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Towards a Comparative History of Touch and Spaces of Display: The Body as Epistemic Object

Anna Maerker[*]

Abstract: *»Zu einer vergleichenden Geschichte von Berührung und Ausstellungsräumen: Der Körper als epistemisches Objekt«.* In European history, natural and artificial bodies and body parts have been put on display in a wide range of contexts – from votive art in churches to effigies in public ceremonies, from dolls in shop windows to anatomical models and specimens in medical schools, museums and fairgrounds. Scholars have argued that the spatial context of such displays shapes and choreographs the encounter between object and visitor. This "museum effect" (Svetlana Alpers) mediates the way people interact with an object, as it is set apart for a particular kind of attentive viewing. However, despite this alleged exclusivity of visual perception, the history of sculpture, education, anatomical models and collections shows that touch continued to be an important element of visitors' appropriation of the body as an epistemic thing. Even in the context of public museums, visitors continued to touch the bodies, sculptures and models on display, and exhibition makers and anatomical modellers frequently returned to the possibility of touch as a crucial component of knowledge production, adapting models and specimens to be touched and held rather than seen and contemplated. This paper argues that to understand the persistence of touch we need to develop a comparative history of spaces of display. Such comparative analyses can illuminate how different spaces created different sets of expectations and encounters between epistemic object and subject. This analytical perspective also raises the question to what extent such repertoires of behaviour transferred from one spatial context to another. Thus, comparisons offer an opportunity to interrogate critically the concept of the "museum effect", and to reframe visitors' actions.

Keywords: Touch, museums, anatomy, visitors, models, materials.

1. Introduction: The Focus on Vision

How, historically, have audiences appropriated images and models of the human body? Traditionally, anatomical representations have been created for a wide range of purposes and in different settings, including the display of votive offerings in churches, the production of portrait busts in wax for private con-

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sumption and public display in processions and ceremonies, but also for commercial displays such as shop windows, and educational purposes such as the use of anatomical models and preserved specimens for medical study. The present paper asks how these different spatial contexts matter for encounters with the body as an epistemic object, and interrogates in particular the role of the sense of touch, and the materiality of the objects on display. Historical cases such as the late-eighteenth-century anatomical wax models of the Florentine museum La Specola and the nineteenth-century papier-mâché anatomical models of Dr Auzoux call into question the focus on vision so prevalent in studies of museum visitors. Putting visitors' experiences in the context of contemporary theories and practices of education and connoisseurship highlights the continuing importance of touch for audiences' encounters of bodies as epistemic things. Historical examples show that makers of exhibitions and anatomical models responded to this persistence of touch by abandoning purely visual modes of appropriation in favour of displays which enabled physical contact with three-dimensional representations of the body.

The paper uses these brief examples to argue for the use of a comparative mode of analysis in order to understand this persistence of touch. Such comparative analyses enable historians and scholars of museums to illuminate the ways in which different spatial contexts inform visitors' expectations, and shape visitors' encounters with epistemic objects. Ultimately, such comparisons enable analysts to engage critically with central analytical concepts of museum studies such as Svetlana Alpers' notion of the "museum effect."

Michel Foucault famously characterised the museum as an example of a "heterotopia," an environment in which the visitor becomes part of the museum through its spatial arrangements (Foucault 1984 [1967]). This constellation has consequences, as the spatial context of displays shapes and choreographs the encounter between object and visitor. This setup produces what Svetlana Alpers has called the "museum effect": "the tendency to isolate something from its world, to offer it up for attentive looking" (Alpers 1991, 27). Thus, the museum mediates the way people interact with objects, as objects in the museum are set apart for a particular kind of attentive viewing.

