Harvey's discovery of blood circulation had in principle provided medicine with a new scientific object—the hydraulic forces and motions of circulation and secretion—but observing these motions to induce the laws of mathematical medicine proved more difficult than Pitcairne had proclaimed in his confident Leiden lecture. The attempt to *imitate* the systematic observation, induction, and mathematical demonstration of Newtonian astronomers was complicated by the necessity of *translating* medicine into a mathematically certain science and the method of observation and induction from physics into medicine.

In this chapter I explore one aspect of early modern mathematical medicine, the quantification of temperament—the balance of qualities or humors in the human body indicating a state of health or illness—as an example of this dynamic between the imitation and translation of a particular scientific practice. I use "translation" in Sven Dupré's expansive sense, as the transformative transfers of phenomena—linguistic, cultural, epistemic, sensory, or geographical—from one domain or place to another, both intentional and unintentional, that science "cannot avoid, not even when written in the universal language of mathematics." Translation, in this sense, involves the intended or unintended change of the phenomena in or by a transfer for testing, disseminating, or applying scientific knowledge.[13]

I argue that Pitcairne's Newtonian medicine is an example of a failed, or at least incomplete, translation from one scientific discipline to another, insofar as it aimed at imitation of the method of astronomical observation without sufficient determination of how its own scientific object—the human body as a hydraulic system of circulating fluids—should be systematically observed and measured. Pitcairne's Newtonian physician might attempt to imitate an astronomer, but he lacked a specific scientific norm to observe circulation and secretion inside the body as the Newtonian astronomer would observe planetary motion. Observing and quantifying temperament as an internal balance indicating a state of health or illness, therefore, remained an arbitrary and impracticable mathematization of qualitative properties of the blood.

By contrast, the mathematical medicine of the Paduan physician Santorio Santori (Sanctorius) (1531–1636) offered physicians a means of observing and quantifying temperament. Now most often remembered as the first Western physician to use a medical thermometer and quantitative methods in medicine, Sanctorius was celebrated in the seventeenth century for establishing the "static" medical method of observing what is added to, and subtracted from, the body in order to measure its internal balance and for his design of instruments to measure signs of imbalance—thermometers, the weighing chair (*statera medica*), hygrometers to measure humidity, and pulsimeters (*pulsilogia*) to measure pulse rate.[14] In a series of weighing experiments using his specially designed chair, Sanctorius claimed to have systematically measured the difference between ingesta and excreta every day over the course of thirty years, through weighing himself and over ten thousand others, in order to track changes in the temperament influenced by environment and habit.[15] With more precise measurements of the balance or imbalance of intake and output given a specific location, age, and routine, Sanctorius argued, the physician could know with more certainty what to add or remove from a patient's regimen order to maintain or restore health.[16]

As Sanctorius left no detailed records of these experiments, later physicians wishing to replicate them were left with perplexing questions about when, what, and how often to weigh in order to quantify such differences. In this sense, Sanctorian static medicine offered an experimental norm of testing and recording quantities that required translation. Followers of Sanctorius who restaged the weighing experiments were forced to guess the correct method of Sanctorian measurement and recording. Yet the retrying of the Sanctorian experiments was productive, gathering a variety of experimental results from different locations, including England, Ireland, Scotland, and South Carolina. Observing and calculating the difference between ingesta and excreta in various places and translating them into a common frame allowed physicians to measure the effects of a variety of climates, cultures, and routines—including the patient's diet, sleeping habits, exercise, and sexual activity—on the temperamental balance.[17]

Early modern mathematical medicine has traditionally been cast as one of the exceptions to the "mathematization thesis" of nature in the seventeenth century.[18] According to the most famous twentieth-century formulation of that thesis, by Alexandre Koyré, the origins of modern science can be traced to the early modern shift from the medieval Aristotelian "closed" cosmos of hierarchically ordered natures, "qualitatively and ontologically differentiated," to an infinite world of quantities governed by universal laws of nature and represented geometrically.[19] Medicine remained one of the scientific domains in which "very little mathematization was successful or even attempted" in the seventeenth century, according to a recent reassessment of the mathematization thesis.[20] Modern histories of mathematization in medicine, while often citing Sanctorius as a pioneer of quantitative physiology, date the actual mathematization of medicine to the development of biomedical statistics and clinical diagnosis later in the nineteenth century.[21] Pitcairne's Newtonian medicine, in particular, enjoyed only a very short life before the turn of medicine and natural philosophy away from mathematical mechanism and towards vitalism later in the eighteenth century.[22]

The prevailing characterizations of "mathematization" in the standard historiographies as the direct application of mathematics to nature, however, have been increasingly critiqued for flattening out historically distinct translations between mathematical and non-mathematical domains and the emergence of new scientific objects. As Sophie Roux has argued, since the ideal of early modern mathematization was that "all the phenomena of nature can be in principle submitted to mathematics and that mathematical language is transparent; it is the language of nature itself," the history of that mathematization requires careful attention to the distinctions and relations between mathematical and non-mathematical languages, the construction of "mathematized" scientific objects, and the specific goals, instruments, and techniques of representing nature mathematically.[23] Rather than focusing on early modern mathematical medicine as an exception to the mathematization thesis, then, this chapter suggests that the attempt to imitate Newtonian mathematical physics in medicine was an incomplete translation of a new scientific object—the hydraulic body of circulating fluids—into an observable phenomenon, in the specific case of the internal balance of temperament.

A New Scientific Object: The Hydraulic Body in Pitcairne's Euclidean Medicine

Pitcairne's system, based on his Leiden lectures, was posthumously published in 1717 as *Elementa medicinae*, named after Euclid's *Elements*, which presented medical theory and practice as an extension of Euclidean geometry. The text begins with an explicit invocation of the *Elements* and positions itself as a continuation of its certain demonstrations. Given Proposition 117 from Book X on the incommensurability of the side and the diagonal of a square, it can be supposed that all matter is infinitely divisible.[24] The identification of geometrical magnitude and physical extension is assumed here rather than stated as an axiom or postulate: since there is no common measure that makes the side and the diagonal of a square commensurate lengths, magnitudes do not consist of indivisible parts and are therefore infinitely divisible. Thus matter is also infinitely divisible. The mathematician John Keill, the brother of James Keill and popularizer of Newton at Oxford, similarly appealed to Proposition 117 in his introduction to natural philosophy:

> If all Magnitude consisted of Indivisibles, an Indivisible would be an adequate and common Measure of all Magnitudes of the same kind; for it would be exactly contained some number of times in all, and therefore all Magnitudes would have a common Measure, and the Side of a Square would be commensurate to its Diagonal; [which is] contrary to the last Proposition of the tenth Book of Euclid's *Elements*.[25]

Unlike Pitcairne, however, Keill offered geometrical proofs for the infinite divisibility of quantity and explicitly addressed the distinction between a geometrical quantity and a material one. Philosophers who distinguished between mathematical and physical bodies, according to Keill, misunderstood the natures of extension and divisibility: a mathematical magnitude can be infinitely divided *because* it is extended insofar as extension is a property of both geometrical and physical space.[26]

The identification of geometry and physics, by contrast, is not justified or discussed at all in Pitcairne's *Elementa*. Indeed, the text seems addressed to a reader who already accepts this identification but needs instruction on how to conceive the human body as a geometrical object. Once thus conceived, the body could be properly observed as quantities in motion from which the physician could induce the laws governing those motions.[27] The divisibility of matter, according to Pitcairne, necessitates some action of dividing, which can only be a kind of motion. Physicians must be guided by their senses, moreover, and it would run contrary to everyday sense perception to deny that bodies are in motion: the most fundamental sense experiences of moving bodies reveal that some bodies are solid and others fluid.[28]

Combining the Newtonian axioms that all matter is subject to the same laws and that all matter is inert—that bodies have no internal principles of motion or change—with Harvey's discovery of blood circulation, the physician can thus begin with the following postulates for medical science: 1) All matter is divisible, and certain material bodies are solid and others are fluid; 2) certain bodies are alive; 3) a living body is defined as one in which blood circulates as a result of the force of the heart; 4) where blood circulates, there is life.[29] Since the basic motion of the living animal body is blood circulation, the most basic division of the body is between the moving parts that circulate (the contained fluids) and the moving parts that facilitate circulation (the containing solids of the vessels). All the "laws" of the solids and fluids in animal bodies can then be discovered "by a due Collection of Observations" of numbers, weights, speeds, thicknesses, and shapes.[30]

On this basis, according to Pitcairne, the physician can demonstrate the particulars of blood circulation, unknown to Harvey, by conceiving the body's solids and fluids as the quantifiable components of circulation and secretion: the solid vessels of specific number, sizes, elasticities, figures, and thicknesses (making up what are commonly identified as "arteries," "veins," "nerves," etc.) and the circulating fluids of measurable quantities, thicknesses, and velocities.[31] Charles Wolfe has noted that what was most important for Pitcairne was this "literal transposition" of Newtonian axioms and empirical method into medicine in order to achieve the certainty of mathematical physics.[32] Pitcairne remained agnostic on the nature of the "life" of the animal body beyond the claim that it is present wherever there is circulating blood; "life" as such is just the apparent movement of blood through a body.

Quantifying the New Scientific Object: Translating Temperament into Degrees of Blood Fluidity

Pitcairne's conceptualization of the body as a hydraulic system of circulating fluids and vascular solids, however, proved difficult to observe and measure for Newtonian physicians. When the physician William Cockburn attempted to apply the quantification of "temperament" as a specific value of blood fluidity for dosing purgative medicines, for example, his results were arbitrary and largely ignored.[33] Pitcairne had defined temperament as a specific blood fluidity that determined a proportionately greater secretion from the blood of bile, urine, and saliva—corresponding to three of the traditional temperaments, bilious (choleric), melancholic, and phlegmatic (pituitous).[34] The differences between the temperaments, according to Pitcairne, was just the difference in the size and "slipperiness" or "smoothness" of the smallest fluid particles. In fact,

> if the Blood of all Men consisted of Parts equally small and slippery, then all Men would have the same Temperament. The Temperament of every Man is a Change (whatsoever it be, and which is to be discovered by some sensible Appearance) of those Conditions in the Canals and Blood that are required to continue a Life destitute of all Pain. But since those Conditions may be infinitely varied (for the Proportions of different Bodies, constituting the same Fluid in any given Quantity, are without number) and which it is of the utmost moment for our Health to be acquainted with, although surpassing all our Industry [to discover]. … There are therefore three kinds only of Temperaments to be observ'd in the Fluids of a human Body, defined in terms of different fluidities of the Blood that … allow the Parts to be secreted from it, in any given Velocity of separation.[35]

Pitcairne's definition of temperament here is characteristic of his descriptions of the hydraulic body as the scientific object of mathematical medicine. Temperament is some kind of sensibly observable change in the "conditions" of the solids and fluids in the body. These conditions are quantifiable, if not directly measurable: they are the proportions of variously slippery and small particles, with varieties too numerous to count. There are three different *kinds* of fluidities in general, however, which correspond to the effect that the smallest parts of the blood have on the secretion of fluids at different places in the body.

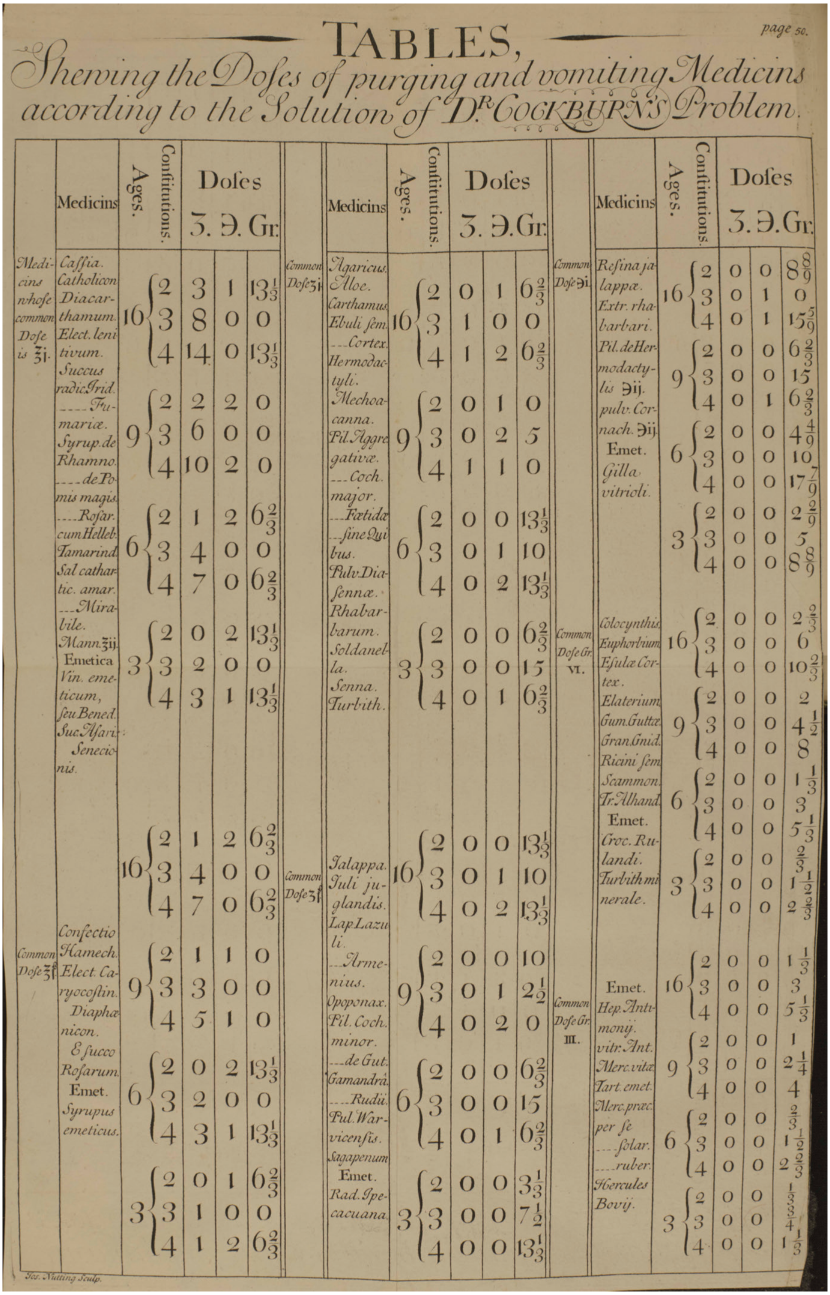
As Anita Guerrini has shown, Pitcairne's understanding of fluidity was directly influenced by a conversation with Newton in spring 1692 on matter theory that Pitcairne recorded and sent to friends.[36] According to Newton, Pitcairne recounted, fluidity was the resistance to flow—viscosity—as determined by the size and smoothness of the smallest parts: "Viscosity is either just a deficiency of fluidity (which is located in the smallness, and thus the separability of parts, understood as parts of last composition) or a deficiency of slipperiness or smoothness preventing the lowest parts from sliding over others."[37] Yet in Pitcairne's discussions of fluidity, the size and slipperiness of these minimal particles remained highly speculative and only abstractly quantifiable. Every circulating fluid, Pitcairne claimed, has specifically sized particles that only a particular force can separate out. A bilious or "choleric" temperament, for example, is one in which bile is secreted in greater proportion because of the greater quantity of particles that, with the requisite force and large enough orifices, are secreted from the rest of the blood in the liver. Pitcairne did not, however, elaborate on the precise sizes of these particles of different fluids, or how their slipperiness could be measured, beyond specifying that the three temperaments are different degrees of fluidity that allow different fluids to be secreted from the blood in greater proportion.[38]

Cockburn attempted to quantify Pitcairne's definition of temperament in a series of papers published in the *Philosophical Transactions* that began with two postulates directly adopted from Pitcairne's system and assigned numerical values to fluidity. First, because health is a function of the facilitation of circulation, medicines are only effective insofar as they are dissolved in the blood; second, medicines change the temperament of the blood, namely, the blood's fluidity or thickness.[39] In order to calculate the most effective doses of medicines for specific temperaments or "constitutions," Cockburn quantified Pitcairne's three temperaments according to greater and lesser degrees of fluidity:

> The quantity of any medicine affects us differently according to Quantity and Constitution of the Blood, or its thickness … [If the] thickness were the same the Dose should always be [the same] as its Quantity[.] There are only three healthy constitutions, which are numbered 2, 3, and 4. That of the most fluid Blood as the first number, and so on.[40]

Cockburn does not explain why, exactly, fluidity is quantified by integers of 2, 3, and 4, nor which temperament corresponds to which degree. Yet if the effect of medicines is ultimately a quantitative change to circulation, increasing or decreasing blood fluidity and the resulting secretions of fluids from the blood, some value of fluidity is necessary to calculate this change in relation to the quantity of the blood and the medicine administered. Cockburn listed such values in tabular form (Figure 8.1). Two patients having the same fluidity and the same quantity of blood—which Cockburn estimated by age—would receive the same dose; if two patients have the same quantity of blood, the doses will differ in proportion to the degree of fluidity, since the dose is proportional to the degree to which the medicine will affect fluidity (and thus the temperament).

Although Cockburn promoted a Newtonian approach to medicine as a mathematically certain science, his primary concerns in quantifying temperament as blood fluidity were the explanation of clinical observations and the improvement of drug therapies through more precise dosing.[41] The physician's "daily experience" that purging medicines, for example, take effect more quickly when ingested in a liquid form rather than a powder, and that patients with illnesses that thicken the blood such as edemas (dropsies) and jaundice require larger doses, is best explained by the inference to the proportional relation between the dose dissolved or mixed in the blood (as opposed to the administered dose) and the effectivity of the medicine.[42]



TABLES, page 50.

Shewing the Doses of purging and vomiting Medicins according to the Solution of Dr. COCKBURN'S Problem.

Medicins whose common Dose is ℥i.: *Cassia. Catholicon Diacarthamum. Elect. lenitivum. Succus radic. Irid. ---- Fumariæ. Syrup. de Rhamno. ---- de Pomis magis. ---- Rosar. cum Helleb. Tamarind. Sal cathartic. amar. --- Mirabile. Mann. ℥ij.* Emetica *Vin. emeticum, seu Bened. Suc. Asari. Senecionis.*

Ages	Constitutions	ʒ	℈	Gr.
16	2	3	1	$13\frac{1}{3}$
	3	8	0	0
	4	14	0	$13\frac{1}{3}$
9	2	2	2	0
	3	6	0	0
	4	10	2	0
6	2	1	2	$6\frac{2}{3}$
	3	4	0	0
	4	7	0	$6\frac{2}{3}$
3	2	0	2	$13\frac{1}{3}$
	3	2	0	0
	4	3	1	$13\frac{1}{3}$

Common Dose ℥ß.: *Confectio Hamech. Elect. Caryocostin. Diaphænicon. E succo Rosarum.* Emet. *Syrupus emeticus.*

Ages	Constitutions	ʒ	℈	Gr.
16	2	1	2	$6\frac{2}{3}$
	3	4	0	0
	4	7	0	$6\frac{2}{3}$
9	2	1	1	0
	3	3	0	0
	4	5	1	0
6	2	0	2	$13\frac{1}{3}$
	3	2	0	0
	4	3	1	$13\frac{1}{3}$
3	2	0	1	$6\frac{2}{3}$
	3	1	0	0
	4	1	2	$6\frac{2}{3}$

Common Dose ʒi.: *Agaricus. Aloe. Carthamus. Ebuli sem. --- Cortex. Hermodactyli. Mechoacanna. Pil. Aggregativæ. --- Coch. major. --- Fœtidæ --- sine Quibus. Pulv. Diasennæ. Rhabarbarum. Soldanella. Senna. Turbith.*

Ages	Constitutions	ʒ	℈	Gr.
16	2	0	1	$6\frac{2}{3}$
	3	1	0	0
	4	1	2	$6\frac{2}{3}$
9	2	0	1	0
	3	0	2	5
	4	1	1	0
6	2	0	0	$13\frac{1}{3}$
	3	0	1	10
	4	0	2	$13\frac{1}{3}$
3	2	0	0	$6\frac{2}{3}$
	3	0	0	15
	4	0	1	$6\frac{2}{3}$

Common Dose ʒß.: *Jalappa. Juli juglandis. Lap. Lazuli. --- Armenius. Opoponax. Pil. Coch. minor. --- de Gut. Gamandrâ. ---- Rudii. Pul. Warvicensis. Sagapenum* Emet. *Rad. Ipecacuana.*

Ages	Constitutions	ʒ	℈	Gr.
16	2	0	0	$13\frac{1}{3}$
	3	0	1	10
	4	0	2	$13\frac{1}{3}$
9	2	0	0	10
	3	0	1	$2\frac{1}{2}$
	4	0	2	0
6	2	0	0	$6\frac{2}{3}$
	3	0	0	15
	4	0	1	$6\frac{2}{3}$
3	2	0	0	$3\frac{1}{3}$
	3	0	0	$7\frac{1}{2}$
	4	0	0	$13\frac{1}{3}$

Common Dose ℈i.: *Resina jalappæ. Extr. rhabarbari. Pil. de Hermodactylis ℈ij. pulv. Cornach. ℈ij.* Emet. *Gilla vitrioli.*

Ages	Constitutions	ʒ	℈	Gr.
16	2	0	0	$8\frac{8}{9}$
	3	0	1	0
	4	0	1	$15\frac{5}{9}$
9	2	0	0	$6\frac{2}{3}$
	3	0	0	15
	4	0	1	$6\frac{2}{3}$
6	2	0	0	$4\frac{4}{9}$
	3	0	0	10
	4	0	0	$17\frac{7}{9}$
3	2	0	0	$2\frac{2}{9}$
	3	0	0	5
	4	0	0	$8\frac{8}{9}$

Common Dose Gr. VI.: *Colocynthis. Euphorbium. Esulæ Cortex. Elaterium. Gum. Guttæ. Gran. Gnid. Ricini sem. Scammon. Tr. Alhand.* Emet. *Croc. Rulandi. Turbith minerale.*

Ages	Constitutions	ʒ	℈	Gr.
16	2	0	0	$2\frac{2}{3}$
	3	0	0	6
	4	0	0	$10\frac{2}{3}$
9	2	0	0	2
	3	0	0	$4\frac{1}{2}$
	4	0	0	8
6	2	0	0	$1\frac{1}{3}$
	3	0	0	3
	4	0	0	$5\frac{1}{3}$
3	2	0	0	$\frac{2}{3}$
	3	0	0	$1\frac{1}{2}$
	4	0	0	$2\frac{2}{3}$

Common Dose Gr. III.: Emet. *Hep. Antimonij. vitr. Ant. Merc. vitæ Tart. emet. Merc. præc. per se ---- solar. ---- ruber. Hercules Bovij.*

Ages	Constitutions	ʒ	℈	Gr.
16	2	0	0	$1\frac{1}{3}$
	3	0	0	3
	4	0	0	$5\frac{1}{3}$
9	2	0	0	1
	3	0	0	$2\frac{1}{4}$
	4	0	0	4
6	2	0	0	$\frac{2}{3}$
	3	0	0	$1\frac{1}{2}$
	4	0	0	$2\frac{2}{3}$
3	2	0	0	$\frac{1}{3}$
	3	0	0	$\frac{3}{4}$
	4	0	0	$1\frac{1}{3}$

Jos. Nutting Sculp.

Figure 8.1 William Cockburn, Tables of Purging and Vomiting Medicines According to Age and Constitution. *Philosophical Transactions* 26 (1708), 53.

Royal Society Publishing

Changing the degree of "most fluid" blood requires a smaller dose, to be sure, but in assigning this fluidity the number 2, Cockburn combined his adoption of Pitcairne's definition of temperament, his translation of the degree into a specific value for use in calculating doses, and his and other physicians' clinical experiences of discerning blood fluidity in relation to other signs and symptoms. For Cockburn, in other words, blood fluidity was defined not principally as subvisible minimal particles of specific sizes and smoothness, but as a clinically observable phenomenon of a more or less viscid state. When thick, for example, the blood was condensed, sticky, slowly moving through contracted vessels, and indicated by pale skin, a weak pulse, and tremors.[43] The geometrical conception of the hydraulic animal body was the theoretical foundation of Cockburn's quantification of fluidity, but it seemed secondary to the clinical usefulness of quantifying qualitative characteristics of the blood that the physician was already trained to observe in practice.

Despite the relative historical insignificance of Cockburn's quantification of temperament as degrees of blood fluidity, the table of ages, doses, and temperaments ("constitutions") reproduced in Figure 8.1 indicates one of the central epistemic and phenomenological transformations of quantification in early modern medicine: the abstraction of specific qualitative assessments of the physician's trained senses into numerical values that generated new experiential data and scientific objects. Even though Cockburn's practicing physician, calculating doses, still discerned temperament through expert sensing, that sensing was at least conceptually restricted to observing the thickness or viscosity of blood, which became a discrete value referring to new categories of patients (those with the least, average, and most fluid blood) as the basis for therapeutic interventions. Temperament in the tables—as a "constitution" of 2, 3, or 4—remained a subjective assessment by the individual physician that Cockburn translated into an arguably arbitrary numerical value.

More specifically, the quantification of blood fluidity simplified and reduced temperament to a state of the blood. A fundamental notion in Galenic medicine, temperament or complexion (*temperamentum* and *complexio*, both translations of the Greek *crasis*, or mixture) referred to a particular physiological balance of Aristotelian qualities—hot/cold and wet/dry—in a particular organ, individual body, species, food, or drug, either as an innate and natural condition or a temporary and mutable one.[44] Latin Scholastic medicine made "complexion" both central and polysemous, variously indicating a permanent or temporary qualitative state or a predominant humor. A male physician in his thirties, the old woman he is treating, the dog at his feet, the drink on his table, the bee bothering him, and the plant in his window will all have different natural complexions. In the course of treatment, the physician might look at and touch various parts of the woman's body for the sensible signs of the complexionate balance of various parts—the thermal temperature, humidity, color, and resistance of her skin; the volume, weight, color, and viscosity of her saliva, sweat, vomit, urine, and feces; the rate and strength of her pulse; and the shape, position, and function of organs. These signs may be substantial and certain, such as immediate sensations of hot, cold, wet, or dry, or accidental and more conjectural, such as color, texture, resistance, and function.

A perfectly balanced complexion—*temperamentum ad pondus*—was considered a theoretical construct, the precise indivisible midpoint between qualitative extremes marking the perfect quantitative balance, and was regarded as relatively useless in practical medicine. The physician instead sought the "just" equality of a specific complexionate entity—*temperamentum ad iustitiam*—of a range or "latitude" with specific degrees proper to a part or a whole organism, within which the part or whole was able to exercise its natural function.[45] Medieval commentators often characterized this complexionate latitude as a continuum between the qualitative contraries along which the part or whole was always moving.[46]

Determining the temperaments of the patient as a whole, as well as the different body parts (particularly the brain, heart, and liver), was thus a complex and often speculative task even for the physician's trained gaze, touch, and clinical reasoning. Signs, symptoms, and causes as diverse as the color, temperature, texture, and shape of the body and face, the position and shape of organs, sleep patterns, excreta, pulse, eating and drinking habits, geographical area of residence and travel, age, and the time of year, among many others, were traditionally listed as criteria that the physician should take into account.[47] Once defined only as a degree of blood fluidity in Pitcairne's mathematical medicine, however, the physician's senses and focus contracted to a quantified state of the blood and what that state implied about circulation and secretion. More importantly, temperament conceptually became a single value (if not an actual measurement) of blood fluidity rather than a dynamic system of qualitative latitudes in one organism.

If Pitcairne's and Cockburn's Newtonian physician thought of temperament quantitatively, there is little indication that his practical assessments of temperament changed as a result. Cockburn's (and Pitcairne's) quantifications of temperament are thus historically significant perhaps less as examples of the "mathematization" of medicine than as attempts to imitate Newtonian physics in Harveyan medicine without a consensus on how to observe the motions of circulation or on how such observations would be practically useful to the physician.

The Trials of Quantified Temperament: "Such Troublesome Experiments"

A much more useful quantification of temperament for Newtonian physicians came from a distinctly non-Newtonian source: Sanctorius's weighing experiments. Assiduously committed to clarifying the medical canon and improving medical practice, Sanctorius's works, including commentaries on Galen's *Ars medica*, Avicenna's *Canon*, and the Hippocratic *Aphorisms*, were both profoundly traditional and innovative. They combined new quantitative practices and measuring instruments with a dynamic Galenism and expertise in academic medicine.[48] Sanctorius's most famous and popular work, *De statica medicina*, is a collection of medical aphorisms based on weighing experiments he had performed over the course of thirty years, using a specially designed steelyard chair (Figure 8.2), to measure the effects of the Galenic non-naturals or external factors impacting complexionate balance—air, food and drink, exercise and rest, sleep, excretions, and the passions or emotions.

Promoting this book to Galileo soon after its publication, Sanctorius described his "static" method as the experimental perfection of Hippocratic medicine, based in two certain first principles: the Hippocratic definition from *De flatibus* of medicine as the addition of what was missing and the subtraction of excess, and experience, through which the physician could track the bodily changes indicating privation or excess.[49]

De statica medicina quantified the effects of the six non-naturals on what Sanctorius claimed was the most fundamental index of health, the amount of "insensible perspiration" in addition to other excreta.[50] Citing Hippocrates and Galen as authorities, Sanctorius centralized and elaborated their notion of an invisible vapor or exhalation through the pores or mouth, and declared that he had invented a new art of medical statics based on its accurate measurement.[51] By systematically and regularly weighing the body, consumed food and drink, and urine, stool, and sweat, Sanctorius calculated the amount of insensible perspiration as the differences between the weights of sensible ingesta and sensible excreta. In a perfectly balanced state of health, ingesta (food and drink) and excreta (including sensible evacuations and insensible perspiration) were proportionate; insensible perspiration, Sanctorius claimed, was the most plentiful bodily excretion.[52] A physician who only observed a patient's sensible evacuations would know so little about their state of health, in fact, that their therapies would be deceptive and destructive: only by measuring the amount of insensible perspiration as the differences between body weight, ingesta, and sensible excreta could the physician observe the effects of the non-naturals on the patient and how these should be regulated through the proper diet, drugs, and habits.[53]

The centrality of the non-naturals in static medicine supported a particular understanding of temperament that was thus easily quantified both conceptually and practically in experimental measurement. The specific complexionate balance measured through weighing was what Sanctorius termed the *external* or *adventitious* temperament: a balance that was always in flux as a result of the influence of the non-naturals, and with which the physician was principally concerned in diagnosis and treatment.[54] This temperament was both directly measurable by weighing and mutable by changes in environment and habit. Whereas

Figure 8.2 Sanctorius, The Weighing Chair. *Ars de statica medicina* (1625). Wellcome Collection, CC BY 4.0

an innate temperament might be relatively permanent and less amenable to medical treatment, adventitious temperament was measurable by systematic weighing and could be corrected through the regulation of the non-naturals.

Sanctorius famously left no explicit record of his experiments, however, much to the chagrin of many eighteenth-century followers, such as the Scottish physician Francis Home, who praised Sanctorius's measurement of insensible perspiration but lamented the laconic aphoristic style of the *De statica medicina:*

> There is no discovery, next to that of the circulation of the blood, that has so much affected our reasoning in medicine, as that of insensible perspiration. The origin of most diseases, and the operation of most medicines are accounted for from it. Sanctorius, to whom we are indebted for the discovery, would have done more service to the science of medicine, had he simply narrated the different experiments that he made, with the proper circumstances belonging to each, and allowed the reader to be a proper judge of the conclusions which he drew from them. By neglecting this, his particular conclusions meet with less credit.[55]

In the preface to his retrials of the weighing experiments in *Medicina statica Britannica*, the Newtonian physician James Keill similarly complained that Sanctorius's aphoristic style in the *De statica medicina* had breached the scientific conventions of collective witnessing and judgment of experiments. Keill included tables recording his own experiments so that "whosoever looks over the Tables, will be as it were present at the Experiments, and will seem to be made his own judge of the truth of the Aphorisms. He may also draw other more useful Observations from them, which escaping in the Aphoristical way of writing, would have lain hid in perpetual darkness."[56] And the physician John Lining (1708–1760), writing to Royal Society physician James Jurin (1684–1750) about the experiments he conducted in South Carolina, complained that Sanctorius had left behind obscure aphorisms rather than explicit experimental instructions and results: "hence we are not only deprived of the Authorities from whence he deduced his Aphorisms, but likewise of a long-continued Series of Experiments; from whence the Changes induced upon the human Frame, in the different Seasons, might have experimentally appeared."[57]

Sanctorius's experiments, then, proved easier to translate than to imitate. As Teresa Hollerbach has noted, Sanctorius described his experiments as trials or risks (*periculum feci*) in the preface to *De statica medicina*, invoking Latin translations of the Hippocratic aphorism "experience [is] treacherous" (*experimentum periculosum*), a contrived event with an uncertain and possibly dangerous result.[58] Because Sanctorius only communicated his experiments as aphorisms, however, later static experimenters were left to guess their subject and aim: Who should weigh what, how, how often, and why?

In his translation of *De statica medicina* into English, the physician and apothecary John Quincy argued that readers had misunderstood the aphorisms as cryptic instructions for further experiments rather than as dietetic recommendations for a general readership. Quincy had also translated Pitcairne's *Elementa*, and criticized the Latinisms and academic jargon of contemporary medicine. Readers of Sanctorius's aphorisms were not meant to restage the experiments themselves, he argued, but rather, considering the purpose of static medicine to measure and regulate the non-naturals, to become more aware of the effects of such external factors on the state of their health. Quincy's translation of Sanctorius from Latin into English thus aimed to popularize the importance of regulating the non-naturals in everyday life:

> I have endeavoured only to bring [the aphorisms] into a larger Acquaintance, both by rendering them in our own Language, and giving such Explanations of some of the most difficult, as may make them easie and intelligible, almost to any Person who has given himself the Leisure to reflect at all, upon the Nature of his Constitution, and the Changes it is most apt to undergo by the Influence of external Causes.[59]

Quincy made these arguments in the Preface to his translations of *De statica medicina* and James Keill's *Medicina statica Britannica* in one volume; by offering both translations together, Quincy hoped that a wider lay readership would learn the importance and influence of location, custom, and climate on their health.[60]

This was precisely Quincy's understanding of the benefit of Sanctorian static medicine, namely, to promote the importance of self-regulation in preserving and restoring health rather than obsessive self-tracking. He complained that weight-obsessives inspired by Sanctorius would only "eat and drink by the Ounce," compulsively weigh themselves, and record their excreta. The aim of static medicine, according to Quincy, was self-control and the regulation of the non-naturals rather than constant (and ultimately useless) measurement: "any person may soon be a judge of the present State of his Constitution without going into a Pair of Scales."[61] Lucia Dacome has persuasively argued that for Quincy, replicating these experiments was largely worthless, first, because the "exactness" of Sanctorius's calculations was immaterial to the text's didactic purpose of educating the literate public about the medical significance and influence of the non-naturals, and second, because Sanctorius's Paduan environment and lifestyle would have yielded very different results, "both our Climate and Way of Living being so very different from his."[62]

In this sense, Sanctorian statics offered Newtonian physicians a practical quantification of observable motion as body weight, ingesta, and excreta, differently measured according to their interpretation of the nature and purpose of Sanctorius's original experiments. This different mathematization, emerging from Sanctorius's attempt to make Galenic diagnosis more precise and systematized in his static weighing experiments, thus practically enabled the quantification of temperament through the translation and comparison of experimental measurements. For the Newtonian physicians who had embraced Harvey's law of circulation, translating Sanctorius's weighing experiments both quantified and externalized temperament by connecting the observable quantities of weight with the internal motions of circulation. Since the life of the animal body was a function of the motions of circulation, a healthy body was one in which these motions were unobstructed and could be measured directly by weighing.[63]

Adventitious temperament was therefore translated and materialized as and through the scale itself—or, in Quincy's interpretation, self-control and moderation of one's regimen—and the changes in body weight. In his 1747 account of retrials undertaken in England, Ireland, and South Carolina, for example, the physician Bryan Robinson (1680–1754) argued that had Sanctorius recognized blood circulation as the principle of life, he might have made the important connection between measuring and regulating the non-naturals and the internal motions of the heart, circulation, and secretion—that is, between the inner quantities of motion and the external quantities of weight.[64] Introducing his comparison of the retrials, Robinson connected the geometry of circulation with static experimental data and the measurement of the effects of the non-naturals:

> As the Discharges of human Bodies depend upon, and are regulated by, the Motion of the Blood; so it may be proper to premise a short account of Motion, by which the Nature of the Discharges by Perspiration, Urine, and Stool, will be more clearly understood than they would be without it. … The disturbing Causes of the Motion of the Heart are the Changes in the sensible qualities of the Air, Heat and Cold, Dryness and Moisture, Errors in Food, in Exercise of Body, in the Times of sleeping and waking, and the Passions of the Mind; that is, a wrong Use of the *Non-naturals* is the common disturbing Cause of the motion of the Heart.[65]

For Keill and Robinson, in particular, Sanctorian statics provided a bridge between the hydraulics of circulation and secretion (the mathematical foundation of medicine, according to Pitcairne) and systematically observable and measurable quantities. This bridge, however, was not so much built as begun and abandoned: as Keill wryly remarked, he gave up his ten-year static retrials without finding a clearer connection between the hydraulics of blood circulation and static measurements, since systematic static measuring required such "a constant and certain way of living" that "a man of business cannot find leisure to pursue [it] with sufficient diligence."[66]

Conclusion

Pitcairne's program to induce the laws of the animal economy from systematic observations "after the rule" of astronomers attempted to imitate Newtonian mathematical physics without due consideration of how theoretical and practical medical concepts would be transformed once they were translated into quantities. On the other hand, for physicians eager to mathematize medicine in order to secure its epistemic authority, the appeal of Sanctorius's static experimentalism was its translatability into different methods of quantifying excess and privation as the measure of health. Sanctorius's lack of experimental instruction meant that his experimental program was, in a sense, inimitable; readers and experimenters had to translate, rather than virtually witness or precisely replicate, his experimental practices. Yet because the Sanctorian notion of static balance was based on an externalized definition of adventitious temperament as the state of being influenced by the non-naturals, the "balance" being measured in static experiments was both materially concrete (in the form of the scale or weighing chair itself and the difference in weights of ingesta and excreta) and transferable. It could be compared across different geographic locations, different physicians as experimental subjects and objects, and more or less precise and repeated measurements. In this sense, the quantification of temperament in static experimentalism was arguably part of the longer transformation of temperament from a dynamic interplay of complexionate parts and wholes in the individual body into new scientific objects—such as the systematic observation and recording of body weight—that both externalized and collectivized temperament as measurable quantities.[67]

Notes

1 Pitcairne, "An Oration," in *The Whole Works* (the original Latin is in Pitcairne, *Oratio*).
2 Ibid., 5. After receiving his medical degree from the University of Reims in 1680, Pitcairne was introduced to Newton's *Principia Mathematica* by the Edinburgh mathematics professor David Gregory. On Pitcairne's reading of Newton, see Brown, "Medicine"; Cunningham, "Syndenham versus Newton," 88; Guerrini, "James Keill"; Guerrini, "Archibald Pitcairne"; Guerrini, "Isaac Newton.' "
3 On Newton's metaphysical agnosticism about physical causes, see Janiak, *Newton as Philosopher*, 14–25.
4 Pitcairne, "An Oration," 7.
5 Ibid., 9.
6 Newton, *Principia*, def. VIII, trans. Cohen and Whitman, 4–5.
7 Pitcairne, "An Oration," 10–11.

8 Ibid., 9–10.
9 According to Lindeboom in "Pitcairne's Leyden Interlude," 280–82. See also Guerrini, "Archibald Pitcairne," 75.
10 Pitcairne, "A Dissertation upon the Circulation of the Blood," in *The Whole Works*, 33–65.
11 Guerrini, "Isaac Newton,'" 224.
12 Pitcairne, "A Dissertation," 34–35.
13 Dupré, "Introduction," 303; see also the articles in the Focus section of that volume.
14 On Sanctorius, see especially Dacome, "Living with the Chair"; Hollerbach, "Weighing Chair"; Hollerbach, "Sanctorius Reconsidered."
15 Sanctorius, *De statica medicina*, "Ad lectorem."
16 Ibid., aph. 1, 1.
17 On these retrials, see Dacome, "Living with the Chair."
18 See, e.g., Gingras, "Mathematics"; Gorham, Hill, and Slowik, "Introduction"; Jalobeanu and Vida, "Introduction"; Tomazella Ferreira and Celestino Silva, "Roles of Mathematics."
19 Koyré, *Newtonian Studies*, 7. In Dijksterhuis's account, modern science began with Newton's distinction between rational mechanics, which expressed motion in "exact proportions and demonstrations," and the inexact, practical art of constructing useful machines. See Dijksterhuis, *Mechanization*, 3; Newton, *The Principia*, trans. Cohen and Whitman, 381. See also Kuhn, "Mathematical vs. Experimental," 28. For an overview of the mathematization thesis, see Mahoney, "Mathematical Realm."
20 Gorham, Hill, and Slowik, "Introduction," 15.
21 Magnello and Hardy, *Road to Medical Statistics*, iv; Matthews, "Probabilistic and Statistical Methods," 1372–73; Matthews, *Quantification*, chs. 1–2; Reiser, *Medicine*, 110.
22 Guerrini, "James Keill," 259; Guerrini, "Archibald Pitcairne," 82.
23 Roux, "Forms," 320 and 325. See also Lorraine Daston's critique of E. A. Burtt's metaphysical presumptions about mathematization and mechanization in Daston, "History of Science."
24 Pitcairne, *Elementa medicinae*, 1. 1. This proposition from Euclid was most likely a later interpolation.
25 John Keill, *Introduction to Natural Philosophy*, 30. On Keill's interpretation of Newton, see Guerrini, "James Keill," 253–54.
26 Keill, *Introduction to Natural Philosophy*, 31.
27 Pitcairne, *Elementa medicinae*, xxiii.
28 Ibid., 1. 1.
29 Ibid., "Postulata."
30 Pitcairne, "An Oration," xxiii.
31 Pitcairne, *Elementa medicinae*, 1. 4.
32 Wolfe, "Newtonian Analogies," 227.
33 Cockburn and Southwell, "Gulielmi Cockburni M. D. Solutio Problematis De Purgantium"; Cockburn, "Problema medicinæ cultoribus solvendum proponit Guilielmus Cockburn"; Cockburn, "Practice of Purging and Vomiting Medicines."
34 Pitcairne rejected "sanguine" as a temperament, claiming that it was only a plethora or "greater quantity" of fluid than were present in the other three. See *Elementa medicinae*, 1. 3. 6.

35 Ibid., 1. 3. 3.
36 Guerrini, "Archibald Pitcairne," 70 and 74–76.
37 Isaac Newton, "Pitcairne with Newton at Cambridge, 1691/2, Cambridge, 2nd March 1691/2," in *Correspondence*, 3:211.
38 Pitcairne, *Philosophical and Mathematical Elements of Physick*, 13.
39 Cockburn and Southwell, "Solutio Problematis De Purgantium," 2119–20.
40 Cockburn, "Practice of Purging and Vomiting Medicines," 48–49.
41 Cockburn's quantification of fluidity and calculations of doses found little support at the Royal Society at the time, and in Edinburgh the physician Charles Alston derided Cockburn's method as arbitrary, "hypothetical," and of little use in estimating doses. See Alston, *Lectures*, 2:565–67.
42 Cockburn, "Practice of Purging and Vomiting Medicines," 47–48.
43 See Cockburn's discussions of treating sailors in *Sea Diseases*, 76–79. Cockburn's varied career indicates that "it is probably much too simple to divide turn-of-the-century physicians into theorists and experimenters, … or Newtonians and Baconians-Sydenhamians," Cook, "Practical Medicine," 21–22 n. 107.
44 On the reception of Galenic complexion in Latin Scholastic medicine, see Thorndike, "De Complexionibus"; Jacquart, "De crasis à complexio"; Ottosson, *Scholastic Medicine*, 120–200; Siraisi, *Medieval Medicine*, 101–4; Groebner, "Complexio/Complexion."
45 Galen, *De complexionibus* 1. 6, ed. Durling, 30.
46 On the concept of latitude in medieval commentaries on Galen and Avicenna, see Kaye, *History of Balance*, ch. 4.
47 See, e.g., Nance, "Determining."
48 Hollerbach, "Sanctorius Reconsidered," ch. 3. On the vibrancy of Galenism in sixteenth- and seventeenth-century academic medicine, see Maclean, *Logic, Signs and Nature*.
49 Quoted in Castiglione, "Life and Work," 773; see Hollerbach's discussion of this letter in "Sanctorius Reconsidered," 41–42.
50 On the history of insensible perspiration, see Renbourn, "Natural History."
51 Quoted in Castiglione, "Life and Work," 773; Sanctorius, *De statica medicina,* "Ad lectorem."
52 Sanctorius, *De statica medicina*, aph. III, 2.
53 Ibid., aph. II, 2.
54 Sanctorius, *Commentaria in Artem medicinalem Galeni*, 117.
55 Home, *Medical Facts and Experiments*, 234–35.
56 James Keill, *Essays on Several Parts of the Animal Oeconomy*, Preface.
57 Lining, "Extracts of Two Letters," 492; on Lining, see Dacome, "Living with the Chair," 484–85.
58 Hollerbach, "Sanctorius Reconsidered," 211.
59 Quincy, *Medicina Statica*, Preface, iii.
60 Ibid., Preface, vii.
61 Ibid.
62 Ibid; Dacome, "Living with the Chair," 477–78.
63 Keill, *Essays on Several Parts of the Animal Oeconomy*, Preface.
64 Robinson, *Dissertation on the Food and Discharges of Human Bodies*, iii–iv and 11.
65 Ibid., 1 and 11.

66 Keill, *Essays on Several Parts of the Animal Oeconomy*, Preface.
67 On the change from internal *complexio* to external complexion over the course of the late fifteenth and early sixteenth century, see Groebner, "Complexio/Complexion."

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Part IV

Verbal and Visual Systems

Part IV Introduction

Translation in Practice: Visualizing Experience

Katharine Park

"Life is short, the art is long, opportunity fleeting, experience precarious, and decision difficult." Physicians have always been pressed for time, caught between their patients' needs and the complex and messy reality of medical practice, as opposed to the abstract principles of medical theory.[1] Hippocrates's First Aphorism captured the essence of the medieval physician's working world: there was so much to know about bodies (each one unique), illnesses, the vast world of natural substances that made up the premodern pharmacopoeia, and the myriad and contingent ways the three interacted. A lifetime of study was not enough to master the complexities. In theory, seasoned physicians could draw on a deep repertory of experience—their own and that of the myriad generations of medical authors whose works made up their curricula and their libraries—but who had enough time to sift through all that material every time a judgment about treatment or a preventive regimen had to be made?

Physic, corresponding roughly to internal medicine, is perhaps an extreme case in the extraordinary range of experiential knowledge it required—of human bodies, minds and personalities; of the properties of plants, animals, and minerals; of cooking and dietetics; of the ages and the seasons—but all of the practical arts were subject to the same kinds of constraints. The laboratory, the garden, the orchard, the field, the artist's workshop, the pharmacy, the hospital, and the sickroom differed in fundamental ways from the classroom and the study, where most kinds of experience—those not directly entailed in the actions of lecturing, listening, and reading—could be held at a distance, as an object of reflection rather than as the inescapable matter of the work at hand. The same reality is reflected in the particular ways experience was translated in the practical arts: many of these involved techniques to manage the too-muchness of experience, recasting it in ways that allowed practitioners to focus on, identify, and remember those aspects most germane to the things they were trying to accomplish. The essays in this section, focusing on the practical arts of medicine, its spin-off, botany, and alchemy reflect

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this reality, albeit in very different ways. What they all have in common is the invention and/or use of visual tools to corral the complexities of experience, whether first- or secondhand, recasting it in forms that made it usable in real-time situations.

As Dror Weil's essay recounts (Chapter 10), the eleventh-century physician Ibn Buṭlān, confronting the realities of medical practice so precisely captured by Hippocrates, had an inspiration: to translate the vast body of medical experience into handy visual form, a "quick reference for the careful examiner." He modeled his tables on those devised by astronomers—another kind of translation—to track and predict the motions of the heavenly bodies. Although his original tables may have been circular, the version that survives took the form of a rectangular grid, which summarized and laid out the properties and effects of medicinal ingredients and foodstuffs for easy consultation; even better, tables of this sort would allow literate patients to make decisions about a healthy lifestyle, on their own or in consultation with their physicians, saving doctors time and conferring agency on patients. Ibn Buṭlān's tabular format was a hit by any standard. It was adapted by other Arabic medical writers, as Weil describes, and the thirteenth-century Latin translation of Ibn Buṭlān's work, which survives in an astounding twenty manuscripts, eventually became the basis for Latin and German printed editions, which appeared 1532 and 1533 respectively.

