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*

Yehuda Halper

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 *'emet*, 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 *'amiti* in Moses ibn Tibbon, *hit'amtut* in Ahitub, and *vada'i* in Vivas.[21] Whereas Vivas's *vada'i* later became standard for certainty and Ahitub's *hit'amtut* usually refers to verification, though it could be intended to mean "certain" here, Moses ibn Tibbon's *'amiti* 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 *Shiʿur 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 Meymūn'un, *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-haqddamot 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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