Accounts of museum audiences have long prioritized visual perception above any other type of sensory engagement with museum objects. This tradition has deep roots in the history of epistemology and physiology which have imposed hierarchies on the senses. Vision has frequently been singled out as the most important or noble of the senses, from Ancient Greece to Early Modern Europe: Plato suggested that the eyes provided access for divine inspiration, and his successors privileged sight because it provided contemplative access to knowledge which did not require physical contact. Aquinas elevated vision and hearing above other senses because we attach the notion of beauty to things we see and hear, but not to things we touch and smell. Early modern natural philosophers from Kepler and Galileo to Boyle equally accorded primacy to vision

(Kambaskovic and Wolfe 2014; see also Smith 2007, especially chapter 1, "Seeing"). Natural historian Lorenz Oken created a hierarchy of the senses parallel to a racial hierarchy, which placed the European "eye-man" at the top, the African "skin-man" at the bottom (Classen 2012, xii). The very notion of "Enlightenment" contains at its core a visual metaphor.

Of course, there have always been dissenting voices – epicureans such as physician Walter Charleton for instance claimed that "All Sensation is a kind of Touching" (Charleton 1654, quoted in Kambaskovic and Wolfe 2014; see also Anstey 2000, 26). Condillac celebrated the value of the hand in his *Treatise of Sensations* of 1754. By many, however, touch was condemned as morally and epistemologically dubious, associated with lust and animality due to the necessity of physical contact, a kind of intimacy with the object that raised concerns even among empiricists.

This prioritising of vision is perpetuated in influential scholarship, both in history and in contemporary studies of the relationship between museums and their visitors. Constance Classen has shown that nineteenth-century historians dismissed the "lower" senses (Classen 2012, xii). This changed with the Annales school, who drew attention to "the sensory underpinnings of thought in different periods" (Febvre 1982, 436). This new focus on the senses has led to a rich new historiography (Juette 2005, Smith 2007; for touch in particular see e.g. Gowing 2003).

Despite framing his analyses of power/knowledge in terms of disciplinary effects on the body, it was the more specific role of vision which formed the core of Foucault's understanding of the disciplinary power of institutions. Famously, he described Bentham's late-eighteenth-century ideal prison, the Panopticon, as a paradigm for modern institutions' spatial arrangements which "trapped" the inmate in a pattern of total visibility and control (Foucault 1977 [1975]). Foucault's work has been a central influence on the scholarship of the "new museology" such as the work of Tony Bennett, whose evolving account of the disciplinary function of museums highlights the role of seeing in encounters between museum visitors and objects (see e.g. Bennett 1995).[1] His contribution to Sharon Macdonald's *Companion to Museum Studies* (Bennett 2006) for instance is entitled "Civic seeing: museums and the organisation of vision."[2]

However, both contemporary visitor studies and historical documentation highlight that the relationship between visitors' bodies, objects and museum spaces operates on levels beyond the visual. The encounter with the object is always multi-sensorial, involving sounds, smells, sights, touch (Söderqvist and Bencard 2010). The present paper focuses on the sense of touch in particular – not in order to suggest that vision and touch are the only senses that matter in the

[1] For the "new museology" see also Vergo (1989), and for a critical assessment Starn (2005).
[2] In the *Companion* as a whole, there are nine entries for "vision" and none for touch.

museum setting, but merely to highlight the connections between objects, users, spaces and materials by creating a deliberate contrast between vision and touch.

There are of course practical issues for historians who try to capture audiences' sensory engagements with museums. Actors' and analysts' longstanding focus on vision has frequently obscured the presence of non-visual elements of appropriation. For historians who cannot resort to participant observation in their study of visitors past, it remains a major challenge to identify types of historical sources which may provide some insights into visitor comportment. There are several possible analytical strategies. Some museums still afford the opportunity for modern scholars to visit sites and spaces which have remained largely unchanged for long periods of time, but this kind of "historical re-enactment" carries its own methodological problems, raising questions about the authenticity of re-creating past experiences. The literature on the recreation of historical instruments and experiments in the history of science in particular can be used here to evaluate the difficulties, and the potential, of investigating the "gestural knowledge" of the past (e.g. Sibum 1995, Morus 2010, Jardine 2001). A comprehensive treatment of methodological challenges in the reconstruction of past practices in the production, use and display of epistemological things is beyond the scope of this paper. However, the following examples will briefly highlight some of the research and reading strategies employed to address methodological issues.