Dominic Olariu's essay (Chapter 11) traces the Latin translation of Ibn Buṭlān's *Tacuinum* (a transliteration of its Arabic title, *Taqwīm*) through yet another change in format: from tables into lavishly illustrated manuscripts. Produced in late fourteenth-century Italy in close connection with the court of the Duke of Milan, these were used as gifts to other princes. In the manuscripts, each foodstuff or medicinal substance had its own page, as in the *Tacuinum*, but where the table was essentially a verbal diagram, the masterminds of the *Tacuina* project, likely some combination of court physicians, gardeners, and painters, compressed the verbal element into a kind of caption and greatly expanded the visual one, adding careful painted depictions of the kinds of therapeutic entities and substances, mostly but not exclusively plants and foodstuffs, inventoried by Ibn Buṭlān. The effect was to readmit many of the sensory elements abstracted from Ibn Buṭlān's severe and utilitarian schema—color, scent, taste, passion, pleasure—but in manageable form, and to include an additional dimension: men and women involved in cultivating, harvesting, processing, selling, and enjoying them. Beautiful objects in themselves, these manuscripts, like Ibn Buṭlān's tables, were meant to be of practical use to elite patients, visual contributions to a new medical genre of regimens of health that flourished in late medieval Italy.[2] As Olariu documents, this translation had a cultural dimension as well as a visual one: therapeutic practices like bathing, largely unfamiliar to the inhabitants of northern Italy, were de-emphasized, unfamiliar Arab dishes were eliminated, and Italian plants and foodstuffs were added. But still, as with Ibn Buṭlān's tables, the format emphasized simplicity, clarity, consistency, and memorability, helpful to a professional audience and essential for a lay one.

Jaya Remond (Chapter 12) takes the visual translation of experience a step further in her chapter on the emergence of early printed botanical atlases. Here too, the original goal was therapeutic: each plant's image was accompanied by extensive verbal descriptions of its medical uses taken from ancient and medieval medical authorities, but the images themselves show an even higher level of reflection on the part of their makers regarding what made a "living" image of a plant and how best to pack as much information as possible into that image, an ideal Remond describes as "hypervisibility." Compared to the images in the *Tacuina*, paradoxically, this involved stripping away the riot of sensation, the fascinating human interactions, the meticulously rendered clothes worn by lords and ladies, shopkeepers, farmers, and servants, in service of a more focused goal: facilitating the accurate identification of particular plant species by, in the first instance, people interested in their medical uses. The approach here was not to evoke as vividly as possible the human social and sensory experiences organized around plants and other agents of health, appealing to a lay audience, but to focus on only those elements relevant to selecting particular plants for particular purposes. As in Ibn Buṭlān's tables, the process of translation focused on a highly conscious process of winnowing out extraneous details and zeroing in on the essentials, rather than invoking the richness of experience offered by every interaction with the natural world.

Vincenzo Carlotta's essay (Chapter 9) on techniques of alchemical reading and writing in medieval Greek manuscript culture takes us to a very different place: the library and the study. Rather than trafficking in visibility, let alone hypervisibility, the pictorial translations in his sources—alchemical symbols—allude to the substances involved in alchemical operations, but erase the rich world of sensory experience involved in alchemical practice, with its furnaces and stills, its heat, its fumes, and its colorful repertory of minerals, metals, and other natural materials. His Greek students of alchemy lived in a world of text. The visual elements here, the planetary and other symbols used to refer to alchemical materials and processes, functioned in various ways. They served as scribal abbreviations meant to lighten descriptions of procedures and as residual gestures to the indirection once used to obscure the nature of proprietary practices. They alluded to chemical processes, staged by somebody sometime, but the experience of these processes, rather than being translated, was registered as happening somewhere else.

At the same time, the scribal annotations analyzed by Carlotta evoke another kind of experience: that of readers and students, as they sought to decode, explain, and comprehend physical processes described obliquely in the text. They indicate that libraries and classrooms were also places for experience, though of a rather different sort than laboratories, and dominated by a subtle choreography of eye, hand, and ear.[3] In a world of manuscripts, both the teacher's oral commentary and the reader's personal notes might become part of the text. Anchors for memory, tools for fixing attention, the annotations also remind us that not all experience is sensory and that reading is a practice in itself.

Notes

1 See Ragab, *Around the Clock*.
2 Nicoud, *Les régimes de santé*.
3 Agrimi and Crisciani, *Edocere medicos*, ch. 4 ("Maestro, discepolo, testo"). For a measured assessment of the evidence for early reading practices, silent and otherwise, see McCutcheon, "Silent Reading."

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9 Translating Alchemical Practice into Symbols

Two Cases from Codex *Marcianus graecus* 299

Vincenzo Carlotta

The adoption and use of symbols in the alchemical tradition is a complex process that deeply influenced the transmission of alchemical knowledge. In the Byzantine anthologies of alchemical works, a considerable number of symbols are listed and used for various purposes. However, we still lack a systematic study of the use of alchemical symbols in the Greek tradition. Through a number of case studies from the Byzantine alchemical tradition, this chapter explores how alchemical symbols were used to convey operative information, and how the iconic language of the symbols interacted with the natural language in which the alchemical works were written.[1]

Originating around the first century CE and lasting until the end of the Byzantine period in the fifteenth century, Greek alchemy was a discipline that aimed in general to transform material substances and, in particular, to achieve a complete transformation of various metallic substances into silver and gold. Despite the operative nature of their discipline, Greek alchemists maintained great secrecy about the operations they actually performed. Thus, alchemical texts were largely encoded though "code-names" (Decknamen), the omission of crucial ingredients and instructions, extensive metaphors, and symbols in the proper sense of the word.[2]

In the earliest extant alchemical texts—two papyri drawn up in Egypt at the end of the third century CE and now preserved in Leiden and Stockholm—two symbols are already in use. The astrological symbols for the Sun (☉) and the Moon (☾) are used as part of the main text, where they stand for gold and silver respectively. Alchemical symbols derived from the astrological tradition remain the most commonly attested class during the Byzantine period, but many new symbols were original developments proper to the alchemical tradition.[3] All these symbols were commonly used in Byzantine anthologies of alchemical works as substitute forms for terms that denoted substances and operations frequently mentioned by the alchemists. In most cases, the symbols were simply part of the characteristic code of the written transmission of alchemy. They were primarily a scribal convention.

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The proliferation of alchemical symbols is well exemplified by the manuscript *Parisinus graecus* 2327, which was copied in 1478 and includes a list enumerating more than two hundred symbols and the alchemical substances corresponding to them (fols. 16v–18v). Similar lists of alchemical symbols were placed at the beginning or, less frequently, end of many collections of alchemical works—a position connoting these lists as tools for the reader. However, most of the symbols included in these lists were used only rarely by the scribes copying alchemical texts or the readers annotating them. Indeed, many are found exclusively in the lists. The lists of alchemical symbols, therefore, did not simply record actual examples of a scribal convention found in the alchemical texts. Instead, they were productive sources of alchemical language.[4]

Given that the use of symbols in the Byzantine alchemical tradition was a developing process, and that Byzantine anthologies of alchemical texts differ profoundly with respect to their original composition, destination, and manuscript tradition, I will focus on a single—but extremely relevant—manuscript: codex *Marcianus graecus* 299 (**M**). This "Venice codex" was drawn up in Constantinople between the end of the tenth century and the beginning of the eleventh. It preserves a collection of texts that follows the model of many Byzantine anthologies, in which the works of the most relevant exponents of a certain discipline were assembled in order to be preserved. The opening text is richly illuminated with gold leaf and brightly colored inks, pointing to a prestigious commission for the manuscript, possibly an order from the Imperial Library itself. The Venice codex reveals a direct interest in alchemy among the highly educated circles of Byzantine culture, an interest that continued during the subsequent centuries, as is attested by Michael Psellos's alchemical interests in the eleventh century and Nikephoros Blemmydes's in the thirteenth century. The manuscript belonged to the collection assembled by Cardinal Bessarion (1403–1472), and in 1468 he presented it, as a part of his library, to the Republic of Venice. For all these reasons, codex **M** is an extremely valuable witness for the *consitutio textus* of Greek alchemical works, and provides direct evidence concerning the history of alchemy during the Byzantine period.[5]

In the following, I analyze two passages in **M**. These two exemplary cases not only reflect the general practice of using symbols in the Greek alchemical tradition, but also reveal some peculiar adaptations of those symbols undertaken to convey (and reinterpret) the practical contents of alchemy.

Translating Natural Philosophy into Alchemical Operations: The Fifth Book of Stephanus's *Lessons*

In the fifth book of Stephanus's *On the Sacred and Divine Art of Gold Making* (*Peri tēs hieras kai theias technēs tēs tou chrysou poiēseōs*), which is commonly known as the *Lessons* (*Praxeis*), we find an exemplary case of alchemical symbols used in the context of a theoretical discussion on alchemy.[6] The work, written in Constantinople during the first half of the seventh century, is divided into nine books (entitled "lessons"), in which the author covers various topics around the practice of alchemy and its theoretical foundation. Frequently, this teaching takes the form of a commentary on authoritative alchemical works. The ninth and last book of the *Lessons* is addressed to the Byzantine emperor Heraclius (r. 610–641), who is praised as a patron of alchemical studies.

The *Lessons* were the opening text in the collection of alchemical works upon which codex **M** is directly based. Scholars generally agree that this anthology was put together by the end of the seventh century. Moreover, there is a lacuna at the end of the *Lessons* that was produced by a mechanical loss of text in the Venice manuscript, or possibly in its model, and suggests that the textual transmission of the *Lessons* depends primarily on the manuscript family descending from the Venice codex. As regards the *Lessons*, therefore, the alchemical symbols found in manuscript **M** seem to be independent of other branches of the manuscript tradition and also chronologically close to the original composition of the treatise.[7]

In the fifth book, Stephanus writes at length of the four elements of the natural world (fire, air, water, and earth) and the relationship between their transformations and the operations performed by the alchemists. He maintains that the various alchemical substances must be unified completely, and the study of natural transformations of the four elements offers a model to achieve that goal. The most direct example of the kind of "complete blending" (*synkrasis*) and "unification" (*henōsis*) sought by the author can be found in the physiology of the human body. There, the four humors are physiologically transformed into one another and correspond to the four elements of the sublunary world. Accordingly, Stephanus introduces a series of associations between elements, humors, and alchemical substances: fire corresponds to blood and quicksilver; air to yellow bile and copper; earth to black bile and the slug of copper melted with quicksilver; water to phlegm and the "souls" of the copper, that is, the vapors that arise when copper is melted with quicksilver.[8]

In the version found in codex **M** (fols. 20v–23v), the main text of the fifth book includes many alchemical symbols, used in two different ways. This difference becomes clear in the following passage, which is not an isolated case but displays a pattern characterizing most of the fifth book. In this passage, I have marked in bold or italics all the terms represented by symbols in the Venice manuscript (Figure 9.1):

> These are the four elements, which are opposite, so that they cannot be completely unified one with another if not by means of something acting as a medium insofar as it has the qualities of the two higher (parts of the opposite elements). For instance, the fire—**quicksilver**—is unified with the water through the earth, that is, the slag, just as

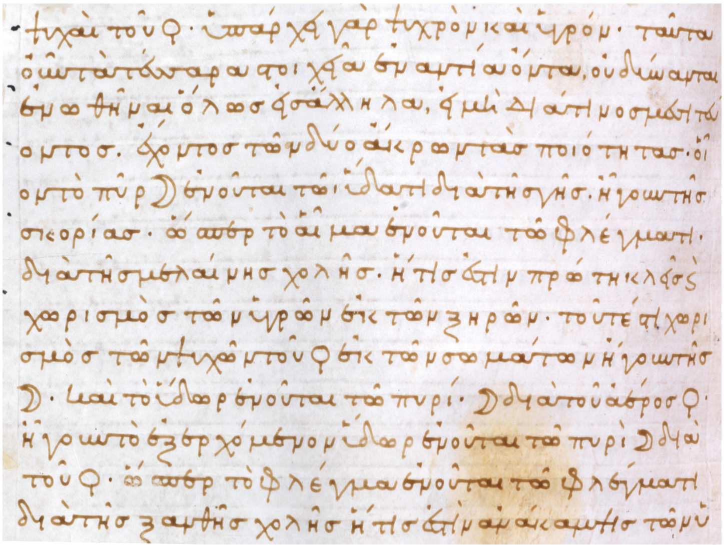

Figure 9.1 Codex *Marcianus graecus* Z. 299 (= 584), fol. 21v (detail).

> the blood is unified with the phlegm through the black bile. This is the first key and the separation of the moist substances from the dry ones, that is, the separation of the "souls" of the *copper* from their bodies, that is, from the *quicksilver*. And the water is unified with the fire—**quicksilver**—through the air—**copper**—that is, the water coming out of (the still pot) is unified with the fire—**quicksilver**—through the *copper*, just as the phlegm is unified with the blood through the yellow bile.[9]

The words in italics indicate symbols that are used as substitutes for common alchemical terms, here the names of two metals, within a sentence. If the alchemical symbols corresponding to these words were eliminated from the text, the sentence in which they feature would become ungrammatical and potentially meaningless. This is the same type of use also found in the papyri of Leiden and Stockholm and in most alchemical works as preserved by the Greek manuscripts. In these cases, the alchemical symbols can be regarded as a simple scribal convention that aims to shorten the written text by substituting a fully written word with a single symbol. In the case of the terms in bold type, the symbols are grammatically redundant: they do not substitute any technical terms in the main text, but are placed directly next to another word without further qualifications. More precisely, all these symbols are juxtaposed with some of the mentions of the four elements of the physical world.

Dealing with the transformation of the four elements of natural philosophy, the fifth book has a clear theoretical focus. In this passage, each element is understood as having an opposite element (fire and water are opposite, as are air and earth). As the author explains immediately before this section, the opposition is due to the different elemental qualities (hotness, coldness, moistness, and dryness) proper to each element.[10] Opposite elements share no elemental qualities—for example, fire, being hot and dry, is opposite to water, which is cold and moist. Since the fifth book is intended to give an account of the complete unification of all four elements, the author of the *Lessons* here addresses the problem that unifying more than two elements entails the union of at least one pair of opposite terms. The proposed solution is to introduce a middle term between each pair of opposites. Leaving aside the philosophical intricacies of the passage, this section of text is an integral part of the theoretical discussion characterizing the fifth book of the *Lessons*.[11]

The process leading to the complete union of opposite elements is expounded further by the text's reference to the correspondences between physical elements, medical humors, and alchemical substances, already established at the beginning of the same book. In the Venice manuscript, the juxtaposition of alchemical symbols with many of the mentions of the four elements follows that same pattern of correspondences, emphasizing the relevance of the practical aspects of alchemy in a passage that is otherwise focused on the transformations of the physical elements. In other words, the addition of the alchemical symbols makes explicit for the reader the implicit reference to the alchemical substances when the four elements are mentioned. In this way, the symbols shift the focus of the passage from the theoretical problem of elemental transformation to the alchemical combination of substances such as quicksilver and copper.

In manuscript **M**, these mentions of the four elements and the related alchemical symbols are both part of the main text and are written by the same hand. The addition of the symbols must therefore predate the writing of the Venice codex (tenth/eleventh century). The most plausible hypothesis is that a reader of this treatise who was active between the original composition of the *Lessons* (seventh century) and the tenth century superscripted the symbols (or the spelled-out names of the alchemical substances) above the lines of the original text, and the scribe of the Venice codex (or that of its model) then incorporated the annotations into the main text. This group of alchemical symbols attests that at a very early stage of the manuscript tradition, there were already Byzantine readers of the alchemical anthology preserved by **M** who were actively bringing to the fore implicit references to an alchemical work's practical aspects. They also show that by the tenth century, alchemical symbols were used as a way of directing readers towards specific readings of a passage. In particular, they gave later readers a guide on how to translate the theoretical contents of an alchemical work into instructions for the practice of alchemy.

Decoding Alchemical Operations: The *Dialogue of the Philosophers and Cleopatra*

Another use of alchemical symbols is illustrated by the version of the *Dialogue of the Philosophers and Cleopatra* (*Dialogos philosophōn kai Kleopatras*) preserved in the Venice manuscript. The treatise is a fictional dialogue between Queen Cleopatra VII (69–30 BCE) and a group of alchemists led by the Persian magus Ostanes (fifth century BCE?). Written, or at least largely rewritten, during the seventh century, it focuses on the preparation of the agent of alchemical transmutation: a substance by means of which it would be possible to transform silver into gold. These practical aspects of the pseudo-Cleopatrean *Dialogue*, however, are concealed to a significant extent by means of the highly metaphorical language characterizing the entire work. Moreover, the *Dialogue* develops other themes besides the description of the alchemical operations. In particular, pseudo-Cleopatra's teachings extensively address the relationship between heavenly movements and alchemical operations, and also the topic of alchemical practice as a parallel to the religious idea of the resurrection of the dead.[12]

The second half of the treatise establishes the connection between alchemical practice and the resurrection of dead bodies though a complex treatment of the interactions between the body, spirit, and soul of the alchemical substances. In codex **M**, a later hand (eleventh–thirteenth century) added alchemical symbols above the lines of the main text. In the following passage (Figure 9.2), I have placed in angled brackets the words rendering alchemical symbols and underlined the terms above which they are placed:

> [Cleopatra said:] "For the spirit <cinnabar> rejoices once again in the body <lead>, just as does the soul <quicksilver> which is in it <gold>, and (the spirit) hastens for joy to flee into the embrace of the body, and (the body) embraces it (in return), and the darkness does not dominate the body ever since it submitted to the light <native sulfur>, and it will not accept being separated from the spirit for all eternity. And (the soul) rejoices in its own house <gold>, since, after leaving the body behind in the darkness, it found that the body was full of light <native sulfur>, and (the soul) was unified with the body, after (the body) became divine like the soul, and now (the soul) lives in the body; for (the body) has been clothed in the light of the divine essence [*theotēs*] and the darkness fled from it. And all of them—the body <gold>, the soul <quicksilver>, and the spirit <cinnabar>—were unified out of love and became only one (substance), in which the secret is hidden."[13]

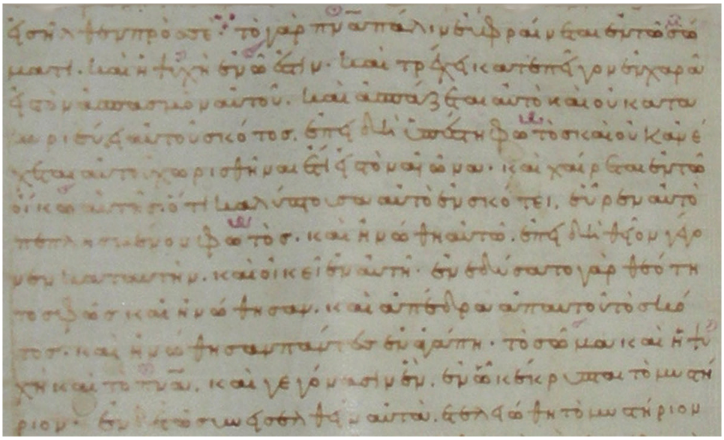

Figure 9.2 Codex *Marcianus graecus* Z. 299 (= 584), fol. 42v (detail). Copyright Ministero della Cultura: Biblioteca Nazionale Marciana. Reproduction prohibited.

Reading the original text without the alchemical symbols, the reference to some unspecified process of sublimation or distillation can be understood in light of the metaphorical framework already established in the *Dialogue*, where the image of the cloud rising from the water to bring about the transformation of the alchemical substances is frequently used by pseudo-Cleopatra to illustrate the crucial role of distillation in the production of the transmuting agent. The details of the process, however, as well as the substances involved in it, remain almost impossible to identify in this passage. Instead, the metaphorical language of resurrection fulfills a pivotal function in its own right: it presents the alchemical practice as an imitation of a divine operation. By keeping exclusively to these metaphors, pseudo-Cleopatra does not constrain the argument to any particular application of alchemy. On the contrary, any alchemical form of sublimation or distillation can be understood as divine in character precisely because pseudo-Cleopatra omits to mention any specific substance. Nonetheless, Greek alchemists—at least starting from pseudo-Olympiodorus (sixth century)—devoted great effort to identifying the exact substances used by their predecessors and supposedly kept secret by means of code-names and metaphors.[14] At least in retrospect, then, the metaphorical and religious language of the *Dialogue* could be interpreted as performing the role of an encoding device.

The alchemical symbols added to this passage offer a more or less consistent set of identifications with various alchemical substances: the spirit is cinnabar, the light of resurrection is native sulfur, the soul is quicksilver, and the body is identified first with lead and then, after its transmutation, with gold. The same hand also added further symbols throughout the treatise: the symbols of quicksilver (☽) and cinnabar (⊙) being the most frequent. The introduction of alchemical symbols in those sections of the *Dialogue* that were perceived as most secretive by its later readers suggests a particular interpretation of the text based on the identification of precise alchemical substances and operations. The metaphor of the death and resurrection of the bodies is connected to a process of distillation in general, but that process is specified through alchemical symbols as a form of the distillation of quicksilver. Thereafter, the substances undergoing distillation are consistently explained through the symbols of quicksilver and cinnabar. The production of quicksilver through the distillation of cinnabar was a technical operation well known in Antiquity, and the Greek alchemists improved it substantially by developing more complex distillation devices.[15] The hand adding the alchemical symbols, therefore, did not offer an entirely vague technical interpretation of pseudo-Cleopatra's teachings, but identified a specific technical operation behind a web of intricate metaphors.

The same hand also added alchemical symbols in a similar way in other works preserved in the Venice manuscript. Although an analysis of all these instances would go beyond the limitations of this chapter, I would like at least to point out the addition of alchemical symbols in the treatise *Of Ostanes the Philosopher to Petasios On the Sacred and Divine Art* (*Ostanou philosophou pros Petasion peri tēs hieras kai theias technēs*). The topics developed there are extremely close to those of the pseudo-Cleopatrean dialogue, where Ostanes is the most important of Cleopatra's interlocutors. Alchemical symbols are used in this case, as well, to put forward an operative interpretation of a passage on the resurrection of dead bodies to new life.[16]

The consistent interpretation of sections with religious connotations in terms of alchemical practice across different works makes it obvious that these alchemical symbols cannot be dismissed as the annotations of a generic "Byzantine scribe." The person who added the alchemical symbols to the *Dialogue of the Philosophers and Cleopatra* had at least a limited knowledge of alchemy and its practical operations. However, since the new references introduced though symbols are based on very common and widely known operations, such as the distillation of quicksilver from cinnabar, it is impossible to say if this person had any actual experience of alchemy. Still, it is clear that she or he was interested in the practical aspects of alchemy and regarded the metaphorical language of these alchemical works as an encoding of specific alchemical operations.

The version of the *Dialogue* preserved in the Venice codex demonstrates that, in some special cases, alchemical symbols were used as genuine interpretive tools in order to decode texts that appeared to be detached from any reference to the practice of alchemy. They did not simply emphasize one reading of the text over another—as in Stephanus's case—but introduced entirely new interpretations of the original texts. Another crucial difference between the passage of the *Dialogue* quoted above and Stephanus's *Lessons* is that in the *Dialogue*, the alchemical symbols were added by another hand just above the terms to which they refer. Exactly the same was probably true of the *Lessons* before the alchemical symbols were incorporated into the main body of the text. Nonetheless, the alchemical symbols superscripted to the main text of the *Dialogue* interact differently with the manuscript transmission of alchemical works. In the Venice codex, the original text of the *Dialogue* remained unaltered, but once the alchemical symbols had been added, any reader could find a technical interpretation of the work visually overlaid onto the main text. The symbols did not replace the original contents of pseudo-Cleopatra's teachings, but were rather conjoined to them. Their iconic character meant that every later reader of the *Dialogue* was presented at first glance with a particular interpretation of the work, which may have influenced them to read the text in line with indications conveyed entirely by means of alchemical symbols.

Conclusions

The examples I have analyzed here are sufficient to suggest that, during the Byzantine period, alchemical symbols were used not only as a device to reduce the length of a manuscript text, but also as interpretive tools able to emphasize a particular reading of a text or even put forward an original interpretation of it. Specifically, since these symbols stand for particular alchemical substances and operations, the information they convey is always linked to the operative aspects of the alchemical practice, and their addition defines a set of identifications of ingredients and materials for the original texts. In the cases discussed here, it remains extremely dubious whether the symbols were ever used to record any alchemical operation actually carried out by those who added them to the text. Nonetheless, they provided Byzantine readers of the alchemical works with a technical language that facilitated and even encouraged the cyclical process of "practical exegesis" characterizing much of the transmission of alchemy over its long history.[17]

Alchemical symbols can also be found in the Coptic, Syriac, and later the Arabic and Latin traditions. The Syriac alchemical symbols, especially, are well attested and extremely similar to the Greek ones. For example, the alchemical lexicon compiled by Bar Bahlul in the tenth century, which describes the substances used by the alchemists, lists not only the various names used to denote a certain substance, but also the symbols corresponding to them. As part of the process of translating alchemical works, especially from Greek into Syriac and Arabic, the alchemical symbols conveyed operative information through a visual language with the potential to become largely intelligible across different linguistic traditions. Although it exceeds the limitation of the present study, it would seem extremely promising to explore the extent to which alchemical symbols were able to cross linguistic boundaries and influence the transmission of alchemical knowledge across the Mediterranean basin, especially with reference to the more technical aspects of alchemy.[18]

Within the Greek tradition, the iconic form of the alchemical symbols also produced noticeable interactions with the natural language of the alchemical works. Through the symbols, it was possible to translate operative knowledge into a language that stands out in comparison to the letters making up the main text. In the example from Stephanus's *Lessons*, the symbols are based on indications already provided by the author, but when the information is made explicit, a passage originally focusing on the theoretical foundation of alchemy is immediately transposed into an operative context. In the case of the *Dialogue*, the operative knowledge of the reader who added the symbols—though limited and unlikely to have been acquired from direct experience—is visually superposed to the original text and contributes to its epistemic codification as an alchemical work for later readers of the manuscript.

The creation of a large set of alchemical symbols during the Byzantine period and their combination with the texts of previous alchemical works cannot be reduced to a scribal convention. It was a ramified process that deeply influenced the transmission of alchemical knowledge, especially in its operative aspects. The addition of alchemical symbols to previous authoritative works can be understood as a process of partial graphic translation, which did not replace the natural language of the original works but was conjoint to it, making the alchemical works more easily relatable to the practical contents of alchemy. In some rare cases, studying the alchemical symbols can also offer invaluable insights into the expectations, interests, and expertise of the Byzantine readers who approached the richly varied topics, styles, images, and practices captured in an alchemical manuscript.

Acknowledgment

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Notes

1 On the general characteristics of Byzantine alchemy and the production and circulation of anthologies of alchemical texts in Byzantium, see Mertens, "Graeco-Egyptian Alchemy"; Viano, "Byzantine Alchemy." On the symbols used in the Greek alchemical tradition, see Berthelot and Ruelle, *Collection des anciens alchimistes grecs*, 1:92–126 (introduction); Zuretti, *Alchemistica signa*.

2 On the use of images, code-names, and symbols in the alchemical tradition and the related process of encoding and decoding alchemical texts, see Halleux, *Les textes alchimiques*, 114–19; Principe, *Secrets of Alchemy*, 143–56.

3 On the symbols used in the Leiden and Stockholm papyri, see Halleux, *Les alchimistes grecs*, 1:10–11. The associations between planets and metals were still fluctuating during Late Antiquity and eventually crystallized around the seventh/eighth century CE. See Halleux, *Le problème des métaux*, 149–56.

4 On the lists of associations and their place in the manuscripts, see Berthelot and Ruelle, *Collection des anciens alchimistes grecs*, 1:92–126 (introduction). The proliferation of alchemical symbols was possible mainly because of the combinatory character of the alchemical symbols: two or more symbols could be combined into a new symbol whose meaning derived from its components. For example, the symbol for silver (☾) and that for foil (▭) can be combined into a third symbol standing for "silver foil" (☾▭).

5 On the characteristics of the main alchemical anthologies, see Festugière, "Alchymica." On the role of the Venice codex in the history of Greek alchemy, see Saffrey, "Historique."

6 The complete critical edition of the *Lessons* has recently been published in Papathanassiou, *Stephanos von Alexandreia* (hereafter *Lessons*). For a partial edition of the first three *Lessons* with English translation and introduction, see Taylor, "Alchemical Works." Although Papathanassiou considers the attribution to Stephanus of Alexandria authentic, there are sound reasons to regard the *Lessons* as a case of pseudo-epigraphic attribution; see, e.g., Roueché, "Philosophical Portrait." For the sake of the present argument, I will refer to the author of the *Lessons* simply as Stephanus.

7 See Saffrey, "Historique."

8 See Stephanus, *Lessons*, V, 181.18–182.34.

9 Ibid., 182.35–44 (I have replaced all the terms that are expressed by alchemical symbols as in **M**, fol. 21v.6–18): ταῦτα οὖν τὰ τέσσαρα στοιχεῖα ἐναντία ὄντα, οὐ δύνανται ἑνωθῆναι ὅλως εἰς ἄλληλα, εἰ μὴ διά τινος μεσιτεύοντος ἔχοντος τῶν δύο ἄκρων τὰς ποιότητας. οἷον τὸ πῦρ ☽ ἑνοῦται τῷ ὕδατι διὰ τῆς γῆς, ἤγουν τῆς σκωρίας, ὥσπερ τὸ αἷμα ἑνοῦται τῷ φλέγματι διὰ τῆς μελαίνης χολῆς, ἥτις ἐστὶ πρώτη κλεὶς καὶ χωρισμὸς τῶν ὑγρῶν ἐκ τῶν ξηρῶν, τουτέστι χωρισμὸς τῶν ψυχῶν τοῦ ♀ ἐκ τῶν σωμάτων, ἤγουν τῆς ☽. καὶ τὸ ὕδωρ ἑνοῦται τῷ πυρὶ ☽ διὰ τοῦ ἀέρος ♀, ἤγουν τὸ ἐξερχόμενον ὕδωρ ἑνοῦται τῷ πυρὶ ☽ διὰ τοῦ ♀, ὥσπερ τὸ φλέγμα ἑνοῦται τῷ αἵματι διὰ τῆς ξανθῆς χολῆς.

10 Stephanus, *Lessons*, V, 181.28–182.34.

11 The problem of elemental change in Stephanus's alchemical work is extremely complex and requires further investigation. For the influence of the philosophical tradition on the *Lessons*, see Papathanassiou, "L'oeuvre alchimique."

12 On the *Dialogue of the Philosophers and Cleopatra*, see, e.g., Reitzenstein, "Zur Geschichte der Alchemie." On the resurrection of the dead as discussed in the *Dialogue*, see Festugière, "La création des âmes."

13 I have reproduced and translated the text according to my forthcoming edition of the *Dialogue of the Philosophers and Cleopatra*; the same passage can be read in Reitzenstein, "Zur Geschichte der Alchemie," 18.130–40. I have also included in the main text all the superscripted terms expressed by alchemical symbols as in **M**, fol. 42v.5–16: Τὸ γὰρ πνεῦμα ☉ πάλιν εὐφραίνεται ἐν τῷ σώματι $\overset{\lambda}{\mu}$, καὶ ἡ ψυχὴ ☽ ἐν ᾧ ϭ ἐστι, καὶ τρέχει κατεπεῖγον ἐν χαρᾷ εἰς τὸν ἀσπασμὸν αὐτοῦ, καὶ ἀσπάζεται αὐτό, καὶ οὐ κατακυριεύει αὐτοῦ σκότος, ἐπειδὴ ὑπέστη φωτί ω, καὶ οὐκ ἀνέχεται αὐτοῦ χωρισθῆναι ἔτι εἰς τὸν αἰῶνα. Καὶ χαίρεται ἐν τῷ οἴκῳ ϭ αὐτῆς, ὅτι καταλιποῦσα αὐτὸ ἐν σκότει εὗρεν αὐτὸ πεπλησμένον φωτός ω, καὶ ἡνώθη αὐτῷ, ἐπειδὴ θεῖον γέγονεν κατ᾽ αὐτήν, καὶ

οἰκεῖ ἐν αὐτῷ· ἐνεδύσατο γὰρ θεότητος φῶς, καὶ ἀπέδρα ἀπ᾽ αὐτοῦ τὸ σκότος. Καὶ ἡνώθησαν πάντες ἐν ἀγάπῃ, τὸ σῶμα 🜪 καὶ ἡ ψυχὴ ☽ καὶ τὸ πνεῦμα ☉, καὶ γεγόνασιν ἕν, ἐν ᾧ κέκρυπται τὸ μυστήριον.

14 See pseudo-Olympiodorus, *On Zosimus's According to the Operation*, in Berthelot and Ruelle, *Collection des anciens alchimistes grecs*, 1:70.4–21 (Greek text) and 75–76 (French translation).

15 See Martelli, "Greek Alchemists," 292–98.

16 See Bidez and Cumont, *Les mages hellénisés*, 1:198–207 and 2:334–35. For the alchemical symbols added to the text, see **M**, fol. 66r–v.

17 On the concept of "practical exegesis," see Rampling, *Experimental Fire*, 97–98.

18 On the Coptic alchemical symbols and their similarities to the Greek symbols, see Richter, "What Kind of Alchemy." On the Syriac alchemical symbols and Bar Bahlul's lexicon, see Berthelot and Duval, *L'alchimie syriaque*, 121–40. Matteo Martelli has just published a new study on alchemical symbols and lexica in the Syriac tradition (Martelli, "Alchemical Lexica"). I would like to thank him for sharing with me the results of his research in advance and to point the interested reader to his article for a detailed analysis.

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10 Translating Medical Experience in Tables

The Case of Eleventh-Century Arabic *Taqwīm* Works

Dror Weil

In his monumental project to introduce the foundations of the Chinese medical and pharmaceutical expertise into Persian, the thirteenth-century Ilkhanate vizier and physician Rashīd al-Dīn (d. 1318 CE) included the following description of one of the pharmaceutical texts he translated:

> The third book consists of two parts [*fann*]. The first includes an introduction to the principles of [medicinal] compounds, the statements of the emperors of antiquity, and the answers of their ministers. It [presents] the background for the compilation of a book on drugs in antiquity, the reasons for the renewal [of interest] in it, and the kings that ordered it. They [the Chinese] named this book *Yaocao Zongxu*.[1] The second part deals with simple drugs and comprises two volumes. The first volume is a translation of their [original Chinese] book, including their statements on the powers, effects, temperaments, and properties of drugs and the ways to obtain them from minerals, plants, humans, and animals. They [the Chinese] call this book *Bencao*. The second volume is our addition. It includes the drugs that the Greek and Chinese physicians used in the past. It presents detailed information on the drugs' whereabouts, as well as their description, properties and effects. This part is presented tabularly [*mujadwal*] and comprises a number of tables [*alwāḥ*]. Each table is divided into two sections: the first section includes [a list of] attributes, as applied [*mustaʿmal*] and tested [*mujarrab*] by the Chinese in the past, such as the name, property, temperament, utility etc.; the second section, placed to the side of the first, includes additional information on the application [of the drugs] by past Greek physicians. This [layout] aims to provide a quick reference for the careful examiner on a drug's previous names, effects, and method of application.[2]

For Rashīd al-Dīn, it seems, translating Chinese pharmaceutical expertise entailed more than literal translation of texts. It involved a series of adaptations and reconfigurations, predicated on the inherent differences and tensions between methods of collecting, circulating, and putting into

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practice knowledge of the natural world in the original sources and in the target language.[3] These adaptations and reconfigurations may enjoy a more comprehensive assessment in the future, but for the purpose of this discussion, I will call attention to Rashīd al-Dīn's thought-provoking decision to add an additional volume with tabulated text that at once summarizes and expands the pharmaceutical information given in the Chinese original. In particular, I will investigate the relationship between the tabulated format and the qualification of certain knowledge as medical experience. Medical experience as it is articulated in tabular texts, I suggest, constitutes the author's epistemic justification for presenting knowledge on medicinal substances and medical practices. The intriguing relationship between layout and content, and the use of tabulation as an act of translation to encode, qualify, and transmit medical experience in the late medieval Islamicate literary tradition, will be the focus of this essay.

The first part of the chapter introduces two medieval Arabic prototypes of tabular medical texts—Ibn Buṭlān's *Taqwīm al-ṣiḥḥa* and Ibn Jazla's *Taqwīm al-abdān*—and explores the grounds for the authors' selection of tabulation as the layout for their medical treatises. The second part investigates the particular epistemic justifications, such as perceptual experience, reason, or authoritative testimony, according to which these tabulated works define medical experience. The final part asks what translation of medical experience into tabular layout entails in terms of the cognitive practices that it calls into play and its role in the transmission of medical practice, as these are presented in the works of Ibn Buṭlān and Ibn Jazla.

Articulating Medicine in Tables

In the passage quoted above, Rashīd al-Dīn tells us that his reason for using tabular layout in one of his works is to provide "a quick reference for the careful examiner." He does not explain how tables allow "quick reference" and what type of aspects a "careful examiner" would examine. What does seem to be clear from this statement is that he chose the tabular layout to accommodate, or maybe enforce, certain cognitive and reading practices, and to satisfy certain scholarly requirements.

The use of textual elements other than prose was not one of Rashīd al-Dīn's original innovations: its history goes back to early traditions of writing and recording. Evidence from Babylonian cuneiforms suggests that tables of different sorts were used to record, process, and present information and widely applied in horoscopes, mathematical ephemerides, multiplication tables, and so on.[4] We find tables in Egyptian and Greek texts that were later translated and transmitted into Arabic, Syriac, Hebrew, Latin, and other languages. In Ptolemy's *Almagest*, for example, as well as in his other works on geography, musical harmony, and optics, tables are an integral part of the text,[5] though interestingly they were only partly retained throughout the long history of these texts' transmission.[6]

Several different non-prose layouts circulated in the Islamicate world during the late medieval period, including matrixes of rows and columns (Ar. *jadwal*) and branch-diagrams (Ar. *tashjīr*).[7] These various layouts can be collectively referred to as "tables," although they significantly differ in their form and the organization of their constituent elements. I will limit my discussion here to the first type of tables, *jadwal*. This was predominantly identified with the presentation of astral measurements (known in Arabic as *taqwīm*, "establishing [parameters]") and calendars.

By the eleventh century, Ibn Buṭlān's *Taqwīm al-ṣiḥḥa* and Ibn Jazla's *Taqwīm al-abdān* used tabulation for recording pharmaceutical and medical experiences, borrowing the term *taqwīm* in the titles of their books. The popularity of these two Arabic works across the Islamicate world and their Latin (and subsequently other European) translations, made from the second half of the thirteenth century onwards,[8] established them as prototypes for tabulated records of pharmaceutical and medical experiences. The various available witnesses of these two works, supplemented by prefaces and epilogues, provide important glimpses into the rationales and mechanics of making medical tables and the cognitive practices that they fostered.

The eleventh-century Christian physician al-Mukhtār Yuwānīs ibn Buṭlān (d. 1075) was a prolific medical author from Baghdad, known for his philosophical zeal and literary eloquence.[9] His treatise *Taqwīm al-ṣiḥḥa* (*Establishing Health*) is compiled as a series of tables that covers forty-six themes. These themes include lists of *materia medica*, such as fruits, grain, pastries, or animal parts, as well as factors with physiological or mental effects such as movement, auditory activity, or ablution. In his preface, Ibn Buṭlān gives a certain rationale for using tabulation as the format for this work. As he explains, ruled tables are a device that facilitates and simplifies reading by summarizing the practical and useful aspects. Tabulation, the following passage shows, is Ibn Buṭlān's response to "exhaustive discourses" on proofs and limitations, which might be interesting to the philosopher but are not to others. By singling out core and substantial elements and ordered attributes and allowing comparison across different authorities and their professional debates, tables offer a suitable platform to transmit practical medicinal experience:

> Our reason for preparing it [in the form of] a ruled table [*fī jadwalin nasturuhu*] is that people are annoyed by the exhaustive [discourses] of the scholars and the copiousness of professional books [*al-kutub al-mudawwana*], and their concern with the sciences is for their practical use not their proofs [*barāhīnihā*] or their definitions [*hudūdihā*]. We employed in our work an abridgment of lengthy discourses and an assemblage of distinct meanings, with the aim of juxtaposing the opinions of the old [*al-qudamāʾ*] and new schools [*wa-l-muḥaddithin*]. In doing so, we only wished to clarify [*taqrīb*], organize [*tartīb*], and facilitate [*wa-tashīl*] a search or a quotation of

> a justification to support a view. We cannot vouch to satisfy [all] the people with their different understandings and inclinations, but we resort to God's help with what we convey to them, as human nature is not infallible, and all is made by a measured opinion.[10]

The ease of access to medical expertise presented in tables, for Ibn Buṭlān, apparently has to do with the prevalence of literacy in astral tabulation, and especially in horoscopes. The spatial organization of *Taqwīm al-ṣiḥḥa*, we are told, is designed to resemble that of an astral table (known as *taqwīm*, the same term Ibn Buṭlān chose for his title). Each theme is represented by a large table spread over two consecutive folios (Figure 10.1). The table has rich marginalia, in which Ibn Buṭlān lays out his methodologies and the laws of nature (sing. *qānūn*) that he deems fundamental for understanding the contents. Each table has fifteen columns. The entries, which are the particular types or manifestation of the table's theme, appear on almost the far right, after the consecutive numbering of entries. The next eleven columns to the left are populated by attributes or medicinal functions that characterize the entry. The last two columns include excerpts from medical authorities relevant to the particular entry.

When describing this layout, Ibn Buṭlān employs terminology mainly reserved for astronomical tables: he calls the columns "Houses" (sing. *bayt*), and particular areas in the marginalia are compared to the places in astral tables where celestial conjunctions and oppositions are recorded. Even the table of contents, which lists the themes of each table, is presented in the form of a *rāyizja*, a common horoscope map:

> We begin, by God's help, with tables [*jadāwil*] related to food, drinks, and other themes. We have prepared it in [the form of] a horoscope map [*zāyirja*] to facilitate its use by monarchs, who are familiar with astronomical tables [*taqāwīm*] that resemble it in shape. We include numbers under House *A*. These numbers appear on the horoscope's outer layer and direct to the specific folio of the entry sought; under House *B*, the entry's name; under House *C*, its natural propensities; under House *D*, the degree [of intensity, of the natural propensities]; under House *E*, its best types; under House *F*, its benign effects; under House *G*, its malignant effects; under House *I*, generators of malignant effects; under House *J*, compounds it is used for; under the next four houses, we recount the [inferred benefits in terms of] temperaments, age groups, seasons, and geographies; under House *O*, opinions related to it; under House *P*, excerpts from the literature [*ikhtiyārāt*] and peculiarities [*khawāṣṣ*]. We placed the general principles of a category in the part [on the page] where [astronomical tables record] astronomical conjunctions and oppositions;[11] on the [right] margin, we indicate the first entry of the kind and the category it belongs to, and on the [left] margin, [we include] astrologers' opinions on it [*mā yarāhu al-munajjimūn fī dhālika*].[12]

Figure 10.1 Ibn Buṭlān, *Taqwīm al-ṣiḥḥah*, "Types of fruits."

British Library: Oriental Manuscripts, Or 1347, fols. 5v–6r (22/106), in Qatar Digital Library, www.qdl.qa/archive/81055/vdc_100023896871.0x000017.

Further justifying the decision to use tabular layout for his medical treatise, Ibn Buṭlān suggests an analogy between the various states of the human body and the gradual movement of the moon. Thus, he claims, physiological reactions to various substances can be broken into constituent aspects, parameterized, and presented in a similar layout to the one used to record astral movements:

> The human being, in his various states, resembles the moon. Just as the moon has a state in which its nature is vitiated, that is the eclipse; a state in which his nature is perfected, that is the full moon; a state that begins from an exhausted state and concludes with perfection, that is the gradual movement from new moon to full moon; and a state that begins with a sustained state [*ṣalāḥ*] and ends with exhaustion, that is the fading from full moon to new moon. Bodily reactions are similar. Some vitiate [the body], such as poisons; others sustain it, such as nourishment; others begin from an exhausted state and reach a sustained state, such as medicine; and others begin from a sustained state and reach exhaustion, such as nourishing medicine. Accordingly, a person should know what benefits his condition and what might harm it.[13]

A contemporary of Ibn Buṭlān's, and a fellow member in Baghdad's Christian community who eventually converted to Islam, Yaḥya b. ʿĪsa ibn Jazla (d. 1100) served as a physician at the court of the Abbasid caliph al-Muqtadī (ruled 1075–94), to whom he dedicated many of the medical works he composed.[14] In addition to his work at court, Ibn Jazla volunteered to provide free medical services and medicinal supplies to the poor around Baghdad[15]—an activity that may help explain his desire to compile books summarizing medical expertise to be practiced without a physician. One of his major works, *Taqwīm al-abdān fī tadbīr al-insān* (*Establishing the Body for Treating the Human*), introduces treatments for forty-four disease categories and 352 medical conditions (sing. *ʿilla*) in the form of tables.

Applying a similar organization to that used by Ibn Buṭlān in his *Taqwīm al-ṣiḥḥa*, but with a stronger focus on treatments for particular medical conditions, each of the tables in Ibn Jazla's work is dedicated to a disease category (such as ephemeral fever, ear- and nose-related diseases, or lung and tracheal diseases) and is read as lines of text that run continuously across columns over two consecutive folios (Figure 10.2).[16] Each table breaks down the disease category into a list of related medical conditions, presented in the table's rightmost column. This is followed by four columns marking the temperaments, age groups, seasons, and geographies in which the appearance of the medical condition is rather bountiful, and a column on the recovery chances. All these five columns are filled with a fixed set of parameters relevant to each column. Next are columns that pertain to the causes of the disease, its symptoms, and the

Figure 10.2 Ibn Jazla, *Taqwīm al-abdān*, “An ephemeral fever known as pneumatic fever.” Staatsbibliothek zu Berlin - PK, Ms. or. fol. 4073, http://resolver.staatsbibliothek-berlin.de/SBB0000B70700000000

available methods of purging. Two more columns describe treatment for the more prosperous (*al-tadbīr al-malakī*) and less prosperous patient (*al-tadbīr al-sahl al-wujūd*). The final column, which spreads across a whole folio, provides instructions for a general treatment and useful recipes for the particular medical condition.

Despite the remarkable resemblance between Ibn Jazla's tables and those in Ibn Buṭlān's *Taqwīm al-ṣiḥḥa*, a closer look reveals some significant differences in the two works and their target audiences. Though both employ tables to present medical knowledge, they differ in how they frame their discussion, that is to say, in the focus of their tables: Ibn Buṭlān's tables center on medicinal usages of specific substances, Ibn Jazla's on the medical conditions and their various treatments. Readers of Ibn Buṭlān's tables are thus required to look for certain substances through the organizing categories, and thence get a sense of the characteristics of the substances and how they could be used for medicinal purposes; readers of Ibn Jazla's tables would have to find the disease category that interests them, then the particular medical condition, and thence would get information on the disease and available treatments. The difference in focus seems to follow the different audiences each work catered for. Ibn Buṭlān, as he mentions in his preface, pitches at Baghdad's court and aristocrats; Ibn Jazla seems to aspire to provide medical guidance for the common people as a substitute for visiting a physician. Tabulation as a method of organizing and presenting information seemed useful for both works despite the major differences in content and audiences.

Ibn Jazla hints at the rationale underlying his use of tabulation in colophons and prefaces to the work. In a remarkable parallel to Ibn Buṭlān, he explains that the layout of work is modeled on astronomical tabulation, and just like Ibn Buṭlān he refers to particular rubrics using vocabulary borrowed from astronomical tables. He also adduces library classification systems. According to a short colophon, his work is organized "according to the Rational Division [*al-qisma al-ʿaqlīyya*] in the Library of the Caliph al-Muqtadī [*al-khazāna al-muqtadīyya*]."[17] In the main preface, Ibn Jazla explains that he "wished to render the necessary service to the libraries of wisdom at Caliph al-Muqtadī's court on the science of medicine, so that it would be able to do without much of tediousness of physicians and their published books." He therefore "employed an organization that would simplify its reading, increase its utility, and make it of smaller size and greater knowledge." He continues: "I compiled it in the form of an astronomical table [*taqwīm*], in which I placed the discussed disease categories in the part [of the page] where [astronomical tables record] astronomical conjunctions and oppositions."[18] He then describes the various columns using the term "House," borrowed from astronomical tables, almost identically to Ibn Buṭlān's explanation.

Establishing Medical Experience

Simplicity and practicality are tropes that Rashīd al-Dīn, Ibn Buṭlān, and Ibn Jazla reiterate as the main reasons for their tabular compilations. People are not, the authors tell us, interested in lengthy proofs or tedious definitions, but seek reliable, useful knowledge. Part of the challenge faced by the authors of these tabular texts was to establish a qualified knowledge that could enjoy universal validity across geographies and seasons while still adhering to particular epistemic categories, such as perceptual experience, logical reasoning, or authoritative testimony. These categories record the authors' experiential knowledge of medicinal substances and medical practices, constituting the foundations upon which information was gathered and articulated in their tables.

In the passage quoted at the start of this chapter, Rashīd al-Dīn emphasized that the information he gathered in his tables was "applied and tested" by the Chinese and Greek physicians in the past, suggesting that medical experience for him is not an ephemeral event that is limited to one's own act of sensory perception, but includes the reiteration of testimonies by past physicians. Elsewhere in his preface to this translation project, Rashīd al-Dīn explains that his translation selectively reports on the utility and properties of aspects related to human physiology and anatomy, which he learned of from lengthy and detailed Chinese books by using "inference [*qiyās*] and experience [*tajriba*]."[19] His presentation, he says, will begin with certain introductions, followed by proofs (*adilla*), similar cases (*naẓāʾir*), and examples (*amthila*).

This description shows that the medical experience Rashīd al-Dīn included in his translations, and probably also in the tabular text now lost, was acquired not only by literally translating the Chinese work, but also by using inference and his own personal practical experience—in other words, he brings together direct and indirect experiential medical knowledge. Rashīd al-Dīn also notes that his translation of Chinese books aims to disprove claims that the Chinese do not have scientific books and compilations, or that their books do not provide "unequivocal proofs and evidence" (*barāhīn va adilla-i qāṭiʿa*).[20] This suggests that the act of translating medical experience, for Rashīd al-Dīn, both reproduced the articulation of the experiential knowledge as it was recorded in Chinese texts and corroborated this by means of the translator's own experience and his own epistemic judgments.

As for the universality of experience across time and space, Rashīd al-Dīn's introduction discusses the potential difference in the experience of people living in different geographical climates.[21] There is no doubt, Rashīd al-Dīn writes, that Chinese experience as it is recorded in their books can offer insights into the utility and properties of things and propose solutions to some thorny issues that they faced on account of the nature and temperament of their particular geographical location. However, their experience (*tajriba*) and intellectual exigencies (*iqtiḍāʾ-i* *fikr va andīshih*) suit their particular nature and temperament, and such experience might be at odds with that arrived at in other geographical locations.[22] Similarly, at another point Rashīd al-Dīn tells us that his translation methodology aims to give guidance for scholars of any generation on how to acquire expertise (*sarrishtih*) in Chinese sciences through the methods of inference (*qiyās*) that he has devised, suggesting that the medical experience he presents in his translation is universal across time.[23]

Tracing the definition of medical experience back to early tabular prototypes, biographical information on Ibn Buṭlān and Ibn Jazla that highlights aspects of their motivations to practice medicine offers clues as to the type of medical knowledge that they privileged as useful and reliable, and accordingly their definitions of medical experience. Moreover, the detailed marginalia of the two texts testify to the importance the two authors attached to disclosing and defending the epistemic categories on the basis of which they collected and presented medical information in their works.

Having witnessed the devastating ramifications of the plagues and ecological calamities that swept through the Levant during the eleventh century, Ibn Buṭlān intertwines his medical inquiries with astrological reasoning while also grieving the loss of the great physicians of his generation and their medical expertise. He is quoted as saying: "And so the lanterns of learning were snuffed out and, after their passing, the minds of men remained in darkness."[24] Many of Ibn Buṭlān's medical publications aimed to perpetuate and introduce traditional medical expertise as it was recorded in the compendia and medical formularies of earlier medical authorities. He criticized contemporaries whose medical practice abandoned these precedents.[25] Medical experience, for Ibn Buṭlān, was not limited to the physician's own perceptual sensory experiences, but included the physician's knowledge of past medical authorities.

That is not to say that Ibn Buṭlān propagated theoretical knowledge and exclusive reliance on the medical canon. In a polemical exchange with a contemporary Egyptian physician, Ibn Riḍwān (d. 1061), Ibn Buṭlān disagreed vehemently with his interlocutor regarding the appropriate ways to acquire medical expertise.[26] Ibn Riḍwān, who studied medicine from books without formal instruction, emphasized the centrality of medical texts for the acquisition of knowledge; Ibn Buṭlān argued that "personal instruction is preferable to instruction through the written word."[27] To back this up, he listed seven reasons for the superiority of personal instruction, all pointing to the attentiveness and proximity in speech and thinking required by a human instructor as against the distance and silence of medical books. The acquisition of medical knowledge can be hindered, too, by various difficulties inherent to the reading of medical texts, such as misreadings, insufficient knowledge of syntactical inflection, and unfamiliar foreign jargon. These criticisms of bookish medical training may have encouraged Ibn Buṭlān to seek alternative didactic tools to transmit medical knowledge, notably his use of tabulation in *Taqwīm al-ṣiḥḥa*. They also suggest that, for Ibn Buṭlān, medical experience meant a juxtaposition of direct and indirect (or transmitted) experience. This definition is mirrored in the format of *Taqwīm al-ṣiḥḥa*, which sets perceived knowledge alongside excerpts from the past authorities (under the rubric of *ikhtiyārāt*).

In the marginalia of his tabulated text, Ibn Buṭlān lays out the epistemic judgments he employed to populate the tables, privileging sensory perception (which he refers to as *tajriba*) and logical inference (*qiyās*) as his main methods. He lists four fundamental principles (*qawānīn*, which can be read also as "laws") by which he arrived at the various parameters and suggests that experience has a certain epistemic superiority over logical inference. Ibn Buṭlān opens his explanation of the "four principles [*qawānīn*] by which the natural properties [*ṭibāʿ*] of a foodstuff are recognized" with the method of logical inference (*ṭarīq al-qiyās*).[28] The use of inference together with information on a foodstuff's flavors, bodily organs' reactions to its smell, and the speed of its digestion all facilitate access to knowledge of their natural properties. Ibn Buṭlān lists eight types of simple flavors and their graded effects on the human tongue, followed by typologies of smells, qualities of foodstuffs' essences, and their graded effects on digestion. These typologies provide a basis for establishing a foodstuff's parameters using the method of inference.

The second principle that Ibn Buṭlān presents is "using experience [*tajriba*] to deduce [*istikhrāj*] the qualities of simple foodstuffs, their scope and intensity."[29] He argues that sensory perception (or experience, as he calls it) is more reliable than logical inference because it arrives at the actual effects of the foodstuff's essence on the body, whereas inference uses flavors in isolation and thus overstates the effects.

Whereas these first two principles help the reader to arrive at the properties of simples, the third and fourth principles are used with composites. To discover the natural properties of composites, first the properties of the simples are established by inference and sensory perception, then their grades are added in to arrive at the properties of the composites. The fourth principle is used to infer the benign and malignant effects of a foodstuff, with logical inference and sensory perception deployed to identify the best way to counter malignant effects. These four principles reveal the importance that Ibn Buṭlān attaches to juxtaposing logical inference and sensory perception as sources of medical experience.

Turning now to Ibn Jazla, some hints in his preface, his lengthy epilogue, and the marginalia in the expanded frame of the text shed light on his notion of medical experience and the epistemic judgments that underlie his compilation. Throughout the text, marginal comments give physiological explanations and name visible signs of the medical conditions discussed. Medical experience in these parts is based mainly on the treatment-giver's sensory perception of signs on the patient's body. Ibn Jazla tells us that his epilogue was written specially for those who claim that "temperaments have changed and old treatments have been invalidated and abolished"; he responds by "following what the scholars among physicians [*ʿulamāʾ al-aṭibbāʾ*] mentioned and its valid inferences."[30] This statement and its unfolding in the epilogue indicate the epistemic judgments that Ibn Jazla adds to sensory perception as essential constituents of medical experience—indirect experiential knowledge transmitted from past authorities, and the use of methods of inference to apply that knowledge to particular cases.

In the epilogue, Ibn Jazla presents general guidelines on how to correctly diagnose and treat a disease and what to pay special attention to. These further reveal the various epistemic judgments that are incorporated into his notion of medical experience. Good treatment that leads to the patient's recovery of a healthy state includes recognition of the type of medical condition, its causes, the strength of the patient, his natural temperament, the temperament that appears out of the ordinary, the patient's age, his daily routine (*ʿādatuhu*), the season, the patient's geographical location, and the weather during the time of sickness. The diagnostic procedure that Ibn Jazla describes begins with the physician observing the type of medical condition and its causes. He then decides on a medicine, the precise dosage of which is determined by a combination of logical inference (*al-qiyās al-ʿaqlī*) and practical intuition (*al-ḥads al-ṣināʿī*). The physician should look for any additional symptoms and adjust the dosage accordingly.

This explanation shows that for Ibn Jazla, similarly to Ibn Buṭlān, logical inference plays a central role in applying established medical experience to particular cases. Practical intuition, which he combines with inference, is a method of finding the middle term in an act of syllogistic reasoning, a central component in Avicennian epistemology.[31] Valid experience is a crucial element in selecting the medication. Ibn Jazla warns the reader against the use of "strange medicines [*al-adwiya al-gharība*] whose experience has not been validated [*mā lam taṣiḥḥ tajribatuha*] and whose utility is illogical" and adds that "one should not rely on medication experienced [*jarrbathu*] by women and their like." He criticizes those who argue for medical knowledge to be confined to what is practiced by contemporary physicians—in other words, the empiricist pharmacologists who denied the usefulness of rational inference as grounds for medical expertise—and advocates the use of logical inference when applying "teachings of past physicians [*al-aṭibbāʾ al-mutaqaddimīn*] and past scholars [*al-ḥukamāʾ al-sālifīn*] whose experience was sound [*ṣaḥḥat tajribatuhum*] and its utility for [their treatment of] all diseases attested [*taḥaqqaqat*]."[32] Medical experience, according to Ibn Jazla, is not exclusively limited to the physician's sensory perceptions, but is transmitted from past authorities and put into practice using methods of inference.

By emphasizing the role of indirect experiential knowledge for medical practice, rather than exclusive reliance on direct sensory experience, Ibn Buṭlān and Ibn Jazla were contributing to a long-lasting debate between those who grounded medical experience on the physician's personal sensory experience and those who expanded it to include transmitted knowledge. This debate, early versions of which go back to the pre-Galenic period, prompted medieval natural philosophers, pharmacists, and physicians to deliberate profoundly on the skillset that is required for practitioners of medicine. Galen (d. 199/216) attempted to reconcile the epistemological programs of the dogmatists—who adhered to a medical tradition and viewed theoretical reasoning as the exclusive means of extending medical knowledge—and the empiricists, who privileged personal experience and unmediated observation, by proposing a middle path, what he called "qualified experience" (Gk. *diōrismenē peira*).[33] Galen sought to find consistencies between, and evidential support for, theories and concepts accumulated through generations, on the one hand, and the physician's collection of information from his own observations, on the other. At the methodological level, he tried to bridge the gap between the use of methods of reasoning (such as deductions and inferences) to extend knowledge in the former and the physician's observations and sense-perception to extend knowledge in the latter.[34]

Qualified experience prescribes a series of rules and conditions upon whose fulfillment an experience's outcomes could be validated.[35] One of its major applications was to assess the effectiveness of drugs and other medicinal substances.[36] Although they do not explicitly mention Galenic "qualified experience" in their works, the bountiful theoretical and methodological contemplations that Ibn Jazla and Ibn Buṭlān added to their tabulated texts as textual paraphernalia seem to reflect the two authors' stances in that debate and the importance that both attached to indirect experiential knowledge as part of the experience required for the practice of medicine.

Translating Medical Experience into Tables

Representing medical experience by a set of parameters that populate tabular rubrics, and equally the process of reconstructing practical knowledge from such parameters, can be seen as an act of translation. The preparation of tables requires a transformation in the semantic and semiotic relationships of a given text, which involves taking particular terms out of their common morphological, syntactical, and rhetorical usages in prose to form value-bearing parameters. "Hot," for example, acts in prose as a descriptive element with no precise definition, but in medical tables, the term becomes a value in the binary hot/cold that can be further predicated as "wet" or "dry." Tabulation as an act of translation requires new vocabularies—in the form of concise, unequivocally informative parameters—and, above all, a transformation of the syntax that links a subject matter to a set of predicates. The producer of a table, just like its reader, needs to bring meanings across into new linguistic settings.[37] Moreover, the three-dimensional reading of a table—that is, taking as a point of reference any one table, or any of the rows, or any of the columns—translates the linear statements of prose into a 3D matrix of comparable variables. This entails cognitive practices of reading through and across tables, rows, and columns; assessing commonalities and differences between particular conditions; and possibly even producing predictions as to missing information.

The use of tabulation and parameterization in medicinal expositions did not begin with Ibn Buṭlān and Ibn Jazla. Astral tables may have been the source and the more popular genre using tabulation and parameters, but the application of such layouts for medicinal purposes goes back earlier than the eleventh century, even in the Arabic tradition. In fact, translations of the Galenic medical corpus into Arabic in ninth-century Baghdad had already made use of parametrical representation and even the use of tabulation. Substances were analyzed by the two parametrical pairs hot/cold and dry/wet as well as a four-graded scale to express their intensity. Ḥunayn b. Isḥāq's Arabic translation of the Galenic treatise *Summaries on Simple Drugs* (Ar. *Jawāmiʿ jālīnūs fī al-adwiya al-mufrada*)[38] organizes medicinal substances alphabetically and analyzes them by the categories of Natural Propensities (*ṭabāʾiʿ*), Benign Effects (*manāfiʿ*), Malignant Effects (*iḍrār*), Adequate Administration (*iṣlāḥ*), Substance's Best Part (*al-mukhtār*), and Dosage (*awzān*). These categories are populated using sets of fixed parameters.[39]

Moreover, a surviving copy of this translation uses tables and branch-diagrams to present the analysis, and includes the following precious editorial remark that links tabulation to simplicity, brevity, and aesthetics: "I found seven chapters of the book, and so I decided to arrange them in branch-diagrams [*tashjīr*] and tables [*jadāwil*] so that the book would be a better abridgment, more worthy of being taken seriously, more attractive to see, easier to read, and not so boring."[40]

Although the parametrical system of analysis was perpetuated and expanded by later scholars such as Al-Kindī (d. 873) and Ibn Sīnā (Avicenna, d. 1037), who applied elaborate versions of such categories and parameters in their pharmacological and medical discourses,[41] it was not until Ibn Buṭlān and his contemporaries in the eleventh century that we see the use of tabulation to present such analysis. The eleventh-century polymath Ibn al-Haytham (d. 1040, known in the Latinate West as Alhazen), who comprehensively studied the Galenic corpus, asserts that he compiled a book titled *Taqwīm al-ṣināʿa al-ṭibbīyya* (*Establishing the Art of Medicine*), in which he excerpted from thirty Galenic summaries and epitomes.[42] There is, however, no evidence that the work was presented in tabular form.

By employing astral tabulation to record medical knowledge, Ibn Buṭlān and Ibn Jazla advanced a parametrical view of medical knowledge—that is to say, the view that medical knowledge can be broken down into a fixed set of computable and comparable elements. Indeed, many of the rubrics in both *Taqwīm al-ṣiḥḥa* and *Taqwīm al-abdān* are designed to be populated by a fixed set of parameters. The Natural Propensities column in the former, for example, analyzes the substance discussed in terms of the two pairs hot or cold, dry or wet.

The same parameters are used in Ibn Jazla's tables to analyze a certain temperament in which the medical condition in question commonly appears. The Degree column adds a gradation on a scale of 0–4 to express the intensity of the substance's propensities. The four columns that analyze the substance's potential effects on particular populations, Natural Temperaments, Ages, Seasons, and Geographies, are filled by a fixed set of possible parameters: the two pairs hot or cold, dry or wet for Natural Temperaments; the parameters young (*shabbāb)*, middle-aged (*kuhūl*), elders (*shuyūkh* or *mashāyikh*), and everyone (*jamīʿuhā* or *kullhā*) for Ages; autumn, winter, spring, and summer (as well as the beginning and end of each season) for Seasons; and northern, southern, western, eastern, hot, cold, and equatorial for Geographies. The same parameters are used by Ibn Jazla in his columns. References to medical authorities throughout the tables are made using acronyms.

The translation of medical experience into tabular form was predicated on breaking down experience into constituent elements and producing sets of parameters. The arrangement of these parameters across fixed rubrics mirrors the real-life complexity of medical practice and the variation between individual cases. The user of these texts was required to locate the page on the relevant medical condition or group of substances, find the entry, and then read across the parameters. The layout allows vertical reading across entries, for example in order to compare medical conditions with the different feverish syndromes or to compare benefits and harms of different types of sugar. In addition, reading horizontally allows the user to evaluate the chances of recovery or decide on a suitable treatment. The final rubric—abridged summaries of past medical authorities—provides the evidentiary support and sources for the information and accordingly claims the reliability of the medical experience represented. Translating medical experience into tables thus means articulating the physician's accumulated verified knowledge in a set of algorithms and parameters.

Accordingly, reading a medical table in Ibn Buṭlān's or Ibn Jazla's work itself constituted an act of decoding in order to arrive at the medical experience that underlies the various rubrics and parameters. A user of these tables would need to apply sensory perception to choose the entry and a series of inferences to extract practical medical information from the given parameters. In the case of Ibn Buṭlān's tables, the reader would infer the medicinal application from the natural propensities of a substance and their degree of intensity and, using the parameters given under other rubrics, could then assess whether the substance was appropriate for the case in question. The precise dosage was assessed by inference from the benign and malignant effects of the substance, presumably with sensory perception of the patient's bodily reaction. For Ibn Jazla's tables, a user would seek the particular medical condition using sensory perception, choosing the table according to the general features that characterize the group of medical conditions and then finding the entry according to list of related symptoms. The rubrics would then provide information on the associated temperaments, age group, seasons, geographical location, the pathological cause, and the chances of recovery, enabling the practitioner to diagnose the medical case more exactly. The tables would suggest different treatments. To apply these, the user of Ibn Jazla's tables would need to apply sensory perception, inference, and intuition to match the dosage to the patient's condition.

An intrinsic tension between personal and transmitted medical experience is a feature of these works. The tables in both dedicate much space to surveying past medical authorities and their opinions on a given treatment. This suggests that medical experience was intimately bound to its historical originators; its application involved recognition of this tacit historical bond. At the same time, the practitioner's own personal observations and assessments are crucial when making use of the tables, and in some cases, the transmitted experience might be at odds with personal observations. As Ibn Jazla explains in his prologue, it is crucial to know what past scholars said, but also to recognize their potential shortcomings (*ʿuyūb*).[43] Conversely, there are cases in which a treatment is effective without reasonable explanation. Then, the practitioner would have to accept transmitted experience at face value.

Conclusion

The eleventh century saw the rise of Arabic tabulated works on medicine and pharmacology, including texts that became prototypes of such tabulated works across medieval and early modern Eurasia. There are various reasons, some of them made explicit in the introductions to these works, for the appeal of the tabular layout: tables are didactic and mnemonic devices, offer commercial advantages by condensing wordy discourses, and their use requires only limited literacy. An additional appeal of tables arises from a particular epistemic stance with regard to the way nature is studied and recorded.

Focusing on a number of medieval Arabic works, this essay has examined some of the cognitive practices required for reading tabulated texts and the ways in which tables represented and reproduced medical experience. In particular, I have suggested that tables and their parameters constructed a liminal space between rational reasoning and personal experience, and thus provided a suitable textual way of approaching the Galenic idea of qualified experience. Through their rubrication and embedded information, moreover, tables offered great flexibility in the framing of medical experience, its thematic anchors, and its authorities. They provided a suitable space for compilers and readers to produce commensurability across different languages, epistemologies, and practices.

The practicality and professional reliability of Ibn Buṭlān's and Ibn Jazla's tabular works inspired others to adopt this layout for their own compilations. In some cases, as we saw in Rashīd al-Dīn's translation of a Chinese medicinal compilation, tables turned out to be the most suitable vehicle for carrying medical experience across time, space, and language.

Notes

1 The transliteration in Arabic script seems to stand for *Yaocao Zongxu* (藥草總序).
2 Rashīd al-Dīn, *Tanksūqnāmih-i īlkhānī yā ṭibb-i ahl-i khitā* (*The Ilkhanic Treasure or The Medicine of the Chinese*, hereafter *Tanksūqnāmih-i īlkhānī*), MS at Ayasofya Kütüphanesi, Istanbul, dated to 10 Sha'bān AH 713/1313 CE, fols. 41r–41v. The translated text of this third book is not extant. Here and throughout, all translations are mine unless otherwise indicated.
3 Rashīd al-Dīn marks a difference between two types of Chinese pharmaceutical texts, built around the medicinal application of their objects: those that are used independently and with minimal processing (such as herbs or animal parts), and those that are consumed as prepared concoctions or mixtures. He refers to these two types by terms borrowed from Greco-Arabic medical literature: "simples" (Per. *adviyah-i mufrada*) and "compounds" (Per. *tarākīb*). Rashīd al-Dīn uses these Western terms to distinguish between "recipes" (Ch. *yaofang* 藥方 or *fangji* 方劑) and "materia medica" (Ch. *bencao* 本草). In addition, his selection of texts indicates a tension he observed between texts that deal with theoretical principles and methodologies and those that aim to provide practical reference. The distinction reflects to some extent his bifurcated view of medical expertise as serving two distinct ends: medicine as a theoretical science and medicine as a practical art. For the former, medical expertise is to be sought through the prism of past physicians' recorded experiences (Per. *tajarrub*); for the latter, it is achieved firsthand with the help of recorded practical data.
4 On Babylonian tables and their applications, see Gandz, "Babylonian Tables"; Aaboe, *Some Lunar Auxiliary Tables*; Rochberg, *Babylonian Horoscopes*; Friberg, *Remarkable Collection*.
5 Sidoli, "Mathematical Tables," 14.
6 Ptolemy's Handy Tables have come to us through Theon of Alexandria's version of the text. See Juste, "Handy Tables." Juste suggests that no Arabic or Latin translations of the Handy Tables have survived, but Maria Mavroudi points to Byzantine late medieval copies that include the tables. Mavroudi, "Translations," 46–47; see also Hsia in this volume.
7 Emilie Savage-Smith shows, for example, that Arabic translations of Galenic treatises included non-prose textual devices such as branch-diagrams and tables to present their contents in a succinct and didactic fashion. Savage-Smith, "Galen's Lost Ophthalmology," 122–25. She speculates that the origin of some of these textual devices, in particular the branch-diagram, goes back to Alexandria in Late Antiquity.
8 See Olariu in this volume. I will not discuss Ibn Biklārish in this essay. On his tabulated work, see Levey, "Pharmacological Table"; Savage-Smith, "Ibn Baklarish."

9 On Ibn Buṭlān's biography and works, see Schacht, "Ibn Buṭlān." For his biography, see Ibn Abī Uṣaybiʿah, *A Literary History of Medicine*, ed. Savage-Smith, Swain, and van Gelder (hereafter *Literary History*), ch. 10, biography 38.
10 Al-Mukhtār Yuwānīs Ibn Buṭlān, *Taqwīm al-ṣiḥḥa*, MS Or 1347 (dated AH 610/1213 CE), British Library, Oriental Manuscripts Division (hereafter *Taqwīm al-ṣiḥḥa*), fol. 1v.
11 On the layout of early Persian astronomical tables, see Ābiddūst and Habibollah, "Sayr-i taghyīr va taḥavvulʾi taqvīm dar Īrān."
12 *Taqwīm al-ṣiḥḥa*, fol. 2v.
13 Ibid., fol. 2r.
14 On his biography by Ibn Abī Uṣaybiʿah, see the editors' notes in *Literary History*, 10, biography 51; also Ibn Khalikān, *Wafiyāt al-aʿyān wa-anbāʾ abnāʾ al-zamān*, 6:267–68.
15 Ibn Khalikān, *Wafiyāt al-aʿyān wa-anbāʾ abnāʾ al-zamān*, 6:268.
16 I refer to Yaḥyá ibn ʾĪsá ibn Jazla, *Kitāb Taqwīm al-abdān fī tadbīr al-insān*, MS or. fol. 4073, Staatsbibliothek, Berlin (hereafter *Taqwīm al-abdān*).
17 *Taqwīm al-abdān*, fol. 1r.
18 Ibid., fol. 1v.
19 *Tanksūqnāmih-i īlkhānī*, fol. 21r.
20 Ibid., fol. 10r.
21 It should be mentioned that this statement comes up in the context of Rashīd al-Dīn's discussion of the differences in language and writing across different nations and the utility of interlingual translation. Though not directly related to medicinal expertise, it spells out some of Rashīd al-Dīn's ideas about the translation of local experiences.
22 *Tanksūqnāmih-i īlkhānī*, fol. 6r.
23 Ibid., fol. 11v.
24 *Literary History*, 10, biography 38.
25 Ibid.
26 On this famous controversy with the Fatimid physician Ibn Riḍwān, see Schacht and Meyerhof, *Medico-Philosophical Controversy*.
27 *Literary History*, 14, biography 25, 5.
28 *Taqwīm al-ṣiḥḥa*, fol. 3v.
29 Ibid., fol. 4v.
30 *Taqwīm al-abdān*, fol. 98r.
31 See Gutas, "Avicenna's Philosophical Project," 36–37.
32 *Taqwīm al-abdān*, fol. 97v.
33 I follow here Philip van der Eijk's terminology. Van der Eijk, *Medicine and Philosophy*, 279. On Galen's "qualified experience," see ibid., 279–98; Pormann, "Avicenna," 98; Totelin, "And to End on a Poetic Note."
34 Van der Eijk, *Medicine and Philosophy*, 282.
35 Pormann, "Avicenna," 98.
36 Ibid.
37 Tabulation has not received much attention in the disciplines of translation studies or communication, and it seems to fall between theories of intersemiotic translation (looking at tables as a reconfiguration of the semiotic setting) and adaptation. On these theories, see Krämer and Ljungberg, *Thinking with Diagrams*.

38 On Ḥunayn b. Isḥāq's Arabic translation, see Savage-Smith, "Galen's Lost Ophthalmology," 122–23.
39 Pormann and Savage-Smith, *Medieval Islamic Medicine*, 53.
40 Quoted in Savage-Smith, "Galen's Lost Ophthalmology," 122.
41 Al-Kindī even developed a full-fledged mathematical approach in his Formulary (*Aqrābādhīn*) and his treatise "On Degrees" (*Fī maʿrifat quwwat al-adwiya al-murakkaba*). His main concern in the latter was how to calculate the levels of intensity in compound drugs. He proposed a mathematical solution using geometrical progression. A copy of al-Kindī's work at the Bayerische Staatsbibliothek presents his theory with tables displaying dosages and the degrees of heat, coldness, dryness, and wetness of various drugs (*ʿaqāqīr*). See Hamarneh, "Al-Kindī," 337. On al-Kindī's mathematical approach to pharmaceutics, see Adamson, *Al-Kindī*, 161–66. On his method and its application in medieval medical practice, Atiyeh, "Al-Kindī," 484; Hamarneh, "Al-Kindī," 336–37.
42 Quoted in *Literary History*, 14, biography 22, 4.3. The translators render the Arabic title as "On the Organization of the Art of Medicine."
43 *Taqwīm al-abdān*, fol. 97v.

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11 From Textual to Visual

Translation and Enhancement of Arabic Experience in the New Book Genre *Tacuina sanitatis* of Giangaleazzo Visconti (c. 1390)

Dominic Olariu

The story of the translation process discussed in this essay is one of cultural, linguistic, and visual transfer of experiences from the Arabic into the Western world, the assimilation of Arabic health knowledge to Italian needs and practices. At its beginning stands the ingenious medical treatise *Taqwīm al-ṣiḥḥa* (*Reestablishment of Health*) written by Ibn Buṭlān, a Christian native of Baghdad, some time before his death in 1066.[1] The *Taqwīm al-ṣiḥḥa* presented prophylactic health practices, in terms of hygiene and dietetics, and curative medical remedies and measures. Its main novelty was its format, with synoptic tabulations allowing fast and easy use: to each of the 280 remedies discussed, it assigned a separate row divided into fifteen columns, each expounding one aspect of the remedy.[2]

Ibn Buṭlān's tabulations became the starting point, in northern Italian court culture, for a different but equally innovative book type, based upon extraordinary pictures accompanied by shortened texts from the Arabic tract. Four illustrated Latin manuscripts of the *Tacuinum sanitatis* made for the Lombard Giangaleazzo Visconti (1351–1402), Count of Milan and Pavia, around the last decade of the fourteenth century bear witness to this new genre.

The adaptation of Ibn Buṭlān's text as I discuss it in this essay is manifold. Arabic medical knowledge was transferred geographically and culturally to Italy; in that process, some of the remedies were replaced with Italian drugs tried and tested in their own environment, and the textual knowledge of the Arabic treatise was adapted to Italian customs, and simultaneously enhanced, by transforming it into pictures. The original, accessible format of tabulation inspired a different—but equally user-friendly—format with images, which also incorporated messages from the contemporary courtly society of northern Italy. Thus, when adapting the Arabic text, experiences were central for the makers and users of the manuscripts discussed, to the point of aligning them to the personal tastes of the addressees.

To trace this customization to Italian needs, I first turn to the Latin translation of Ibn Buṭlān's *Taqwīm al-ṣiḥḥa*. I then compare this with

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Giangaleazzo Visconti's *Tacuina*, showing what information was omitted from the Arabic and what was added from the Italian context. This leads me to a discussion of the images and the empirical evidence they contain. My essay shows that medical proficiency was required to write the texts and paint the pictures of Giangaleazzo's *Tacuina*. Moreover, by adding a visual component to Ibn Buṭlān's tract, the manuscripts shifted the emphasis to visual documentation: the pictures took on the role of conveying knowledge and were no longer auxiliary accessories to the texts.

The Latin Translation of Ibn Buṭlān's *Taqwīm al-ṣiḥḥa*

The Latin translation I discuss first—the basis for the illuminated manuscripts analyzed later in this chapter—was made in the thirteenth century. The translation retained the entire text of Ibn Buṭlān's treatise, the format of synoptic tables, and each of the 280 table entries, and was called *Tacuinum sanitatis* (*Table of Health*) (Figure 11.1, upper half).[3] Just as in Ibn Buṭlān's treatise, the entries are arranged in forty tables, each devoted to a superordinate topic, such as Table XI, "On Various Herbs and Their Nature."

The translation's time and place are disputed due to differing accounts in two sources, but only one of these refers to the original translation. This indicates King Manfred of Sicily's reign (1257–66) and his court at Palermo.[4] King Manfred's *Tacuinum sanitatis* is a very close translation of the Arabic tract, and, like its source, it emphasizes experience gained through empirical observation. Depending on the passage, the text refers to mere perceptual observation by the senses, for instance when describing the color of a fruit, or to the cognitive processing of experience, for instance when defining eight different flavors. Like the Arabic source, the translation presents the habits of people when eating and drinking, but it underlines the point by adding a claim to discuss "all other activities that are carried out in people's rooms," thus in their particular homes and places.[5]

The *Tacuinum*'s innovative format of succinct, tabulated texts indicates the emergence of a new practice of medicine. Although we do not yet know exactly how the Arabic or Latin tables were applied, it is certain that the first fourteen columns present the extensive Greek, Indian, and Arabic literature on dietetics and hygiene, used by Ibn Buṭlān, in a groundbreaking way by condensing it to brief statements. Only the last column contains a more extensive text, showing Ibn Buṭlān's own remarks (Figure 11.1, lower half).

Although doubts have been expressed about the aim and intended audience of Ibn Buṭlān's Arabic treatise, the Latin translation certainly introduced a dual purpose, addressing first rulers and secondarily their subjects, to whom the rulers were to apply or transmit the treatise's knowledge.[6] This double concern of the Latin *Tacuinum* seems to be echoed

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
number	name	nature	degree	best species	utility	harmfulness	removal of damage	effect	temperaments	age	seasons	regions	philosophers' opinions	advice and properties
17	Indian or Palestinian Melons	cold and wet	cold and wet in 2	juicy sweet	in acute diseases	indigestion	with penidiis	watery blood	bilious	young	summer	Southerners	Ras§ Taberi§ [= acronyms for Rhazes and Al-Ṭabarī]	They are recommended against acute fevers, inflammation and for those with a hot nature. If their juice is taken with sugar or something acidic, it has a diuretic effect and purifies the kidneys. They are dangerous for the elderly. They also purify the humours that damage the liver, spleen and stomach when there is an abscess in them. Constant intake causes reflux and indigestion.

Figure 11.1 Double page showing the typical layout of the *Tacuinum sanitatis*. Latin translation of Ibn Buṭlān's *Taqwīm al-ṣiḥḥa*, Bevagna, Biblioteca comunale, MS 9, parchment, 313 x 211 mm, fourteenth century, fols. 3v–4r. Superposed below: My translation of entry 17, *Melones indi palestini*.

Bevagna, Biblioteca communale.

by a slightly later medical treatise in tabular format, Ibn Jazla's *Taqwīm al-abdān fī tadbīr al-insān*.[7] Jazla's tables were composed for the Abbasid caliph Al-Muqtadi (d. 1094), but its Latin translation, made for King Charles of Anjou in 1280,[8] again addresses both the king and secondarily his subjects. In his proem, the translator Faraj ibn Sālim mentions twice that his translation was made both "for the king's personal use" and "for a common use."[9]

The twofold intention of the *Tacuinum sanitatis* is reflected in the later printing of the text. In his 1532 Latin edition of the *Tacuinum aegritudinum*, the Strasbourg printer Johannes Schott inserted a definition of the *Tacuinum* book genre. This was based on philological study of Ibn Jazla's and probably also Ibn Buṭlān's prefaces and is thus difficult to reproduce in detail, but Schott's conclusion is clear:

> By the proof of what is said in the proem, you shall know that *Tacuinus* is a concise, useful, easy, and proven art or science, as is the science of conclusions. It was especially invented to suit men of our time, especially the richest and noble who ask only for results of science and are little interested in demonstrations.[10]

Nevertheless, by publishing the two *Tacuina* in print and in vernacular translation (as *Schachtafelen der Gesuntheyt* (*Chessboards of Health*), 1533), Schott attested their relevance to a wide readership as well.

It was without doubt the noble destination of the *Tacuinum sanitatis* that aroused curiosity about it at Western princely courts. Western princes may well have wished to acquire the new dietary information developed in the Arabic lands. Furthermore, diet books called *regimina sanitatis* were produced in Italy in the second half of the thirteenth century, with a first boom between 1300 and 1348 prompted by university interest in diet.[11] This undoubtedly contributed to the later success of the *Tacuinum sanitatis*.

The *Tacuina sanitatis* of Giangaleazzo Visconti

From about 1390, at least four exquisitely illustrated codices on parchment of the Latin *Tacuinum sanitatis* were produced for the court of the Visconti in Pavia. Each kept part of the text, but omitted the tables and added an illustration to every entry, thus significantly altering the layout and function of the original treatise. Even so, they remained dietary books in line with the content of the original *Taqwīm*, engaging with the *materia medica* described by Ibn Buṭlān and emphasizing the importance of a balanced lifestyle to prevent disorders and disease. The manuscripts are now held in libraries in Vienna, Rome, Paris, and Liège.[12]

Either Giangaleazzo Visconti or one of his close supporters commissioned the four manuscripts.[13] As Carmélia Opsomer has observed, several figures in the *Tacuina* show Giangaleazzo's striking features, corresponding with other depictions of the count.[14] In fact, the oldest surviving inventory of the Visconti library, dating from 1426, lists an exceptionally high proportion of medical writings, including a Latin translation of Ibn Buṭlān's tract.[15]

The illustrated *Tacuina* are characterized by an elaborate illustration apparatus with innovative iconography and a sumptuous painting style. Their extensive pictorial content drew on visual experience, using naturalistic elements related to daily life—a novelty in book illumination on

Figure 11.2 Page of the Vienna *Tacuinum sanitatis* showing "Indian or Palestinian Melons," detail. Vienna, Österreichische Nationalbibliothek, Cod. Series nova 2644, parchment, 332 x 230 mm, c. 1390, fol. 22r.

Vienna, Österreichische Nationalbibliothek, Cod. Ser. n. 2644, fol. 22r.

this scale—that conveyed the lifestyle of aristocrats and their subjects.[16] An entire page and an almost full-page illustration is assigned to each remedy (Figure 11.2). The pictures usually show protagonists engaged with the remedy: producing it, applying or selling it, or delighting in its qualities.

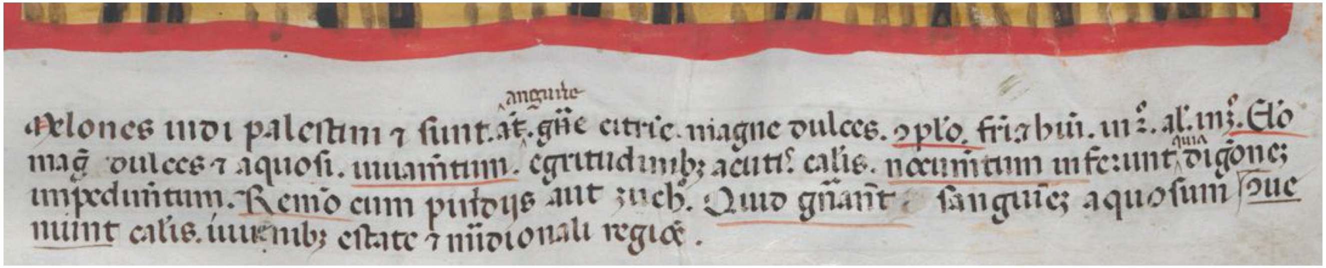
A three- to four-line paragraph beneath each illustration discusses the particular medicine, but its content is reduced compared to Ibn Buṭlān's treatise. The textual abridgement does, however, principally accord with Ibn Buṭlān's intention of summarizing medical knowledge into a concise and clear display.[17] Hence, two of the four *Tacuina* repeat almost literally the Arab writer's statement in their introduction and announce themselves as a new kind of book whose main aim is to provide help, not long explanations and definitions.[18]

Medical Proficiency and the Textual Abridgements

The Visconti *Tacuina* reproduce much information from the earlier translation, but they also make adaptations that reflect the medical experience and preferences of the northern Italian addressees. Though scholarship has assumed that these abridged texts were no longer useful as instructions or dietary rules of conduct compared to King Manfred's translation,[19] there are reasons to think the contrary. One is the perception of contemporaries, who regarded the manuscripts as medical books. The oldest textual source, from 1410, calls the Vienna manuscript *Herbalarium cum figuris depictis*, "herbal with depicted figures," thus associating it with the *materia medica* of herbal books.[20] In 1520, the title on the binding was *Medicinari cum figuris*, probably meaning "remedies with pictures."[21] And an inventory of 1523–24 lists Liège as "les vertus des phisiciens et herbes, viandes et aultres choses" (the virtues of physicians and herbs, meats, and other things).[22]

Similarly, the texts accompanying the images suggest a medical genre. When comparing the image caption of an illustrated *Tacuinum* with King Manfred's translation—say the more extensive Vienna with a copy of the King Manfred translation kept in Bevagna, Italy—the textual differences are strikingly small. The entries for "Melons from India or Palestine" (Figure 11.3), for instance, lack only the information in columns 1, 14, and 15.[23] Vienna even adds details to the information in columns 2 and 5.

Furthermore, the omissions of the information in columns 1, 14, and 15 seem minor. The absence of the number of the remedy in the first column is insignificant, since the remedy occupies the whole page and can be identified using the folio number and the index at the beginning of the book. At first glance, the absence of the column 14 information, listing the medical authorities who discussed the remedies, seems more important. However, in the Arabic, Ibn Buṭlān had offered only acronyms of the authors' names without references to their works,[24] so the user of Ibn Buṭlān's text and King Manfred's translation would have


Melones indi palestini et sunt. at. gne citrie. magne dulces. cplo. fri et hu. in 2. al. in 3. Elo mag dulces et aquosi. iuuamentum. egritudinibus acutis calis. nocumentum infe(cunt) digone; impedimentum. Remo cum psidoys aut zuch. Quid generant sanguine aquosum conueniunt calis. iuuenibus estate et meridionali regione.

Melons from India and Palestine:[2] these are lemon-colored, large and sweet melons **Complexion**:[3-4] cold and wet in the 2nd, after others in the 3rd degree **Prefer**:[5] large, sweet and watery ones **Benefits**:[6] against acute and warm diseases **Harm**:[7] they cause prevention of digestion **Prevention**:[8] with barley sugar or sugar **What they produce:**[9] watery blood Beneficial for people with **warm complexions**[10], **adolescents**[11], in **summer**[12] and in **southern areas**[13].

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
number	name	nature	degree	best species	utility	harmfulness	removal of damage	effect	temperaments	age	seasons	regions	philosophers' opinions	advice and properties
17	Indian or Palestinian Melons	cold and wet	cold and wet in 2	juicy sweet	in acute diseases	indigestion	with penidiis	watery blood	bilious	young	summer	Southerners	Ras§ Taberi§ [= acronyms for Rhazes and Al-Ṭabarī]	They are recommended against acute fevers, inflammation and for those with a hot nature. If their juice is taken with sugar or something acidic, it has a diuretic effect and purifies the kidneys. They are dangerous for the elderly. They also purify the humours that damage the liver, spleen and stomach when there is an abscess in them. Constant intake causes reflux and indigestion.

Figure 11.3 Comparison between the Vienna manuscript and the Bevagna manuscript (top to bottom): text of "Indian or Palestinian Melons" in Vienna; my translation of Vienna; my translation of the same entry in Bevagna. The superscript numbers refer to the columns in the Bevagna manuscript. Note the additional information relating to column 2.

needed considerable knowledge to find the precise passages. Liège and Paris provide—under their first illustration, a picture of Ibn Buṭlān—the names and acronyms of all authorities cited.[25] Rome possibly did so as well, but an index that was originally present has been lost. Paris additionally placed an acronym at the beginning of many entries, indicating the most relevant author mentioned in column 14.[26] We can assume that the aristocratic readers did not wish to trace Ibn Buṭlān's sources, since the aim of the treatise was to give a concise synthesis, not a discussion of sources. It is even conceivable that the books were used by the aristocrats' physicians, some of whom would have been familiar with the Greek, Indian, and Arabic authorities, or by the aristocrats and physicians together. Interestingly, Cathleen Hoeniger found an addition in Rome for the jujube nut, "perhaps by the original patron," that refers to Avicenna's commentary on this plant.[27] Given that neither Ibn Buṭlān's treatise nor the Visconti manuscripts cite Avicenna, this suggests that the readers may have been very knowledgeable.

The main textual difference between the Vienna *Tacuinum* and King Manfred's translation is the absence of information in column 15, containing the opinions of Ibn Buṭlān or other authorities and "miscellaneous advice."[28] All of this was certainly important, but perhaps not indispensable for using the manuscript. In short, the knowledge supplied by Vienna reflected the lion's share of the *Taqwīm al-ṣiḥḥa*'s knowledge; the other three Visconti *Tacuina* reproduce at least the information of the first eight of Ibn Buṭlān's columns for most remedies, and sometimes even add further evidence.

It is hard to know how the Visconti *Tacuina* were used for medical purposes. In fact, though, the same question must also be raised for the tabulation of Ibn Buṭlān's *Taqwīm* and King Manfred's translation. At the very least, the information in the omitted columns will have been negligible for an amateur's personal use, for the *Tacuina* did not include any medicines that could cause immediate and serious harm, such as belladonna or colchicum. As dietary and hygienic tracts, they discussed drugs ingested as food and advised a healthy lifestyle. Based on the drugs included, diarrhea, headaches, and stomach aches were probably the worst that users could suffer. Readers could thus have made personal use of the *Tacuina*, though more efficiently if they also sought the advice of a medical professional. In this sense, the Visconti *Tacuina* may quite conceivably have been used in a similar way to the Arabic tables.

Although the text of the entries remains close to King Manfred's translation, the coverage differs considerably. Compared with the tabular *Tacuinum*, the illustrated manuscripts both add and omit remedies.[29] A closer look at the items in the Visconti manuscripts reveals that they have been adapted to northern Italian life and remedies available locally. Research has suggested that each *Tacuinum* was tailored to the personal predilections and experiences of its audience, selecting remedies favored by the addressee.[30] All four Visconti manuscripts, for example, add "Sweet cherries," "Sour cherries," "Sweet almonds," "Spelt," "Rye," "Millet," "Parsley," "Common rue," "Anise," and other drugs.[31] Some of the remedies added in the three other manuscripts are missing in Liège, probably because it has lost an entire quire.[32] The total number of added remedies is considerable: in Vienna, for instance, twenty-nine of 205 entries are new, and even in the incomplete Liège, twenty-seven entries are new.

Conversely, typically Arabic dishes such as "Madira" (meats prepared with sour milk) and "Maslia" (meats prepared with whey), included in King Manfred's translation, are omitted in all four manuscripts.[33] In King Manfred's translation, forty-nine entries are devoted to grilled foods of the Arab world, Arab jam, sweet pastries, and medicines for the teeth.[34] In the illustrated *Tacuina*, all Arabic foods are omitted with the exception of two pastries (and two more Arab foods in Liège, a chickpea dish and "Salted fried meats").[35] Other remedies have been ignored: only one of the seven entries dealing with constipation, coitus, drunkenness, and teeth cleaning has been retained, and none of the entries on bathing.

Despite the abridgements affecting columns 14 and 15, the medical content of the *Tacuina* suggests significant medical proficiency. The author or authors obviously had the expertise to take excerpts from well-established treatises and condense them into key statements, similar to Ibn Buṭlān's approach. Considering that King Manfred's translation circulated as early as 1309 in Lombardy, we may assume that it was experts at the Visconti court who made the modifications.[36] In all four manuscripts, the texts of the non-omitted drugs match the King Manfred translation quite closely, but they are partially revised. For "Plums" and "Peaches," Vienna gives a different nature and other degrees of the nature,[37] and for "Dry figs," Paris seems to contradict the authority cited by Ibn Buṭlān.[38]

While we must consider corrupted templates and some scribal errors,[39] many of the discrepancies are probably deliberate revisions. The scribes were perhaps specialized in copying medical treatises but still introduced errors in content, showing that they were no medical experts. The nature of their misspellings suggests the use of several text templates. We may therefore assume that more illustrated *Tacuina* were produced for the Visconti court than the copies that survive today.

Sources of Knowledge about Added Remedies

The medical knowledge in the new remedies of the Visconti *Tacuina* and their references to medical sources confirm that they were authored by medical specialists. One important source of such knowledge was most certainly other medical writing of the period, in various genres. However, a comparison with the widely circulated *Aggregator* (1355) by the physician Jacopo Dondi dell'Orologio, a kind of encyclopedia of the healing effects mentioned by well-known medical authorities, reveals almost no correspondence.[40] In contrast, Vienna and Rome integrated remedies, described as “derived from animals,” that seem to come from a chapter of the same title in a text by the Arab author Serapion the Younger (Ibn Sarābī), written several decades after Ibn Buṭlān’s treatise and translated into Latin as the *Liber aggregatus* in about 1290.[41]

Other entries in the Visconti *Tacuina* also match descriptions in Serapion’s book. In all four codices, “White horehound” is particularly close to passages from Serapion.[42] The description of juniper, included only in Liège, corresponds with the effect of healing pulmonary ailments mentioned in Serapion’s *Liber aggregatus*.[43] The high reputation of this Arabic treatise in late-fourteenth-century northern Italy is attested by Francesco Novello da Carrara, a member of another powerful northern Italian dynasty. Around 1400, he commissioned a luxurious translation of Serapion’s treatise into the vernacular. Because of the high naturalism of its miniatures, this “Carrara Herbal” has been described as one of the first instances where plants were copied from life.[44]

Nevertheless, the Visconti *Tacuina* contain drug texts that cannot be traced back to the *Liber aggregatus*. “Hyssop” shows little agreement,[45] “Crocus” only with regard to Dioscorides’s description of the drug’s best quality,[46] and “Liquorice,” “Turnip,” and “Rutabaga” disagree with Serapion entirely.[47]

The *regimina sanitatis* books mentioned above adapted medical knowledge to the curative needs and predilections of the addressees and to newly available findings on remedies, to the point that each court physician felt obliged to compose a personalized diet or conduct book for his master “according to the prince’s personality and no doubt also his gastronomic, clothing, or sexual preferences.”[48] Was Maino de Maineri (d. c. 1368), physician at the Visconti court from about 1347, or his son Pietro, who succeeded his father in 1382 at the latest, responsible for the knowledge of the added remedies? Maino’s *regimen*, completed in Paris in 1333, does not contain all the additional remedies mentioned in the *Tacuina*,[49] but many, including “Sage,” “Turnip,” and “Rutabaga,” bear very close similarities to the *Tacuina* texts.[50] The *regimen* of Maino follows a similar course to that of Ibn Buṭlān, shortening content to key statements, though these are arranged not in tables but in short paragraphs.[51] Further research on Maino’s writings and on *regimina* emanating from his sphere of influence, including one *regimen* dedicated to Giangaleazzo’s father Galeazzo, may yield a better understanding of his influence on the Visconti *Tacuina*.[52] It is also possible that Maino’s son Pietro was responsible for the knowledge about the added remedies.