2. The Re-Emergence of Touch

Despite this focus on vision, touch always reappears in encounters between epistemic objects and bodies, whether these are described in theoretical reflections or documented in practice. A number of related fields of scholarship may be of particular interest to historians of museums, such as the history of education. Theorists of learning such as Swiss reformer Pestalozzi famously advocated "learning by head, hand and heart," stressing active physical engagement with objects as a central element of the learning process (Stadler 1988). Another useful point of reference is the history of sculpture: In his famous 1778 essay *On Sculpture*, Johann Gottfried Herder argued that touch was indispensable for the development of human understanding:

> For what are properties of bodies if not relations to our own body, to our sense of touch? The light that strikes my eye can no more give me access to concepts such as solidity, hardness, softness, smoothness, form, shape, or volume than my mind can generate embodied, living concepts by independent think-

> ing. […] Only human beings have them, because alongside reason we possess a hand that can feel and grasp (Herder 2002 [1778], 36).[3]

This central role of touch was not just a theoretical assertion, but also of practical importance for Herder's own experience of sculpture. He noted of his visit to see the sculpture of the "Sleeping Hermaphrodite" at the Villa Borghese in Rome his compulsion to touch the figure's back since it presented "an uncommonly lascivious stance which quite invites one to grasp the back [...] one wants to enjoy and touch everything, the arched back, the shoulders."[4] Indeed, it was common practice for early modern art collectors to appreciate sculptures through touch (Johnson 2012). However, Herder's open acknowledgement of the sensual qualities of physical contact with works of art also posed a potential threat to the use of touch for educational purposes – a threat which would become especially salient as collections were opened up to the general public.

Histories of education and art thus provide an important context for the history of anatomical models and collections. Here too, senses other than vision were of continuing importance for users of anatomical objects such as preparations and models. Touch, in particular, has been a recurring element of visitors' appropriation of the body as an epistemic thing in different settings through the ages. Even in the context of public museums, visitors continued to touch preparations and models on display, and exhibition makers frequently returned to the possibility of touch as a crucial component of knowledge production, adapting models and specimens to be touched, held and manipulated rather than seen and contemplated.

One historical example may serve to illustrate this point. The public museum of physics and natural history 'La Specola' was founded in late-eighteenth-century Florence by the Tuscan grand duke as a space for public enlightenment through science education (Contardi 2002, Mazzolini 2004, Maerker 2011). The museum represented all realms of creation, from minerals and plants to physical instruments and models of machines. Its most celebrated element was a large collection of wax models representing the healthy human body. The models were mostly life-sized, although some were miniaturised or enlarged. They were generally to be visually attractive, and some contained real hair to make their appearance more convincing. In addition to being beautiful, the models were also to represent the latest anatomical knowledge: they were based on medical textbooks, and on dissections of corpses obtained by grand-ducal privilege from the local hospital and orphanage. The collection was housed in Palazzo Torrigani, near the grand-ducal residence and adjacent to the botanical garden. Like many educators of the period, the curators at the new museum prioritised vision in their

[3] For recent appraisals of Herder's theory of sculpture see e.g. Zuckert (2009).

[4] "Eine ungemein wollüstige Stellung, die recht einladet, nach hinten zu greifen…man möchte den ganzen gebognen Rücken, Schultern, alles genießen u. fühlen." (Herder 1988, 602-3, author's translation).

original didactic concept for the museum displays. The museum's first director, Felice Fontana, claimed that "At one glance, everything is seen, everything is known." ([Fontana] 1775; also Maerker 2007, 3). This instantaneous understanding was supposedly achieved by enabling a synoptic view of human anatomy: at La Specola, galleries of anatomical models were arranged thematically, with life-sized whole bodies at the centre of a room, and series of model fragments arranged around the walls in series, supplemented by schematic drawings and lists of anatomical details which could be pulled out from drawers underneath the model showcases.

Figure 1: Enabling a Synoptic View of Human Anatomy[5]

Source: Joanna Ebenstein, Morbid Anatomy.