The Illustrations of the *Tacuina sanitatis*

The images of plants in the Visconti *Tacuina* are carriers of knowledge about the remedies, especially as regards the plants’ qualities (e.g., their morphology and growth habits).[53] The first point to make here is that the visual experience in the images matches the empirical knowledge in the texts. Otto Pächt has described the extraordinarily natural rendering of the garden backgrounds, activities, and detailed workrooms and shops as groundbreaking in Western art. He saw in them the first empirical renderings of landscapes,[54] and emphasized their experiential features, especially the illusion of a natural spatial continuum, while also noting the artists' interest in depicting details of contemporaneous objects and settings. There were in fact antecedents for this, including Ambrogio Lorenzetti's famous fresco *The Effects of Good Government*, painted in 1338–39 in the Sala della Pace in the Palazzo Pubblico at Siena, mentioned by Hoeniger.[55] This fresco is filled with testimonials from everyday life. The *Tacuina* pictures also show similarities with miniatures of bird hunting in French courtly manuscripts.[56] In terms of the sheer number of images conveying visual experience, however, the Visconti *Tacuina* were unparalleled at the time.

Strangely enough, Pächt did not discuss the naturalistic quality of the plant pictures, though he aptly noted that "the development of nature studies runs parallel to the growth of empirical science."[57] The pictorial characterization of the plants is not homogeneous in all four *Tacuina*. Paris, believed to be the oldest, is less precisely rendered than the others, perhaps because it was the first illustrated *Tacuinum* at a time when artists were still grappling with the difficulties of the new pictorial subject. Rome and Vienna have the fewest errors in the texts and the most accurate pictures. Opsomer likened the *Tacuina* to the fifteenth century's opulently illustrated books of hours, arguing that in both cases, the images are "devoid of any utilitarian or documentary function."[58] However, although the lushness of Giangaleazzo's *Tacuina* paintings is indisputable, the images cannot be considered merely ostentatious, given that they are not accompanied by trivial texts. It also remains to be asked why a health manual has been selected as an occasion for luxurious miniature painting.

I do not argue that all the plant pictures are botanically correct. But many plants are depicted with a recognizable morphology, demonstrating that the artists painted them from life or faithfully copied nature-like models.[59] In recent studies, a group of botanists concluded that the *Tacuina* illustrations allow the species to be distinguished.[60] Sampling thirty-four plants from all four *Tacuina*, they identified them based on appearance, also using the plant titles and characteristics mentioned in the texts.[61] The images provide identifying details in different and unsystematic ways: morphological features, the size of the plants compared with the individuals depicted, characteristic growth forms, the behavior of the figures shown with the plants, the way the plants are cultivated, and so on.

The illustrations do not, like today's botanical atlases, always show only individual plants, details in single images, and all plant parts and their appearance at different times of the year. Instead, they function on different levels to convey empirically experienced details of the plant.

As the botanists demonstrated, in order to identify the melon (*Cucumis melo*), for example, the artists depicted the density of the vines, the heart-shaped form of the leaves, the round fruits, all yellow, and their size, slightly larger than the heads of the human figures in the image. In Vienna, the reader received the correct information that the flowers are yellow, but in Rome the flowers, incorrectly painted white, would have misled him; the other two manuscripts do not show the flowers at all.[62] The fact that one protagonist in Vienna holds a fruit close to his nose indicates that the fruit is fragrant.[63] When the text advises that the cucumber's fruits are best used when young, fresh, and green, but the picture shows yellow fruits, the reader will have understood that they turn from green to yellow when ripening.[64] These points are all information additional to Ibn Buṭlān's text, serving to record the plant's appearance. Although the illustrations do not assemble all the features of the plants in today's terms, they suffice for identification.

The case of cucurbits and nightshades is particularly impressive. The botanists identified six cucurbit species, with a total of eight horticultural variants, and two species of nightshades, one of which is still on sale in markets today.[65] Enough features are shown for us to recognize errors in assigning the captions to the corresponding illustrations. The picture of *Cucumis melo*, subspecies *melo*, is correctly attributed to the caption "Melones indi i palestini" in Vienna, whereas in the other three codices the picture has been switched with that of "Melones insipidi."[66]

The errors in the paintings are revealing. They show that specific botanical and horticultural knowledge was necessary in order to paint the plants, author the texts, and assign the correct illustrations to them, all of which was carried out correctly in many illustrations. Painting the melon blossoms white instead of yellow indicates the artist's inadequate botanical knowledge, while the discrepancies between the images point to irregularities in the complex medieval process of producing manuscripts, common in larger workshops: different artists with different skills may have been responsible for the pictures, the copies of models may have been corrupted by inattentive painters, or misunderstandings may have arisen about the title of a plant and the corresponding text-caption.

Giovannino de' Grassi's workshop, or the network of artists who worked under his direction, was certainly of considerable size.[67] Given that the botanists' analysis detected analogies between Vienna and Rome and between Paris and Liège, as well as elements common to all four, we must assume an originally larger number of manuscripts of illustrated *Tacuina*, and a common source for all of them.[68] This seems to be confirmed by the fact that the *Tacuina* illustrations and their corresponding texts were painted as frescoes in interiors at the end of the fourteenth century. Three frescoes—showing wheat starch, dill, and old wine—from the Palazzo del Cansignorio in Verona have survived, indicating the widespread use of this type of depiction.[69]

As the botanists showed, the artists must have had access to botanical knowledge. The accurately reproduced morphological features in their plant images imply that they were advised by plant experts—that is, physicians—at least for the manuscript that served as the template. Again, it seems clear that botanical and horticultural knowledge was necessary to author the texts of the remedies. The artists seem not to have copied older picture models. For some plants, no older pictures are known, and for others, the older images (for example in herbals) were not informative enough to underpin the *Tacuina* pictures. Only through collaboration between plant specialists and artists could the imagery be mastered.

The great difficulty for painters without botanical knowledge in accurately depicting plants was noted by Pliny the Elder (d. 79 CE) in his critique of plant imagery,[70] but chronologically much closer to the Visconti *Tacuina*, the physician (or apothecary) Manfredus de Monte Imperiali made the same point around 1335 in his illustrated herbal: "With my own hand I have hereafter written down what I learned about which herbs, as well as their names; I wrote it in this book and showed it by means of pictures."[71] Whether he painted the pictures himself is open to doubt, but he accentuates his own control—the pictures, it seems, could only be effective if they were informed by expert knowledge. Later, the botanist and physician Leonhart Fuchs followed the same reasoning when, in his herbal *Historia stirpium* of 1542, he described supervising the three artists responsible for the pictures. He illustrated this collaboration with portraits of himself and the artists: printed on the first and last pages of the book, they frame all of the knowledge between, as if to assert that it was only made possible by their mutual association. Before Fuchs, Otto Brunfels noted in his herbal of 1532 that he waited for each of the drawings by his artist Hans Weiditz, probably also in order to verify them, and only then composed the textual descriptions of the plants. To his regret, Brunfels writes, he could not always proceed in this way due to time constraints.[72]

Empirical Details in the Illustrations

The Visconti images discussed in visual format what Ibn Buṭlān had discussed in words. Evidence was essential for both book genres: the medical experience collected in Ibn Buṭlān's treatise is paralleled in the Visconti manuscripts by the evidence of the textual entries and observational experience recorded pictorially. As well as the novel scientific material in the texts, the pictures added a visual dimension to Ibn Buṭlān's tract, shifting the emphasis to visual documentation. In fact, neither the Arabic treatise nor its early translation had supplied any information for identifying the remedies or, especially, plants. Ibn Buṭlān was interested only in their curative, dietetic, and hygienic effects, just occasionally mentioning external features, such as the green color of the unripe cucumber. The *Tacuina* pictures now offered a supplementary scientific-experiential category, one of recognition and identification by sight. The concept of the *Tacuina* thus broke new ground: the illustrations were no longer mere accessories to the texts, but embedded cognitively processed experience into a pictorial framework. In this respect, the Visconti manuscripts stood at the zenith of the science of their time.

In the illustrated *Tacuina*, evidence in the guise of a prestigious painting made a good picture. The clearer the reference to a particular drug, the better the picture. Pictorial credibility and trustworthiness were thus important components.[73] The illustration for "Acorns" in Vienna shows their typical shape and leaves, but also depicts a herdsman driving his pigs, which look like wild boars because in the Middle Ages pigs were kept in herds in oak woods, where they often crossed with their wild relatives.[74] Yet such pictorial details referring to visual experience would be merely anecdotal if they were not linked to precise intentions. For example, the empiricism and narrative joy of Lorenzetti's painting *The Effects of Good Government* have been interpreted as pictorial means to make political manifestos credible. Hans Belting saw the evidence of empiricism in the Siena fresco as a deliberate pictorial device to convey the benefits of good government in Siena to its citizens. For Belting, reference to empirical details is a painted form of the allegory that was otherwise expressed in texts or painted personifications.[75] Klaus Krüger, discussing defamatory pictures, has shown that the empiricism of details observed in the environment in trecento frescoes could also be made to disgrace political opponents.[76] In both cases, a certain painted empiricism bolstered the credibility of the fresco's statement, "making use of the viewer's personal experience in order to lead him to higher insights."[77] The empirical evidence of the *Tacuina* imagery, likewise, served as a reference to a particular agenda associated with Giangaleazzo Visconti.

A brief look at the medicine and plant culture in northern Italy will help us to understand that message. In Pavia, medicine and plants were eminent elements of Visconti's governance. In 1361, Giangaleazzo's father, Galeazzo II Visconti, had not only established the university and medical faculty of the city of Pavia, the city where he had taken up residence, but also started to lay out a vast garden next to his castle.[78] The correspondence with the Counts of Mantua, Guido and Ludovico Gonzaga, from 1366 to 1374 reveals his continuing zeal to decorate the garden with flora that met his requirements. Galeazzo's chamberlain traveled to the Gonzaga court in 1366 to acquire plants, with detailed instructions as to which plants and how they were to be delivered.[79] Later, Galeazzo sent a list of plants to be dispatched and even asked the Gonzaga to enclose a letter with each plant giving its precise description. His son, Giangaleazzo, enlarged and enhanced the university and the garden. The garden housed five thousand rare animals and birds, kept in special enclosures to prevent them from devastating sown fields, along with expensive and unusual plants.[80]

Likewise, promoting the university in Pavia was an important monetary, scientific, and prestige factor of the Visconti governance.[81] The medical faculty attracted the European intelligentsia in the form of students and professors and, with them, financial capital. Marilyn Nicoud has shown that the two northern Italian courts, the Visconti in Pavia and the Carrara in Padua, tried to attract professors from other cities to their own universities.[82] To increase enrollment at the University of Pavia, in 1392, five years after his conquest of Verona, Giangaleazzo obliged local students to study in Pavia.[83]

From the perspective of medical history, Nicoud has proposed that the *regimina sanitatis* be regarded as part of the genre of "mirrors of princes." The dietary or hygiene aspects dealt with in these health books were associated with the ability to govern well.[84] This suggestion aligns with findings on the influence of Roman monarchy on the Renaissance prince. Petrarch had revived an antique ideology of rulership in his *De viribus illustris* of 1337.[85] This conceived a unity of prince and state, which Petrarch compared to the human body, postulating that keeping the ruler and his subjects healthy was a key aim to be respected at courts. The Carrara Herbal should be read as part of these princely ambitions around the health and good governance of the ruler. The herbal's patron, Francesco Novello da Carrara, aimed to promote an image of himself as "a 'physician prince' who orchestrated the moral and physical health of his community."[86] We may add that Francesco Novello intended to appear as a public promoter of the Paduan medical school, fostering innovation in medicine. As an outstanding pharmacopoeia in terms of both text and painting, the Carrara Herbal manifested Francesco's active efforts to promote the science of medicine.

Conclusion

Against this background, the reference to empirical observations presented in the *Tacuina* can be interpreted as a means of convincing readers of Giangaleazzo's good rule. The *Tacuina* displayed the importance of health for the metaphorical body of the ruler and his subjects even before the Carrara Herbal, influencing the latter's approach. The *Tacuina* propagated a perspective in which Giangaleazzo Visconti shone as a protector of good health, good governance, and well-being in his territories and a promoter of the local school of medicine. The sceneries in the pictures and their empiricism are true to life, but the life they reflect is one in a well-governed, flourishing state. Harmony and wellness are omnipresent.[87] In this sense, the Visconti miniatures exhibit close parallels with Lorenzetti's fresco and illustrate an idealized state.

Lifelike details were also painted in another of Giangaleazzo's herbals. Shortly before the execution of the *Tacuina*, he had commissioned an oversized herbal work for Wenceslaus, King of the Romans, who was competing for the title of Holy Roman Emperor. The frontispiece of this herbal, similar in many ways to the *Tacuina*, presented Wenceslaus in a pictorial iconography traditionally associated with imperial portraits, thus making a political statement.[88] The precious book for Wenceslaus was a symbol of obeisance, in which Giangaleazzo made sure to support the king's imperial aims by presenting the metaphor of the corporal unity of ruler and subjects.

The reasoning of the *Tacuina* pictures, combined with the experiential knowledge conveyed in the medical texts, must have presented an extremely powerful line of argument. Every reader could identify with the textual references to health and illness, and with some of the precise sensations mentioned in the texts: the taste of sour cherries, the sight and smell of garlic planted in beds, and so on. The fact that the Latin translation of Ibn Buṭlān's treatise claimed relevance to kings and their subjects may have been an additional reason to choose it for illustration. Perhaps, in the eyes of contemporaries, the King Manfred translation of Ibn Buṭlān's treatise already expressed preliminary forms of the ideology of the bodily unity of prince and state.

What is most impressive in the *Tacuina* of Giangaleazzo Visconti, however, is that these books, which at first glance seem nothing more than ostentatious, allow deep insights into late-fourteenth-century processes concerning the use of empiricism in medicine, natural history, and art. Ibn Buṭlān's experiences are assimilated to northern Italian practices and expanded by means of pictorial material based on empirical observation, indicating intense activity in these fields in northern Italy. Plant science, medicine, and art seem to have been closely intertwined in the period. Pictorial representations of nature and empirical sciences did not merely run in parallel, but influenced each other—the latter provided the knowledge of what was relevant to depict, and the former provided the medium to translate knowledge into visual discourse.

Notes

1 On the *Taqwīm*'s origins, see Weil in this volume. The main sources for this physician's biography are the *Tarīkh al-ḥukamāʾ* (*History of the Experts*) by the Egyptian historian Ibn al-Qiftī (d. 1248) and the *ʿUyūn al-anbāʾ* (*Life of the Physicians*) by the physician and historian of medicine Ibn Abī Usaybiʿa of Damascus (d. 1270). Conrad, "Ibn Buṭlān," and Schacht, "Ibn Buṭlān," set Ibn Buṭlān's death at 1066; see also Dire, "Commerces et commerçants," 16.

2 Although Ibn Buṭlān's treatise originally seems to have used circular tables, these were replaced by a rectangular format before arriving in Italy. For instance, Bibliothèque nationale de France, Paris, MS Arabe 2947, dated 1152: https://gallica.bnf.fr/ark:/12148/btv1b11002068n/f82.item

3 The impact on the Latin-speaking world becomes evident from the fact that the word *tacuinum*, from *taqwīm*, was introduced into Latin with the translation, indicating the novelty of synoptic tables in Western medicine. *Tacuinum* remained associated with medicine in the Western world for centuries. See Thorndike, "Question No. 10."

4 About twenty manuscripts exist; Magionami, "Tacuinum sanitatis," 25–26. Most recently, Tuliani, "Il autore," 22–23, referred to the contradictory wording in two of them, which has made the dating of the translation difficult. Biblioteca Nazionale Marciana, Venice, MS lat. Z 315, *incipit*, refers to King Manfred, whereas Vendôme, Bibliothèque municipale, MS 233, fifteenth century, only carries a corrupted version of the *explicit* of another Arabic medical treatise with tabulations, the *Taqwīm al-abdān fī tadbīr al-insān* (Tables of the Bodies on Human Dietetics), written by the Baghdad physician Ibn Jazla before 1100 and translated in 1280 as *Tacuinum aegritudinum*.

5 *Il Tacuinum sanitatis di Bevagna*, ed. Tuliani (hereafter *TSB*), distinction 2, fol. 1r: "secundum … cameris suis." For the eight flavors, see fol. 1v. For the content of the non-illustrated *Tacuinum sanitatis*, I use Tuliani's edition, with facsimile reproduction in the accompanying volume, of the manuscript at Bevagna, Biblioteca comunale, MS 9.

6 *TSB*, distinction 2, fol. 1r, announces the author's intention: "I will order all in a circle [the original table was circular, D. O.], through which it will be easier for kings and lords to understand; for they have a habit of possessing Tacuina that resemble this work." However, scholars have suspected a social concern underlying the original writing, making it useful to a broad public. See Weil in this volume; Elkhadem, *Taqwīm al Şihha*, 19–20.

7 On this treatise, see n. 4 above and Weil in this volume.

8 See Graziani, *Arabic Medicine*.

9 "ad opus camerae regis" and "nec minus ad utilitatem communem." Few manuscript copies of the *Tacuinum aegritudinum* are known: Wrocław, University Library, MS U III F 28 (dated 1347); Krakow, Jagiellonian Library, cod. 843; Leipzig, University Library MS 1175 (c. 1418) and MS 1177 (fifteenth and fourteenth century); Oxford, Magdalen College, MS 152; Oxford, Corpus Christi College, MS 75; Vatican, Biblioteca Apostolica Vaticana, Pal. lat. 1153 (1358); and probably Vendôme, Bibliothèque municipale, MS 233 (fifteenth century). I cite from the printed edition Ibn Jazla, *Tacvini Aegritvdinvm*, 3.8–12. On Faraj ibn Sālim, see Cohn, "Jüdische Übersetzer."

10 Ibn Jazla, *Tacvini Aegritvdinvm*, 4.6–10, at http://digital.ub.uni-duesseldorf.de/ihd/content/pageview/1270292

11 Nicoud, *Les régimes de santé*, second part.

12 Vienna: Österreichische Nationalbibliothek, Series Nova 2644; Rome: Biblioteca Casanatense, 4182; Paris: Bibliothèque nationale de France, Nouvelles acquisitions latines 1673; Liège: Bibliothèque de l'Université, 1041 (hereafter Vienna, Rome, Paris, Liège). There is extensive literature on the *Tacuina* from diverse perspectives. The most recent bibliographies are in Bertiz, "Picturing Health"; Hoeniger, "Illuminated Tacuinum"; Segre Rutz, *Historia plantarum*; Ibn Buṭlān, *Tacuinum sanitatis*, ed. Unterkircher; Ibn Buṭlān, *Tacuinum sanitatis*, ed. Rössl and Konrad.

13 Current scholarship attributes Rome, Paris, and Vienna to the workshop of Giovannino de' Grassi, court artist of Giangaleazzo, and his son Salomone; Liège may have been executed in the Veneto area. Segre Rutz, "L'*Historia plantarum*," 128.

14 For instance with the portraits in the *Offiziolo*: MS BR 397, Florence, Biblioteca Nazionale, late fourteenth century, fols. 115r, 105r, 128r. Opsomer, *L'art de vivre*, 23–24; Opsomer, "Le scribe," 187–88. Giangaleazzo's face can

be seen in the MS at fols. 3r, 4r, 6v, 7r. The entry on ostrich eggs in Liège is related to Giangaleazzo's taste for them: Opsomer, *L'art de vivre*, 109; Nicoud, *Le prince*, 231 n. 401.

15 Pellegrin, *Bibliothèque des Visconti*, 180, no. A 482. Paris, Rome (the *Theatrum sanitatis*), and Vienna are iconographically related and also show similarities with King Wenceslaus's *Historia plantarum*. Segre Rutz, "L'*Historia plantarum*," 128.

16 On the novelty in book illumination, see Pächt, "Nature Studies," 35–36.

17 Elkhadem, *Taqwīm al Şihha*, 140.

18 Vienna 2644, fol. 4r: "Ideo intentio nostra in hoc libro est abreuiare sermones prolixos." The reference to the brevity of the texts is also in the preface to Rome 4182.

19 Hoeniger, "Illuminated Tacuinum," 55–57 and n. 19; Opsomer, *L'art de vivre*, 26. Nicoud, *Les régimes de santé*, 482, proposes that dietary texts in general were incompatible with a didactic practice of illustrations.

20 Mayr-Adlwang, "Urkunden und Regesten," cxxxii.

21 Mazal and Unterkircher, *Katalog*, 310.

22 Opsomer, "Le scribe," 186–87.

23 The text of Paris is shorter than the others and only reproduces the content of eight out of fifteen columns.

24 For "Melons from India or Palestine," Rhazes and Al-Ṭabarī are named.

25 Opsomer, *L'art de vivre*, 28, for Liège; Delisle, "Traités d'hygiène," 519, for Paris.

26 See, e.g., "Spinachie," fol. 26v, and remedy no. 72 in *TSB*.

27 According to Hoeniger, "Illuminated Tacuinum," 76–77, the notes refer to Avicenna's *Canon*.

28 In Elkhadem, *Taqwīm al Şihha*, 15.

29 See also Opsomer, *L'art de vivre*, 25.

30 Hoeniger, "Illuminated Tacuinum," 76. Although the illustrated *Tacuina* are linked with Giangaleazzo Visconti, none of them appears in the 1426 inventory of the Visconti library, and two were presented to aristocrats associated with him. Paris was owned by Verde Visconti, the cousin and sister-in-law of Giangaleazzo Visconti and wife of Leopold III, Archduke of Austria and Count of Tyrol. Vienna belonged to George of Liechtenstein, Bishop of Trento, probably from 1407 at the latest, though the manuscript formerly belonged to another unknown nobleman; the original owners of Rome and Liège are unknown. Ibid., 59 and 61.

31 I am most grateful to Prof. Noriko S. Yamabe for sharing her research on foods inserted into the illustrated *Tacuina*. See also Yamabe, "Comparison of Items."

32 Opsomer, *L'art de vivre*, 23. These remedies are "Laurel berries," "Chestnuts," "Sorghum," "Isop," "Marjoram."

33 *TSB*, no. 136.

34 They are contained in tables XX–XXVI of Ibn Buṭlān's treatise.

35 *TSB*, nos. 137, 159; Liège fols. 27v, 47v.

36 Segre Rutz, "L'*Historia plantarum*," 125–26. See also Nicoud, *Le prince*, 176 n. 147.

37 Vienna, fols. 5v, 6r; *TSB*, nos. 3, 4.

38 Paris, 2v. "Ficus sicce" (*TSB*, no. 24), names an authority whose name is not completely legible and starts "Por… ."

39 For instance, in "Granata accetosa," "aloe" has been misread as "calor" in Paris (fol. 5v), Liège (fol. 5r), Vienna (fol. 7v); only Rome, ch. 8, is correct.
40 For Dondi, I use Jacobus de Dondis, *Aggregator medicinarum*.
41 Serapion the Younger, *Libro agregà*, ed. Ineichen, 1:x; Harvey, "Ibn Sarabi." On the entries, Opsomer, *L'art de vivre*, 25.
42 It contains direct excerpts from Serapion's text, mostly from passages referring to Galen and Dioscorides. Vienna, fol. 33v; Rome, ch. 40; Paris, fol. 30r. Serapion the Younger, *Libro agregà*, ed. Ineichen, 1:300 and 2:152.
43 Liège, 85r. Serapion the Younger, *Libro agregà*, ed. Ineichen, 1:276.
44 Among many others, Kyle, *Medicine and Humanism*; Baumann, *Erbario Carrarese*; Pächt, "Nature Studies," 30–32; Smith, "Artisanal Knowledge," 17–18.
45 Serapion the Younger, *Libro agregà*, ed. Ineichen, ch. 254, 1:267; 2:139.
46 Serapion the Younger, *Simplicibus medicinis*, ch. 173, 119–20. The text is almost identical in Rome and Vienna.
47 "Liquiritia," Rome ch. 77, Paris 41v, Liège 18r, Vienna 42r; Ineichen, ch. 142, 1:148; "Rape," Rome ch. 96, Paris 42v, Liège 23v, Vienna 52v; "Napones": Rome ch. 97, Paris 43r, Liège 24r (both remedies are grouped under "Verça" in Serapion the Younger, *Libro agregà*, ed. Ineichen, ch. 32, 1:36–39; 2:227–28).
48 See Opsomer, *L'art de vivre*, 21; Nicoud, *Les régimes de santé*, ch. 8.
49 On this regimen, see Nicoud, *Les régimes de santé*, 242–45.
50 Maino de Maineri, *Regimen sanitatis*, "De salvia," fol. XXXIIIv, "De rapis et napis," fol. XXXIXr. Of a second, later regimen written by Maino de Maineri, only one manuscript exists, which I could not consult for this essay: Paris, Bibliothèque de l'Arsenal, MS 873. See Nicoud, *Les régimes de santé*, 230 n. 1.
51 See the entries of his "Tertia pars," in Maino de Maineri, *Regimen sanitatis*.
52 This regimen is referred to in Proctor, "Perfecting Prevention," 23, and is contained in Naples, Biblioteca Nazionale, VIII.D.35, and BAV Pal. Lat. 1260.
53 On medieval botany, see Reeds, *Botany*.
54 Pächt, "Nature Studies," 36.
55 Hoeniger, "Illuminated Tacuinum," 78.
56 Segre Rutz, "L'*Historia plantarum*," 148–49.
57 Pächt, "Nature Studies," 31.
58 Opsomer, *L'art de vivre*, 25. Nicoud, *Les régimes de santé*, 482, writes: "the image serves essentially for the pleasure of the eyes and enhances the aesthetic aspects of the copy."
59 On the development of botanical illustration since the fourteenth century, see Olariu, *Botany*.
60 Paris, Daunay, and Janick, "Cucurbitaceae"; Daunay, Janick, and Paris, "*Tacuinum Sanitatis*."
61 Daunay, Janick, and Paris, "*Tacuinum Sanitatis*."
62 Paris, Daunay, and Janick, "Cucurbitaceae," 1192.
63 Ibid., 1193.
64 Some pictures emphasize other points than those mentioned in the entries, for instance when "Cucumbers" are shown yellow but the entries advise consuming them before they turn yellow. Ibid., 1203.
65 For *Cucumis melo*, they identified the subtle differences between "Chate group," "Casaba melon," "Snake melon," and "Adana group."

66 Ibid., 1192.
67 See n. 13 above.
68 Ibid., 1203–4. Hoeniger, “Illuminated Tacuinum,” 62, arrived at the same conclusion.
69 Today they are in Verona’s Museo Castelvecchio. See Varanini, *Gli Scaligeri*, 388–90. Hoeniger, “Illuminated Tacuinum,” 63, also discusses them, referring to further literature.
70 Plinius, *Naturalis historia*, 25. 4.
71 Manfredus de Monte Imperiali, *Tractatus de herbis*, Paris, Bibliothèque nationale de France, lat. 6823, fol. 3r. This herbal contains very accurate plant illustrations for its time of creation, around 1335, and was in possession of Giangaleazzo Visconti. Pellegrin, *Bibliothèque Visconti*, 278–79, no. A 929. On this manuscript, see Ventura’s comments in Bartholomeus Mini de Senis, *Tractatus*, 142–73.
72 Brunfels, *Contrafayt Kreüterbuoch*, ch. 32, ciii, C (not paginated). See also Kusukawa, *Picturing*, 16–19.
73 On recognition and detail in early plant illustrations, see Egmond, *Eye for Detail*, 126–50, 164–91.
74 Vienna, “Glandes,” fol. 15r. See Frugoni, *Paradiso vista Inferno*, 273.
75 Belting, “Das Bild als Text,” esp. 31–34.
76 Krüger, *Politik der Evidenz*, 16–30. In the fresco discussed by Krüger, surviving only in a miniature in Domenico Lenzi’s *Specchio umano*, evidence was evoked not only by compositional means but also by details observed in the environment.
77 Belting, “Das Bild als Text,” 33.
78 Magenta, *Visconti e Sforza*, 1:96–108.
79 On this and the following details, ibid., 2:119–20.
80 Ibid., 2:119 n. 3, referring to Maruli, *Historia sagra*, II. 153.
81 Magenta, *Visconti e Sforza*, 1:96–108. On the neighboring city of Padua, see Kyle, *Medicine and Humanism*, ch. 3; on Italian medical universities at the time, Siraisi, *Medicine*.
82 Nicoud, *Le prince*, ch. 1, esp. 82–84.
83 Varanini, *Gli Scaligeri*, 525. On such imperatives, see also Nicoud, *Le prince*, 83–84.
84 Nicoud, *Les régimes de santé*, 225, 347–55.
85 Stacey, *Roman Monarchy*, esp. 139.
86 Kyle, *Medicine and Humanism*, 9–12, 97–98, quotation 13.
87 Schlosser, “Ein veronesisches Bilderbuch,” 156.
88 Segre Rutz, *Historia plantarum*, 49–56 and 87, reproduction 53.

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12 The Pictorial Idioms of Nature

Image Making as Phytographic Translation in Early Modern Northern Europe

Jaya Remond

Perhaps more than in other aspects of the natural sciences in early modern Europe, the need to think in terms of images was felt acutely in the domain of plant studies. Botany was gaining traction as a new type of science in which visual observation played an increasingly dominant role, and pictures attained a new importance, as becomes especially evident in a type of publications that appeared from the 1530s, initially in southern German-speaking regions. For the first time, printed books devoted to plants contained images that were explicitly presented as having been made after nature, as in Otto Brunfels's *Herbarum vivae eicones* (Strasbourg, 1530) and Leonhart Fuchs's *De historia stirpium commentarii insignes* (Zurich, 1542).[1]

This emphasis on firsthand access to plants gave the pictures in these groundbreaking herbals a distinctively vivacious quality, which authors and publishers did not fail to highlight. For example, Brunfels's title states that the book's pictures are "lively" or "lifelike" (*vivae*). And in *De historia stirpium commentarii insignes*, portraits of the image-making team similarly indicate the premium put on pictures and on making processes based on direct observation: the team is shown at work, with one draftsman engaged in drawing a plant in a vase.

Referencing, but considerably expanding on, antique sources (such as Dioscorides), these new printed herbals sought to renovate plant studies. They initially connected to the practice of medicine, informed by a long tradition of *materia medica* within which plant knowledge had flourished.[2] In a break with previous publications,[3] they emphasized firsthand experience of nature gained during field trips over the course of the seasons. The goal of these images was to record, describe, and stabilize the shape of ephemeral plants on paper for purposes of identification; the texts provided much crucial information for identification and additional knowledge on the plants' environment and curative virtues.

Of course, these innovative herbals did not emerge from a vacuum. Their pictures owed much to the graphic experiments that had taken place in the late fifteenth and early sixteenth century, particularly in ornamental design, miniatures, and easel painting.[4] Artists started to rethink

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their relationship with nature in the direction of greater verisimilitude, and nature arose as an independent and autonomous visual subject of study.

Examining the importance of early modern images in the construction of scientific arguments, historians of science and art have demonstrated that the early modern emphasis on naturalistic details bolstered the epistemic value of pictures.[5] But because the usefulness of pictures in the natural sciences was not self-evident, images became a potential site of contestation between image makers and naturalists.

Attending to modes of making and transmission and to the rhetoric of creation and authority, this essay examines the intrinsic construction of pictures, and the discourses that emerged around their production, through the prism of translation. This is because the graphic production of images resulted from several processes of translation in the wider sense. Quite literally, observations made after nature (and/or after other images) were transferred—*carried over*—from a model (live or not) onto a two-dimensional support. The transfer of observations into two-dimensional formats necessitated several phases, often culminating in the production of a printed image. Artists translated from acts of viewing, to first sketches, to more elaborate ones that might also be informed by other pictorial sources; from drawings to woodblocks or copperplates; then back onto paper, from the block or the plate. I argue that this phytographic process—the detailed pictorial description of plants—encompasses multiple maneuvers of transfer and transplantation, as the observational experience is stabilized, redeployed, and acclimated to new material environments made of paper and ink.

The firsthand experience of nature implied instantaneous and unmediated optical inspection, connecting with a form of immediate eyewitnessing of the objects of study (in this case, plants).[6] This way of doing science did not involve intermediary or secondhand observations, such as those based on pictures—at least in theory. In fact, objects and practices tell a slightly different story, one in which pictures played a non-negligible role in the translation of experience.

Certainly, the production of images made after nature entailed a particular set of actions that involved movement in space and changes in format: moving plants from their natural environment to a different place (albeit metaphorically); putting visual observations of nature onto paper; and presenting those observations in a two-dimensional format that aimed to retain as much as possible of the original information present in nature—transplanting them, so to speak. Because of the authority ascribed to directness of scrutiny in the early modern period, such procedures presented representational and discursive challenges: the desire for faithfulness to the original object of study had to be reconciled with an acknowledgment that modifications were unavoidable. A plant depicted on paper would never be quite like one seen in the field. Losses of information (some of which the text could compensate, such as smell or taste) were inevitable, but other things could be gained. In this transitional phase in the history of plant imagery, artists found themselves in possession of an enviably wide set of tools and skills, both observational and technical—expertise that they marshaled to negotiate the passage from the field to paper through their senses, minds, and hands.

The presence of a strong, dynamic printing trade, combined with a change in world view spurred partly by the Reformation, meant that northern Europe was particularly fertile ground for making botanical imagery and thinking about its role.[7] In the following, I examine the pictorial agenda that unfolded in the botanical representations produced in this terrain. Pictures here function as historical objects and evidence, in tandem with texts, for as Fuchs's herbal shows, northern European naturalists working in the realm of botany at the time engaged more forcefully than elsewhere with the status of the image and the practical conditions of its making. They thought deeply about what a good and efficient image of nature should be, more so than south of the Alps, where a rich botanical culture was nonetheless thriving.[8] The early naturalistic printed herbals that appeared in German-speaking regions were the first to generate elements of discourse about what an image—specifically, a botanical image—was and what it should achieve. However, objects and people traveled widely. Indeed, the making of botany as a new type of science was largely contingent on the transnational and global transfers of plants, the dissemination of plant-based artifacts, and the circulation of both artists and naturalists. These protagonists depended on pan-European networks of informants and connections that supplied seeds and dried plants, along with drawn and written descriptions of natural specimens.[9]

More often than not, the pictures that resulted from the multiple translation processes I have outlined did not so much make things visible as make them hypervisible, generating forms that had been manipulated, but also sometimes borrowed from other templates, to show the inner workings of nature.[10] This faces us with concrete material problems, for many moments are missing in the paper trail. The very first sketches were often discarded, and blocks do not always survive. Still, careful observation of the prints and the discourses that arose around them allows us to regain some information about the process.

Praising Pictures: Discourse and Practice

New Images of Plants

Propelled by a novel emphasis on observation as a rising epistemic category and the expansion of the printing press, innovative ways of describing nature appeared in lavishly illustrated herbals printed from the 1530s onwards in German-speaking lands.[11] In the epistle prefacing his own celebrated herbal, for instance, Fuchs praised pictures in the following terms:

> What sane person, I ask, would despise a picture, which certainly expresses objects much more clearly than they can be *delineated* by any words, even the most eloquent? Indeed, it has been thus arranged by nature, that we are all captivated by a painting; and those things that are set forth and pictured on canvas and paper are fixed even more deeply in our minds than those described in bare words. Hence it is certain that there are many plants that, although they cannot be *described in words so that they are recognized*, are placed before our eyes in a painting so that they are grasped at first glance.[12]

Proclaiming the superiority of image over word, Fuchs reverses the conventional subservient relationship of painting to text: here, words only outline.[13] By comparing words to the contour lines of a drawing, he underscores the captivating power and immediacy of pictures in conveying visual information instantly, as well as their ability to fix impermanent shapes in one's memory.

The high value placed on images as privileged vehicles of knowledge, transcending words and language barriers, went hand in hand with a contemporary reassessment of drawing, which was deemed important as both an instrument of cognition and a noble art. Accordingly, Fuchs's prefatory epistle highlights the prime position of drawing in the liberal education given to freeborn boys in ancient Greece.[14] This type of discourse hinged upon an emerging rhetoric that celebrated the merits of drawing as a memory aid, an art loved by emperors, kings, and noblemen. Such rhetorical ploys had appeared in Albrecht Dürer's pedagogical writings and in art manuals published in German-speaking regions between the early 1530s and the 1560s.[15] Fuchs's defense of drawings as objects and of draftsmanship as a practice also echoed Baldassare Castiglione in his *Book of the Courtier* (1528). When Castiglione praised drawing as an ancient, virtuous, and noble occupation practiced and prized by the powerful and famous, he presented it less as an aristocratic pastime than as a useful art with epistemic and even martial value. The act of drawing was therefore particularly well-suited to the study of both natural and built environments.[16] Fuchs's own celebration of drawing as a cognitive tool is steeped in his own practice and experience of images and image making, but it also marshals some of the rhetorical strategies deployed in such contemporary defenses of drawing, in a similar attempt to raise it to the level of the liberal arts.

In the same programmatic preface, Fuchs drew up a fairly detailed program for what constituted a good image of nature, and listed the components of pictorial efficacy:

> As for the pictures themselves, every single one of them portrays the lines and appearance of the living plant. We were especially careful

> that they should be absolutely correct, and we have devoted the greatest diligence that every plant should be depicted with its own roots, stalks, leaves, flowers, seeds, and fruit. Over and over again, we have purposely and deliberately avoided the obliteration of the natural form of the plants lest they be obscured by shading and other artifices that painters sometimes employ to win artistic glory. And we have not allowed the craftsmen so to indulge their whims as to cause the drawing not to correspond accurately to the truth.[17]

In Fuchs's pictorial program, foreshortening, shadowing, and modeling—in fact, all the illusionistic and aesthetically pleasing features that earned artists praise—should be excluded from the representations of plants. The pictures in his herbal implement this agenda, with a focus on accentuated outlines. Fuchs's remark hints at a tension at play in the relationship between image maker and naturalist: Who has the authority to decide what the image of a plant should look like? Fuchs here positions himself as the figure of authority regarding image making.

Additionally, his remarks in the preface may be interpreted as a not so thinly veiled criticism of Hans Weiditz's woodcuts in Brunfels's herbal, which had been published a little more than a decade earlier and had set an important precedent.[18] The pictures from the *Vivae eicones* used many of the elements so frowned upon by Fuchs, including hatching, foreshortenings, and individualist details, such as leaves nibbled by insects, that are also found in Weiditz's model drawings for the woodblocks. Such graphic choices could make the identification of plants more difficult, undermining the adequacy of images as study tools for plants. In Weiditz's woodcuts, the design remains clear, mostly expressed through contour lines, but the outlines swell and taper delicately enough to convey a sense of volume and liveliness, as we see in the woodcuts of water lilies (Figure 12.1).[19]

Dürer's aesthetic of verisimilitude clearly informed Weiditz's style and handling of the line. Taking up a full folio, the picture is placed on an equal footing with the text, which is driven by the image.[20] Represented complete with its root, the plant is endowed with a sense of monumentality unprecedented in printed images of nature. Detached from all environmental context as they spread against the white background, the water lilies have an overwhelming and vivid presence. The variation in viewpoints in one single image—from the front, the back, the side—creates an illusion of animation and movement. Foreshortening, used quite extensively throughout the herbal, and hatching express contrasts of light and shade, modeling, and three-dimensionality. Yet the pictures remain uncluttered, and hatching is minimal to leave enough space for later hand-coloring.

Like Weiditz's water lilies, the other pictures in the *Vivae eicones* often show the plants at different stages of growth, with the flowers in bud and in full bloom. Setting new benchmarks of pictorial excellence for later

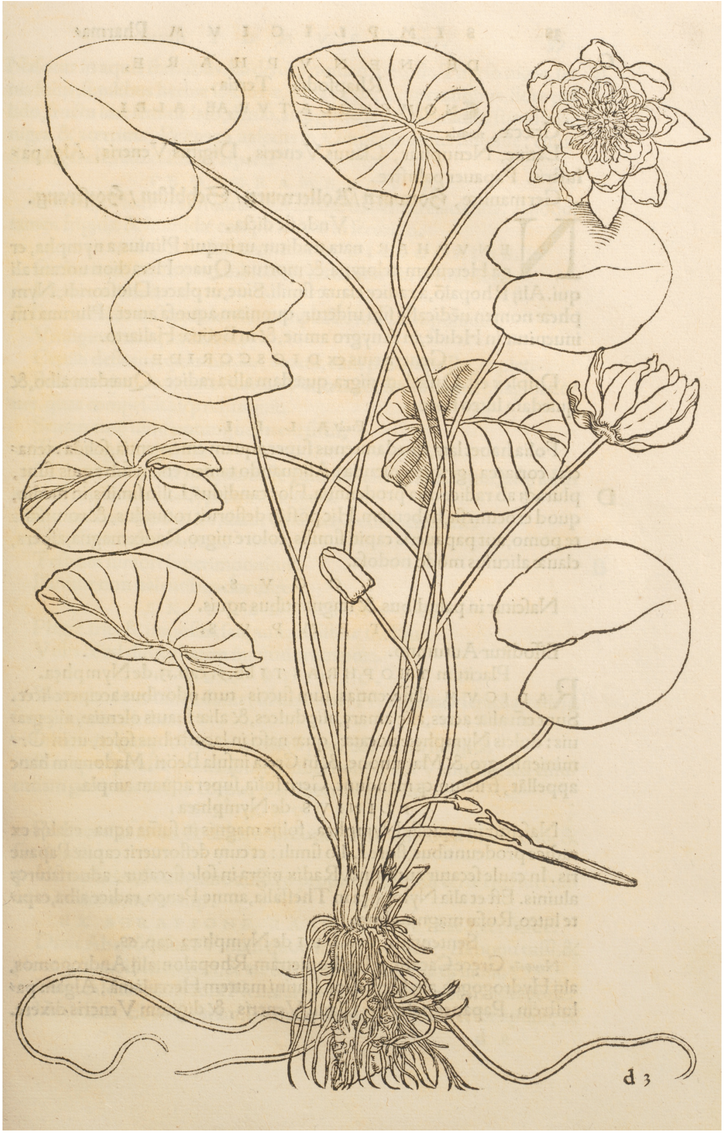

Figure 12.1 Hans Weiditz, Water lily, woodcut, in Otto Brunfels, *Herbarum vivae eicones ad naturae imitationem* (Strasbourg: Schott, 1530), 37. Zentralbibliothek Zürich, NB 253 | G, doi.org/10.3931/e-rara-51632 (public domain).

botanical imagery and offering strategies that would be reprised in other herbals, including Fuchs's, Weiditz's woodcuts exemplify the epistemic image as defined by historians of science such as Lorraine Daston: an image that does not merely reproduce its object of study faithfully, but seeks to replace it by virtue of its truthfulness.[21]

The artistry with which such images were made generated both admiration and a distrust verging on anxiety. Their vivid naturalism was seductive but also threatening, as it potentially challenged or even took precedence over the authority of the text. When describing the physical qualities of plants, words were bound to be limited.[22] For instance, though Fuchs's text was celebrated for its precision, reflecting a firsthand engagement with nature, it could also be quite terse, as in this description of a dead nettle: the plant "consists of leaves small, ridged, bright, fuzzy, but not at all sharp; with a quadrangular stalk; with white, yellow or purple flower; with a hairy root at curled intervals. The whole thing reeks with a heavy odor. It is harmless and does not sting. The seed extends abundant and dark at intervals from the stalk."[23] The text gives useful but partial information about the plant, while the woodcut informs viewers on the shape of the leaves and petals, the form of the slender stem, the number of petals. In fact, the picture combines three different types of dead nettles in one, with flowers of different colors (white, yellow, purple, as stated in the text and made clear in hand-colored versions).[24]

The image created in this combinatory process represented a plant that did not live in nature and therefore could only exist in picture: a prototypical synthesis, which blended multiple images.[25] Such pictures aimed for a form of hypervisibility, seeking to show as much as possible in one shot: not just what was barely visible to the naked or untrained eye, but also *beyond* what was visible in nature itself. Small details were highlighted, made extra-present through graphic enhancement. Short dark single strokes, for example, which are given the same width as other contour lines, materialize tiny white, nearly transparent, hairs covering the stem of *Papaver erraticum*.[26]

Such woodcuts exhibited more than could be seen in one live viewing session from a unique vantage point. They merged different angles in a single shot, something achievable in person only by walking and moving around the plant. To this end, the plant was visually manipulated on paper: the stem was twisted to show the stalk, leaves, and flowers from the front and back, from above and below, all at once, while the root, usually inaccessible to the eye in the field, was exposed to the viewer's gaze. In pursuit of comprehensiveness and usefulness, thus, these hypervisible pictures compounded different moments in the life and growth of a plant in a sole image rather than in a sequence of several images. This creative graphic solution undoubtedly answered practical purposes by eliminating the need for more pictures and thus limiting production costs. At the same time, the pictures pushed the boundaries of pictorial potentiality by coalescing different points in time and space, disclosing details that would normally escape attention while striving for clarity. Translating and fusing information on paper, they directed viewers where to look, sharing and developing a new kind of optical expertise.

These uses of images encountered some resistance. The botanist Hieronymus Bock, for example, initially regarded images as unnecessary, particularly for the experienced user, as he explained in the preface to his own herbal:

> Regarding herbals, they are clearly useful to a certain extent, when we do not have any living plants, or cannot obtain ones that have been gathered recently. But whoever has his own garden and gardeners can plant numerous and various plants … and contemplate their living images … [has] no need of pictures except for those plants that are especially foreign and that we cannot see recently gathered everywhere, and that absolutely refuse to be accustomed to our soil.[27]

Indeed, Bock's herbal, like Fuchs's, essentially dealt with German plants that could grow in most gardens and be examined at leisure. However, as his comment suggests, some plants were deemed particularly worthy of pictorial attention: those coming from distant regions, whose physical features needed to be stabilized on paper. To some, those new, beautiful botanical specimens even deserved to be depicted by great artists, as Gonzalo Fernández de Oviedo claimed in his *Historia general y natural de las Indias* (1535). Mentioning a particularly strange tree seen in the newly conquered territories of the Americas, this Spanish civil servant and chronicler noted that it needed "to be painted by the hand of a Berruguete or some excellent painter like him, or by Leonardo da Vinci or Andrea Mantegna, famous painters whom I knew in Italy."[28] This suggests that artists were ideally equipped to translate natural forms into a two-dimensional format.

The Artist as Interpreter

The new normative images found in sixteenth-century herbals resulted from a considerably older reevaluation of the relationship between artist and nature, as theorized by artistic and didactic literature. This crucial reassessment made artists into privileged interpreters of the natural world: they were the ones with the visual and technical expertise to record observations of nature. Around 1400, Cennino Cennini was already instructing readers of his artist's handbook to follow the example of nature by imitating it.[29] A few decades later, capitalizing on the potential of oil technique, painters in the southern Netherlands developed a novel, vivid, and precise rendering of nature, a naturalistic manner in which they sought to scrutinize and then truthfully depict the objects in front of them.

In the late fifteenth and early sixteenth century, in the wake of Leonardo and Leon Battista Alberti, Albrecht Dürer became the first in northern Europe to theorize more precisely, in both his writings and his art, the early modern artist's renegotiation of his relationship to nature. In his *Four Books on Human Proportions*, Dürer stated that truth could be seen in nature.[30] Consequently, he recommended the close, attentive study of nature and a life in harmony with it, in order to avoid mistakes. For Dürer, as for many after him, the excellence of an artwork lay in the degree of its faithfulness in imitating nature. The idea of remaining as close to possible to the original model parallels some of the ways in which literary translation was envisioned in the early modern period. In his *Art poétique* of 1555, for instance, Jacques Peletier sees the translator's duty as being to "approach the author as closely as possible."[31] Artists and translators alike strove for a loyal proximity to the source, their original object of scrutiny.

Dürer put these principles into practice in a series of detailed studies depicting local animals and plants. In *The Large Piece of Turf*, he adopted a low vantage point, captured the different gradations of green with microscopic precision, and defined the blades of grass individually with fine brushes.[32] Artists before him had made nature studies after life, but Dürer was the first to leave such an extensive body of drawings of plants and animals made in that way.

But the relationship of nature to art was not a simple, one-way transaction, limited to imitation. For Dürer, art and artworks should be a means of acquiring knowledge of the world. Pictures unpack the world by making it visible and understandable. They clarify, reveal, and translate: they express the world in intelligible terms.[33] Dürer championed the potential of pictures to help a large audience understand the natural world, yet his *Four Books on Human Proportions* are devoted only to the making of good—meaning proportional—images of men or women; no similar treatise exists on pictures of plants or animals.[34]

What Dürer's writings show is that although nature was routinely invoked as a guide to follow and art was assigned the lofty goal of exposing and translating nature's mysteries, such discourses remained rather theoretical in the first decades of the early modern period. This vision of nature remained largely anthropocentric, as certain aspects of the natural world—particularly the human body—garnered more analytical attention than others. Unlike Dürer's studies, the pictures of plants in editions of the *Hortus sanitatis* were frequently stylized, making them sometimes difficult to use for purposes of identification except by those who already knew the plants. The structure of the plants was often misunderstood, with some representational mistakes when mythological or allegorical factors were given preeminence over verisimilitude, possibly confirming that artists had often not seen the plants they depicted or else deliberately preferred to stick to certain visual conventions, basing themselves on earlier templates rather than their own experience of nature.[35] Thus, naturalistic breakthroughs occurred in panel and manuscript painting and decorative prints rather than in these late fifteenth- and early sixteenth-century natural history books. Though the art of Dürer testifies to the beginnings of an innovative style based on firsthand observation, there were few guidelines on how to depict nature until the first naturalistic printed herbals of the mid-sixteenth century, particularly Fuchs's work.

Transplantations

Creative Reuses

On close inspection, Fuchs's and Weiditz's herbals share more than it might seem at first sight. For the woodcuts of white and yellow lilies (Figure 12.2), Fuchs's team of artists borrowed Weiditz's composition, which has been a little streamlined. Some marginal hatching remains, but less than in Weiditz's template, making Fuchs's plants appear a little flatter. Such reuse may contradict Fuchs's assertion, prominently featured on the title page, that the pictures were made *ad naturae imitationem*. However, as Claudia Swan has shown, the notion of "after nature" could mean lifelike, as opposed to necessarily based on firsthand observation of nature.[36] In early modern artistic practice, *ad vivum* also designated ways of representing nature with a degree of mimetic detail that conveyed the impression of lifelikeness, rather than just a mode of depicting after live models. Thus, even though Dürer's 1515 woodcut of a rhinoceros, which the artist had not seen in the flesh, contained many anatomical inaccuracies in the depiction of the animal's armor-like, textured skin, the picture was still able to make claims of truth, authority, and reliability—thanks in part to the detail and vividness of his rendering—and remained a source of reference, copied by many.[37]

However, Fuchs's nearly identical reproduction of previously published images reveals a more general gap between discourse and practice, as well as Fuchs's ambivalence regarding the relationship of images to nature. After all, in theory, his title page and epistle clearly predicate their value upon firsthand contact with nature, the unmediated observation of plants.[38] Nevertheless, the copying of images was widespread, and could coexist with such claims of direct observation.

The practice of copying operated on different levels. Foundational to the workshop training of artists, it was also crucial to the transmission of knowledge before (but also after) the rise of mechanical reproduction.[39] The printing press enabled the copying of images on a whole new scale and facilitated the circulation of normative standards. Botanical imagery was no exception, and its dissemination through copies was not only customary—early modern users also thought about and commented on the practice. For instance, when the Netherlandish physician and botanist

Figure 12.2 Albrecht Meyer, Heinrich Füllmaurer, and Veit Speckle, White water lily, woodcut, in Leonhart Fuchs, *De historia stirpium commentarii insignes* (Basel: Isengrin, 1542), 535.

Universitätsbibliothek Basel, Lo I 4, doi.org/10.3931/e-rara-1717 (public domain).

Rembert Dodoens reused Fuchs's images in his own printed herbal, the *Cruydeboeck*, including the woodcut of two water lilies, author and publisher openly acknowledged the act of borrowing.

To describe this operation, Dodoens used the Latin term *transferre* in the epistle to the reader in his *Trium priorum de stirpium historia commentariorum imagines*, which also featured woodcuts copied from Fuchs (including the water lilies).[40] While *transferre* can be translated literally as "transfer" or "move" (and, as we have seen, is the root of the term "translate"), in this particular context it can also mean copying. Dodoens justified the reuse of images partly by highlighting their exceptional formal qualities: "I wanted also to *transfer* the images of Fuchs in my work and my commentaries … not only because they are fine and well made," but above all because those studying the discipline have favored them for years and anyone who learned to know plants from Fuchs's images will recognize them more easily from those than from new images.[41]

The reuse of images, common in the book trade, could thus take different forms. Without the consent of the publisher or author, it amounted to piracy and could lead to well-documented lawsuits.[42] But images could also be reused lawfully, for instance when a publisher bought woodblocks, sometimes entire stocks, from another publisher. This was the case when the Antwerp-based publisher Christophe Plantin purchased a stock of woodblocks from Dodoens's publisher Jan van der Loe, who had himself obtained a privilege to reuse and revise Fuchs's herbal.[43] Such transregional transfers of images, from one printed herbal to another and from one country to another, served an obvious commercial purpose, since they saved both time and money. Reprinting images from old ones was cheaper than having them redrawn and new blocks cut.

To be sure, Dodoens did not adduce such mundane, pedestrian explanations to warrant his reuse of older templates. Although we may question his ingenuousness, his statement indicates, I would argue, that the pictures he transplanted from Fuchs's herbal had established new standards of excellence in terms of representation, layout, and composition. They provided a collectively intelligible graphic idiom that made them ideal models.[44] Laying claim to these pictures, acknowledging their source in print, and emphasizing the transfer process, as Dodoens did, bestowed a certain authority, legitimacy, and reliability on the objects that recycled them. This is why Dodoens did not hide the images' birthplace: on the contrary, he insisted on it. Evidently, some pictures had acquired such authoritative status that underlining their origin in writing could enhance the value and trustworthiness of the new pictures made after them.

Far from being limited to herbals, the enduring influence of these early printed templates can be felt widely across visual and verbal genres.[45] Pictorial transfers, copies, and borrowings challenge boundaries between types of objects and media. In fact, the authoritative models that appeared first in herbals and went on to be copied multiple times profoundly shaped the ways in which early modern nature came to be represented in two dimensions. What came to be labeled, perhaps too hastily, as "botanical" and "ornamental" pictures actually often overlapped, informing and acknowledging each other in a continuous transfer loop of replications. This loop cemented the authority of certain visual templates and strategies that were deemed especially efficient in preserving pictorial forms for posterity.

In the *Florilegium*, an innovative series of twenty-four ornamental sheets by the Netherlandish artist Adriaen Collaert published around 1587–89, the flowers are mostly borrowed from other sources, particularly herbals.[46] For instance, the crown imperial at the center of Plate 7 (Figure 12.3) is copied from Dodoens's , Clusius's, or de Lobel's herbals (all published by Plantin) (Figure 12.4), with very few modifications.[47] But the change of technique, from woodcut to engraving, entails a pictorial translation that allows subtler contrasts of light and shade between the front and the back of the leaves. Thin parallel arched lines in Collaert's Plate 7 replace the thicker, homogenous hatching found in the original woodcut and delicately emphasize the curvature of the petals. Signaling the shift in frameworks, the root has been deleted in Collaert's engraving, where the focus of attention is the extravagant blossom.

The journey of images, reinterpreted and modified along the way through processes of translation, does not stop here. Collaert's pictures found their way back into botanical inventories in an uninterrupted transfer loop. In the natural history albums of Anselmus de Boodt (1550–1632), another prominent Netherlandish naturalist and court physician to Rudolph II, many drawings seemingly made after nature are in fact based on earlier templates, including Collaert's *Florilegium*. For instance, a pink orchid (Figure 12.5) faithfully reproduces a motif from Collaert's plate 7.[48] In the resulting change of graphic idiom from print to drawing, variations in hatching are retranslated as soft gradations of pink, which also create a heightened sense of volume and texture. Such reuse also indicates the authoritative status that certain pictures had achieved as they were copied over and over again.

The addition of color, absent from Collaert's print, suggests the incorporation of firsthand observation of the plant (or, at the very least, of sketches made after life) into the drawing. If technology transfers and graphic translation could occasion losses of information, they could also enhance some effects and add new details useful for identification purposes. In De Boodt's albums, the passage back to drawing allowed the crucial reintroduction of color. In short, prints offered a representational lens through which firsthand observations could be filtered, remodeled, and recombined. The translation loop from print to print and back to drawing highlights a permeability between media that enabled the constant reinterpretation and reinvention of forms.

Figure 12.3 Adriaen Collaert, Crown imperial, orchid, lilies of the valley, and other flowers, engraving, *Florilegium* (Antwerp: Galle, c. 1587–89), Plate 7, 177 mm x 126 mm.

Rijksprentenkabinet, Rijksmuseum, Amsterdam, RP-P-BI-5996 (public domain).


332 Tvveede Deel. Cruydtboeck van Dodonæus.

wat wittachtich van verwen. In stede van de Wortel heeft dit gewas eenen ronden bol oft bulb/ niet als de ander soorten van Lelien klisterachtich ende van veel loockachtighe kaernen oft schubben bij een vergadert / maer gheheel ende ront / den Ajuyn van ghedaente wat naeder comende / van reuck den Loock eenichsins gelijckende.

Corona Imperialis, oft Keysers Croone.

Het v. Capittel.

Van de keysers Croone/ oft Corona Imperialis.

Geslacht.

Plaetse. Dese vreemde ende wtlandsche/ selden gevonden soorte van Lelien wast in de landouwen van Orienten oft Oosten: van daer is sij in de hoven van Italien ende Oostenrijc verplant ende voorts in ander landen ghesonden gheweest/ ende van de liefhebbers naerstelijck onderhouden ende gheoeffent.

Figure 12.4 Crown imperial, woodcut. In Rembert Dodoens, *Cruydt-Boeck* (Leiden: Raphelengius, 1608), 332.
ETH-Bibliothek Zürich, Rar 59, doi.org/10.3931/e-rara-9881 (public domain).

Figure 12.5 Anselmus de Boodt, Elias Verhulst (?), Orchid and campanula, watercolor, body color, and chalk, 223 mm x 145 mm, c. 1600, part of an album of drawings of plants and mushrooms.

Rijksprentenkabinet, Rijksmuseum, Amsterdam, RP-T-BR-2017-1-11-18 (on loan from a private collection; public domain).

Though *florilegia*, often intended as repertoires of images for artists and artisans, were not preoccupied with the medical virtues of plants and emphasized pictures rather than text, artists often made an explicit connection between plant science and the making and display of these pictures. In Crispijn de Passe's own celebrated *Hortus floridus*, the title page features medallion portraits of two prominent botanists, Rembert Dodoens and Carolus Clusius, first prefect of the botanical gardens in Leiden.[49] The portraits are not decorative props, but discursive and validating tools that shed light on De Passe's intention to link image making with the making of knowledge.

Unlike Collaert's *Florilegium*, the *Hortus floridus* does not borrow heavily from the pictures in previous herbals. By placing his pictures under the aegis of two recognized experts in the domain of plant science, De Passe connected his artifact with the botanical study of plants. He inscribed the *Hortus floridus* within a specific genealogy, rooted in an identifiable (northern) geographic terrain, and thereby asserted the legitimacy and authority of his pictorial record, which could serve as a plant catalogue as well as a repertoire of images to be copied.[50] De Passe's detailed engravings purported to be more than aesthetically pleasing: they also aimed to function as reliable visual information and evidence, purportedly based on firsthand observations, as further attested by the mention of identifiable flower amateurs (*liefhebbers*, who provided some of the flowers depicted *ad vivam veramque formam*) at the beginning of the volume. In the engravings, a wide range of hatching, lines, and dots permitted not just fine gradation effects in shading and volume but overall a better optical definition and rendering of texture, adding up to a high level of accuracy and precision. De Passe's inventive pictures offer close-up views, where corollas occasionally delicately open up to show their inside. Translating attentive visual observation into words, short ekphrastic texts referring to the black-and-white engravings precisely describe the colors of the blooms and instruct on how to apply them.

Protocols of Image Making

As De Passe's *Hortus floridus* shows, a premium was put on unmediated observation (at least in theory) in order to produce reliable images of nature. Despite the importance of prints as filtering lenses in image-making practices, it was the direct experience of nature, unaided by pictorial props, that was advocated as a crucial first step in the production of effective pictures of plants. The writer and pedagogue Henry Peacham spelled this out in his education manual *The Gentleman's Exercise*, which dealt with the teaching of drawing. Although primarily directed at amateurs, Peacham's manual was based on the type of training given in painters' workshops, and it testifies to the connections that Peacham had developed with artists, particularly the influential De Passe clan (to which Crispijn de Passe, of *Hortus floridus* fame, belonged).[51]

Peacham's methodology draws upon the well-known rhetorical trope of nature as a master to be imitated. To draw plants, Peacham encouraged firsthand observation as the initial phase and carefully described the different steps. He urged readers to collect the plants they wished to draw:

> For flowers, flyes, and such like, I [advise you], when you walke abroad into the fields, to gather and keep them in little boxes until you shall have occasion to use them. To draw a flower, begin it *ab umbone*, or the bosse in the midst: as in a Rose, or a Marigold, there is a yellow tuft, which is being first made, draw your lines equally divided, from thence to the line of your compasse, which you are the first to give, and then the worst is past.
>
> You may shew your flower, either open and faire in the bud, laden with deaw and wet, worme-eaten, the leaves dropt away with over ripenesse, &c. and as your flower, so first draw rudely your leaves, making them plaine with your coale or lead, before you give them their veines or jaggednesse.[52]

Peacham's advice to go out into the field grew from the ways artists had renegotiated their relationship with nature nearly two centuries earlier, but this author gave clearer guidelines than most of his predecessors. Drawing instruments, including rulers and compasses, were part of the tool kit needed to capture nature and translate it onto paper. In fact, geometry and its instruments could be mobilized to draw anything, not just nature. In the artist's manuals and other pedagogical resources that began to appear in northern Europe from the mid-sixteenth century, one of the first lessons is to master simple geometric forms and then reduce and simplify the shapes of objects and beings into geometric figures. In the drawing exercises he presents in *'T Light der Teken en Schilderkonst*, for example, Crispijn de Passe relies on straightforward geometric directions to decompose and depict objects. Animals are reduced to ovals, with contours made of dotted lines, at the initial stage of the drawing process.[53] These dotted lines had a very practical purpose: they could be either reproduced by hand for a first sketch or pricked for transfer onto another sheet of paper, a process widely used in the visual arts. Knowledge of geometry, along with mastery of a grammar of lines and figures, helped learners to mediate observations made after nature and translate them onto paper.

Looking, Translating, Making

When it came to translating the shapes of nature, artistic expertise was not limited to manual techniques of making, the ability to draw a line or develop compositional strategies. It also encompassed techniques of purposeful and systematic vision, which modeled pictorial approaches but could also be informed by them. Artists amplified some features found in nature and adopted viewpoints inaccessible to the unaided human eye. To this purpose, artists might draw viewers closer to or even inside the plant, placing them in the position of insects. As they carried over observation onto paper, they tried to ensure that as little as possible would be lost in translation and to find ways of making up for losses by orienting the viewer's gaze, instructing them where to look. Nature was manipulated to fit on a page and made hypervisible through an exaggerated sense of texture and presence. As drawing was increasingly mobilized as a cognitive tool on scientific expeditions overseas, image makers continued to generate innovative compositional and descriptive strategies that responded to the novelty of unfamiliar objects of scrutiny—giant plants that could not fit on a folio, or palettes of unfamiliarly rich colors.[54] To achieve this, they built on representational techniques and guidelines developed in previous decades.

Reinterpretive transfer and copy, in this context, were generative practices as much as derivative ones: they produced authoritative images through which the observation of nature could be translated and filtered to deliver more images. In this pioneering process, botanists and image makers instituted image making as a valuable form of knowledge—as science, in the sense of a theoretical and practical activity of systematically studying the structure of the natural world through observation and experience. The images thus created did more than stabilize and document ephemeral forms: they constituted innovative ways of observing and understanding plants, and offered a pictorial and discursive apparatus to engage with nature more broadly and dynamically. As a result, artists established themselves as essential visual translators, capable of making sense of a natural world that was expanding apace.

Notes

1 On this turning point in botany, see Kusukawa, *Picturing*; Ogilvie, *Science of Describing*.

2 Fuchs (1501–1566), for instance, was a physician; Brunfels (c. 1488–1534) trained as one later in his professional career.

3 Particularly the printed herbals and natural history encyclopedias of the *Hortus sanitatis* type, published from the 1480s and illustrated with often schematic and stylized woodcuts.

4 Ogilvie, *Science of Describing*, 88–208; Koreny, *Albrecht Dürer*, 11–26.

5 See especially the groundbreaking work of Horst Bredekamp, Lorraine Daston, Florike Egmond, David Freedberg, Sachiko Kusukawa, Brian Ogilvie, and Claudia Swan.

6 See Davies, "Catalogical Encounters," 230–31.

7 On the geographical background and religious environment, see Harrison, *Bible*, 64–120.

8 On the Italian materials and context, see Bellorini, *World of Plants*; Tomasi, "Study."

9 See, e.g., Egmond, "Clusius."

10 I thank Kristyna Comer for helping me flesh out the notion of hypervisibility.

11 On observation, see Pomata, "Observation." On printing botanical pictures in early modern Germany, Kusukawa, *Picturing*, 26–97. On reproducible

images and the printing press, Ivins, *Prints*, 51–70; Landau and Parshall, *Renaissance Print*, 28–30 (and on printing images for herbals, ibid., 247–59).

12 Emphasis added. Fuchs, *The Great Herbal*, dedicatory epistle, ed. Meyer, Trueblood, and Heller (hereafter *Great Herbal*), 213.

13 We find here distant echoes of the *paragone* debate on painting and poetry. See Ames-Lewis, *Intellectual Life*, 163–76; Azzolini, "In Praise of Art."

14 Fuchs, *Great Herbal*, 213–14.

15 See, e.g., Dürer, *Underweysung der Messung*, dedicatory epistle. On drawing practices and manuals in early modern Germany, Remond, "Artful Instruction."

16 Castiglione, *Book of the Courtier*, 96–98. See also Remond, "Draw Everything," 302–3.

17 Fuchs, *Great Herbal*, 213; Ogilvie, *Science of Describing*, 195–96; Kusukawa, *Picturing*, 109–13.

18 Ibid., 208.

19 Brunfels, *Herbarum vivae eicones*, "De Nenuphare," 36–40.

20 This is not systematically the case in Weiditz's herbal, unlike Fuchs's.

21 Daston, "Epistemic Images."

22 Ogilvie, *Science of Describing*, 197.

23 Fuchs, *De historia stirpium*, CLXXVI "De Lamio," 468; I thank John Burden for his help with the translation. On text and argument in Fuchs and the reception of his herbal, see Kusukawa, *Picturing*, 101–37, esp. 131–36 on notions of translation and transmission.

24 Fuchs, *De historia stirpium*, 469. See, e.g., the hand-colored copy in the Hunt Institute Library, Carnegie Mellon University, Pittsburgh (Call no. +CA F951h).

25 See also Lorraine Daston's discussion of the synoptic image in different realms of natural history. Daston, "Synoptic Scientific Image."

26 Fuchs, *De historia stirpium*, "Papaver erraticum alterum," 516.

27 Bock, *De stirpium*, XI, Praefatio (translated from the 1552 Latin edition). See also Ogilvie, *Science of Describing*, 198–99.

28 Cited in Elliott, *Old World*, 21. Fuchs's herbal includes 402 European plants (325 of them German) out of 511 plants. Fuchs, *Great Herbal*, 124–25.

29 See Smith, "Art, Science, and Visual Culture," 93–94.

30 Dürer, *Vier Bücher*, III.

31 Peletier, *Art poëtique*, 34. On early modern translation, see Dobenesque, "Style et traduction."

32 See Koreny, *Albrecht Dürer*, cat. 61.

33 Rupprich, *Dürer*, 100; see also Hess, "Die Natur."

34 The *Four Books* do not discuss horses, but Dürer left material on the topic, plagiarized by Sebald Beham. See Cuneo, "Artist."

35 Gauvin, Jacquemard, and Lucas-Avenel, "L'*Hortus sanitatis*"; Mayer, "Die Wahrheit."

36 See Swan, "*Ad Vivum*," and for an excellent discussion of the term, Balfe and Woodall, "Introduction." On Fuchs's water lily, also Kusukawa, *Picturing*, fig. 3.3.

37 Such as the woodcut copy in Conrad Gessner's *Historiae animalium* (1551). Dackerman, *Prints*, cat. 35, 37, 38. On naturalism in natural history, see Ackerman, "Early Renaissance 'Naturalism.' "

38 On eyewitnessing, see, e.g., Fuchs, *Great Herbal*, dedicatory epistle, 209–10, 212.

39 On early modern copying at the crossroads of art and science, see Fransen and Reinhart, "Practice of Copying."
40 Dodoens, *'Trium priorum de stirpium historia commentariorum imagines*, 221–22.
41 Ibid., Epistle to the reader (emphasis added).
42 Such as Schott v. Egenolph (1533), http://copyrighthistory.org/record/d_1533. On control, see Kusukawa, *Picturing*, 83–97.
43 Plantin purchased blocks from van der Loe's widow in 1581. Fundamental on the circulation and recycling of blocks for herbals in the Plantin workshop is Chen, "Woodblock's Career." Chen uses the category of "transfer" in the context of knowledge transfer.
44 On images and translation in early modern science, see Fransen, "Introduction," 8–12.
45 On the long-lasting influence of Fuchs's templates, see Pinault-Sørensen, *Livre de botanique*, 145–47.
46 Leesberg and Balis, *Collaert Dynasty*, 6:244–54, and on the Collaert family, 1:xxxix–xcvii; on printed *florilegia*: Segal and Alen, *Dutch and Flemish Flower Pieces*, 2:917–95. Collaert seems to be the first to use the term *florilegium* to denote a collection of flower motifs, in the title plate to his series of floral engravings.
47 See, for example, Dodoens, *Pemptades*, II. V, 202. The same picture appears in Clusius's 1583 *Rariorum aliquot stirpium per Pannoniam Austriam et vicinas quasdam provincias observatarum Historia* and de Lobel's 1581 *Kruydtboeck*.
48 On De Boodt's albums, their complex history (including the presence of different hands), and copying practices, see Maselis, Balis, and Marijnissen, *Albums*, 30–71.
49 De Passe, *Hortus floridus*. Similar portraits appear on the title page of the posthumous 1608 edition of Dodoens's *Cruydt-boeck*, published in Leiden. Emanuel Sweerts also nodded to Dodoens, along with Mathias de Lobel and Carolus Clusius, in the brief note to the reader (in Latin, Dutch, German, and French) opening his own *florilegium*. Sweerts, *Florilegium*, fols. 4–5.
50 See Nissen, *Buchillustration*, 1:73–75, 2: no. 1494; Veldman, *Crispijn de Passe*, 205–12.
51 The De Passes were an important family of engravers and publishers active in the late sixteenth century and seventeenth century. On Peacham and the De Passes, see Veldman, *Crispijn de Passe*, 179.
52 Peacham, *The Gentleman's Exercise*, 54.
53 See the plates in De Passe, *'T Light*, V; also Remond, "Draw Everything," 293, 307–9.
54 On the global context, see Bleichmar, *Visual Voyages*.

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Part V

Expertise in Translation

Part V Introduction

Expertise in Translation

Sven Dupré

Translation is an epistemic practice. In the wake of the seminal work on the cultural history of translation initiated by Peter Burke, the field of the history of science and medicine has shifted towards discussing practices of translation.[1] Instead of asking about the "fidelity" or "faithfulness" of a translation (previously thought of as a copy or replica of an original), the focus on translation has allowed historians of science and medicine to scrutinize the changes and transformations of knowledge in motion. We no longer look at these processes of translation as betrayals of the original, but as processes productive of knowledge.

Against the "illusion of linguistic transparency" (in the words of Lawrence Venuti), making the translator invisible, the agency of translators is key in processes of epistemic translation. Yet, as Venuti has argued, "all translation, regardless of genre or text type, including translation that seeks to register linguistic and cultural differences, is an interpretation that fundamentally domesticates the source text."[2] Consequently, not all translators become visible nor is all translators' agency recognized. Paying attention to the ethics and politics of translation highlights that translation is a process of inclusion and exclusion. The contributors to this section scrutinize the conditions under which translators become visible or remain invisible.

A focus on translation can reveal silenced, marginalized, and multilingual voices without falling into the trap of repeating the binary logic of translation as a movement between distinct languages or cultures. But we should also acknowledge that translation is destructive, and that translation is as much about silencing the voices of translators of all sorts—such as local informants—and erasing knowledge as it is about creating new knowledge. Importantly, Marwa Elshakry has shown how the strategies of translators and attitudes towards translations have depended upon ideas of the nature of science, which were also shaped by geopolitical factors.[3] In a recent essay on a new global history of science, James Delbourgo relates this anecdote:

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> When Sultan bin Salman of Saudi Arabia left Earth on the shuttle *Discovery* in 1985, the prince became the first Arab and first Muslim astronaut in space. In preparing for this flight, NASA officials were unsure how this cross-cultural collaboration would work, so they invited personnel from the oil company Aramco to provide bin Salman's American colleagues with a one-day seminar in Saudi culture. "When people heard about Saudi Arabia, … they would have perhaps been reminded of Lawrence of Arabia, of camels and sand, of harems and sultans and princes and sheikhs. A lot of Americans didn't quite know what to make of a Saudi astronaut. What kind of person would that be, and how do you integrate him as a crew member on a space shuttle?" In reality, this knowing Saudi prince had an MA in communications from the University of Denver, understood American culture, and spoke English rather better than the French astronauts associated with his mission. ... "But somehow … NASA administrators had less worries about cultural misunderstandings with the French."[4]

Views on translation are colored by geopolitics, regardless of the historical period in which they occur. Translations, Ralph Bauer and Jaime Marroquín Arredondo have argued, were not "the happy product of multicultural cooperation conducted for the benefit of humanity at large"; rather, "they were deeply enmeshed in early modern geopolitics and sociopolitics of conquest, imperial rivalry, and protonationalism."[5] European translations of Amerindian knowledge were highly dependent upon networks established by colonial authorities in the Americas, which included native sources of knowledge—for example, knowledge of the names and uses of local plants. However, the colonial character of cultural translation in the early Americas caused the voices of these native informants to be suppressed in the European publications. Bauer and Marroquín Arredondo adopt the term "transculturation," emphasizing the personal agency in translations, which they regard as "open and conflicting processes of negotiation across cultures."[6] That contrasts sharply with views of translation as encapsulation, resonating with the construction of the idea of Europe as the rightful heir to the Greek heritage, which underlies much scholarship on translation movements. Envisioning translation as transculturation holds the promise of reorienting the Eurocentric history of science and medicine.

In this section, Amos Bertolacci (Chapter 13) and Nicola Polloni (Chapter 14) both go the heart of one of the most important premodern translation movements, in twelfth-century Toledo. They bring out the teamwork involved in translation and describe how several translation teams collaborated and competed in the city. The choices of what and how to translate depended upon the institutional frameworks of which the translators were part, the identity and the aims of translators, and the intended audiences of the translations. Likewise, in her chapter

(16), Maria Auxent shows that Richard Eden's translation of Sebastian Münster's *Cosmographia universalis* transformed it to make it serve the needs of the political environment in which it was designed to land.

All these chapters thus speak intricately to the new histories of translation written by Peter Burke, Laurence Venuti, Marwa Elshakry, James Delbourgo, Ralph Bauer, and Jaime Marroquín Arredondo. Some linguistic transformations did violence to the source texts. As Bertolacci shows, the Latin translations of Avicenna were selective, excluding most of his work in logic and mathematics, to create an image of Avicenna that was very different from its Arabic original and more in line with the philosophical identity of the translators and their intended audience. It is an instantiation of the destructive character of translation, and the entanglement of translation in geopolitics, that the translations of Avicenna also erased most of its Islamic elements.

Moreover, Bertolacci and Polloni focus on the collaborative character of translation. Collaboration was necessary, as translation teams had to rely on complementary linguistic expertise. In twelfth-century Toledo, Ibn Daud and Gundissalinus combined their knowledge of Arabic and Latin. However, as Polloni shows, they also used vernacular Castilian as their language of communication. This not only highlights the multilingual environment—often richer than just consisting of the languages of the source and destination texts—upon which translation depended, but also reveals the complex relationship of translation with orality and literacy. With reference to Michel Callon's work on the sociology of translation, Harold Cook approaches translation as the process of speaking on behalf of a concern, thus extending the meaning of translation to that of giving voice (by speaking on behalf of groups of humans, or in the case of Callon's research, even scallops), sometimes by displacing other voices. This once more underscores the destructive character that translations can have.[7]

On the other hand, in her chapter (15), Florence Hsia quotes Walter Ong's seminal work on orality and literacy: "Orality knows no lists or charts or figures."[8] Hsia scrutinizes the process of translation of celestial observations into tables, thereby showing how translation is embedded in a range of paper practices—that is, a much wider set of practices of reading and note-taking. The compilation of translations, the piling up of multiple renderings from multiple source languages, and the reorganization of source materials adding commentary upon commentary seems to have been characteristic rather than exceptional for translations in the premodern period. Embedding translation in a world of paper practices nicely brings out this point, the continuum between translated texts and commentaries upon them. But it also raises the important issue of the limits of the concept of translation, and leaves us with an open question to ponder for the future: What is epistemic translation? What does it encompass? And when do we no longer speak of epistemic translation?

Notes

1 Burke and Hsia, *Cultural Translation*. For an overview of the more recent literature, see Dupré, "Science and Practices of Translation."
2 Venuti, *Translator's Invisibility*, viii, xii.
3 Elshakry, *Reading Darwin in Arabic*.
4 Delbourgo, "Knowing World," 397–98.
5 Marroquín Arredondo and Bauer, *Translating Nature*, 22.
6 Ibid., 16.
7 Cook, *Translation at Work*, 16; Callon, "Some Elements."
8 Ong, *Orality and Literacy*, 96.

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13 The Translator's Cut

Cultural Experience and Philosophical Narration in the Early Latin Translations of Avicenna

Amos Bertolacci

The Latin medieval translations of the philosophical magnum opus of Avicenna (Ibn Sīnā, d. AH 428/1037 CE), the *Kitāb al-Shifāʾ* or *Book of the Cure/Healing*, are interesting in many respects—for example because of their chronological closeness to Avicenna's original work and their cooperative nature. Most importantly for the present purposes, the translations were of only one of Avicenna's philosophical works, and of this they covered a portion that was significant, but in no way complete. In this chapter, I explore the ways in which the translators "pruned" the content of the *Shifāʾ* and carried into Latin an extensive picture of this highly structured encyclopedia without covering its full scope. The Latin translators of Avicenna's work—especially the earliest ones, discussed here—made their selections according to a discernible design of their own. To use the language of cinematography, and imagining the translators as movie directors, the translations they made are their "translators' cut," in a double sense. On the one hand, the translations are the result of the translators' careful sorting of parts of Avicenna's work; on the other, in the subsequent process of "distribution" in the "movie theaters" (universities and other cultural centers of the time), they seem to have circulated in a configuration different from that devised by the translators—piecemeal, or in partial aggregations, not in their full scope.

The Latin translations of Avicenna were made in two phases: in the second half of the twelfth century in or in connection with the city of Toledo, and in the thirteenth century in Burgos.[1] Here, I focus on the Toledan phase and the very first two known translators of the *Shifāʾ* into Latin, the Jewish Abraham ibn Daud (or Avendauth, d. c. 1180), and the Christian Dominicus Gundissalinus (or Gundissalvi, d. probably before 1194).[2] I only glance at the other two translators of the Toledo phase, Alfred of Sareshel (or Shareshill) and Michael Scot, since they translated parts of the *Shifāʾ*, or were trained to do so, in the footsteps of Ibn Daud and Gundissalinus. The latter deserve special attention as the true initiators of the enterprise of translating Avicenna's *Shifāʾ* into Latin.[3] Since they worked as a team (most famous is their joint translation of the section of the *Shifāʾ* on psychology), I study Ibn Daud and Gundissalinus together, ascribing to both of them not only the translations they made

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together, but also those that they individually executed on the basis of a shared plan.

The "cut" of Ibn Daud and Gundissalinus as translators of the *Shifāʾ* is an interesting indicator of the intellectual climate in which they lived, their understanding of the *Shifāʾ*'s architecture, and the interreligious environments in which Avicenna's masterpiece was circulating in contemporary Andalusia. They selected the encyclopedic *Shifāʾ* from Avicenna's many philosophical works (some of which appear to have been available in Andalusia in the twelfth century) as his most Aristotelian work. Within it, they prioritized some parts and sections over others, preferring natural philosophy and metaphysics over logic and entirely excluding mathematics. In the pivotal final part—the metaphysical section (*Ilāhiyyāt*, *Science of Divine Things*), the doctrinal and structural pinnacle of Avicenna's *summa*—their translation choices left visible marks on the beginning (its title) and the end (the last two chapters, on Islamic tenets).

These three kinds of interventions might conceivably be explained as purely contingent, resulting from the unavailability of the other works of Avicenna in Andalusia or the defective manuscripts at the translators' disposal. I leave this possibility aside. Instead, I would like to follow a more ambitious path, assuming that Ibn Daud and Gundissalinus made deliberate choices. These choices can be explained on the basis of three interrelated, broadly "cultural" experiences, deeply rooted in the translators' educational upbringing, epistemic approach to reality, and scholarly agenda. First, a sense of school affiliation and the acknowledgment of Aristotle's paramount authority may have led them to opt for the most Peripatetic work of Avicenna available—their "screenplay." Second, their scholarly interest in the *philosophia realis* seems to have inspired their selection of natural philosophy, psychology, and metaphysics, above logic and mathematics, as the parts of Avicenna's philosophical encyclopedia most worthy to be translated—their "shooting and montage." Finally, their sense of acting as philosophers and of belonging to the philosophical class, together with their awareness of the limited scope of any religious affiliation (be it Jewish, Christian, or Muslim) in comparison to the universal force of *falsafa*, may have determined their "philosophization" of the title of Avicenna's metaphysics and "de-Islamization" of its last two chapters—their "final close-up and dissolve."

In all these ways, Ibn Daud and Gundissalinus conveyed to Latin readers an image of Avicenna's philosophy that was palpably different from its Arabic original as their cultural experience prompted a special narration of the work they were translating. They narrowed Avicenna's wide range of philosophical genres down to the one they considered most important, the *summa per modum expositionis* (a comprehensive philosophical exposition in which Avicenna reworks the inherited canonical texts on the subject), and chose a single specimen of that genre (the *Shifāʾ*) among the several offered by Avicenna. They disjointed the all-encompassing structure of the *Shifāʾ*, reassembling the Latin translations of some of its sections with a different balance of disciplines and a new theoretical orientation. Finally, they inserted the *Shifāʾ* into a non-confessional terrain of philosophical discussion, in which Aristotle's "lay" and universalist philosophy as elaborated by Avicenna was to provide neutral ground for philosophical speculation common to the three "religions of the book."

In so doing, these translators manifested what the movie director Pier Paolo Pasolini called an "ingenious analytical mind."[4] Paraphrasing Pasolini and applying his analysis of the filming of Kennedy's death to the present case, I argue here that Ibn Daud and Gundissalinus's "work of choice and coordination" produced a novel narration of the *Shifāʾ* by selecting and assembling the "truly significant moments," and gave a new "objectivity" to Avicenna's work that catered to the cultural needs of their Latin audience. This operation was, in a way, truly Avicennian in spirit: it echoed the kind of updating and reform to which Avicenna himself subjected Aristotle's corpus in the *Shifāʾ*.

Screenplay

The *Shifāʾ* (c. 411–18/1020–27) is the only major philosophical work by Avicenna systematically translated into Latin during the Middle Ages and the Renaissance.[5] Among Avicenna's other seven *summae* of philosophy, only some fragmentary quotations of the *Kitāb al-Ishārāt wa-l-tanbīhāt* (*Book of Pointers and Reminders*) and of the *Kitāb al-Najāt* (*Book of the Salvation*) are preserved in the thirteenth-century *De pugio fidei adversus Mauros et Judaeos* (c. 1270) by the Spanish Dominican Raimundo Martì. The many other types of philosophical works written by Avicenna (classifications of the sciences, systematic commentaries, etc.) do not appear to have left any trace in Latin medieval culture until the Venetian Andrea Alpago (d. 1521) translated a handful of them, together with some works of medicine by Avicenna, presumably in the first two decades of the sixteenth century. The fact that Ibn Daud and Gundissalinus chose a *summa per modum expositionis* to the exclusion of the other genres of Avicenna's works shows that they were interested in the systematic arrangement of philosophy that Avicenna uses in his *summae*.

Avicenna's medicine presents a different case. His magnum opus *Qānūn fī l-ṭibb* (*Canon of Medicine*) was integrally translated into Latin in the twelfth century and was accompanied quite early by full Latin translations of another two of his medical treatises—*al-Adwiya al-qalbiyya* (*Cardiac Remedies*) and *Urjūza fī l-ṭibb* (*Poem of Medicine*)—between the late thirteenth and early fourteenth century.[6]

Whereas in medicine Avicenna produced a single unparalleled masterpiece, the *Qānūn fī l-ṭibb*, in philosophy many of his *summae* competed for preeminence. Why, then, did Ibn Daud and Gundissalinus select the *Shifāʾ*, preferring it to, say, the *Ishārāt wa-tanbīhāt* and the *Najāt*, two works by Avicenna that were then enjoying great exegetical attention and doctrinal dissemination in the East?

The reason is unlikely to have been a lack of access to Avicenna's other works.[7] We may therefore wonder whether the *Shifāʾ* was selected for translation into Latin as the most extensive, the richest and most complete, exposition of philosophy ever produced by Avicenna. This possibility cannot be discarded, but it does not explain everything: if the translators chose the *Shifāʾ* because it was Avicenna's most extensive work of philosophy, why would they have decided to translate only some portions of it and skip others, according to the piecemeal strategy I will detail below?

I argue here that the *Shifāʾ* was selected by the translators because it was the most Aristotelian of Avicenna's *summae*, as Avicenna himself claims in the Prologue. That the Latin translators had some perception of the particularly Peripatetic character of the *Shifāʾ* within Avicenna's philosophical output is undisputable: one of the first parts of the work they translated was that Prologue, in which Avicenna says that the book is "more accommodating to my Peripatetic colleagues" (*cum participibus de peripateticorum numero plus concordans*) and that Aristotle is "the paradigmatic master" in the discipline of natural philosophy (*praecellens in hac arte*).[8] Moreover, Ibn Daud and Gundissalinus in their translation of the *Shifāʾ*'s psychology, followed by Alfred of Sareshel in his translation of some chapters of the meteorology and Michael Scot in his translation of the zoology, stress the connection of these parts of the *Shifāʾ* with the corresponding writings of Aristotle.[9] This option in favor of an "Aristotelian" Avicenna by Ibn Daud and Gundissalinus, and by the other translators of the first phase, is congruent with the diffusion of new Latin translations of Aristotle's works and their scholarly and institutional success at the time—a fundamental step in the process that would make Aristotle the acknowledged *Philosophus* and the unparalleled philosophical authority in thirteenth-century Europe.

The Aristotelian narrative, then, seems to have guided the screenplay chosen by Ibn Daud and Gundissalinus and their immediate successors. It will also have left its mark on the decisions made by the later, thirteenth-century translators.[10]

Shooting and Montage

Missing Footage

After the Preface (comprising the Introduction to the *Shifāʾ*, written by Avicenna's disciple, secretary, and biographer Abū ʿUbayd al-Jūzjānī, and Avicenna's own Prologue), the *Shifāʾ* consists of twenty-two distinct sections (nine on logic, eight on natural philosophy, four on mathematics, plus the single section on metaphysics, which ends with a short appendix on practical philosophy). It fills more than five thousand printed pages in the standard Cairo edition (1952–83). This *summa* is Aristotelian primarily in its organization, using Aristotle's corpus as its remote source and doctrinal model with the addition of Porphyry's *Isagoge* in logic and the mathematics of Euclid, Ptolemy, and Nicomachus of Gerasa (possibly also of Aristoxenus) to substitute for the mathematics that is missing in the transmitted *corpus Aristotelicum*.

The overall articulation of the *Shifāʾ* and its dependence on canonical writings in ancient Greek philosophy and science can be seen in the first two lines of each section of Table 13.1. The remaining lines document which of these sections was translated into Latin during the various phases of the translation process: LT 1.1, the translations by Ibn Daud and Gundissalinus; LT 1.2, the subsequent translations of the first phase, by Alfred of Sareshel and Michael Scot; and LT 2, the translations of the second phase.

The Latin translations cover the four main parts of the *Shifāʾ* differently. Logic was very selectively translated into Latin: only one full section, the first, corresponding to Porphyry's *Isagoge*, and some excerpts of the fifth and the eighth sections, corresponding to the *Posterior Analytics* and the *Rhetoric*, are extant; the remaining six sections were overlooked. Natural philosophy was translated almost completely (with the exception of the final chapters of treatise III and the entire treatise IV on the general principles of physics, mysteriously left untranslated in LT 2, and botany, whose Latin translation is merely attested), but cumulatively—over the course of the three stages of translation considered here. Metaphysics was fully translated at the very start. By contrast, no section of the mathematical part of the *Shifāʾ* was ever translated.

The selectiveness of the translations appears very clearly in Figure 13.1, which shows the length of the four main parts of the *Shifāʾ* on the basis of the current edition. In the Cairo edition, logic is by far the longest part, followed by natural philosophy, mathematics, and metaphysics. In the absence of a more precise measurement, a certain lack of uniformity among the four parts should be expected, not only because of the variable length of the canonical writings that Avicenna uses as models, but also because he develops the content of some parts more than of others.[11]

In the Latin translation, the length of these parts departs considerably from the Arabic original. Aggregating all three translations, we find that only 108 pages of logic were translated, almost the entire natural philosophy (1,265 pages out of 1,388), nothing pertaining to mathematics, and all the 453 pages of metaphysics.

In other words, the decision by the Latin translators, following in the footsteps of Ibn Daud and Gundissalinus, to pay less attention to the *Shifāʾ*'s logic than its natural philosophy and metaphysics, and to totally neglect its mathematics, does not reflect the importance that Avicenna himself ascribes to these disciplines in his *summa*. In the Arabic work, logic is a very extensive part and mathematics a substantial one, unlike in other, shorter *summae* by Avicenna, where mathematics is absent or

Table 13.1 The Content and Latin Translations of Avicenna's *Shifāʾ*

Preface and (I) Logic (9 sections)

Shifāʾ	Preface	*Madkhal*	*Maqūlāt*	*ʿIbāra*	*Qiyās*	*Burhān*	*Jadal*	*Safsaṭa*	*Khiṭāba*	*Shiʿr*
Model	---	Porph. *Isag.*	*Categ.*	*De int.*	*An. Pr.*	*An. Post.*	*Topica*	*El. Soph.*	*Rhetor.*	*Poet.*
LT 1.1	*Verba discipuli Avicennae; Verba Avicennae*	*Logica*	---	---	---	*De convenientia et differentia scientiarum* II.7	---	---	---	---
LT 1.2	---	---	---	---	---	---	---	---	---	---
LT 2	---	---	---	---	---	---	---	---	Fragms.	---

(II) Natural Philosophy (8 sections)

Shifāʾ	*Samāʿ ṭabīʿī* (I–IV)	*Samāʾ wa-ʿĀlam*	*Kawn wa-Fasād*	*Afʿāl wa-Infiʿālāt*	*Maʿādin wa-Āthār ʿulwiyya*	*Nafs*	*Nabāt*	*Ḥayawān*
Model	*Physica*	*De caelo*	*De gen. corr.*	*Meteor.* A.3 B.1–3 Δ	*Meteor.* A–Γ	*De anima Parva naturalia*	Ps.-Arist. *De plantis* I	*Hist. Part. Gen. Animal.*
LT 1.1	*Liber primus naturalium* I-III.2	---	---	---	---	*Liber de anima seu Sextus naturalium*	---	---
LT 1.2					*De miner.* I.1 I.5 II.6			*De animal.*
LT 2	III.2–10	*De caelo*	*De gen. corr.*	*De act. pass. qualit. prim.*	*Libri metheor.*	---	Attested	---

(III) Mathematics (4 sections)

Shifāʾ	*Uṣūl al-handasa*	*ʿIlm al-Hayʾa*	*Ḥisāb*	*Jawāmiʿ ʿilm al-mūsīqá*
Model	Euclid *Elements*	Ptolemy *Almagest*	Nicomachus of Gerasa *Introduction to Arithmetic*	Ptolemy (Aristoxenus?) *Harmonica*
LT 1–2	---	---	---	---

(IV) Metaphysics [+ Appendix of Practical Philosophy] (1 section)

Shifāʾ	*Ilāhiyyāt*
Model	Aristotle, *Metaphysics* [Arist., *Nicomachean Ethics*; Bryson, *Oikonomikos*; Plato, *Republic, Laws*]
LT 1.1	*Liber de Philosophia prima sive scientia divina*
LT 1.2–2	---

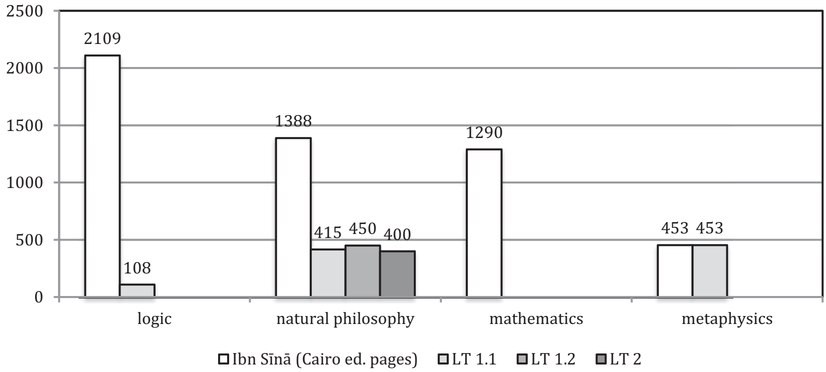

Figure 13.1 The length of different sections of Avicenna's *Shifāʾ* in the Arabic and the Latin translations.

Source: Author.

simply copied from previous works. In general terms, we can say that, thanks to the translators' choices, Avicenna appeared to Latin readers as a much less prominent logician than he was in his own setting, ceased to be a mathematician at all, and emerged primarily as a physicist and metaphysician.

From this general viewpoint, Ibn Daud and Gundissalinus's seminal choices seem to reflect the distinctive large-scale cultural experience noted above, and an intention of responding, on its basis, to the cultural needs of the intended audience. Within the logic of the *Shifāʾ*, for example, the translators' decision to privilege the section on Porphyry's *Isagoge* may be seen as a contribution to the debate on universals that had been thriving in Latin philosophy since the time of Roscelin and Abelard in the first half of the twelfth century. The omission of the rest of the logic suggests various explanations. Perhaps the translators understandably hesitated in the face of this part's enormous length and the expertise in logic required for its translation; perhaps, too, they thought that the culture of the day would not benefit inordinately from a logical theory that, despite its originality, was not entirely new in the Latin world—at least in part, it was already available in Latin in the *logica vetus* of Aristotle and its commentaries.[12] The *Shifāʾ*'s natural philosophy and metaphysics, in contrast, was unprecedented. It seemed capable of flanking the new physics and metaphysics of Aristotle, then being translated from Greek into Latin, with a competent interpretation and a seminal form of commentary. Finally, previous translations meant that Latin readers already had access to abundant material on the Arabic *quadrivium*; the total neglect of the mathematics of the *Shifāʾ* should be set against this background.

Individual Scenes

Thanks to recent progress in lexicographical analysis, six distinct translations of the *Shifāʾ* can be ascribed to Ibn Daud and Gundissalinus within LT 1.1, as follows.

(i) Jūzjānī's Introduction with *quaedam capitula intentionum universalium* ("some chapters on general goals" or "on universal concepts") of Avicenna, which can be identified with Avicenna's Prologue and at least chapter I.12 of the *Madkhal* (Introduction: Avicenna's reworking of Porphyry's *Isagoge* in the first section of the logic of the *Shifāʾ*).[13] The Latin translation of *Madkhal* I.12 is entitled *De universalibus* and is ascribed to Ibn Daud in the manuscript tradition. Ibn Daud translated this group of chapters,[14] wrote a short Foreword, and sent them "privately" to the archbishop of Toledo (arguably John of Castelmoron, in office 1152–66) to attract his attention and gain his support. This translation was probably made at the very beginning of the project and later added, either by its author or in the subsequent manuscript tradition, to translation (ii).[15]

(ii) The rest of the *Madkhal*: an anonymous translation that scholars ascribe either to Ibn Daud or to Gundissalinus, now edited, together with (i), as *Logica*.[16]

(iii) Chapter II.7 (the seventh chapter of the second treatise) of the section on logic that corresponds to the *Posterior Analytics* (*Kitāb al-Burhān*, *Book of Demonstration*) was published as *Summa Avicennae de convenientia et differentia subiectorum*. This chapter was probably translated by Gundissalinus, who incorporated it into his *De divisione philosophiae*.[17]

(iv) The first two treatises (I–II), the first chapter of the third treatise (III.1, called *Prologus* in the Latin translation), and some lines of the following chapter (called *Capitulus primus*) of the *Samāʿ ṭabīʿī* (*Natural Auscultation*), which is the first section of the natural philosophy of the *Shifāʾ* in four treatises. This translation is edited by Simone Van Riet as *Liber primus naturalium*, with differing specifications of the individual treatises' subject matter. It is anonymous in all the known manuscripts, but recent lexicographical analysis suggests it can be ascribed to Gundissalinus.[18]

(v) The translation of the *Kitāb al-Nafs* (*Book of the Soul*), the sixth section of natural philosophy of the *Shifāʾ*, was edited as *Liber de anima seu Sextus de naturalibus*. It was made jointly by Ibn Daud and Gundissalinus in teamwork, as Ibn Daud's foreword to the translation attests.[19]

(vi) The translation of the *Ilāhiyyāt* (edited as *Liber de philosophia prima sive Scientia divina*), the part of the *Shifāʾ* dealing with metaphysics.

> Three of the translation's twenty-five manuscripts ascribe it to Gundissalinus, who may be regarded as its probable translator.[20]

These six translations were made in the course of two decades, between 1161 or 1162, when Gundissalinus came to Toledo, and 1180, when Ibn Daud died there. Scholars disagree on their sequence.[21] Translation (i) falls naturally at the beginning of the period, not far removed in time from translation (v), since both are dedicated to the same bishop of Toledo, in office until 1164. Translation (iv) can tentatively be placed as the last, if we take its abrupt end, in the middle of the second chapter of the third treatise, as a sign of incompleteness, usually attributed to vicissitudes on the translators' side.[22] The time of composition of the other translations is still to be ascertained.

The mismatch between the sequence of the translations and the order of their Arabic sources suggests a gradual understanding of the *Shifāʾ* by the translators and a translation project refined and updated over time. The *Maqāṣid al-Falāsifa* (*Intentions* or *Doctrines of the Philosophers*) of al-Ghazālī (Algazel, d. 1111), structured according to the sequence logic–metaphysics–natural philosophy, as opposed to the *Shifāʾ*'s sequence logic–natural philosophy–metaphysics, may have played a role in this process. This work was translated into Latin by Gundissalinus and a certain Magister Johannes as *Summa theoricae philosophiae* or *De philosophorum intentionibus* in the same Toledan environment as the translations LT 1.1.[23]

The Plot

Ibn Daud and Gundissalinus translated entire sections or chapters of three of the *Shifāʾ*'s four main parts—always including the first (or, for metaphysics, only) section. Being the only Latin translators ever to engage with more than one part of Avicenna's work,[24] they probably had comprehensive access to the Arabic original of the entire *Shifāʾ*.[25] They also translated at least three fundamental texts explaining how the *Shifāʾ* is constructed: Avicenna's remarks on the parts of the work and their raison d'être in the Prologue, complemented by al-Jūzjānī's sketch of the work's material genesis in his Introduction; and the overview classification of the different philosophical sciences in the chapters *Madkhal* I.2 and *Burhān* II.7, which also schematically map the parts and sections of the *Shifāʾ* itself. *Madkhal* I.2 has a prominent place at the beginning of the first part of the *Shifāʾ* translated by Ibn Daud and Gundissalinus, whereas *Burhān* II.7 achieved widespread visibility in Latin by being inserted into Gundissalinus's own *De divisione philosophiae*.

All this allows us to go beyond the impression of a translation project planned ambitiously, but realized incompletely and left unfinished, or of a collection of unconnected individual translations, randomly extracted from the *mare magnum* of Avicenna's *Shifāʾ*. A more interesting explanation is that the translations ascribed to Ibn Daud and Gundissalinus are the ones they specifically wanted to make, and that a keen understanding of Avicenna's philosophy in the *Shifāʾ* governed their choice.

The hypothesis advanced here is that Ibn Daud and Gundissalinus gave Latin readers a sampling of the entire *Shifāʾ*, in which some fundamental connections between the work's distinct parts come to the fore more strongly than in the Arabic original because of the translators' selectivity. A well-defined profile of the *Shifāʾ* emerges from Ibn Daud and Gundissalinus's selection, emphasizing the main structural junctures or nodal points. A special bond connects the parts of the *Shifāʾ* they translated—the doctrine of universals in logic, the theory of the general principles of physics, and the doctrine of the soul in natural philosophy, all of which culminate in metaphysics.[26]

This is hardly a coincidence. The doctrine of universals, the general principles of physics, and psychology are the sections of the *Shifāʾ* in which Avicenna most often points his readers forward to metaphysics for a definitive discussion, and to which he makes frequent back-references in the *Ilāhiyyāt*.[27] This network of cross-references, which Avicenna deploys in order to keep all the elements of his immense *summa* epistemologically interconnected, finds its fullest expression in *Madkhal* I.2 and *Burhān* II.7, chapters that also refer forward to the metaphysics section and are recalled there.[28] *Madkhal* I.2 emphasizes the place of logic in the classification of the philosophical sciences; *Burhān* II.7 establishes the status of metaphysics as *regina scientiarum*.

To resume our guiding analogy: putting together the various scenes created during shooting, we obtain a movie with a well-defined plot, one that is encoded in the "trailer" of *Madkhal* I.2 and *Burhān* II.7,[29] and finds its doctrinal "happy ending" in the *Ilāhiyyāt*. The metaphysical orientation of Ibn Daud and Gundissalinus's translations is evident on quantitative grounds: as we have seen, the *Ilāhiyyāt* is the only part of the *Shifāʾ* that was fully translated into Latin (not only in LT 1.1, but also subsequently), and, though shorter than the other three parts in the Arabic original, it was longer than the sections of logic and natural philosophy translated in LT 1.1.[30] By connecting the alpha and omega of the *Shifāʾ* more directly than in the Arabic original, Ibn Daud and Gundissalinus's "cut" encapsulated the quintessence of Avicenna's work. They would go on to use Avicenna creatively as a philosophical source in their own ways, with equal emphasis on metaphysics.[31]

Final Close-up and Dissolve

"Philosophizing" Avicenna's Science of Divine Things

The title of the *Ilāhiyyāt* (*Divine Things*) in LT 1.1 reads *Liber de philosophia prima sive scientia divina* (*Book on First Philosophy or Divine

Science) in the critical edition of the Latin translation; the first chapter is headed "On beginning to seek after the subject matter of first philosophy so that its whichness [*ayyiyya*; Cairo ed. *anniyya*] among the sciences becomes evident" in the Arabic, and "Capitulum de inquisitione subiecti primae philosophiae ad hoc ut ostendatur ipsa esse de numero scientiarum" ("Chapter on the enquiry about the subject-matter of first philosophy, in order to show that this is one of the sciences") in the Latin.

Whereas *scientia divina* corresponds to the Arabic *ilāhiyyāt*, the preceding element of the Latin title, *philosophia prima*, has no equivalent at all in the Arabic title, or, if it has in some manuscripts, that equivalent (*falsafa ūlá*) comes after, not before, "divine things."[32] In the absence of further evidence in the Arabic, it seems that the Latin translators either added the expression "first philosophy," projecting back on the entire *Ilāhiyyāt* the status of metaphysics as "first philosophy" that they found in the title of the first chapter of this part of the *Shifāʾ*; or, if they read it in the Arabic title of the *Ilāhiyyāt*, they moved it from second to first position. Either way, they enhanced the status of Avicenna's metaphysics as a philosophical discipline and its rank at the top of the system of philosophy, also endorsing what was a typically Aristotelian name for metaphysics.[33] Their purpose may have been to avoid from the outset any possible view of the *Ilāhiyyāt* as a theologically inspired *scientia divina* rather than a properly philosophical treatise.

The stress on philosophy in the title of the *Ilāhiyyāt* is not an isolated case in these translations. Ibn Daud calls himself "Avendauth Israelita philosophus" when addressing the bishop of Toledo in the foreword to the Latin translation of *Nafs*.[34] There, he also calls Avicenna "Avicenna philosophus."[35] These two epithets can be connected with the reference to Aristotle as "Aristoteles philosophus" in Ibn Daud's Latin translation of al-Jūzjānī's Introduction.[36] A clear line of philosophical ascendance connects Avicenna with his Greek model (Aristotle) and his Latin translator (Ibn Daud).[37] Ibn Daud's insistence on the philosophical character of Aristotle and Avicenna, as well as his own, matches the emphasis on the philosophical tenor of the *Ilāhiyyāt* in Gundissalinus's "zoom" onto the title of the section.[38]

"De-Islamizing" Avicenna's Science of Divine Things

The last two chapters of the *Ilāhiyyāt* (X.4–5) are summarized and paraphrased rather than translated verbatim, contrary to what happens to the rest of the work. These two chapters deal with practical philosophy (politics, economics, ethics), with many references to Islamic tenets and figures. The role of the Muslim prophet as lawgiver in the domains of civil life, family management, and individual conduct assures the intersection of practical philosophy with issues and figures relevant to the Islamic faith. On these topics, the Latin translation is much shorter than the Arabic source text.[39] The end of the *Ilāhiyyāt*—and thus of the entire *Shifāʾ*—fades away before the Latin reader's eyes.

A significant example of the looser translation technique adopted by the Latin translators in these two chapters comes at the beginning of *Ilāhiyyāt* X.5. The Arabic title of this chapter is "Concerning the caliph and the imām: the necessity of obeying them; remarks on politics, transactions, and morals," which is translated in Latin as "Capitulum de eligendo successore et summo sacerdote et de contractibus et de moribus" (Chapter on how to choose the successor and the highest priest, on contracts and morals). We immediately see that the Latin translation of the title is not literal: *imām* is translated in more familiar terms as *summus sacerdos*, and the idea of the necessity of obeying him and the caliph is replaced with that of properly choosing them, a point that Avicenna will develop only later in the chapter.

The changes affecting the first lines of chapter X.5 are even more substantial. There, some parts of the source are heavily interpreted, others are abbreviated, still others completely omitted, such as the passage in which Avicenna recalls the cooperation between the third and fourth caliph, the wise ʿUmar and the intelligent ʿAlī. The same applies *mutatis mutandis* for the Latin translation of the entire chapters X.4–5. As I have mentioned, Ibn Daud and Gundissalinus's earlier translation of the *Ilāhiyyāt* tended to be more literal.

Several different hypotheses can be advanced to explain this switch of strategy:

a) Chapters X.4–5 were shortened in the Arabic exemplar of the *Shifāʾ* used by the translators
b) Chapters X.4–5 deal with practical philosophy, and are less directly related to metaphysics, the main subject of the *Ilāhiyyāt*
c) Because of their Islamic content, chapters X.4–5 are difficult to translate for the translators and/or difficult to understand for the audience
d) Because of their Islamic content, chapters X.4–5 conflict with the religious beliefs of the translators and/or the audience
e) Because of their Islamic content, chapters X.4–5 conflict with the translators' belief in the universal scope and universalizing force of philosophy.

Given that chapters X.4–5 instantiate (if in a particularly striking way) a more general tendency in the early Latin translations of Arabic philosophy—the translators often omit Islamic accretions on philosophical topics[40]—we can confidentially discard hypothesis (a); anyway, we have no record of Arabic manuscripts of the *Ilāhiyyāt* in which the last two chapters are abridged. All the other hypotheses are viable. With regard to (c), other cases of cultural distance affecting Arabic–Latin translations can be invoked.[41] Hypothesis (d) is supported by other, more limited and less conspicuous, examples of de-Islamization in the translation of the *Ilāhiyyāt*.[42] One might also wonder whether Gundissalinus's ecclesiastical function as canon, or the Bishop of Toledo's sponsorship of the translation, played a role in this tendency to reduce or eliminate the Islamic elements of Avicenna's discourse.

Hypotheses (b) and (e) are strictly philosophical and very much congruent with what we have observed about the translators' emphasis on the philosophical character of the *Ilāhiyyāt*, the interreligious environment (Muslim, Jewish, Christian) in which the translations of the *Shifāʾ* were conceived and first realized, and Ibn Daud's and Gundissalinus's self-identification in the social class of the philosophers.

To Be Continued

The Arabic Ibn Sīnā wrote many philosophical works, both in Arabic and in his mother tongue, Persian. In the most extensive and influential of these, the *Shifāʾ*, he acted as a logician and a mathematician no less than as a natural philosopher and a metaphysician, and he opened up metaphysics to incorporate practical philosophy with suggestions and motifs taken from Islam. The Latin Avicenna, by contrast, turns out to be the author of only one philosophical work. Seen through the parts of this unique opus selected for translation, he leans much more towards natural philosophy and metaphysics than towards logic, is not at all interested in mathematics, and makes minimal concessions to Islamic religion.

Ibn Daud and Gundissalinus's direct involvement in the trends of twelfth-century European culture, as *engagé* intellectuals, knowledgeable scholars of Avicenna, and holders of a universalistic view of philosophy, determined this transformation. The selection of the Peripatetic *Shifāʾ* as the only Avicennian work to be translated into Latin, the choice of the portions to be translated, and the joint process of philosophizing and de-Islamizing Avicenna's metaphysics all exemplify their approach. From this vantage point, the acknowledgment of Aristotle's authority in philosophy, the ability to grasp the epistemological scaffolding of Avicenna's work, and the appeal to the universal dimension of philosophy across dogmatic barriers—by means of which the *Shifāʾ*, written by a Muslim, could be jointly translated by a Jew such as Ibn Daud and a Christian such as Gundissalinus—look like facets of the same prism.

The translation procedures by which Ibn Sīnā's *falsafa* was transformed into Avicenna's *philosophia* help to relativize the famous adage "to translate is to betray." Ibn Daud and Gundissalinus' translations are certainly not the mirror image of the Arabic original of Avicenna's *Shifāʾ*. Yet it is by these very means that Ibn Daud and Gundissalinus—the true "directors" of the Arabic–Latin translation of Avicenna's *Shifāʾ*—convey to the historian of philosophy an insightful reading of Avicenna's masterpiece in philosophy. It is a reading that speaks to the cultural needs of the twelfth-century European readership, contributes to the era's organization of scientific research and of the curricular *ratio studiorum*, and gives a glimpse of the translators' view of themselves as philosophers.

This picture might be prolonged in different directions. In the "distribution" of the movie, for example, something has been lost, since there is a relative dearth of manuscripts of the *Shifāʾ* in present-day Spain, whether in Arabic or in Latin translation.[43] A consideration of "audience reactions" would also be in order. Judging the success of the various translations by the number of extant manuscripts, we obtain a ranking in which the translation of Avicenna's *De anima* is followed, in descending order, by those of the *Philosophia prima*, the *Liber primus naturalium*, and the *Logica*. This documents that the single translations did not circulate *en bloc*, according to the "translators' cut." It also indicates that the audience's taste somehow amplified the translators' emphasis on natural philosophy and metaphysics within the *Shifāʾ*, as well as their downplaying of logic.[44] It should not be forgotten, finally, that this movie received severe, though competent, "reviews" in thirteenth-century Parisian theological circles, at the time of the reiterated Paris prohibitions of philosophical texts and condemnations of philosophical theses.[45]

If taken all together and regarded as translations of one and the same Arabic work, the Latin translations of the distinct parts and sections of the *Shifāʾ* constitute one of the most extensive Arabic–Latin versions of philosophy ever made during the Middle Ages. In this enlarged perspective, new and fruitful questions arise: the continuities and distinctions between the translations of Avicenna's *Shifāʾ* discussed here (LT 1.1) and the subsequent ones (LT 1.2; LT 2); the relationship of these translations of the *Shifāʾ* with Gerard of Cremona's Latin translation—also made in Toledo in the second half of the twelfth century—of the medical work by Avicenna best known in the Middle Ages, the *Canon of Medicine*;[46] and the interplay between the Latin translations of Avicenna's philosophical and medical works with those of the *Shifāʾ*'s "companion," al-Ghazālī's *Maqāṣid al-Falāsifa*,[47] and its "counterpoint," the Aristotelian commentaries of Avicenna's arch-critic Averroes.[48] One could widen the angle even more by taking an intercultural perspective, for instance—because Latin is not the only medieval language in which Avicenna's *Shifāʾ* was translated. Hebrew and Persian translations of the work are also extant, as are extensive quotations of it in Syriac.

All these overlappings can be grasped only through a synoptic view, capable of detecting analogies and differences and tracing continuities and changes over time. In other words, this key event of the Arabic-to-Latin transmission of philosophical culture should be approached from a comprehensive and multidisciplinary angle. Ibn Daud and Gundissalinus, and their selective translation of the *Shifāʾ*, have given us a crucial line of orientation in that inspiring network of interrelations.

Notes

1 See Bertolacci, "Community"; Bertolacci and Alpina, "Introduction."

2 Fontaine and Eran, "Abraham Ibn Daud"; Polloni, "Toledan Translation Movement"; DB-Dominicus Gundissalinus at https://pagines.uab.cat/gundisalvi/.

3 Ibn Daud took the courageous step of seeking logistical and financial support from alien religious authorities such as the Christian bishopric of Toledo. Gundissalinus probably moved to Toledo around 1161–62 in order to translate Avicenna together with Ibn Daud, and returned to Segovia in 1181 when his collaborator died, probably then ceasing his activity as a translator of Avicenna.

4 Pasolini, *Observations on the Long Take*, 5: "Let's suppose that among the detectives who have seen these hypothetical films spliced end-to-end there is one with an ingenious analytical mind. His ingenuity might show itself only in coordination. Intuiting the truth from an attentive analysis of the various pieces, he could gradually reconstruct it by choosing the truly significant moments of the various long takes, thereby finding their real order. One has, simply, a montage. In the wake of such work of choice and coordination, the various points of view would be dissolved and subjectivity would give way to objectivity; the pitiful eyes and ears (or cameras and recorders) which select and reproduce the fleeting and none too pleasant reality would be replaced by a narrator."

5 On this work and its pivotal place in Avicenna's oeuvre, see Gutas, *Avicenna*.

6 The first of these treatises deals with cardiology; the style of argumentation in the second shifts from prose to poetry. On account of these various Latin translations of Avicenna's medicine, Dante Alighieri and Geoffrey Chaucer, among others, were justified in portraying Avicenna primarily as a physician.

7 Raimundo Martì in the thirteenth century could have had access to *Ishārāt wa-tanbīhāt* and *Najāt*; Averroes (Ibn Rushd, d. 1198) in the previous century, in the same Andalusian context in which Ibn Daud and Gundissalinus operated, could also refer to Avicenna's *Najāt* in one of his logical treatises, although the *Shifāʾ* remained his main repository of Avicenna's philosophy. Dunlop, "Averroes," 33.

8 Ibn Sīnā, *Al-Shifāʾ, al-Manṭiq, al-Madkhal*, Cairo ed., 10.14, 11.4; Avicenna, *The Healing, Logic: Isagoge*, 16.22, 16.27; English translation in Gutas, *Avicenna*, 44–45; Latin translation in Avicenna, *Logica*, ed. Hudry (hereafter *Logica*), 115.12–13, 116.10–11.

9 See Bertolacci, "Community," 51–52. Polloni, "Aristotle," 185, notes that apart from Aristotle's *De anima*, the two other Aristotelian writings that Ibn Daud and Gundissalinus believed were included in Avicenna's psychology (*De sensu et sensato* and the pseudo-Aristotelian *De intellectu et intellecto*) were never translated in Toledo, suggesting that their incorporation in Avicenna's work made a translation unnecessary.

10 The second-phase translators of the section of the *Shifāʾ* corresponding to Aristotle's *Physics* resumed exactly where the translation had stopped in the first phase, in chapter III. 2. However, they did not complete the translation of the rest of this section, but stopped at the end of chapter III. 10, omitting III. 11–15 and the entire fourth treatise (see Janssens in Avicenna Latinus, *Liber primus naturalium. Tractatus tertius*, 1*–4*). The first omitted chapter (III.

11) refers to God with names that allude to creative agency and as the "True One" (*al-aḥad al-ḥaqq*), ending with issues regarding heresy. These non-Aristotelian overtones may have played a role in the translators' decision to end the translation at III. 10. See Astesiano, "Latin Translation," 446 n. 20.

11 According to al-Jūzjānī's Introduction, Avicenna expanded on certain sections of the *Shifāʾ* (especially the logic) more than others because he had more freedom from non-scholarly duties and richer bibliographical resources. We may wonder, however, whether he felt a special predilection for logic, making it, also in extent, the doctrinal foundation of the work.

12 Hudry, in *Logica*, 79, supposes that the Toledo archbishop had reservations about the Latin translation of the *Madkhal* of the *Shifāʾ* not only for stylistic reasons, but also because Boethius's commentary on Porphyry's *Isagoge* was already available to Latin philosophers. An important question for future research is the extent of Ibn Daud's and Gundissalinus's knowledge of and expertise in logic.

13 The expression *quaedam capitula* ("some chapters") seems to refer neither to the entire *Madkhal* (which is called *liber*, "book," and cannot be equated to a group of chapters), nor only to Avicenna's Prologue to the *Shifāʾ* (= *Madkhal* I. 1), which figures as a single chapter both in the Arabic text and in Hudry's recent edition of the Latin translation.

14 That Ibn Daud was assisted in this translation by some unknown Latinist was first suggested by d'Alverny, "Notes," 341 and 349, and taken up in later studies (e.g., Burnett, "Arabic into Latin," 394).

15 The Latin text of Ibn Daud's Foreword, al-Jūzjānī's Introduction, and Avicenna's Prologue is in *Logica*, 105–10, 113–17, and see 197–209 for the Latin translation of chapter I. 12 of the *Madkhal*.

16 Hudry, "La traduction latine" (cf. *Logica*, 67–71), takes Ibn Daud to be the translator of the entire *Madkhal* on account of his translation of the preliminary chapters and chapter I. 12. Hasse and Büttner, "Notes," 333–36, regard Gundissalinus as the translator of the *Madkhal* on the basis of lexicographical analysis, corroborating the hypothesis of Alonso Alonso, "Coincidencias." Based on differences of vocabulary, d'Alverny, "Notes," 350, finds that the translator is unlikely to have been Gundissalinus, as does Burnett, "Arabic into Latin," 394.

17 Janssens, "Le *De divisione philosophiae*"; Strobino, "Avicenna's *Kitāb al-Burhān*." The term *subiectorum* in the title probably stands for *scientiarum*.

18 Hasse and Büttner, "Notes," 333–36.

19 The two translators' interaction has rightly attracted scholarly attention. See d'Alverny, "Les traductions"; Burnett, "Translating"; Polloni in this volume.

20 In another manuscript, the ascription is to Gerard of Cremona (see Bertolacci, "Community," 41 n. 8). Gundissalinus seems to have quoted the Arabic text of the *Ilāhiyyāt* independently of its Latin translation (Polloni, "Aristotle," 172; Polloni, "Gundissalinus and Avicenna," 516 and n. 8).

21 Hudry (in *Logica*, 83–84) thinks the *Ilāhiyyāt* was translated before *Madkhal* I. 12 due to the reference to the "Metaphysica Avicenne" found in the Latin translation of the chapter's title. Polloni ("Gundissalinus and Avicenna," 515) takes the *De anima* to be the first translation made by Gundissalinus.

22 The death of the translator or of one of the associates is cautiously advanced as an explanation in Janssens, "The *Physics*," 312; Janssens, "The *Liber primus naturalium*," 219–20. If Gundissalinus was its translator, the abrupt

end of (iv) might be related to his sudden flight from Toledo and return to Segovia soon after Ibn Daud's violent death in Toledo in 1180 (see Hudry in *Logica*, 81). Alternatively, the incompleteness of (iv) has been explained by the presence of a complete translation of Aristotle's *Physics* among the Aristotelian works translated by Gerard of Cremona at Toledo at the same time (Polloni, "Aristotle," 185).

23 The supposed adoption of a "Ghazalian" order would help explain why translation (iv) was apparently produced at the end of the series, as its incompleteness indicates, despite coming before (vi) in the structure of the *Shifāʾ*. Why translation (iv) was made after (v) remains to be explained.

24 If the recent attribution of the *De diluviis* to Michael Scot in LT 1.2 is confirmed (Hasse and Büttner, "Notes," 344–47), he would have translated both the *De animalibus* and the *De diluviis*. Magister Johannes Gunsalvi and Salomon in LT 2 are reported as the translators of at least five sections of the natural philosophy of the *Shifāʾ*. None of these translators, however, went beyond the second part of the *Shifāʾ* on natural philosophy.

25 There are good reasons to rule out that the selection of the parts for translation arose from the translators' reliance on defective Arabic exemplars of the *Shifāʾ*, since we lack attestations of Arabic manuscripts of the *Shifāʾ* that contain only the *Madkhal* in logic, the *Samāʿ ṭabīʿī* and the *Nafs* in natural philosophy, and the *Ilāhiyyāt* (see http://avicennaproject.eu/, section "All *Shifāʾ* Manuscripts"). Moreover, Ibn Daud and Gundissalinus had more than one exemplar of the work at their disposal, at least for logic (see *Logica*, 106.3–4). The structural connotations of the titles of the translations (iv) and (v), *Liber primus naturalium* and *Liber sextus naturalium*, with their precise indication of the order of the sections within the *Shifāʾ*'s natural philosophy, indicate awareness of the work's full structure.

26 Ibn Daud and Gundissalinus possibly envisaged a similar foundational relationship in the natural philosophy of the *Shifāʾ* between the general principles of physics and psychology.

27 See Bertolacci, *Reception*, 272–74, 279–80, 288–92. The further reference to metaphysics that occurs in *Madkhal* I. 4 is analyzed in Di Vincenzo, "A Discipline." On references to *Nafs* in the metaphysical treatment of prophecy in the *Ilāhiyyāt*, see Bertolacci, "Metaphysical Proof." Avicenna's conception of the relationship of psychology with metaphysics in the *Shifāʾ* and his other philosophical works is analyzed in Alpina, *Subject, Definition, Activity*.

28 Bertolacci, *Reception*, 267, 272, 281, 282–84. It is significant that the *Burhān* is often cited in the first treatise of the *Samāʿ ṭabīʿī*, within the part of the section translated into Latin by Ibn Daud and Gundissalinus in (iv) (ibid., 282 n. 51), and that *Burhān* and *Nafs* are the only two sections of the *Shifāʾ* whose title is mentioned in the *Ilāhiyyāt* (ibid., 282, 292, 572–73).

29 In the still uncertain chronology of Gundissalinus's works, we do not yet know the precise position of the *De divisione philosophiae* (where the Latin translation of *Burhān* II. 7 appeared) with respect to the Latin translations of the *Shifāʾ* considered here—whether it was written before, during, or after LT 1.1.

30 The link between the logical doctrine of universals and metaphysics, and the dependence of logic on metaphysics as regards that doctrine, are made explicit in the full title of the Latin translation of *Madkhal* I. 12: "Incipit liber Avendauth de universalibus asumptus ex quinto *Metaphysice* Avicenne"

("Here starts the book of Ibn Daud on universals, taken from the fifth [treatise] of Avicenna's *Metaphysics*," *Logica*, 197.1–2). *Madkhal* I. 12 is a pivotal chapter, containing two prospective references to the *Ilāhiyyāt* (Bertolacci, *Reception*, 279–80). *Metaphysica* and *Metaphysica Avicenne de prima philosophia sive scientia divina* are additional titles of the metaphysical part of the *Shifāʾ* attested in Latin manuscripts (*Liber de Philosophia prima*, 123*–124*).

31 Polloni, "Gundissalinus and Avicenna," 549–50, contends that in his original works, Gundissalinus "enacts a sort of 'cherry-picking' upon the Avicennian writings he had at his disposal."

32 Ibn Sīnā, *Al-Shifāʾ, al-Ilāhiyyāt (1)*, 3.3, 3.6–7; Avicenna Latinus, *Liber de Philosophia prima*, 123*, 1.3–4. Among the sixteen Arabic manuscripts selected in www.avicennaproject.eu, only MS Mashhad, Kitābkhānah-i Āstān-i Quds-i Raḍavī, 7347 (copied before 630/1232–33) reports "known as first philosophy," after "divine things" (the same reading is added in the margin of MS Oxford, Bodleian Library, Pococke 125, 561–571H/1166–75).

33 The same applies to the title *Metaphysica* used to designate the metaphysics of the *Shifāʾ* in other Latin translations of LT 1.1 (see n. 30 above).

34 Avicenna Latinus, *Liber de anima seu Sextus de naturalibus*, 3.2.

35 Ibid., 4.17.

36 *Logica*, 110.9; Ibn Sīnā, *Al-Shifāʾ, al-Manṭiq, al-Madkhal*, 3.16, Avicenna, *The Healing, Logic: Isagoge*, 8.39 (*Arisṭūṭālīs al-faylasūf*).

37 Likewise, Gundissalinus and Iohannes Hispanus retain the philosophical component of the Arabic title of al-Ghazālī's *Maqāṣid al-falāsifa* (*Intentions* or *Doctrines of the Philosophers*) in both the attested Latin titles: *Summa theoricae philosophiae* and *De philosophorum intentionibus*.

38 We do not know the role that Ibn Daud's bold self-designation as "israelita" vis-à-vis this high-ranking Christian authority may have played in his martyrdom in Toledo some years later (see *Logica*, 81).

39 The chapters are excellent examples of abbreviated translation. The contention that Gundissalinus did not abbreviate significantly (Hasse, *Latin Averroes Translations*, 37) applies, of course, to the parts of his translations that are verbatim translations (in the present case, *Ilāhiyyāt* I–X. 3) rather than abridgments, like chapters X. 4–5. See also Hasse, "Abbreviation."

40 For instance, in his *De scientiis*, Gundissalinus, the probable translator of the *Ilāhiyyāt*, also abridges the part of al-Fārābī's *Iḥṣāʾ al-ʿulūm* (Catalogue of the Sciences) most directly addressing Islamic issues. Political science and jurisprudence are shortened, and dialectical theology is totally omitted.

41 See, for instance, Di Donato, "I traduttori."

42 One such example is *Ilāhiyyāt* IX. 7, where Avicenna discusses the *post mortem* destiny of human souls. At its beginning, Avicenna remits to Islam the treatment of the non-philosophical topic of the awards and punishments regarding the human body, then commences a philosophical analysis of the destiny of human souls. In this initial tribute, he qualifies Islam as the "true religion" and refers to the prophet Muḥammad not only as "prophet," but also as "lord" and "master." In the Latin translation, we find a more neutral "our religion" ("our" refers, of course, to Avicenna, and stands in for the many "our" that refer to Muḥammad in the Arabic text of this passage); the praise of Muḥammad is omitted.

43 See Bertolacci, "Migrazione," 597–99.

44 See Bertolacci, "Community," 47–49.

45 On Avicenna and the Paris prohibitions of 1210–15, see Bertolacci, "Latin Reception," 213–17.

46 Polloni, "Aristotle," remarks that Gerard devoted his translation activity to Aristotelian works, whereas Gundissalinus focused on Arabic and Jewish authors, in a sort of complementary approach. Polloni explains the absence of the *Metaphysics* from Gerard's translations of Aristotle by Gundissalinus's translation of Avicenna's *Philosophia prima*, and the incompleteness of Gundissalinus's translation of the *Liber primus naturalium* by the existence of a complete version of the *Physics* among Gerard's translations.

47 Al-Ghazālī's *Maqāṣid* may have influenced the order in which the early translations of the *Shifāʾ* were produced, as we have seen above. It certainly paved the way for their dissemination in European culture (see Signori, "*Unus de intelligentibus*").

48 Averroes's polemic against Avicenna in defense of genuine Aristotelian philosophy affected a fundamental aspect of Ibn Daud's and Gundissalinus's approach to the *Shifāʾ*, the idea of Avicenna's Aristotelianism. The translators' selection of sections of the *Shifāʾ*, such as *Madkhal*, *Samāʿ ṭabīʿī*, *Nafs*, and *Ilāhiyyāt*, that are more originally Avicennian and less Aristotelian than others, and their neglect of the part of the logic of the *Shifāʾ* corresponding to Aristotle's *Organon*, in which Avicenna closely follows the textual evidence and the order of topics proposed by Aristotle, made Averroes's anti-Avicenna criticism of a lack of adherence to Aristotle more pertinent for a reader of the Latin translation of Avicenna than it had been for a reader of the original Arabic text.

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14 Toledan Translators, Roger Bacon, and the Dynamic Shades of Experience

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Before the fall of Granada in 1492, the Iberian Peninsula was a fragmented area that, over the centuries, included many different kingdoms and city-states. These communities had either Christian or Muslim majorities, very often hosting large Jewish populations. In numerous cases, their governing elite did not practice the same religion as the majority of their subjects. In this cultural, religious, and linguistic melting pot, translations were a central aspect of the everyday life of many medieval Spaniards.[1] It was in this context that written translations of learned texts of theoretical and practical nature gradually began to appear in the eleventh and twelfth centuries. The process found its most eminent manifestation in the second half of the twelfth century in Toledo.

In my contribution, I discuss some aspects of the interaction between translations and "experience" in the translating process and the actors' meta-discussion of that interaction, through the cases of the medieval Toledan translations and the rhetoric of the English philosopher Roger Bacon. As we will see, "experience" is and was an equivocal term that requires some clarification. Here, I use it to indicate the kind of meaningful epistemic content that is not primarily gained through theoretical reflections. Although I am not committed to this broad notion of experience (which is philosophically questionable), it can usefully be deployed to clarify some less immediately obvious aspects of medieval translations. The chapter addresses first the translations made in Toledo in the twelfth century, then Bacon's use of "experience" as persuasive tool in his criticism of translations.

Translations as Collective Epistemic Endeavors

Naively, translating can be regarded as a process characterized by two main requirements:

1. Text A, which is written in language *x*, is rendered into text B, written in language *y*.
2. Text B maintains a specific semantic relation with text A.

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In the cases discussed here, both the origin and the product of this process (A and B) are written texts in the form of manuscripts. In the Middle Ages, the translating experience starts and ends with the materiality of manuscripts that were copied, sold, and dispersed throughout Latin Europe. But notwithstanding the materiality of their starting and end points, the practice by which medieval translations were made was usually quite immaterial, in that it primarily involved spoken rather than written language. This was often the case with the translations made in Toledo in the twelfth century.[2]

One of these was the Latin translation of Avicenna's *De anima*, made by Abraham ibn Daud and Dominicus Gundissalinus in Toledo (before 1166). The two collaborators had different linguistic skills, both of which were required for the translation. As an Andalusian Jew, Ibn Daud knew Arabic, the language in which the source version was written (input language, *x*). The Castilian Gundissalinus knew Latin, the output language of the translation (language *y*).[3] Evidently, these were exclusive or predominant skills of the translators: in order to work together, it seems that only Ibn Daud mastered Arabic and only Gundissalinus mastered Latin, although each may have known something of the other language. The linguistic means they used to mediate between these languages *x* and *y* was vernacular Castilian (*z*). First, Ibn Daud translated the text from written Arabic into spoken Castilian, verbally and word by word; then, Gundissalinus translated the Castilian spoken words into written Latin, again word by word. This bi-phasic working dynamic was a crucial factor that governed translating in medieval Toledo, and defines the process as a collective endeavor.[4]

In the thirteenth century, Roger Bacon would strongly criticize the bi-phasic method. In his *Compendium studii philosophiae*, discussing the Toledan translator Herman the German, Bacon observes:

> Nor did he know Arabic well, as he acknowledged, for he more assisted the translations than was a translator himself, since he retained Saracens with him in Hispania who took the lead in their translations. Likewise Michael the Scot ascribed many translations to himself, but it is clear that Andrew, a certain Jew, worked more on these. So Michael, as did Herman, translated, but they knew neither the sciences nor languages.[5]

Bacon attacks the (Latin) translators as if they were unduly taking credit for work they had not really carried out, since they did not know either the language or the theories of the work they were translating.[6] In the prologues to the Toledan translations of that period, however, the actors' descriptions of the process of translating do not appear to hint at an unequal commitment of the translators. There is no acknowledgment that translator A (Arabic to Castilian) was doing "more" than translator B (Castilian to Latin). What is sometimes acknowledged is the division of tasks that led to the translation.[7] Such recollections by the actors on how texts were translated leaves space to assume that translators did indeed consider their job a collective one, at least when the bi-phasic method was employed. Unfortunately, not much more can be said about this, especially given the relatively small number of prologues that have survived over time.[8]

But Bacon's criticism also touches a more delicate point in the process of bi-phasic translation: the complex structure of the bi-phasic method bore potential for misunderstandings and mistranslations. What might appear as a single act of translation—text A in Arabic (x, the source language) is translated into Latin (y, the target language), producing text B—actually involves at least four processes of translation. In fact, the biphasic method generates two different translations mediated by Castilian (z). An epistemic shift is produced, since the content that the first translator renders into Castilian is implicitly interpreted (or reinterpreted) by the second translator, fragmenting (z) into (z_1) and (z_2). A perhaps weaker epistemic shift is also implied in each translator's passing from the source language (x and z_2, respectively) to the target language (z_1 and y, respectively). Second, the method implies a translation from written to oral means and then back to written. Accordingly, we have the following situation:

apparent translation A → B
semantic level ($x \rightarrow z_1$) → ($z_2 \rightarrow y$)
modality (written → spoken) → (spoken → written)

The scheme visually renders the complexity of the translating experience. The passage A to B entails slippages at both the semantic and syntactic level.[9] The individuality of both translators—reflecting their cultural, linguistic, scientific, and social diversity—may have impacted on the process of translation as well. In order to be effective, the translating procedure requires close agreement among the translators on which steps they have to take, a preliminary shared understanding of the work they are translating, and reciprocal trust in each other's interpretive and linguistic skills. In other words, the translating process is grounded on a dialogical intellectual exchange—a collective epistemic endeavor—in which the translators needed to discuss the content of what they were translating in order to ensure reliability as regards both source and target domains. Not coincidentally, both Ibn Daud and Gundissalinus were also authors of original works closely related to the works they were translating.

Another example may illustrate the implications of this translating process. Gundissalinus collaborated with a third member of his team, John of Spain (Johannes Hispanus), on the Latin translation of Ibn Gabirol's Arabic *Fons vitae*. This work has many peculiar features due to Ibn Gabirol's adherence to pseudo-Empedoclean doctrines and Jewish mystical positions. A recent analysis by Sarah Pessin has shown that the

Latin version of the *Fons vitae* systematically reinterprets and reshapes it in an Aristotelian fashion absent from the original text (which is extant only in fragments).[10] Apparently, Gundissalinus and John of Spain reinterpreted Ibn Gabirol's text while translating it, probably during some of the transitions involved in the translation activity: John's verbal rendering of the Arabic or Gundissalinus's interpretation of John's words. But as mentioned above, the translating process implied a moment in which content and theories from the source domain were presumably discussed in order to ensure accuracy. This seems to mean that the particular version of the *Fons vitae* was the result of an agreed interpretation by the team. In his other works, the leading figure of this team, Abraham ibn Daud, criticized Ibn Gabirol's stances from an Aristotelian perspective, which coincides with the reinterpretation embodied in the Latin version of the *Fons vitae*.[11]

We have seen that the bi-phasic method was a collective epistemic endeavor, as is acknowledged by the division of labor described in some of the translators' prologues. This perspective on translating makes it particularly obvious that the process required expertise. Both translators needed to know the languages they were using, the methods they were adopting, and, to some extent, the theoretical coordinates of the discipline in which the source text arose. However, there is something else that seems to emerge from a consideration of how translations were made: the crucial importance of the collective framework in which the translators were working. When it comes to that framework, the translators' expertise is accompanied by a different kind of experience.

Translators and Their Collective Framework

Before proceeding, let me introduce a preliminary and uncommitted distinction between terms that are both cognate and equivocal: "experience" and "expertise." The two words are cognate in English because they derive from the same Latin verb, *experior*. Latin literates appear to include within the semantic field of *experior* a range of meanings that is at once broader and narrower than we might expect.[12] On the one hand, the semantic field includes both "experience" and "expertise" in contemporary English, plus a set of shaded references to internal states, cognitive endeavors, and external assessments. However, the term does not per se imply "experience" as an epistemically structured empirical ascertainment of states of affairs in order to produce scientific claims about them. Of course, "experience" always implies an epistemic assessment of the outside world that is "felt" by the experiencer. Yet the semantic load that experience has received in the past centuries through empiricism and the Scientific Revolution hardly fits within the Latin *experior*. Though nuances of such an attitude are attested in later medieval texts (as this volume abundantly shows), the main meaning of *experior* seems to be more generic and to express some degree of directedness from the outside (the world of physical interactions) to the inside (our assessment of those interactions) in the formation of different mental states.

Applying these considerations to the Toledan translations, we may distinguish the *expertise* of the translators, as the set of meaningful knowledge required by the process of translation (e.g., knowledge of languages or translating methods), from the different kinds of *experience* that might have affected their work. Taking "experience" in the broad meaning mentioned above, I will now disentangle the different kinds of collective experiences that were entailed in the process of translation, at different levels. This offers us a better appreciation of the collectiveness of the translating process and the irreducibility of that process to the epistemic endeavor described in the previous section, in which expertise, rather than experience, seems to be mostly implied.

As we have seen, translations were often made collectively, and as a result they qualify as interpersonal experiences that may have influenced the work of translating beyond the theoretical endeavor of rendering a text into another language. In other words, there are aspects inherited from the biographical and social framework of the translators that could be meaningful in relation to the making of a translation. In addition, the social and institutional framework in which the translators were working impacted differently—and, one may speculate, profoundly—on the making of Latin translations.

A first case of such impact is the choice of the material to be translated. For the Toledan translations, Arabic texts were needed, and a selection had to be made about which text to prioritize and which to avoid. Whose choice was that? This is a problem that entails questions of different orders, from the availability of texts to the institutional context of the translator's activities. Only on rare occasions is it clear who chose the works to be translated. As Amos Bertolacci has pointed out, when Ibn Daud translated the prologue to Avicenna's *Liber sufficientiae*, he addressed it to John II, archbishop of Toledo, implicitly asking him to sponsor the translation of the entire work (the encyclopedic *Kitāb al-Shifāʾ*, which was translated in Toledo over a period of several decades).[13] It seems that Gerard of Cremona chose to translate Ptolemy's *Almagest* along similar lines: he seems to have moved to Toledo for that purpose, as his students recall in his eulogy.[14]

In the majority of cases, however, the actors choosing the works to be translated are not mentioned. It seems fair to suppose that the translators, especially those skilled in Arabic, had some leverage, as they had first-hand access to—and in some cases, direct knowledge of—the works that could be translated. It is also possible, though, that the chapter of the Cathedral of Toledo, which sponsored the translations, made the decision on which works would be beneficial for the Latin audience to access.[15] Although no extant documents can substantiate either of these hypotheses, it is likely that the choice arose from a combination of both factors. We can conjecture that the translators discussed at a preliminary stage what works might be translated, then proposed them to the chapter, which had the last word.

Another form of impact arises from the organization among teams. In the second half of the twelfth century, Toledo hosted at least two translating teams, one led by Abraham ibn Daud and the other by Gerard of Cremona. Duplications needed to be avoided, in order not to waste time and funds on translating the same work twice.[16] Accordingly, the translating teams needed to agree on which works to translate, a discussion that probably led to some degree of specialization by the two teams in selected subjects and authors.[17] In fact, this process of redundancy avoidance does not always appear to have worked—both Gundissalinus and Gerard of Cremona translated al-Farabi's *Iḥṣā al-Ulūm* into Latin (as *De scientiis*), though the reasons behind the dual translation are still debated.[18] One may certainly speculate that translations required a preliminary phase of discussion and decision that unfolded, first, among the members of one team, second, between the two teams, and third, with lay and ecclesiastical functionaries of the Toledan chapter. Such collective decision-making directly influenced the choice of what was to be translated, by whom, and how.

A third factor is the institutional framework of which the translators were part. The capitular archive of the Toledan cathedral repeatedly refers to Gerard of Cremona as "magister" and to Dominicus Gundissalinus as archdeacon of Cuéllar.[19] Like other translators, both Gerard and Gundissalinus were part of the chapter and received prebends allowing them to work as translators, while, plausibly, other members of the translating teams were paid, either directly or indirectly, through emoluments.[20] Gerard's and Gundissalinus's capitular offices required them to carry out additional functions within the cathedral, aside from translating into Latin. Gerard was almost surely a master of the cathedral school of Toledo, in which clergy were educated, in line with the dispositions of the Council of Coyanza.[21] More difficult to assess is Gundissalinus's additional work, if any. Historical documents do not locate him in the area of Segovia (where Cuéllar is located) before 1190.[22] As a consequence, no specific hypotheses may be proposed, especially since Gundissalinus may have been working on the translations alongside his role in the cathedral with bureaucratic and pastoral functions in Toledo.

In any case, both Gerard and Gundissalinus were involved in the ecclesiastical institutions, managing the archbishopric and participating in the discussions of its chapter. In different ways, these activities—marked by a collective dimension and defining the translators' sets of personal experiences—can be considered influential factors in their translating activity. Gerard's work as a master may have led him to privilege the translation of works connected to his classroom teaching; Gundissalinus's work as an archdeacon may have led him to choose works with special relevance to the chapter and to the clergy more generally. Unfortunately, the complete absence of data allows a plurality of speculations on this point—or none. What is clear is that the collective framework in which the translators were working took concrete shape in a plurality of experiences (chats, fights, aims, enmities, duties, etc.) of which only a small part can be qualified as "expertise" in the meaning of enabling knowledge to pursue a specific task: translating. Such a richness factors that are not purely theoretical—experienced by the translators in their personal interactions with their world—cannot be reconstructed but only speculated, suspected but not proved. That alone, however, is not enough to justify neglecting it when we discuss how premodern translations were made, whether in Toledo or elsewhere.

Roger Bacon and Travels across the Sea

Premodern Arabic-to-Latin translations were immensely influential on medieval debate: they were discussed, criticized, and assimilated by most of the later medieval practitioners. Notwithstanding that pivotal impact, few thinkers at the time entered into meta-discussion of how translations should be made and used. The most important and original of those who did was undoubtedly Roger Bacon (1214/20–post 1292). Having examined Bacon's theory of translation elsewhere,[23] I focus here on a particular aspect of his reasoning: How does Bacon use "experience" in his discussion of medieval translations? Again, I use "experience" in the broad meaning given above, although Bacon on some occasions does use the field of *experior* in a more specific way in connection with scientifically valuable empirical assessments.[24]

Before I turn to two cases in which Bacon expands on experience in reference to translations, a few preliminary remarks are necessary. First, Bacon was not a translator, yet he discussed translations more than any medieval translator. Second, he often uses rhetorical exaggeration in his texts, especially those with a specific social or political aim. Third, in the cases I will discuss, he gives his own account of "experiences" that he or someone else had. These accounts are all related to translations and translated material. They are very difficult to assess on many points, one of which is particularly significant: whether such experiences actually occurred or not. Either way, however, Bacon's references to "experience" fulfill a particular function, as persuasive tools to sustain his own line of reasoning.

Indeed, experience held, and still holds, special value as an epistemic justification of the validity of any item. Its functioning can be appreciated through a simple example from the present day. Suppose the flight attendant is asking for dinner preferences. I am sleepy and slow in responding. The flight attendant, perceiving my indecisiveness, suggests the vegetarian option, saying: "I have tried it and it is delicious." Of course, I can choose not to believe her (totally or partially), for many different reasons, or to do so, for other reasons. Yet complex epistemological implications aside, the reference to her personal experience implicitly works as an epistemic factor of persuasion, contributing to my belief in the goodness of that meal. Something similar happens with written accounts of experience.

Roger Bacon wrote some of his works with the aim of persuading the Pope to sponsor his reform of Latinate education. The first case I wish to discuss is a text directly related to these: a passage from a letter he sent to Pope Clement IV outlining his *Opus maius*. The letter is a valuable witness to Bacon's political agenda and philosophical thought. It details the ambitious reforms of Latin education that Bacon envisioned in order to "save" Christendom.[25] It also makes a series of attacks on proponents of other approaches to science and wisdom (for example, the Scholastic method of commentary and the lack of knowledge of foreign languages), summarizing the harsh criticism that Bacon expresses in the three *Opera*. Discussing the need for Latinate librarians to collect as many scientific and philosophical books as possible, Bacon observes:

> And finally—since the authors contradict each other in many things and have written down many things on the basis of mere rumor—it is necessary to check the truth of the evidence, as I demonstrate in the treatise on experimental science. *This is why I have often sent messengers across the sea*—both to various other areas and to large commercial markets—*to see the things of nature with my own eyes, and to test the truth of creation by sight, touch, smell, sometimes even hearing, and by the certainty of experience, since I could not observe their truthfulness by books alone*—just as Aristotle sent several thousand people to various regions to learn the truth about the things of this world.[26]

Bacon's claim is radical: You must not trust the books, because their authors contradict each other constantly. Hence, it is necessary to include a further assessment that can provide evidence of their reliability. Bacon alludes to his *scientia experimentalis*, a topic that goes beyond the scope of this chapter,[27] but in fact he says something else. He claims to have sent "messengers across the sea" to see, touch, smell, and hear matters on which the books alone cannot be trusted. The context of this passage makes it quite clear that the "books" to be mistrusted are foreign books, that is, translations. We can read the passage following either a weak or a strong interpretation. The former would take "across the sea" as the English Channel (assuming that Bacon was in Oxford, not Paris) and the "commercial markets" as the large hubs in the Continent, such as Bruges. A stronger interpretation would read the "sea" as being the Mediterranean and the "markets" as the commercial hubs in the Islamicate and Greek world, such as Byzantium and Tunis. The latter seems more plausible, since it would make little sense for Bacon to tell the Pope that he sent messengers to modern Belgium to find out what books were misdescribing. In turn, claiming to have sent messengers to the other side of the Mediterranean has a specific persuasive function. It appeals to the direct experience that Bacon's messengers have garnered by going to see the things described in Arabic and Greek books. According to this function, the passage works as criticism of the translations by contrasting a direct assessment of the state of affairs (by the messengers and the source books) with its Latin accounts (the translations), pointing out the untrustworthiness of the latter.

Yet if persuasion was the main goal that Bacon wanted this passage to achieve, should we even suppose that the trips "across the sea" really did happen? It is known that Bacon spent all his money early in his career, investing it in books.[28] Probably for this reason, he entered the Franciscan Order apparently in the mid-1250s. One may therefore wonder how he could have sent messengers across the Mediterranean to check the validity of the assertions he had read in the books. He might have used the wide network of Franciscans stretching across the Mediterranean, but there are no traces of that.

Moreover, Bacon's passage is quite close to the preface of Michael Scot's *Ars alchemie*, a work likely known to him.[29] A translator, Scot offers another account of travels across the Mediterranean in order to discover the secrets that some books—alchemical ones—did not detail:

> Therefore, after having studied and consulted for long time the books of the philosophers, as I said, I have decided to engage personally with a clarification of this darkness. I have gone to the countries beyond the [Mediterranean] Sea and talked with Latin, Hebrew, and Arabic sophists and wise men, acquiring their philosophy and keeping it in my heart.[30]

Scot recalls that he "went" to the other side of the Mediterranean, "talked" with wise men from different cultures, and "acquired" knowledge. The result of these travels and the data he collected—proceeding from indirect experience, for they are accounts by practitioners, yet direct, because Scot collected them himself—is the list of recipes that constitute Scot's treatise. Leaving aside the cognate question of whether Scot did go to Africa, the closeness to Bacon's text is remarkable. They both use the experience of going across the sea as a validating epistemic item ("by seeing it, I know it") and a persuasive tool ("believe me because I have direct experience of it"). It is possible that Bacon drew inspiration from Scot's work when he decided to tell the Pope that he sent messengers to see how things are at first hand. Although it may well be that he never sent anyone across the sea to smell things, the function of the reference to direct experience in the text is quite similar. The message conveyed by Bacon's reference to experience is clear: the Pope should not believe what is written in translations because, when experienced (seen, touched, smelled, heard), things appear rather different from the accounts in those texts. The texts are therefore unreliable and a cause of error for their readers. To address this problem, the Pope should sponsor educational reforms including a complete restructuring of how translations are made. That was the aim of Bacon's letter, and the persuasive end to which he turned his account of the experience across the sea.

Roger Bacon and the Inadequacy of Latin Translations

Roger Bacon also made direct criticism of Latin translations.[31] Discussing why Latins should learn foreign languages (specifically, Greek and Hebrew), he repeatedly criticizes the Latin translations of Aristotle and other works that were used by Latin philosophers and scientists. One of the harshest passages reads as follows:

> This is the explanation for [the tenth reason why Latins need to study languages, namely,] problems with translation, especially in the case of the books of Aristotle and his sciences, which are the foundation of the whole study of wisdom. Whoever is unaware of his efforts labors in vain, ploughs the shore, and will never be able to be promoted to other [sciences]. And even the basic sciences have been translated in this way, e.g., logic, natural philosophy, mathematics, so that *no mortal could reliably understand anything worthwhile from them, as I have fully experienced* [*sicut ego expertus sum omnino*]. For this reason I have diligently *listened to many* [lectures on those works] *and have lectured more* [on them] *than any other has, as all who have been nourished in study are aware*.[32]

A *topos* of Bacon's programmatic positions, bad translations are a fundamental and despicable cause of error to such a degree that it would be better not to have translations at all. Bacon's criticism is as stern as possible. The translators did a terrible job in rendering Aristotle's text and, consequently, his Latin works are riddled with mistakes that mislead the reader. Because of this, Latins need to learn the languages in which wisdom was originally written and gain direct access to the text.

Bacon appeals to experience to substantiate his position. His appeal is dual: he uses experience as a foundation for his knowledge of the mistaken interpretation to which the translation is prone, and he uses it to claim that, after having become aware of the mistaken interpretation, he has experiential knowledge of an alternative, and correct, interpretation of the text, acquired by attending and giving many lectures. These two types of experience have different grounds and, consequently, should be taken as expressing two different parts of the *experior* semantic field discussed above: the two cognate terms "expertise" and "experience."

Bacon's first statement ("no mortal could reliably understand anything worthwhile from them, as I have fully experienced") can be qualified as "experience" in its broader meaning. Bacon here directly claims *ego expertus sum*, using the past participle of *experior*. The passage starts from an external state of affairs that has been known directly (experienced) by Bacon and produced a general statement about it (translations are inadequate). Evidently, that statement is not theoretical (or even scientific) in nature, but moves towards being a universal assessment of the state of affairs. The general claim may be either a rhetorically exaggerated generalization or an experience repeated over time; it may articulate Bacon's evaluation of a general state of affairs—his continuous experience of facing bad translations—or refer to some particular event in his firsthand experience. The latter interpretation is suggested by a passage earlier in the *Compendium*, where Bacon recalls what happened during his Parisian lectures on pseudo-Aristotle's *De plantis*. Teaching his students, Bacon referred to *belenum* (henbane, a poisonous plant) taking it to be a technical Latin term. Since it is actually a Castilian colloquial term, Bacon's Spanish students derided him—an embarrassment that Bacon probably kept in mind for years, as he recalls the incident at least twice in his works.[33] Without wishing to reduce Bacon's criticism to the memory of this mishap, it is plausible that his personal experience in the classroom affected his desire for better Latin translations.[34]

Bacon's second assertion ("I have diligently listened to many lectures on those works and have lectured more on them than any other has") points to the expertise that he professes to have acquired on the matter. It is evidently designed to substantiate Bacon's direct and vast knowledge of Aristotelian philosophy. Bacon wants to show that after long training in Aristotle, he himself has the expertise required to criticize others' translations.

There are many similarities between this text and the previous one. Here, too, aspects related to rhetorical *topoi* are at work: Bacon's acrimonious style, his rhetorical overstatements, and his desire to advance a global reform of the university. Most remarkably, both texts suggest that the corrective function of experience could be deployed to remedy the mistakes made by translators. Experience in its broad meaning led Bacon to the conclusion that errors and misunderstandings abounded in Latinate universities because of bad translations. Yet it was by gaining expertise on the subject that Bacon was able to address the problem and, one might say, alleviate it through the reform of education that he proposed to the Pope.

Conclusions

My short discussion has shown that translations are both the result and the object of "experiences" of different sorts. Such experiences may be the roots of the actor's expertise or a series of personal states of mind induced by her interaction with the external world. In both cases, they affect the making of a translation, either directly or indirectly. As the result of experience, translations, being human products, reflect their translators' experiential universe to an extent far beyond what can be reconstructed by historians. They arose from the interaction of many biographical factors, in which the outside world, regarded as the opposite of pure theoretical reflection, affected the outcome. The process itself is too complex to be fully dissected, even if the historical actors were really giving accurate accounts of their work.

As an object of experience, translations are read, discussed, passed to other practitioners, sought and criticized, burned and banned. But even in their criticism, "experience" plays a pivotal role as persuasive tool. The epistemic implications of a recourse to experience were (and still are) extremely valuable in rhetoric. Bacon's repeated reference to experiences of different sorts shows his strategy of contrasting direct experience with dependence on books, particularly translations. Translations are unreliable, and that unreliability is demonstrated by assessing what happens in "the real world." This rhetorical strategy might seem surprising, for as I mentioned above, Bacon was an eager reader (also of translations), craved the missing books of the ancients, and supposedly even went bankrupt in his effort to buy as many books as possible. There is no contradiction, though: whether direct or not, experience and its implicit directedness, meaningfully connecting extra-mental and mental worlds, are important rhetorical tools and as such they are often used by Bacon, among many others.

In both cases, the role of experience exceeds all particular semantic fields and proper definitions. This is reflected by translations at the different levels of their production and use. Indeed, translations can be considered epistemic vessels of experience. Explicitly, they contain sets of told experiences that are recalled by the written text as meaningful accounts of the author's experience of the extra-mental realm. Implicitly, they also reflect the plane of personal encounter with the external world from which translations were generated as intellectual and material objects. Such is the experiential world of the translators and, one may add, of the manuscript copyist, acknowledging the materiality of each translation individually purchased, read, and interpreted. Translations are also generators of new experiences. These experiences may arise directly from the textuality of the translations: from both reading and understanding the text or from the practical application of an item described by the translation (a recipe, a procedure, an ethical attitude, and so on). However, experiences can also relate to the translations in a different way, when practitioners discuss their impact on different levels of the external world, either descriptively (elucidating a state of affairs) or prescriptively (requesting changes to a state of affairs). Like any written text taken in its temporal dimension, a translation is a multiplier of experiences, collecting and originating experiences of different kinds.

Experience as a complex, many-layered structure is impossible to capture. That is probably due to its overarching presence in human life: experience is the main feature of our mental encounter with the outside world. Consequently, the human world is an experiential world. In the course of time, that dynamic dimension of human life crystallizes into a series of testimonies, objects, and items. Historians collect and examine these remnants of past lives with the aim of reconstructing at least some of the elaborate framework of variables, choices, and actions that surrounds any event. There are cases, though, in which historians can reconstruct almost nothing: they cannot assess the myriad of experiential variables characterizing the life of a translator, or whether Bacon did send messengers across the sea or witness deplorable misunderstandings in Paris. There is no way around the limitation that time imposes on our lives by constantly flowing away. Nonetheless, to mistake the static endurance of historical witnesses for the lively complexity of human existence would, I think, be an inexcusable error, both methodologically and philosophically.

Notes

1 I use the term "medieval Spaniards" to refer to the people dwelling in the Iberian Peninsula during the Middle Ages, without implying any sociocultural, religious, or linguistic characterization.

2 See Burnett, "Translating."

3 On the collaboration between Ibn Daud and Gundissalinus, see Polloni, *Twelfth-Century Renewal*, 1–19. The two translators also appear to have influenced each other philosophically (or, at least, Ibn Daud surely influenced Gundissalinus). See Polloni, "Toledan Ontologies."

4 Ibn Daud describes the method in the preface to their translation of Avicenna's *De anima*. See d'Alverny, "Les traductions"; Bertolacci, "Community."

5 Roger Bacon, *Compendium studii philosophiae*, ed. and trans. Maloney, 175.

6 For a detailed examination of Bacon's criticism of Latin translators, see Polloni, "Disentangling."

7 For instance, see Ibn Daud's and Gundissalinus's prologue to the Latin translation of Avicenna's *De anima*: Avicenna Latinus, *Liber de anima*, I. 4.

8 This scarcity is exacerbated by corruptions and losses due to the history of the text's transmission. The translators of many texts are still unknown and, in some cases, only one translator is mentioned instead of two, for instance in Gundissalinus's later translations. Manuscripts sometimes give only Gundissalinus's name, or they do not name any translator. Does this mean that Gundissalinus learned Arabic and translated without collaborating with any other member of his team? Different interpretations are possible, considering the scanty data; it may be that the name of the other translator was simply lost during the transmission of the text. See Burnett, "Some Comments," esp. 166. Concerning unnamed translators, see Hasse and Büttner, "Notes."

9 Translators themselves underlined the difficulty of rendering Arabic syntax and vocabulary into Latin. Burnett, "Translating."

10 See Pessin, *Ibn Gabirol's Theology*.

11 See Polloni, "Misinterpreting Ibn Gabirol?"

12 I cannot expand further here on the semantic nuances of *experior*, but they can be appreciated by consulting the *Thesaurus Linguae Latinae* (https://tll.degruyter.com/) and dictionaries of medieval Latin such as DMLBS (https://dmlbs.ox.ac.uk/). On the multifarious declinations of "experience" in the Latin Middle Ages, see Benatouïl and Draelants, *Expertus sum*.

13 See Bertolacci, “Community.”
14 See Burnett, “Coherence.”
15 Supposedly, a great number of Arabic works were available in Toledo. It is true that Toledo held a vast library proceeding from the possessions of the Banu Hud family, a large collection of Arabic manuscripts that was moved from Zaragoza to Toledo before the beginning of the translation movement (Burnett, “Coherence”). But the material availability of original works alone did not make them available for translation.
16 On duplications and revisions, see Burnett, “Scientific Translations.”
17 See Burnett, “Coherence,” 275–81.
18 This is a very controversial point, as Gundissalinus’s *De scientiis* is a variously altered version that challenges the label of “translation” in favor of an acknowledgment of the text as an original work. See Polloni, *Twelfth-Century Renewal*, 20–29; Galonnier, *Le “De scientiis Alfarabii”*; Galonnier, “Dominicus Gundissalinus.”
19 See Burnett, “Communities of Learning.”
20 Gundissalinus was archdeacon of Cuéllar before he moved to Toledo, and was probably called into town by the archbishopric in order to collaborate with Ibn Daud. See Polloni, “Toledan Translation Movement.”
21 See García Gallo, *El Concilio de Coyanza*.
22 See Polloni, *Twelfth-Century Renewal*, 14–15.
23 See Polloni, “Disentangling.”
24 See Hackett, “*Ego Expertus Sum*.”
25 See Power, *Roger Bacon*.
26 Roger Bacon, *Letter to Pope Clement IV*, ed. Gasquet, 502; trans. Egel, 151. Emphasis added.
27 On Bacon’s *scientia experimentalis*, see the fundamental studies by Jeremiah Hackett, especially “Roger Bacon on *Scientia experimentalis*.”
28 On Bacon’s life, see Hackett, “Roger Bacon.”
29 On Scot’s biography, see Thorndike, *Michael Scot*.
30 Michael Scot, *Ars alchemie*, ed. Thomson, 533.
31 For a thorough examination of this aspect of Bacon’s thought, see Polloni, “Disentangling.”
32 Roger Bacon, *Compendium studii philosophiae*, ed. and trans. Maloney, 165. Emphasis added.
33 See ibid., 163. Bacon recalls the same incident, giving additional details, in *Opus maius*, I. 3. 1.
34 See Théry, “Note.” Against Théry’s reductive approach, Alessio, *Mito e scienza*, 44–45.

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15 Table Talk

Florence Hsia

Lists and tables have played an important exemplary role in broad claims about human cognition and culture that have identified changes in communication technologies as crucial to the emergence and development of the sciences. In Jack Goody's analysis of the "domestication of the savage mind," the lists so characteristic of the extant cuneiform corpus of ancient Mesopotamia facilitated the classification, reorganization, and analysis of celestial observations, thus laying the foundations for astronomical calculations, mathematical theories, and the growth of knowledge.[1] For students of media shifts, the early modern European printing press enabled an astronomer like Tycho Brahe to gather observations and predictions—his own as well those of his contemporaries and predecessors—for synoptic display.[2] "All these charts, tables and trajectories are conveniently at hand and combinable at will," writes Bruno Latour, "no matter whether they are twenty centuries old or a day old," a consequence of print culture that can explain "a Copernican revolution."[3]

Two closely related assumptions run through these efforts to capture the work that such textual structures perform. First, lists, tables, and other "formal operations of a graphic kind" facilitate cognitive work difficult to accomplish through speech.[4] Operating in not the aural but the visual realm, such devices make it possible to manipulate lexical material in ways that go beyond the conventional patterns of spoken discourse: "Orality knows no lists or charts or figures."[5] Second, inscriptions of this sort make it possible to replace phenomena—the natural world as it appears to us—with representations of the natural world, "written in the *same* language or code."[6] These representations depend on a grammar and syntax distinct from most written prose as well. As a team of Elsevier data scientists working on automated processes to extract information from scientific tables declared in 2018: "Tables are, after all, not your grandmother's natural language."[7]

We can agree that tables have carried much of the epistemic burden by which science professes to "show" us nature as it really is, breaking with the immediacy of perception and the flow of ordinary language to constitute a "second nature" suitable for scientific investigation.[8] Yet astronomy's history tells a complicated story about how tables were

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deployed to represent the heavens. Translating celestial experience into tabular language was largely a matter of projecting the future, not organizing the past. As we shall see, astronomical tables predicted observables long before they disciplined observations.

What Are Astronomical Tables?

In many celestial traditions, predictive schemes for heavenly objects comprised computational rules for producing numerical results. Tables constructed according to such rules have a matrix structure, with sets of related numerical quantities generated algorithmically and displayed in a tabular format of rows and columns.[9] Astronomical tables in this sense were designed to find the changing positions and times of celestial objects and related phenomena (the length of daylight throughout the course of a year; the visibility of the lunar crescent; the time, duration, and phases of solar and lunar eclipses) for a wide range of purposes, whether calendrical, astrological, ritualistic, or political. Sources are legion: over three hundred tabular texts associated with Babylonian mathematical astronomy, written on clay tablets dating from as early as the mid-fifth century BCE but mostly concentrated in the second and first centuries BCE;[10] Ptolemy's second-century CE *Almagest*, containing some 150 numerical tables, and his *Handy Tables*, both immensely influential;[11] examples in Greco-Roman papyri scattered over about half a millennium, beginning in the first century BCE;[12] and some fifty or so known Sanskrit titles, mostly from the sixteenth and seventeenth centuries, perhaps influenced in their tabular format by the extensive *zīj* literature in over two hundred known titles.[13] Produced across the breadth of the Islamic world starting in the eighth century, *zīj*es—astronomical handbooks comprising sets of tables with instructions for using them—were in turn translated and transformed in the Latin West and East Asia.[14]

A sophisticated body of scholarship has capitalized on the mathematical structure of numerical astronomical tables to advance interpretation and analysis. In many instances, tables have survived devoid of associated explanatory or instructional texts; in others, accompanying texts—even those meant to verbally present the algorithms with which tables were generated—state parameters and procedures that may not, in fact, accord with the ones deployed, or do not fully articulate the basis, steps, or information necessary for computing or using the tabulated data.[15] To address these challenges, scholars deploy a technical form of philology that brings together textual collation and the judicious use of modern recomputations.[16] The painstaking work of reconstructing interpolative, rounding, and other computational practices from tabular evidence depends on distinguishing errors in translation and transcription from systematic deviations that, upon further analysis, can be shown to be artifacts of the table-maker's sources and methods.[17] By evaluating arithmetical sequences in tabular texts, for instance, Otto Neugebauer was able to join fragments of broken tablets and establish an ordered corpus in his foundational 1955 edition of the textual evidence for Babylonian mathematical astronomy.[18] In his magisterial study of some ninety textual witnesses to the medieval Toledan Tables, Fritz Pedersen used departures from expected tabular sequences—likely mistranslations of the Abjad alphabetic numeral system—to posit independent translations from Arabic to Latin within an extensive manuscript tradition.[19] And by tracing parameter values implicit in computed tables, scholars have spun lines of tabular filiation across cultures and centuries, linking Seleucid Babylonia, India, Abbasid Baghdad, al-Andalus, and the Latin West.[20]

Close study of both tabular values and formats has also revealed how table-makers sought to ease the task of calculation. Medieval Arabic and Latin astronomers made a number of ingenious "tabular innovations," such as displaced tables in which the addition of a constant to either a table's given quantities (arguments) or its computed values (entries) allowed the user to avoid working with subtraction, or double argument tables in which both horizontal and vertical axes were used to display separate arguments, saving the user some computational steps.[21] Fifteenth-century editions of the *Huihui lifa*—a set of tables translated into Chinese from an Arabic *zīj* by order of the first Ming emperor, soon after the Mongol Yuan dynasty had established an office for Islamic astronomy—closely followed its likely source not only in its double-argument structure, but also its symmetrical layout and use of "color" (e.g., white text on black background) to indicate whether values should be added or subtracted.[22] The computationally heroic and mathematically versatile fourteenth-century Cairene astronomer Najm al-Dīn al-Miṣrī tabulated over 400,000 entries applicable to the rising and setting of any fixed star at any terrestrial latitude, and indeed to spherical astronomy more generally.[23]

These examples highlight what scholars have characterized as a distinctively pragmatic focus of tables computed for astronomical purposes: "user-friendliness" was "the driving force that prevailed in the history of table making."[24] Incunabula production in the Latin West suggests a readership well primed by long-standing textual traditions in such useful tools. Three Venetian printers thought it economically viable within the span of fifteen years to produce four different editions of tables based on the widely diffused and diverse Alfonsine tradition, all in print by 1498 and offering purchasers a variety of approaches to finding celestial positions and times.[25] Ephemerides and almanacs, texts often set in tabular formats, likewise spared their users—not their makers—considerable tablework by providing positions of celestial objects computed at daily or other convenient intervals for a given time period.[26]

With its chronological and global sweep, the history of computed astronomical tables is a history of significant commitment on the part of table-makers, scribes, and printers. Thanks to case studies deciphering the "solutions" hidden within the seemingly "unintelligible sequence[s] of numbers" so plentiful in astronomical traditions, we have considerable evidence of the sheer diversity of tabular layouts and how they facilitated the dexterous manipulation of lexical material through a wide range of computational strategies.[27] The adoption of tabular formats in India—perhaps motivated by the translation of *zīj* literature into Sanskrit—may further testify to the computational affordances of two-dimensional tabular arrays in comparison with "versified tables," a genre reflecting the primacy of the spoken word in its use of alphasyllabic systems or synonyms for number words to represent mathematical operations in metrical verse.[28] Whether inscribed on clay or papyrus, parchment or paper, computed tables well illustrate how tabular structures have been exploited within literate cultures to address highly complex problems in predictive astronomy. But what of empiricism?

Parameters and Empiricism

The kinds of astronomical tables discussed above bore but a distant connection to astronomical observation. Textual genres kept the two separate. Letters, chronicles, and other kinds of texts recounted sightings of notable astronomical phenomena such as solar and lunar eclipses—celestial events that certainly attracted the attention of non-expert observers—but did so without utilizing tabular formats. Nor did specialist genres typically make use of tabular layouts for recording observations of astronomical phenomena. In his foundational classification of Late Babylonian astronomical tablets, for instance, Abraham Sachs distinguished texts containing algorithmic computations of astronomical phenomena, characteristically tabular in format, from non-tabular texts that recorded observations alongside predictions based on the extension of empirically determined period relations (the intervals at which planets repeat their appearances on the same calendar dates).[29] While some cuneiform compilations of observations and predictions of cyclical phenomena were organized in a grid layout that made celestial periodicities visible, others were not, making it difficult to fully assess the use and import of tabularization for Babylonian empirical data.[30]

Computed astronomical tables did depend on parameters that were, in principle, based on observation (e.g., the length of the tropical year—the average time for the sun to return to the same solstice or equinox).[31] But this empirical edge was blunted by various factors. Parameters for astronomical tables in the Islamic world and the Latin West were often not stated. And even where table parameters were explicit, their determination was often left unarticulated for readers. In the absence of direct evidence, scholars have reached radically different conclusions about whether a specific parameter was carried over from a source text or revised on the basis of new empirical data, and what the analysis of parameters can reveal about practices of astronomical observation.[32] Assessing the empirical foundations for catalogs of stellar and geographical positions—often laid out as tables and especially common in the *zīj* tradition—faces analogous challenges.[33]

Reconstructive studies of Babylonian and early Greek astronomy have shown, moreover, that table parameters may have been derived from a remarkably limited set of observational data.[34] Neither the number of places given in computed astronomical tables, nor the long intervals of the periodicities underlying their construction (427 years for Jupiter, 1,151 years for Venus) need reflect underlying observations of great quantity or duration.[35] In the *Almagest*, Ptolemy worked with specific observations both ancient and recent, but was strikingly parsimonious in selecting empirical data that answered his theoretical and methodological needs.[36] He first used a set of three historical lunar eclipse observations and then, as a check, another set of three lunar eclipse observations from his own time to establish the radius of the moon's epicycle and determine parameters for his tables of lunar mean motions.[37] Five dated observations constituted the total empirical data for the model for Saturn, five for Jupiter, five for Mars, with an additional pair of observations for each planet—one historical, the other recent—used to assure the accuracy of the tabulated mean motions. As Richard Kremer has remarked, these observational inputs were "the minimum required" given Ptolemy's geometrical procedures.[38]

Though highly attenuated, the empirical dimension of computed tables enabled medieval users to test predictions and retrodictions of celestial phenomena against observations both historical and modern. Some went further by evaluating accepted parameters or deriving them anew on the basis of observational data.[39] The evidence for such improvements may be more suggestive than substantive. In the prologue to the Alfonsine Tables of Toledo, for instance, the authors assert the continued need to make observations and claim to have obeyed Alfonso's order to correct older tables, but four eclipses comprise the only known dated observations made by those working at the court, and none are mentioned in the tables' accompanying texts. In many cases, it can only be inferred that new parameter values were based on the results of an observational program.[40]

Medieval efforts to use observation in these ways seem to have been infrequent, though several astronomers in the Islamic world undertook sustained campaigns to collect relevant data and, in some instances, improve the parameters in their predictive models and astronomical tables.[41] In the early eleventh century, Abū al-Rayḥān al-Bīrūnī compiled nearly two centuries' worth of solar meridian altitude observations (including his own) to determine a better value for the solar eccentricity, one of the parameters in the Ptolemaic model for the sun's motion.[42] Bīrūnī also revised the Ptolemaic lunar model by using a triplet of his lunar eclipse observations to redetermine the radius of the moon's epicycle, one of very few Islamic astronomers to leave behind a description of how observational data were used to derive this parameter. Over a century later, Muhyī al-Dīn al-Maghribī likewise followed Ptolemy's procedures to arrive at a value for the same parameter on the basis of lunar eclipse observations he had made at the Maragha observatory, which he then used in constructing his tables for lunar mean motions.[43]

Printing Empirical Data

In contrast, the textualization of celestial observations was largely a prosaic affair, not a tabular one.[44] This did not change with the age of print. Consider, for instance, how empirical material appeared in the early printings of Ptolemy's *Almagest*. Copernicus is known to have used the first printed edition of 1515,[45] a medieval Arabic–Latin translation completed in 1175 by Gerard of Cremona. He may have also drawn on the first translation from Greek to Latin, completed in 1451 by George of Trebizond from a manuscript lent him by Cardinal Basilios Bessarion in an unsuccessful series of bids for the patronage of Pope Nicholas V, then of Mehmet II (the Ottoman conqueror of Constantinople in 1453), then of Matthias Corvinus of Hungary, and finally printed in 1528.[46] Copernicus certainly used the *editio princeps* of the Greek text, edited by the professor of Greek at Basel, Simon Grynaeus, and printed there in 1538.[47] He also relied heavily on Johannes Regiomontanus and George Peurbach's 1496 *Epitome of the Almagest*, a paraphrastic translation with significant additions that had been commissioned in 1460 by Cardinal Bessarion.[48] Tables were abundant in all three of these early-sixteenth-century *Almagest* editions, as well as the three early modern editions of Regiomontanus and Peurbach's *Epitome* (1496, 1543, 1550).[49] But none of these tables displayed astronomical observations.

In the first printed *Almagest* (Venice, 1515), facing pages presented the most ancient observations Ptolemy cited: three lunar eclipses observed in Babylon in 721 and 720 BCE. As we have already seen, they appeared as part of a theoretical exposition, Ptolemy's demonstration of his model for the moon's motion, which he proves for "as long a time as possible" by showing its agreement with both ancient observations and those he made himself in Alexandria over eight hundred years later.[50] The text block is solid with relatively few visual interruptions (paragraph marks, indents, illustrated initials, typeface of different sizes) indicating the beginning of new topics and chapters. No visual cues single out observational material. Here, as in the even less visually differentiated Basel 1538 *editio princeps* of the *Almagest* and the 1550 Nuremberg printing of the *Epitome of the Almagest*, the *mise-en-page* makes clear that such data—the empirical givens—are of a piece with the argument's prose.[51]

Representing a different manuscript and textual tradition, the Venice 1528 *Almagest* seems at first glance to present observational data differently, with marginal notes calling out the three oldest Babylonian eclipse observations. Yet the approach is inconsistently applied. Ptolemy's own observations appear a page later but lack marginal notes; elsewhere, ancient observations lack marginal notes, but more "modern" ones have them.[52] Determined readers could, of course, flag observational reports for themselves, as evident in the manuscript marginalia in the Vienna Observatory's copies of the 1496 *Epitome of the Almagest* and 1515 *Almagest*, both printed in Venice and bound in the same volume.[53] Manuscript finding aids such as marginal notes and indexes were soon adopted by printers, often as added value to a new edition of an old text.[54] But the only planetary observations highlighted in the extensive printed index added to the second edition of the *Epitome* (1543) are the three lunar eclipses observed by Ptolemy from Alexandria, hardly a systematic approach.[55] With neither index nor marginal notes to guide the way, readers of the third edition of the *Epitome* (1550)—the last to be printed in the early modern era—were left to work through the prose in which empirical material was embedded.

In short, the textual texture of the principal sources for observational reports available to sixteenth-century astronomers like Copernicus was smooth. The empirical *data* to be found in the *Almagest* were indeed "givens" in the sense that Ptolemy selected observations of celestial phenomena in order to establish numerical parameters for his models of planetary motion. Empirical data were also givens in the sense that they were asserted for the sake of an argument as evidence in favor of one model or against another.[56] The reader encountered observations in the course of theoretical exposition, not set apart in tabulated form.

If readers were perfectly capable of locating someone else's givens, they also turned them to their own purposes. Ptolemy did so with respect to Hipparchus; Copernicus did the same in poaching observational reports from his predecessors and combining them with new data. At the same time, however, Copernicus approached empirical material much as Ptolemy had done. He cited observational reports sparingly, choosing those he needed from textual sources and his own records to articulate his own planetary theories. The two sixteenth-century editions of his *On the Revolutions of the Heavenly Spheres* (Nuremberg, 1543 and Basel, 1566) presented readers with a well-curated set of observations firmly embedded in a theoretical framework. Even the "history" of stellar observations he drew from Greek, Latin, and Arabic sources was marshaled to prove a general point: that the precession of the equinoxes and solstices was not uniform.[57] Nowhere did celestial observations break from the *mise-en-page* of argumentative prose.

Table Trouble

Erasmus Reinhold set himself a task that he thought Copernicus had failed to accomplish: a set of astronomical tables consistent with the observational data that Copernicus himself had used to construct planetary models. For his *Prussian Tables* (1550), Reinhold laboriously compared the observations cited in *On the Revolutions*, carrying his calculations through several iterations to achieve agreement with observed values, derive Copernicus's parameters afresh, and compute Copernican tables anew.[58] Along with its many "user-friendly" improvements—such as introductory precepts and entries tabulated at smaller intervals—Reinhold promised the work would supersede the "old," "commonly used" tables: "Calculation agrees with the history of observations, especially those recorded in Ptolemy," a point on which the Alfonsine tables fell short.[59] But as calendrical texts (ephemerides, almanacs, astrological prognostications) computed from the *Prussian Tables* proliferated, the Copernican tabular tradition's own shortcomings became increasingly obvious.[60]

In 1556, Cyprian Leowitz sought to improve on Peurbach's 1514 Alfonsine-based tables, which he said had erred by more than half an hour for a lunar eclipse of June 1555. Less certain when it came to solar eclipses, Leowitz calculated their visibilities for the city of Augsburg using both Copernicus and Peurbach, leaving it to readers to decide whether either was superior to his own Alfonsine corrections.[61] Later that same year, Johannes Stadius published ephemerides based entirely on Reinhold's tables, with an encouraging letter from his teacher, the renowned mathematician Gemma Frisius, noting "how much the Alfonsine calculation recedes from the experience" of eclipses and other celestial phenomena.[62] Stadius's work, in turn, quickly came under attack. Even as he roundly condemned recent Alfonsine ephemerides-makers for their "ignorance and error," John Feild took Stadius to task in the postface he hurriedly added to his own Copernican ephemerides for the year 1557, printed just a month later in London.[63] Despite an effort to keep Stadius's work current—the posthumous 1581 edition gave predictions through 1606—Giovanni Antonio Magini published another Copernican ephemerides in 1582 that opened with over sixty pages on his predecessor's computational errors, along with the charge that Stadius's supposedly Copernican predictions for 1595 and later had been roughly copied from Leowitz's 1557 Alfonsine ephemerides.[64]

As Magini himself illustrates, this tabular arms race accelerated after Tycho Brahe's new theories of the sun and moon, with tables for computing their motions, were posthumously published in the 1602 *Preliminary Exercises towards a Restored Astronomy*. Magini became embroiled in a protracted exchange with a professor of mathematics at Frankfurt, David Origanus, who had sharply criticized Magini's 1582 work in yet another Copernican ephemerides, published in 1599.[65] Magini provided some worked Tychonic examples in his reply to Origanus and discussed Tycho's solar theory in a supplement to his 1582 publication, but Origanus raised the stakes, answering Magini at length and calculating eclipses and solar positions according to both Tycho and Reinhold for his *Brandenburg Ephemerides* of 1609, valid for sixty years.[66] Still smarting from Origanus's criticisms, Magini tried to enroll Johannes Kepler, whose *New Astronomy* (1609) had previewed for Mars the level of predictive accuracy that new planetary models, derived from the great storehouse of observations made at Tycho's various observatories, might achieve, eventually reverse-engineering his own "Keplerian" tables from the procedures and observational data Kepler had published for Mars.[67] But Kepler's eventual publication of the *Rudolphine Tables* (1627), however renowned for their basis in Tycho's extensive observational logs, achieved no consensus. Nor did Christian Longomontanus, who had worked with Tycho for a decade and finally provided Tychonic models and tables for all the planets in his *Danish Astronomy* (1622). Composers of ephemerides and calendars drew freely from the computational possibilities that Kepler and Longomontanus offered.[68]

Empirical Comparables

Empirical tests had long been hailed in principle as the touchstone for adjudicating between rival predictive schemes, a point on which even competitors agreed. In practice, the kind of celestial experience adduced to justify the need for newer, better astronomical tables veered between the anecdotal and the general. When Gemma Frisius testified that he had seen a conjunction of Saturn and Mars anticipate Stöffler's Alfonsine ephemerides by more than six days, he mentioned neither the month nor the year at issue, and broadly characterized errors in the Alfonsine computations—as great as 4 degrees in the motion of Mars, 10 or 11 degrees in the motion of Mercury—as "intolerable."[69] Decades later, Francesco Giuntini took over Gemma's criticisms largely without comment or acknowledgment, adding a few observations to emphasize Stöffler's deficiencies as he introduced his own user-friendly version of the *Prussian Tables*.[70]

To be useful for determining and testing table parameters, however, empirical data needed to be made comparable. This was no straightforward task. Nicolaus Mulerius sought to make Copernicus's empirical data tractable in his 1617 edition of *On the Revolutions*, which featured an appendix cataloging the observations he had "collected from Copernicus's writings."[71] The empirical data in Mulerius's collection remained within the framework of Copernicus's exposition of planetary theory, as Mulerius chose to present them "preserved in the sequence in which Copernicus used them." This meant, for instance, that they did not necessarily appear in chronological order. But chronological concerns were at the heart of Mulerius's catalog, an issue to which Mulerius was especially sensitive given his own interest in computing almanacs and astronomical tables.[72] Though critical to determining parameters, correctly counting long intervals of time between observations was difficult when they were recorded using different calendrical systems. Tables for computing planetary positions, too, were predicated on chronological landmarks that were not consistently deployed. To save readers the labor—and potential error—of converting dates for astronomical observations on the fly, Mulerius sought to systematically supply all chronological equivalents for the empirical data in his edition of Copernicus's book, giving Julian days in years of the Christian era for ancient observations, Egyptian months for modern observations, and year equivalents reckoned from the death of Alexander for all, an epoch that both Copernicus and Ptolemy had inconsistently used to date observations and compute planetary motions.[73]

European astronomers in the period harbored general doubts about whether and how the historical observations available to them should be used, given uncertainties over chronology, their predecessors' instruments and geographical location, and such perturbing conditions as atmospheric refraction, an issue with which Tycho would be especially concerned. Copernicus excluded the Babylonian observations that Ptolemy had used in the *Almagest* to determine elements of his lunar model, while Tycho limited the eclipse observations he tabulated as the empirical data for his own lunar model to those "carefully observed by us" between 1573 and 1600.[74] The observations of Mars that Kepler displayed in tabular form in his *New Astronomy* likewise came from Tycho's trove, with the interpretive challenges of Ptolemy's empirical data addressed at length in the work's final chapters.[75] The "treasury of astronomical observations" Philips van Lansbergen appended to his 1632 astronomical tables—"constructed" and "agreeing with the observations of all times" from the Babylonians' to his own—made painfully clear how much labor was involved in working with empirical material drawn from disparate sources: Lansbergen took nearly 140 pages to evaluate data for the 162 planetary observations he assembled.[76] For his 1635 astronomical tables and models, both "consistent with the observations of Ptolemy, Copernicus, Tycho, Lansbergen, and other excellent astronomers, as much ancient and modern," Noël Duret went to the other extreme, compiling a one-page "table" that categorized a total of 184 undated observations by type and observer.[77] And when the Jesuit astronomer Giovanni Battista Riccioli assembled both a "history" of eclipse observations made over nearly 2,500 years and a "catalog of eclipses from ephemerides" between 1485 and 1700 CE for his *New Almagest* (1651), he narrated the former and tabulated the latter.[78]

Such attempts to provide empirical evidence for astronomical tables' predictive accuracy or their underlying parameters illustrate a fundamental tension between tabular formats—long familiar to astronomers as a textual tool that made the computed data it generated into observables—and the unruliness of empirical data. The standardizing demands of predictive tables set a high bar for the disciplining of historical observations into tabular form, making the translation of celestial experience into the language of tables a slow and fitful affair in the pages of early modern European astronomical works.[79]

Notes

1 Goody, *Domestication*, 92–93, 108. For recent work on Mesopotamian lists, see Veldhuis, "Continuity"; Watson and Horowitz, *Writing Science*, chs. 2, 7; Van De Mieroop, "Theses," 23–33.
2 Latour, *Science in Action*, 226; Latour, "Drawing," 43, citing Eisenstein, *Printing Press*, 624–25.
3 Latour, *Science in Action*, 227, 226; Eisenstein, *Printing Press*, 623–31.
4 Goody, *Domestication*, 75; Goody, *Power*, 146.
5 Ong, *Orality and Literacy*, 96.
6 Latour, "Drawing," 43; see also 31–35, 40–44.
7 Daniel, Cox, and Harper, "Semi-Automated Exploration and Extraction of Data in Scientific Tables."
8 Strasser, "Collecting Nature," 320; Daston, "Super-Vision"; Marcacci, "Seeing."
9 See the essays by Eleanor Robson, Arthur L. Norberg, and George A. Wilkins in Campbell-Kelly et al., *History*, and the Digital Information System for the History of Astral Sciences project led by Matthieu Husson (https://dishas.obspm.fr/about).
10 Ossendrijver, *Babylonian Mathematical Astronomy*, 1–2, 6, 11–12.
11 Van Brummelen, "Survey"; Sidoli, "Mathematical Tables"; and Tihon and Mercier's critical edition of *Ptolemaiou procheiroi kanones*.
12 Jones, "Classification," texts edited in Jones, *Astronomical Papyri*.
13 Montelle and Plofker, *Sanskrit Astronomical Tables*, 35, 72, 261–70, 34–35; King, Samsó, and Goldstein, "Astronomical Handbooks," 14. See Pingree, "Classification"; Kennedy, "Survey."
14 "Kennedy, "Survey," 123. See Chabás and Goldstein, *Survey*; Chabás, *Computational Astronomy*; Li, "Arabic Astronomical Tables"; King, "Astronomical Tables"; King, Samsó, and Goldstein, "Astronomical Handbooks," 82–96.
15 Ossendrijver, *Babylonian Mathematical Astronomy*, 15, 36–37; Jones, "Uses and Users," 153–55; Kennedy, "Survey," 123; Chabás and Goldstein, *Essays*, 311.
16 E.g., Misra, Montelle, and Plofker, *Sanskrit Astronomical Table Text*; van Dalen and Pedersen, "Re-editing."
17 Van der Waerden, *Mathematical Statistics*, ch. 7; van Dalen, *Islamic Astronomical Tables*; van Dalen, "Islamic and Chinese Astronomy," 345–53; Van Brummelen, "Survey"; Van Brummelen and Butler, "Determining"; Chabás and Goldstein, *Essays*.
18 Neugebauer, *History*, 350, 432–33, referring to his *Astronomical Cuneiform Texts*. For additions to the corpus, see Steele, "Newly Identified Tables" and the forthcoming edition of Babylonian table texts by Ossendrijver.
19 Pedersen, *Toledan Tables*, 19–20, 841.
20 Neugebauer, *History*, 371, as discussed by Rochberg, *Path of the Moon*, 271–72, 294–96; Mercier, "Astronomical Tables"; Chabás and Goldstein, *Essays*.
21 Chabás and Goldstein, *Essays*; Chabás and Goldstein, "Medieval Moon"; King, Samsó, and Goldstein, "Astronomical Handbooks," 79–80; Chabás, "Aspects of Arabic Influence"; Husson, "Remarks."
22 Li, "Arabic Astronomical Tables," 30–36.
23 Charette, "Monumental Medieval Table," 23.

24 Chabás and Goldstein, *Essays*, 150; Van Brummelen, "Travels," 12. See also Weil in this volume.
25 Chabás and Goldstein, *Astronomical Tables*, 10–11.
26 Nothaft, "Ephemerides."
27 Chabás and Goldstein, "Introduction," in Chabás and Goldstein, *Essays*, 3, 1.
28 Kim Plofker ("Sanskrit Astronomical Tables," 89) notes that such versified tables are "conventionally interpreted and described as tables by researchers." Important case studies that address this question are published in the same special issue; see also Montelle, "From Verses in Text." For context, see Plofker, "Spoken Text."
29 Sachs's "non-tabular astronomical texts" are now generally termed "non-Astronomical Cuneiform Texts" and "nonmathematical astronomical texts," effectively equating tabular formats with mathematical astronomy. See Sachs, "Classification"; Rochberg, *Before Nature*, 81–82. On period relations, see Steele, "Goal-Year Periods."
30 Of the twenty known compilations, seven have a tabular format. See Steele, "Early History," esp. 21–26; Steele, "Visual Aspects."
31 Neugebauer, *History*, 366–70.
32 For Indian astronomy, see Billard, *L'astronomie indienne*; Pingree, "Recovery"; van der Waerden, "Two Treatises"; Mercier, "Originality." For Chinese astronomy, see Maeyama, "Astronomical Data"; Cullen, "Huo Rong's Observation Programme."
33 E.g., Swerdlow, "Enigma"; Graßhoff, Mittenhuber, and Rinner, "Paths and Places."
34 Rochberg-Halton, "Between Observation and Theory," 115–16; Swerdlow, *Babylonian Theory*, 29–32, 58–64; Bowen and Goldstein, "Meton of Athens."
35 Aaboe, "Observation," 14; Neugebauer, *History*, 388–91.
36 Swerdlow and Neugebauer, *Mathematical Astronomy*, 1:34–39. For context, see Hsia, "Astronomy," 23–24.
37 Ptolemy, *Almagest*, trans. Toomer, 179–80, 190–204 (IV. 6); tables at 182–87. See Neugebauer, *History*, 73–79.
38 Kremer, "Experience and Observation," 210, 201–16. See Jones, "Ancient Planetary Observations"; Goldstein and Bowen, "Introduction."
39 See Mozaffari and Steele, "Solar and Lunar Observations," 343–44.
40 Goldstein, "Astronomy," 166–67; Saliba, "Theory and Observation."
41 E.g., Goldstein, "New Set"; Mozaffari and Steele, "Solar and Lunar Observations," 343–48.
42 Mozaffari, "Limitations," esp. part 1, 324–25, tables 1 and 2. The observations are not well distributed over time.
43 Mozaffari and Steele, "Solar and Lunar Observations," 347–48; Mozaffari, "Muḥyī al-Dīn al-Maghribī," 68–81, 105. See Said and Stephenson, "Solar and Lunar Eclipse," 45–46.
44 Edward S. Kennedy ("Survey," 158) uses "table" to describe al-Bīrūnī's compilation of twenty-three equinox observations in his *zīj*, entitled *al-Qānūn al-Masʿūdi*.
45 Ptolemy, *Almagestū cl. Ptolemei*, Venice 1515. See Czartoryski, "Library," 358, 364, 372.
46 Ptolemy, *Almagestum seu magnae constructionis mathematicae*, Venice 1528. See Shank, "*Almagest*."

47 Ptolemy, *Kl. Ptolemaiou megalēs syntaxeōs bibl. iḡ*, Basel 1538. See Segonds and Luna, “Greek Text”; Czartoryski, “Library,” 356, 364–65, 367–68.
48 Joannes Regiomontanus and Georg von Peurbach, *Epytoma joa[n]nis de mo[n]te regio in almagestu[m] Ptolomei*, Venice 1496; Swerdlow and Neugebauer, *Mathematical Astronomy*, 1:93.
49 Johannes Regiomontanus and Georg von Peurbach, *Epitome, in Cl. Ptolomaei magnam compositionem*, Basel 1543, and *In Ptolemaei magnam compositionem, quam almagestum vocant*, Nuremberg 1550.
50 Ptolemy, *Almagestū*, Venice 1515, IV. 6, 40v; see also 40v–41r (Babylonian eclipse triple), 42rv (Alexandrian eclipse triple).
51 Ptolemy, *Kl. Ptolemaiou megalēs syntaxeōs*, Basel 1538, 94–100.
52 Ptolemy, *Almagestum*, Venice 1528, IV.6, 38rv, 39v; cf. IV. 11, 42r–43r.
53 Regiomontanus and Peurbach, *Epytoma*, Venice 1496, IV. 19, e4r; Ptolemy, *Almagestū cl. Ptolemei*, Venice 1515, 40v. Vienna Observatory Hw 42.
54 Blair, “Annotating”; Enenkel and Nellen, “Introduction.”
55 Regiomontanus and Peurbach, *Epitome*, Basel 1543, “Index omnium eorum propositionum,” bv.
56 Goldstein and Bowen, “Role of Observations.”
57 Copernicus, *De revolutionibus*, Nuremberg 1543, III. 2, 64r.
58 Erasmus Reinhold, *Prutenicae tabulae coelestium motuum*, Tubingen 1551, [α4]r, β2v; Henderson, “Erasmus Reinhold”; Swerdlow, “Early Responses,” 244–45.
59 Reinhold, *Prutenicae tabulae*, [α4]r, β2v, β3r. On the “handiness” of Reinhold’s tables, see Gingerich, “Role,” 45–47.
60 Kremer, “Copernicus,” 239–45; Omodeo, *Copernicus*, 142–49.
61 Cyprian Leowitz, *Eclipsium omnium ab anno domini 1554 usque in annum domini 1606*, Augsburg 1556, [A5]v; B4r, C4r, Pv–P3r. For his complete ephemerides, already in press, Leowitz reverted to his own Alfonsine corrections. See Leowitz, *Eclipsium*, [A5]v, and Leowitz, *Ephemeridum novum atque insigne opus ab anno domini 1556 usq[ue] in 1606*, Augsburg 1557, a4r.
62 Joannes Stadius, *Ephemerides novae et exactae Joannis Stadii leonnovthesii ab anno 1554 ad annum 1570*, Cologne 1556, [A5]r; Gemma Frisius to Stadius, a1v (quotation); a2r.
63 John Feild, *Ephemeris anni 1557*, London 1556, Aiiir (“Lectori”); [Eiv]r (postface).
64 Giovanni Antonio Magini, *Ephemerides coelestium motuum*, Venice 1582, 1r–32v; for Leowitz, see 1v, 14r, and 26v.
65 David Origanus, *Ephemerides novae annorum xxxvi, incipientes ab anno. 1595*, Frankfurt an der Oder 1599, β5r–β6r; see Pantin, “New Philosophy,” 248–49.
66 Giovanni Antonio Magini, *Tabulae primi mobilis*, Venice 1604, 73r–96v, and *Continuatio ephemeridum coelestium motuum*, Venice 1607, 1r–7r; David Origanus, *Novæ motuum cœlestium ephemerides Brandenburgicæ*, Frankfurt an der Oder 1609, 1:(c)3v–(f)4v.
67 Voelkel and Gingerich, “Giovanni Antonio Magini.”
68 Kremer, “Mathematical Astronomy”; Kremer, “Longomontanus”; Swerdlow, “Lunar Theories.”

69 Gemma Frisius to Stadius (March 1555), in Stadius, *Ephemerides novae* (1556), a1v–a2r; Reiner Gemma Frisius, *De radio astronomica & geometrico liber*, Antwerp 1545, 34rv.
70 Francesco Giuntini, *Speculum astrologiæ*, Lyon 1573, "Tabulae resolutae astronomicae," 2rv.
71 Mulerius, "Thesaurus," in *Astronomia instaurata*, 471. For context, see Netten, "Astronomia instaurata."
72 Vermij, *Calvinist Copernicans*, 46–47.
73 For Copernicus's and Ptolemy's approaches to dates and epochs, see Ptolemy, *Almagest*, trans. Toomer, 9–14; Swerdlow and Neugebauer, *Mathematical Astronomy*, 1:182–88.
74 Brahe, *Astronomia*, 02–[03] (new pagination after p. 112); Swerdlow, "Tycho." The only eclipse reports before 1600 that Godefroy Wendelin compiled in his *Eclipses lunares*, Antwerp 1644, a preview of his "Tabulae Atlanticae," were Tycho's and his own. Wendelin did not tabulate the observations he collected.
75 Johannes Kepler, *Astronomia nova*, Heidelberg 1609, 262–[63], 323–37.
76 Philips van Lansbergen, *Tabvlae motvvm coelestium*, Middelburg 1632, title page.
77 Noël Duret, *Nouvelle theorie*, Paris 1635, title page; "Table des Observations Astronomiques, ausquelles le calcul des Tables Richeliennes & Parisiennes est conforme," C1v.
78 Giovanni Battista Riccioli, *Almagestum novum*, Bologna 1651, 1:361–85 (history), 388–92 (catalog).
79 E.g., Christian Longomontanus, *Astronomica danica*, Amsterdam 1622, 31, 33, 43–45, 50–52, 200, 212, 221, 291, 296–97, 306; Ismael Boulliau, *Astronomia philolaica*, Paris 1645, 149–50, 171, 356; Vincent Wing, *Harmonicon coeleste*, London 1651, 154–55; compare 139–57. Wing's later publications show a similar mix of formats.

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16 The Experience of the Translator

Richard Eden and *A Treatyse of the Newe India* (1553)

Maria Auxent

Experience illuminates the margins of what is presently known. Francis Bacon's "merchants of light" in *New Atlantis* (1626) were trading a similar commodity, extending the boundaries of the visible and enabling new observations. The light of experience unveils new forms for the mind, from where they reach the pages of manuscripts and prints in the shape of signs. A common metaphor describes the process by which those signs are translated into other languages as a prism through which light is refracted and made more visible by being separated into a rainbow spectrum. In epistemic translation,[1] experience is refracted into components, and then reordered and recodified in pursuit of new epistemic and cultural objectives.

Articulations of experience, central to early modern scientific arguments and narratives, had complex linguistic tasks to fulfill. The words into which experience was put were required to convey the evidence of the senses, and at the same time to enable verification and reenactment of that evidence in other settings, for which it had to be capable of translation across different linguistic, cultural, and epistemic realms. Premodern scientists often scrutinized the verbalizations of experience hermeneutically and semantically, and their statements about the capacity of human languages to capture and convey experiences often rang with skepticism.[2]

Early modern naturalists viewed experience as a mediator between sense perception and concepts.[3] Influential Aristotelian formulations generally located experience on a route leading from isolated perceptions to images, memories, and ultimately universal judgments.[4] Early modern natural philosophers, although also aiming to gain universal knowledge, prioritized materiality, as given in the evidence of the senses, and emphasized the importance of meticulous induction from specific cases.[5] Consequently, they queried the role of words and natural language in understanding "things themselves."

In Francis Bacon's legacy, we see such critical reflection on the experience of things and the relationship between things and words, *res et verba*.[6] Bacon's *Novum Organum* (1620) likens experience to light, which manifests "the subtilty of things."[7] Experiences, Bacon argues, comprise

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immediate perceptions of the senses, which are generally reliable. However, "the human mind resembles those uneven mirrors which impart their own properties to different objects," jumbling the rays of experience and distorting the resulting notions.[8] True knowledge can only be achieved by organizing individual experiences into *experientia literata*—learned experience, which follows a sequence reflecting the order of nature and thereby yields true knowledge of "things themselves."[9] Bacon's thinking inspired the "plain language" reform of the Royal Society,[10] which saw the relationship between *res et verba* as the key to descriptive classifications of natural forms and qualities that could lead to universal knowledge. The matter was further probed by the universal language movement in the period, and also found applications in writings on the arts.[11]

Various ideas and schemes concerning the complex relationships between words and things were thus widespread in early modern intellectual, scientific, and artisanal debates. Some actors, however, participated in these debates not as intellectuals or artisans, but as practitioners immersed in the business of communicating experience by means of ordinary language. Translators had to unpick the relations between words and things within different tongues and media for each translation, in many cases applying their own personal experience in order to discern that "subtilty of things." How did translators reflect on their experience, as translating subjects, of matching words and things? How did their own experiences relate to those conveyed in translation? What affected translators' decisions when they repurposed their own and communicated experiences in the twists of epistemic translation?

My chapter approaches these questions through the case of Richard Eden (1520–1576) and his first publication, which translated excerpts from *Cosmographia universalis* (1550) by Sebastian Münster (1489–1552) as *A Treatyse of the Newe India* (1553; hereafter *The Newe India*). This slim volume has attracted less historiographical attention than Eden's subsequent, more substantial *The Decades of the Newe Worlde or West India* (1555).[12] Yet *The Newe India* has been recognized as the first scientific geographical work about the "New World" in English,[13] and it deserves more scholarship, given that it involved some the earliest practices of scientific translation into English. In the following, I examine first Richard Eden's experience of learning, then his methodological reflections on the experience of the translator. Finally, I look at the relationship between his experience and the experiences he conveyed in epistemic translations in which the eyewitness reports of the first European navigators in the New World were harnessed to the task of making geographical exploration a public enterprise.

The Translator's Learning Experience

In mid-sixteenth-century England, translators were recruited from various backgrounds. As translation offered only a precarious livelihood, they often worked as secretaries or with printers as well.[14] Richard Eden was known to his contemporaries as a translator, secretary, and alchemist.[15] From his own curriculum vitae, we learn that he was born into a prosperous merchant family with a tradition of university education and public service.[16] Eden earned his Master's degree at Cambridge, where he seems to have been an undistinguished student,[17] then entered employment as an exchequer clerk.[18] His Cambridge advisor Thomas Smith excelled in making herbal remedies, which apparently secured Eden's brief appointment as a distiller of waters for the royal household. But his heart (and his family's wishes) being in gold, he applied for a position at the Mint. That venture ended in a scandal in which he lost the manuscript of his English translation of Vanuccio Biringuccio's *De la pyrotechnia* (1540), one of the first publications on metallurgy.[19]

Despite this setback, Eden's fascination with metals returned him to translation. In 1552, Sir William Cecil employed him to translate selected chapters from Sebastian Münster's *Cosmographia* (1550), a work describing what were believed to be strategic locations in the New World where the English crown might benefit from rich deposits of precious metals.[20] The selection included excerpts from Book V, containing summaries of Columbus's letters and eyewitness reports on voyages by Magellan and Vespucci.[21] Münster had rendered the experiences of navigators during their exploration of new "lands and islands," incidentally a distinction typical of the progression from "islands" to "continents" in contemporary norms of geographical description.[22] Eden's translation, as *The Newe India*, set up his reputation as a translator, and he subsequently published several pioneering translations and compilations.[23]

In his translator's preface to *The Newe India*, we find Eden's earliest reflections on his own experience of learning to become a knowledgeable translator. Although his intentions are probably dictated by Cecil's patronage, Eden gives a different justification for his decision to translate: in an unfavorable review of an earlier, less ambitious booklet, *Of the Newe Landes* (1511), he contrasts its naive narratives with his own superior geographical competence.[24]

The preface goes into some detail as regards the source of this expertise. Most importantly, Eden presents a distinct position on the translator's experience as part of his broader reflections on how different ways of using experience can validate knowledge claims. The preface summons all epistemic authorities at once, catering to university scholasticism, humanist natural history, and artisanal experimental philosophy.[25] Arguing that the places most apt to bring forth gold, spices, and precious stones—and therefore most lucrative to appropriate—are the south and southeast parts of the world, he offers as evidence that "olde and newe Histories, dayly experience, and the principles of natural Philosophie" all say as much, and "our Sauiour Christ approueth the same."[26] Citations from Albert the Great (1200–1280) and Georgius Agricola (1494–1555) help support this ambitious claim, which is further underlined by the marginal note “Experience, the teacher of al sciences.”[27]

Clearly, Eden’s view of learning through experience was indebted to multiple sources. In the same preface, Eden considers “the experience to be most certayn which is joyned with reason or speculacion.” He derives this dictum from a comparison with medicine and notes how “the Phisicians determin theyr science,” where “neyther practyse is safe without speculacion, nor speculacion without practice.”[28] In fact, it was a widespread outlook characteristic of many learned practitioners. For example, one of Eden’s preferred authorities, Georgius Agricola, in the preface to his *De re metallica* (1556) a few years later, gave an even more detailed recipe in which experience and reason are not epistemic polarities but parts of a continuum: “I have omitted all those things which I have not myself seen, or have not read or heard of from persons upon whom I can rely. That which I have neither seen, nor carefully considered after reading or hearing of, I have not written about.”[29] Every *scientia* worth communicating is derived from experiences on which the practitioner can rely in different cognitive ways according to their different epistemic statuses. Agricola places these epistemic statuses on a spectrum that ranges from his own immediate experiences to experiences mediated through spoken or written sources. Along it, experiences can move from one epistemic status to another through the relationship of intellectual trust and the practitioner’s reasoning when “carefully considering” those experiences.

Despite his rich citation practice, Eden was searching for his own programmatic rules of how experiences acquired in various ways could amount to valid expertise. In his preface, he describes learning as drawing on a range of sources: one’s own experience, the experience of being taught by experts, and the experiences mediated through written texts. Together, these accumulate to form occupational identity:

> And wheras I have here spoken of knowledge joyned with experience, I meane by knowledge that which we commonly call learning, whether it be gotten out of bokes (which are the writinges of wyse and expert men) or otherwyse by conference & educacion with such as are lerned: meaning nought els by learning, but that gathering of many mens wittes into one mans head, & the experience of many yeres, and many mens lyues, to the lyfe of one, whom we call a learned wyse, and expert man.[30]

Eden reflects on the means by which individual experiences are “gathered” from diverse sources, and how they may become validated expertise: progressively, through gradual learning. Learners can also amass the experiences of many thinkers over several generations. Eden’s guidelines for gaining knowledge recommend combining new experiences, obtained from various sources, with existing knowledge based on one's own experience. This anticipates the Baconian vision, in which collecting individual experiences in a reflexive and ordered manner paves the way to true knowledge—far from merely heaping up experiences, learning must enable an *experientia literata* that is ordered and classified. Bacon's *Instauratio magna* suggested practices for ordering experiences in such a way as to approach the knowledge of "things themselves." As I will show, Eden's reflections on experience were moving in a similar direction.

The Translator's "Long Experience"

In the decade after *The Newe India*, Eden's translational career flourished. In 1561, his translation of Martín Cortés de Albacar's *Arte de navigar* as *The Arte of Navigation* was published as the first English-language manual on navigation.[31] In this period, his earlier reflections on learning and experience give way to a more specific vision of the experience of the translator. We are fortunate to have his testimony on that topic in a 1562 letter to his patron, Sir William Cecil:[32]

> Exercise also maketh suche woordes familier, which at the first were difficulte to be understode; … And I have learned by experience that the maryners use manye Englysse woordes, which were as unknowen unto me as the Chaldean toonge before I was conversant with them. It maye therefore suffice that the woordes and termes of artes and sciences be knowen to the professours therof, as partely by experience and partely by the helpe of dictionaries describing them per proprium genus et differentiam, as the logitians teache, and as Georgius Agricola useth to do in the Germayne toonge, which, as well in that parte of philosophic as in all other, was barbarous and indigent before it was by longe experience browght to perfection.[33]

Apparently, Eden was building up his competence in a special field through contacts with practitioners. This was an accepted method among translators at the time; as Juan Luis Vives advised in *Practice in Writing* (1531), "the works of Aristotle will be badly translated by a man who is not a philosopher and those of Galen by a man who is not a doctor."[34] Talking to merchants and mariners, Eden collected the colloquialisms of the navigational arts—words and phrases used in ordinary conversations, where they helped articulate everyday occupational experiences. He then collated them with nomenclatures he acquired from dictionaries and other books during the process of translating the navigation manual. Eden's own experience as a translator thus brought together learning "whether it be gotten out of bokes … or otherwyse by conference & educacion with such as are lerned." His description of the translator's experience gives concrete form to his earlier discussion on experience and learning as the "gathering of many mens wittes into one mans head, & the experience of many yeres."

Moving to the work of the "professors of arts and sciences," not holders of academic chairs but experts in arts, Eden notes that their business involves "knowing the words and terms," which are learned partly by experience and partly through dictionaries. The expert uses these sources actively, winnowing out the terms of art *per proprium genus et differentiam*—that is, through logical semantics. Eden favorably mentions Georgius Agricola's work "in the Germayne toonge," and indeed Agricola's *De re metallica*, then recently printed, speaks of just this topic in relation to mining:

> Since the art of mining does not lend itself to elegant language, … the things dealt with in this art of metals sometimes lack names, either because they are new, or because, even if they are old, the record of the names by which they were formerly known has been lost. For this reason, I have been forced by a necessity, for which I must be pardoned, to describe some of them by a number of words combined, and to distinguish others by new names. … and if anyone does not approve of these [new or old] names, let him either find more appropriate ones for these things, or discover the words used in the writings of the Ancients.[35]

Agricola sees the difficulty of "lacking names," both for translating ancient texts into the vernacular and for articulating his own experiences. He responds by applying logical semantics to create neologisms—as Vives advised, "the translator may add or subtract. He may put two words for one or one for two."[36] Eden acknowledges a similar problem in his letter to Cecil, discreetly contesting his employer's doubts about the translatability of *Historia naturalis* by Pliny the Elder from Latin into English:[37]

> Agen, it is not unknowen unto your honour that ons all toonges were barbarous and needie, before the knowleage of things browght in plentie of woordes and names; Exercise also maketh suche woordes familier, which at the first were difficulte to be understode; … althowgh the Latine toonge be accompted ryche, and the Englysshe indigent and barbarous, as it hathe byn in tyme past muche more then it nowe is, before it was enriched and amplyfied by sundry bookes in maner of all artes translated owt of Latine and other toonges into Englysshe.[38]

The English language lacks key terms, but Eden is willing to perform the same duty for his native tongue as he believes Agricola performed for German. Translating scientific writings from Latin into English, Eden argues, enriches and expands the vernacular. This malleability of the vernaculars has another consequence: the translatability of a Latin treatise changes along with the changing condition of the English language. Eden skillfully presents himself and Agricola, an established and esteemed expert, as colleagues pursuing the same work of accumulating learned experiences by ordering them *per proprium genus et differentiam*.

Ultimately, improving the condition of English "brings in plenty of words and names" for communicating new experiences, which enhances knowledge of things. The role of translation in building up valid expertise is similarly asserted in Eden's *The Arte of Navigation* (1561): "Now therefore thys woorke of the Art of Nauigation, being publyshed in our vulger tongue, you may be assured to haue more store of skilfull Pilots … such as by their honest behauiour and conditions, ioyned with art and experience, may do you honest and true seruice."[39] Eden consistently notes the role of translation in amplifying expertise: the "long experience" of experts, ordered by translators and conveyed through the words and terms of art, helps to articulate the knowledge of things and bring expertise to perfection.

The historical context of Eden's views shows that he elaborated on the cutting-edge translatorial thinking of his time. Étienne Dolet, summarizing the rules of the art from the previous century in his influential *The Way to Translate Well From One Language into Another* (1540), insisted that translators must "not be servile to the point of rendering word for word" or "adopting words too close to Latin," but should choose idioms in common use.[40] Eden's ideas on enrichment through translation can also be related to French discussions epitomized by Joachim du Bellay's *The Defense and Illustration of the French Language* (1549), which explained how to expand the vernacular using translations from classics, thus enriching the language through "the ingenuity and industry of men."[41]

In his native linguistic environment, Eden was evidently influenced by the contemporary program of humanist education exemplified by Thomas Elyot's *The Knowledge which Maketh a Wise Man* (1533).[42] Elyot precedes Eden in declaring his intention "to augment our Englyshe tongue, whereby men shoulde all well expresse more abundantly the thyng that they conceiued in their hartis …, hauying wordes apte for the purpose, as also interprete out of greke, latine, or any other tonge into Englysche."[43] This agenda was also promoted by Elyot's *The Dictionary of Syr Thomas Eliot Knight* (1538), which boasted of vastly surpassing its counterparts in "proper termes belongynge to lawe and phisike."[44] Eden may even have used Elyot's dictionary for translating some terms. For example, his translation of *temperies* (as an air quality) by "temperatenes" follows the dictionary precisely.[45]

The gap between the novelty of things and the poverty of language, necessitating many new words, was already noted in Antiquity.[46] Like numerous other lexicographical ideas of the Renaissance, Elyot's bilingual lexicography and Eden's translational methods, based on a dynamic view of language, were shaped by humanist responses to Cicero's Stoic linguistics with its emphasis on speech acts.[47] Cicero's *De oratore* describes the practices of "rendering" into Latin what has been read in Greek and "coining by analogy certain words such as would be new to our people."[48] And his *De finibus bonorum et malorum* analyzed the lexical operations appropriate for coining new terms in translation, pointing out that "words which the practice of past generations permits to employ as Latin … we may consider as being our own, … [since] the Greek terms have been familiarized by use."[49] Erasmus's critique of slavishly imitating Ciceronian models, together with calls in England and France to systematize and standardize the natural language, advanced such practices of vernacular imitation of the classics, in which translators were likened to orators. This allowed the rules of rhetoric to be used effectively for codifying novel experiences in that "disorderly heroic age" for translation.[50]

Eden's notion of scientific translation draws on humanist linguistics, but complements it with his own understanding of the relationship between language and experience, which emphasizes the "knowledge of things." His assessment of translation as a means of perfecting *scientiae* can be considered in light of critiques of the linguistic processing of experience in early modern natural philosophy.[51] Returning once more to Bacon's *Novum Organum*, published long after Eden's death, let us recall that Bacon distinguishes between disordered experience, *experientia vaga et incondite*, and experience made in good order, *experientia ordinata et bene condita* or *experientia literata*—the latter implying a gradual advancement of learning through a regulated procedure.[52] Such ordering of experiences meant setting up descriptive scientific categories, the words and terms of the art, according to "the true divisions of nature."[53] As we have seen, Richard Eden's reflections as a translator on the role of "long experience" in building expertise thus prefigure the ways that later practitioners handled the relationships between *res et verba*.[54]

The Translator's Experience in the *longue durée*

Sebastian Münster first published his magnum opus *Cosmographia* in German in 1544, as the earliest German-language description of the world.[55] The processing of experience was at the core of his project—the volume collated his own translations from classical treatises with vernacular eyewitness reports on European lands and beyond, such as Muscovy and India, which he collected on his own travels and through a voluminous correspondence. In 1550, Münster rewrote his German text in an expanded Latin version, from which it was translated into several vernaculars including French, Bohemian, Italian, and English.[56]

Cosmographia became a successful specimen of the genre of cosmography, which brought together disparate textual materials on a theme, furnished them with illustrations, and added citations from authorities, resulting in a narrative version of the cabinet of curiosities. Facilitated by the characteristic "aesthetics of *varietas*,"[57] cosmographies spread across Europe from Portugal to Muscovy.[58] Münster's volume was no exception: it circulated widely in various editions, which by the mid-seventeenth century had made it a standard work among anthropological reports. The plain descriptive style of this illustrated folio conveyed the experience of an observant traveler, which accorded well with the tasks set by Eden's patrons for a publication about the New World.

Eden's translation, *The Newe India*, was conceived in 1552, when Sir William Cecil needed assistance in publicizing his planned voyage to China to explore the northeast passage from Europe to Asia through the Arctic.[59] This task was set by his own benefactor, the Duke of Northumberland, who shortly before his ruinous attempt to crown Lady Jane Grey set out to overcome England's financial difficulties by acquiring Spanish colonial mines. The Duke needed to instruct young mariners with new navigational textbooks, for which he consulted with experienced mathematicians such as Thomas Diggs and Robert Recorde, but he also wished to advertise his enterprises and attract prospective seafarers.[60] In 1553, this remit led Cecil to employ Eden to translate selected chapters from Münster's *Cosmographia*.

Eden aimed to do more than just reproduce his source, Book V of the *Cosmographia*'s 1550 Latin edition. He referred to his work as a treatise with its own theme: "A treatyse of the newe India with other new founde landes and islandes, aswell eastwarde as westwarde, as they are knowen and found in these oure dayes, after the description of Sebastian Munster in his boke of universall cosmographie."[61] Pronouncements of a certain autonomy from the original were not exceptional in translations at the time, but most claimed the opposite—to be as faithful a rendering of the original as the translator's competence permitted.[62] Moreover, advertising a new publication as a faithful translation of some presumably already successful original was a common marketing strategy.[63] Eden's mark of self-sufficiency will have pleased his patrons, and the volume's independent structure indeed privileged accounts of India, China, the Spice Islands, and the voyages of Columbus and Vespucci to the West Indies. In fact, the final chapter originates not from Münster at all, but from Aeneas Silvius (Pope Pius II, 1404–1464), whose own *Cosmographia* had stirred Columbus's exploratory zeal.[64] Eden may also have wished to imply that his communications on the New World were more complete—it seems that he collated Münster's Latin text with its earlier German version.[65] Lastly, Eden enlivens the text with his own marginal comments on finding gold, ivory, diamonds, and other valuables, which readjust the readers' economy of attention and whet their appetite for exotic treasures.

In line with his selection and collation, Eden's translation methods were flexible enough to repurpose the experiences of celebrated navigators, as recounted in Münster's narrative, to intrigue English mariners. For instance, a passage describing the Canary Islands, part of the crucial chapter "Of the newe India and Ilandes in the West Ocean sea, how, when, and by whom they were found," depicts Columbus's detour to the islands in 1492—they were the last European port of call before the open seas and at the center of the trade winds. Eden only tells readers that the islands "were in time past called Fortunate, for the excellente temperatenes of the ayre, and greate fruytefulnes."[66] Münster's 1550 Latin text gave more, and potentially less serene, detail: "They [the islands] were then truthfully called fortunate, due to the wonderful mild and favorable air and winds, and there dwelled those wild races, in whom there was no religion, and no modesty, since they walked about totally naked."[67]

In fact, Münster's account of the Canaries was itself not "original," in the sense that he rendered it closely from the 1507 Italian compilation of travel accounts *Paesi novamente retrovati*, attributed to Fracanzano da Montalboddo and translated into Latin in 1508 as *Novus orbis regionum ac insularum veteribus incognitarum*.[68] As a result, Münster's volume reflected the experiences of the first European navigators; by Eden's time, the islands' demographics had changed drastically due to Spanish colonization, which left only a few indigenous people surviving as farmers and sailors.[69] Chillingly, Eden's version is silent on the very existence of the indigenous people on the islands. Instead, earlier on the same page he adds a marginal note encouraging the conquerors: "Great enterprises haue euer ben counted phantasticall."[70]

As can be seen from this brief account, *The Newe India* did not abide by the more recent textual taxonomies that discriminate between translations, compilations, and commentaries, any more than did other translations of his day. The procedures of translational text processing, where we recognize humanist techniques,[71] were far less strictly delineated than that. The experience of the translator also embraced the range of skills that in later times would be redistributed in the production of a book and ascribed to editorial competence.

Apart from the expertise involved in preparing the text for publication, the translator's experience could sustain other permutations in the translation's later fortunes. In Tudor England, politically sensitive materials were sometimes flexibly endowed with different meanings by translators and used as leverage by their patrons. Source text and the translation might even pursue opposite argumentative goals if addressing opposing audiences. In the words of Erasmus, truly persuasive descriptions must be so reinforced with convincing details that they can fight on their own to win the case.[72] If the source and the translation seek to win opposing cases, their convincing details may begin to fight against each other. In the historical analysis of colonialism, situations like these have called for "thick description."[73]

The experiences conveyed in *The Newe India*, together with Eden's own experience, took a peculiar political turn. In 1553, the treatise entered a milieu that suddenly became hazardous due to the misfortune of the translation's dedicatee, the Duke of Northumberland, and

Mary Tudor's marriage to Philip of Spain. Eden's publishing intentions became subject to sharper questioning—was he urging England to compete with Spain for its territories in the New World, or rather praising Spanish conquests?[74] Eden's navigational exemplars focused on voyages east, west, and southwest of Spain,[75] which may have gained him the favor of "certain Spanish nobles" and later a position at Philip's English treasury.[76]

In spite or because of its interventions, *The Newe India* secured a place in the history of geography. It is widely regarded as the first precursor to Richard Hakluyt's famous collection *The Principall Navigations, Voiages, Traffiques and Discoueries of the English Nation* (1589–1600),[77] underlining the findings of statistical book history that works written in English were often preceded by similar writings translated into English.[78] *The Newe India* became one of the first experience-based scientific geographical publications in England, and has been described as an early attempt to make maritime exploration into a public enterprise.[79]

Translations as Communicative Actions

Premodern scientific translations often repurposed the experiences conveyed in their source texts, which were themselves part of a variety of intellectual and political entanglements, especially during periods of prolific scientific development.[80] If these translational encounters call for "thick description," the best means of tackling them may be the methods of detailed contextualization in "thick translation," though this would exceed the scope of the present chapter.[81] Another way to investigate the mélange of descriptors is to approach historical translations primarily as different types of communicative actions,[82] in order to highlight various intentionalities involved in translations and establish what translators "were *doing* in writing them."[83] Viewing scientific translations in this way reveals the heuristic and public objectives that affected what was learned in translation and how new knowledge was made.[84]

Often, what early modern scientific translators were "doing" was to promote particular practices in the target culture. In this sense, the translation was determined not only by its past in the source domain but also by its own desired future in the target domain. François Jacob called science "the machine for making the future," and scientific translation helped make the future of science by suggesting desiderata for its development.[85] This anticipatory temporality of translation offers us a dynamic understanding of translation, in which the invisibility and the agency of the translator do not collide.[86] Premodern scientific translation sought to reconcile in itself the values of lucidity and innovation, as a kind of lens—while staying transparent itself, it aimed to bring closer science's vision of its own future.

In the methodologies that Richard Eden expounds, the experience of the translator involved a range of communicative actions processing individual experiences. In this epistemic translation, the words and terms of art were ordered *per proprium genus et differentiam*, fine-tuning the translator's repertoire of language and consequently other types of expertise in the target domain. Eden's deployment of his own and others' accumulated experience helped him to justify his own undertaking and the dynamic translatability of his sources. Acknowledging the need to produce a readable translation, and alert to issues of incommensurability between the source and target languages, he regarded translation as a process eminently capable of transforming the *scientiae*. I hope my comments on the experience of the translator have shown the role that their accumulating, ordering, and historicizing scientific experience played in the advancement of learning. This essay began by introducing an apparently undistinguished young man who published a small book that became a seminal geographical treatise in English about the New World. And I finish my narrative with the fact that the essay is published internationally in the English language.

Notes

1 As defined in the Introduction to this volume.
2 Discussed by, among others, Lewis, *Language, Mind, and Nature*; Formigari, *Language and Experience*; Howell, "Res et verba."
3 See Formigari, *Language and Experience*, 19–41.
4 See Aristotle on *empeiria* vs. *technē* in *Metaph*. I. 981a; also *Post. Anal.* II.19, 100a4.
5 Aristotelian and Baconian methods are concisely compared in Cushing, *Philosophical Concepts*, 15–28; Larsen, "Aristotelianism."
6 See Formigari, *Language and Experience*, 1–14.
7 Bacon, *Novum Organum*, I. 74, ed. Devey, 51.
8 Ibid., I. 41, 20–21; I. 14–15.
9 Ibid., I. 82, 60 and I. 84, 62. See Barnaby, " 'Things Themselves.' "
10 Sprat, *History of the Royal Society*, 339. See also Hüllen, *Their manner of discourse*.
11 See, among others, Slaughter, *Universal Languages*; Dolezal, *Forgotten Lexicographers*.
12 *The Decades of the Newe Worlde or West India* (1555) translated parts of Peter Martyr's *De orbe novo decades* (1511) and Gonzalo Oviedo's *De la natural hystoria de las Indias* (1526).
13 See Penrose, *Travel and Discovery*, 314; Arber, *First Three English Books*.
14 Bennett, *English Books*, 159.
15 John Bale in *Scriptorium Illustrium Catalogus* (1557) and Lawrence Humphrey in *Interpretatio Linguarum* (1559) mentioned "Johannes Eden, Cosmographus et Alchumista." On Eden's attempts to reconcile texts and experiences in alchemical pursuits, see Rampling, *Experimental Fire*.
16 See Eden's petition submitted to Queen Elizabeth. Arber, *First Three English Books*, xlv–xlvi.
17 Searle and Clark, *Grace Book Gamma*, 333–34.
18 Gwyn, "Richard Eden," 14–15.

19 The disaster is detailed by Kitching, "Alchemy."
20 Hadfield, "Peter Martyr"; Schepper, "Foreign Books," 122.
21 See Cole, "Renaissance Humanist Scholars," 238; Bauer, "Crucible."
22 For more on Münster's account of the New World, see Davies, "America and Amerindians."
23 Eden produced two more translations of excerpts from Münster's *Cosmographia*: in 1555 he added parts of the sections on Muscovy and China to his famous *Decades*, and in 1574 made another compilation from Münster titled *A Briefe Collection and Compendious Extract of Straunge and Memorable Thinges*. In 1561 he translated Martín Cortés de Albacar's *Arte de navigar* and Martin Cortes's *Breve Compendio de la sphaera y de la arte de navigar* (1556), in the process of which he is thought to have helped to devise the volvelle, an astronomical slide chart. Eden is also remembered for an abridged translation of Vesalius's *De humani corporis fabrica* (1559). In 1574, he translated Dr. John Taisnier's *De natura magnetis* (1562) with sections on the shape of hulls and tidal flows.
24 Eden, *A Treatyse of the Newe India* (hereafter *Treatyse*), [4]. The booklet was attributed by printer Jan van Doesborch to Amerigo Vespucci, but it is more an emblem book than a treatise. See Franssen, "Jan van Doesborch"; Arber, *First Three English Books*, 25–36.
25 See Dear, "Meanings of Experience," for a summary of premodern uses of the term.
26 Eden refers to the biblical narrative about the Queen of Sheba, or Queen of the South, and her abundant gifts to the Israelite King Solomon. *Treatyse*, [13]. Here and throughout, my quotations from Eden's texts use the diplomatic transcription.
27 Eden, *Treatyse*, [19]. Eden is probably referring to Agricola's *De veteribus et novis metallis* (1546) and/or *De precio metallorum et monetis* (1550), which both mention Biringuccio's *De la pyrotechnia* (the first translation Eden attempted), *Historia Naturalis* by Pliny the Elder, and Theophrastus's *On Stones*.
28 Eden, *Treatyse*, [19–20].
29 Georgius Agricola, *De re metallica*, trans. Hoover and Hoover, xxxi.
30 Eden, *Treatyse*, [20].
31 This manual went through numerous editions. See Schepper, "Foreign Books," 184–89.
32 The letter thanks Cecil for a £20 advance to start a new translation, which would have been nearly equal to Eden's annual salary ten years earlier. See also Hadfield, "Peter Martyr."
33 Halliwell-Phillipps, *Collection of Letters*, 2–3.
34 Vives, *Practice in Writing*. See Hadfield, "Peter Martyr"; Sherman, "Bringing the World"; Matthiessen, *Translation*.
35 Georgius Agricola, *De re metallica*, trans. Hoover and Hoover, xxxi.
36 Vives, *Practice in Writing*.
37 See Arber, *First Three English Books*, xliii. The English translation of Pliny's *Historia* was indeed published only in 1601, by Philemon Holland, who specialized in classical historical writings.
38 Halliwell-Phillipps, *Collection of Letters*, 2–3.
39 Eden, *Arte of Nauigation*, [9].

40 Dolet, *Way to Translate*, 96. On the fifteenth century, see especially Leonardo Bruni, *On the Correct Way to Translate* (1424–26) and King Duarte, *The Art of Translating from Latin* (1430s).
41 Du Bellay, *Defense and Illustration*, 102.
42 For a recent comprehensive account of Elyot's legacy, see Sullivan and Walzer, *Thomas Elyot*.
43 Thomas Elyot, *The Dictionary*, [3].
44 Ibid., [5–6].
45 Ibid., s.v. Temperies; *Treatyse*, [120]. See also Wortham, "Sir Thomas Elyot."
46 Lucretius, *De rerum natura*, I:136–39, ed. Rouse, 14–15.
47 See Hülser, "Expression and Content."
48 Cicero, *On the Orator*, I. XXXIV, trans. Sutton and Rackham, 107.
49 Cicero, *On Ends*, III. 5, trans. Rackham, 221.
50 Braden, Cummings, and Gillespie, *Oxford History*, 11. See Norton, "Translation Theory."
51 See Formigari, *Language and Experience*, 1–14.
52 Bacon, *Novum Organum*, I. 82, ed. Devey, 60–61. See Jalobeanu, "Disciplininign."
53 Bacon, *Novum Organum*, II. 34, 188.
54 Edward Arber names Eden "a Man of Science in the Tudor Age" and a forerunner of Francis Bacon in scientific inquiry. Arber, *First Three English Books*, xxii.
55 See Burmeister, *Sebastian Münster*.
56 Translations between vernaculars through a Latin edition were very common. See Burke and Hsia, *Cultural Translation*; Gordin, *Scientific Babel*, 31–35; Fransen, "Latin."
57 McLean, *The Cosmographia*, 104.
58 Sergii Shelonin (Semyon Moskvitin, d. 1667), Archimandrite at the Solovetsky Monastery, also produced a cosmography. He was best known for authoring the most comprehensive Russian *azbukovnik* (alphabetical dictionary), with 16,000 entries. See Sapozhnikova, *Russkii knizhnik*.
59 In 1555, the merchants who had funded the expedition established the Muscovy Company, where Eden's father was one of the twenty-four assistant consuls. Gwyn, "Richard Eden," 26. On the role of the Company in commissioning Eden's work, see Schepper, "Foreign Books," 188–93.
60 Gwyn, "Richard Eden," 20–23.
61 Eden, *Treatyse*, [1]. Cf. Münster, *Cosmographiae universalis*, 1083.
62 See, among many others, Aphra Behn, *A Discovery of New Worlds*, *from the French* (1688).
63 Bennet, *English Books*, 152–53.
64 Aeneas Silvius contradicted Aristotle and followed Albert the Great in asserting that the habitable part of the globe extended south of the equator. Tilmann, *Appraisal*, 54.
65 For instance, when describing the Canary Islands, Eden mentions their "great fruitfulness," something hinted at in the Latin text but stressed in the German version. Eden, *Treatyse*, [121]; Münster, *Cosmographiae universalis*, 1099; Münster, *Cosmographia*, dcxxxvii.
66 Eden, *Treatyse*, [121].
67 Münster, *Cosmographiae universalis*, 1099. My translation.

68 Fracanzano da Montalboddo, *Novus orbis regionum*, 79. See Pagano, "Fracanzio da Montalboddo."
69 See Crosby, "Ecohistory."
70 Eden, *Treatyse*, [120].
71 See Grafton, *Defenders of the Text*, for many useful examples.
72 Erasmus, "Copia," ed. Thompson, 592.
73 See Ryle, *Concept of Mind*; Geertz, "Thick Description."
74 See Hadfield, "Peter Martyr," 2.
75 Eden, *Treatyse*, [118].
76 Eden mentioned this in his petition to the queen; see Arber, *First Three English Books*. In 1555, Eden's *Decades of the Newe World* apparently pledged his loyalty to the new Catholic regime.
77 Eden's records on the Muscovy voyages later became part of Richard Hakluyt's collection *The Principall Navigations, Voyages, Traffiques and Discoveries of the English Nation* (1589).
78 Sherman, "Bringing the World."
79 Quinn, *Explorers and Colonies*, 102.
80 See Montgomery, "Mobilities of Science."
81 Appiah, "Thick Translation," 817–19.
82 Boutcher, "Cultural Translation."
83 Skinner, *Reason and Rhetoric*, 7, citing John Austin's *How To Do Things with Words* of 1955.
84 Dupré, "Science and Practices of Translation."
85 Jacob, *Statue Within*, 9, quoted in Rheinberger, "Experimental Systems," 70.
86 Venuti (*Translator's Invisibility*, 1) defines the translator's invisibility following Norman Shapiro: "A good translation is like a pane of glass. You only notice that it's there when there are little imperfections—scratches, bubbles. Ideally, there shouldn't be any. It should never call attention to itself." The translator's agency has been defined as her ability to make independent decisions in the target domain thanks to a Bourdieusian "habitus." See Gouanvic, "Outline."

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Epilogue

Windows, Mirrors, and Beads

Lorraine Daston

Our understanding of translation has not been well served by glassy metaphors. The transparency of the window renders the contributions of the translator opaque; the reflection of the mirror misses the refraction of the original text through new contexts; texts rendered word-for-word like single beads strung into a necklace break up the sense of the whole. The essays in this volume instead appeal to other families of metaphors: those of movement, transformation, and assimilation. Taken together, these alternative metaphors offer a fresh understanding not only of translation but also of intellectual tradition and perhaps experience itself.

Metaphors of movement evoke the root meaning of translation as translocation: a translated text is going somewhere, and the destination matters. Just as the contents of a suitcase packed for a vacation on the beach differ from those of one packed for a business trip to a city, Avicenna translated for a twelfth-century Andalusian readership goes light on the logic and mathematics that a thirteenth-century Parisian Master of Arts might in contrast find riveting (Bertolacci); a treatise on medical dietetics originally written in eleventh-century Baghdad might swap out ingredients and recipes when translated for a fourteenth-century northern Italian audience (Olariu). More medically inclined translators of Maimonides's logical treatise into Hebrew tended to emphasize the role of experience in logic, a bow to the central role of experience in medical reasoning (Halper). Failure to adapt to the destination can end in mutual incomprehension, as in the case of the cool reception Chinese scholars gave to Matteo Ricci's attempt to translate the memorization of Chinese characters into the mnemonics of memory palaces (Jin).

But a modern reader primed by the Whorf hypothesis of languages as worldviews and organicist conceptions of culture might be surprised by how few such moments of mutual incomprehension emerge in these premodern case studies—much less philosophizing about mutual incomprehension (Harvey). It's not that there weren't plenty of opportunities for translational perplexity: how, for example, to translate the ancient

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Greek word that means both "flavor" and "humor" into Latin and Arabic, which require a semantic distinction between the two (Panarelli), or the Latin *ingenium* into various medieval and early modern European vernaculars, each with its own distinctive vocabulary of mental processes (Morton)? The resulting slippage and imprecision jar the ear of modern scholars (who are themselves able translators of many tongues, as these essays show to good advantage) and nowadays occasion meditations on the incommensurability of languages and cultures. Yet although premodern translators were certainly aware of these difficulties and strove for accurate translations, their understanding of "accurate" is not synonymous with our understanding of "precise."

The accolade "accurate" always begs the question, "accurate for what purpose?" For example, early modern artisans being taught the rudiments of geometry by Albrecht Dürer did not aspire to Euclidean standards of rigor as they struggled to impose form on recalcitrant matter, any more than sixteenth-century botanical illustrators aspired to the extreme mimesis of still life paintings of the same period (Remond). "Accuracy" was always judged implicitly with a goal and audience in mind: the compact tables that summarized medical therapies for the use of busy people with neither the learning nor patience for long-winded discourses (Weil) were accurate enough for their intended readers, even if too abbreviated for professors of *medica theorica*. Translations judged by standards of accuracy are suppler—and more context-sensitive—than translations that aim for precision. The latter evolve in tandem with the creation of specialized technical vocabularies that anchor words to definitions and place a premium on consistency. Many premodern discourses in philosophy, mathematics, theology, and astronomy did evolve such vocabularies—to the point that expert readers like Roger Bacon could complain about earlier slipshod translations (Polloni), a sign that fine distinctions and nuances that had not mattered to earlier readers now interested those schooled in the latest specialist debates. Translations travel among epochs as well as cultures, and translations that were accurate for one period may need to be later replaced by translations in the same language: the destination has shifted. In contrast, precise translations crystallize a vocabulary that endures because it is reinforced by a tradition passed on from master to student across generations. Astronomical tables and the technical vocabulary that elucidated them proved astonishingly long-lived and mobile (Geller, Hsia).

Transformation is obviously related to translocation as a form of "transculturation" (Dupré). Texts that travel must adapt to foreign locales just as human travelers do. Avicenna's gloss on Aristotle's evidence that fish can hear transforms the Greek original—people who live near the sea attest to this—into the more generic and epistemologically more forceful Arabic phrase "people of experience." Avicenna and his readers had a general category of expert witnesses that fortified the authority of Aristotle's more casual report (Alpina), a subtle but epistemologically significant change. Other transformations are more literal: the text changes form. Prose is pulverized into tables for handy consultation (Weil); qualitative medical concepts such as the viscosity of humors are more or less arbitrarily quantified to conform to new Newtonian criteria of mathematical certainty (Reed). These two examples of shape-shifting involve deliberate abridgement of, on the one hand, a long medical treatise, and, on the other, the "too-muchness of experience" (Park). These are epistemic strategies familiar from mathematical idealization and modeling, in which many small perturbing factors are deliberately ignored in the hopes of isolating a few big causes or a persistent regularity, as Galileo deliberately discounted air currents and friction in his geometric account of free fall. But mathematics need not be involved in such attempts to separate signal from noise: privileging the outlines of plants over their colors can serve the same goal of focusing attention on essential morphological features over variable ones (Remond).

Occasionally, transformation can take the form of adding rather than subtracting meaning. To insert alchemical symbols into natural philosophical or theological texts thickens accounts of the four bodily humors or death and resurrection with additional layers of association and interpretation (Carlotta). Argumentative techniques of reasoning by analogy from the observable to the unobservable (for example, the nature of God in medieval Islamic theology) similarly enriches both terms of the analogy with new associations (Erlwein). Similarly, to infer the sublime craftsmanship of God's creation from the anatomy of an insect examined under the microscope exalted the humble insect to new levels of dignity and significance in early modern Protestant natural theology.

But do such transformations really count as translations except in the loosest metaphorical sense? The answer depends, first, on how narrowly the practice of translation is confined to language, and second, on the degree to which the competing cluster of glassy metaphors with which I began is allowed to define what legitimate translation is and should be. The import of many of the essays in this volume is that translation among languages is paradigmatic of a larger class of practices that extend the realm of the intelligible by going beyond what is given in either a text or the world: "epistemic translation" (Krause with Auxent and Weil). On this understanding, commentary on a text in the same language would be an act of translation, as would diagnostic inferences from observed symptoms to a hidden disease. Implicit in this broad-church construal of translation is the assumption that the cognitive practices involved in translating *sensu strictu* have something in common with analogizing, commenting, tabulating, and quantifying: in short, with interpretation. All of these activities require that the translator rethink, not just render the text.

Interpretation of any sort is exactly what the glassy metaphors of translation—and of scientific experience—combat. Suspicion of the ways in which the infirmities of the human mind and senses, individual biases, theoretical blinders, and even language itself—Francis Bacon's idols of the tribe, cave, theater, and marketplace—can distort the understanding of nature are rife in the reformed natural philosophy of the seventeenth century (Auxent). Ideally, the human mind should patiently mirror nature, not leap to premature conclusions based on scanty evidence and wishful thinking: the Interpretation of Nature comes only at the very end of Bacon's grand scheme for the renovation of natural philosophy. It is perhaps not an accident that suspicion of premature interpretation in natural philosophy was preceded by over a century of humanist suspicion directed toward medieval translations, both Arabic and Latin, of ancient texts. In both cases, a sudden eruption of new sources—the Greek manuscripts brought to Italy and elsewhere after the fall of Constantinople after 1453, the discoveries of new peoples, flora, and fauna by voyages of exploration to the Far East and Far West—forced European scholars to reexamine everything they thought they knew, and how they knew it. The result was an efflorescence of new translations and dictionaries in both Latin and the vernacular that brought unprecedented scrutiny to the act of translation itself, and also of new inquiries into natural history and natural philosophy that brought unprecedented scrutiny to the act of inquiry itself. In both philology and natural philosophy, it was a moment of acute awareness of past error—and therefore a moment of extreme epistemological caution.

This is the context in which glassy metaphors of both translation and scientific experience became predominant: the translator or naturalist as transparent window or faithful mirror; words or facts as atomized beads deliberately excerpted from the flow of prose or experience, respectively. All of these metaphors highlight the dangers of interpretation, of mingling text and context, observation and theory. They articulate the suspicion of hermeneutics that lives on in almost all epistemology, especially the positivist variety. Because both metaphors and epistemology have become so predominant, it is especially difficult to recover the third cluster of alternative metaphors, assimilation, which is as relevant to experience as it is to translation.

In contrast to the singular sense datum of Enlightenment sensationalist psychology and positivist epistemology, Aristotelian experience was multiple and layered, as much the product of memory and judgment as it was of perception. Experience resulted from the accretion of many sensory particulars that coalesced into universals in the mind, as individual soldiers routed in battle reconstitute a line when one after another turns and stands firm, in Aristotle's famous analogy from Book II of the *Posterior Analytics*. For Aristotelians, true knowledge is knowledge of universals, not particulars—just as true knowledge of a language is knowledge of common, not proper nouns. Experience itself is a palimpsest of countless perceptions, sedimented in memory and ordered by judgment into universals.

The mental processes that generated experience in the individual had their direct counterpart in the processes of "domestication and assimilation" (Krause with Auxent and Weil) by which the knowledge of experience was preserved and transmitted across generations and cultures. It too was a palimpsest of many minds and voices that accreted over time in the form of translations, commentaries, and, above all, in-person teaching (Krause). Quite aside from the imperatives of preserving texts written on fragile media from the ravages of time, there was the need to transmit the secondary knowledge needed to understand and build upon them, especially as access to both ancient languages and ancient contexts faded. These imperatives still govern the modern knowledge economy. Every discipline, including the empirical sciences, is utterly dependent on the work of others preserved in texts; these texts have a material form that must be preserved, whether in a library or on a server; the continuity of scholarship and science is guaranteed for only as long as a next generation can be trained to carry on. But whereas moderns since the advent of printing, and *a fortiori* since the advent of the internet, dread the surfeit of knowledge—too many books, too much data—premoderns dreaded dearth—texts that survived only in fragments or not at all, observations too costly and difficult to make except on rare occasions, codices so rare that they were chained to lecterns, reports of foreign climes and past epochs that were few and unreliable.

In an economy of dearth, the husbanding of resources takes precedence over pruning them. Experience, both first- and secondhand, accumulates in texts as sense impressions do in memory: *historia* supplements *autopsia* (Chase). Because of the emphasis on collection, preservation, translation, and transmission, the line between textual and sensory experience in premodern natural history and natural philosophy was a blurred one not just in practice (as it still is in modern science) but also in principle. Seventeenth-century reformers such as Francis Bacon might have drawn a principled distinction between reliable forms of empiricism and unreliable textual authority, but in practice, Bacon himself indiscriminately mixed together his own observations, those made by others, and excerpts from his reading (including Pliny's much-reviled *Historia naturalis*) in his unfinished natural history, the *Sylva sylvarum* (1627).

Despite all the scorn heaped on bookish learning by seventeenth-century reformers of natural knowledge, they (and their modern successors) were as dependent—indeed, more dependent—on the collective empiricism made possible by the circulation and accumulation of texts. Imagine science pursued in splendid solitude, with neither library nor internet. Descartes was perhaps the last natural philosopher to contemplate deducing all of natural philosophy from first principles, and even he soon gave up on that project. As he explained in the *Discours de la méthode* (1637), he would need research assistants, lots of them—just as Bacon imagined a large research staff of explorers, experimenters, and "depredators" of texts in his utopian fragment, the *New Atlantis* (1627). What distinguished Bacon and other reformers who called for a new kind of empiricism was their deep distrust of exactly the processes of assimilation so characteristic of Aristotelian experience and premodern translation: the smooth process by which sensations sedimented in memory crystallized into universals, and the equally smooth process by which translators tailored texts to new audiences and new uses. In the eyes of their critics, these processes of assimilation, as natural but also as transformative as digestion, of making the nature and texts one's own, were a dangerous source of error. The proposed remedy was methodological guardrails to keep erring intellect on track: "precise norms governing the use of experience in the making of scientific knowledge" (Cohen-Cole).

We moderns are still heirs to their critique and to the glassy metaphors it spawned, although the critique has never been without its own critics. What experience is and how it can be made scientific is still a philosophical battleground. But this exploration of premodern scientific experience in translation revives alternative metaphors that are still very much alive in practice, if repressed in principle. Every intellectual tradition, modern or premodern, depends on the chain of teachers and students to reanimate the accumulated experience of past generations, much of it in translation, in the speaking voices of the classroom, the laboratory, the observatory, and the field. There, experience is still being translocated, transformed, and assimilated for the next generation of students. The glassy metaphors of experience and translation that appeal to the seeing eye are deaf to the speaking voices that insure that science and scholarship will go on.

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