Thomas Schnalke has highlighted how this synoptic display of models and drawings used visual conventions which would have been familiar to medical visitors from contemporary anatomy textbooks (Schnalke 2005), and many visitors with medical training recognised model poses from illustrations used by famous anatomists such as William Hunter.[6]

[5] Gallery of anatomical wax models and drawings at the Zoological Museum 'La Specola' (formerly the Royal Museum of Physics and Natural History), Florence (2007).

[6] This framing of museum experience as a form of "reading" collections is an ongoing theme in museum design. The Bodyworlds exhibition of plastinates by Gunther von Hagens, for instance, is presented explicitly as a three-dimensional "textbook" (Stephens 2011, 3), and Elizabeth Hallam has shown in her work on twentieth-century modelling in biomedical research

Visitors were invited to observe minerals, plants, animals and human bodies walking through the succession of rooms. While the museum had inherited natural curiosities from the *Wunderkammer* of the now-defunct Medici family, unlike such earlier forms of displaying naturalia were presented in a systematic order. The idea of the universality of natural laws was communicated through the uniformity of presentation – all types of specimens were kept in showcases of wood and glass of similar design (Maerker 2011). Overall, the development of the objects on display and the spatial arrangement of the museum were mutually constitutive (see also Introduction). Objects' materiality, and especially the fragility of anatomical models in wax, necessitated their protection behind glass. This, in turn, was based on curators' ideal of knowledge transfer through synoptic vision.

However, in practice the experience of everyday interactions with visitors challenged Fontana's model of learning based exclusively on the visual perception of the synoptic presentation of models and drawings. The "struggle" (Livingstone 2003, 37; see also introduction) between different factions involved in the museum, in this case its curators and its visitors, would come to have direct ramifications for the turn to new materials. The museum was in principle open to everybody free of charge, at least to everybody who arrived "decently dressed" (Maerker 2011). Visitors came on their own, or with friends and family; they were male and female, young and old. The museum's surviving visitor books record visitors' names, and added visitors' profession or social standing if they were of elevated rank, but the high percentage of visitors whose background went unrecorded indicates that the museum was popular with a lay public far beyond doctors, natural philosophers and socially elevated Grand Tourists (Mazzolini 2006, Maerker 2011). Any analysis of visitor behaviour at the museum in its early years is necessarily problematic: beyond keeping a visitor book there was no systematic attempt to record information on visitors. Grand Tourists occasionally published accounts of their visits to the Florentine Museum of Physics and Natural History, but these descriptions were heavily shaped by established literary conventions and cultural expectations. Visitors' responses as described for a reading public were elements of self-fashioning, confirming the writer's claims to artistic sensibility or natural philosophical learning (Maerker 2011). However, there are other sources available to the historian which provide at least a glimpse into other levels of response to the anatomical models. Financial accounts, and in particular the books of receipts which record expenses for repairs and equipment show that visitors felt compelled to touch the wax models. Locks had to be fitted to showcases which contained models of the genitals, which visitors were particularly tempted to touch (Maerker 2011).

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that the metaphor of the book remains central even to accounts of the modeller's or the dissector's physical interaction with the body as a form of reading (Hallam forthcoming).

This experience prompted Fontana and his colleagues to question their pedagogical strategy. At first glance, visitors' tendency to touch urge the models disrupted the director's approach, but perhaps this urge was a natural and even beneficial impulse which could be harnessed to educational benefit? Abandoning his belief in the power of synoptic display, Fontana turned away from wax and to a new material. He now tried to develop detachable wooden models which, unlike the fragile wax, could be touched, taken apart and put back together again. Such physical interaction, he hoped, would provide audiences with a sounder "grasp" of human anatomy in every sense of the word (Maerker 2011).[7]

At La Specola touch played a decidedly ambivalent role, and museum staff could frame it in different ways. On the one hand, it was possible that visitors' urge to touch models was merely a sign of the general public's vulgarity – their irrational, sensual nature which had to be disciplined by locks and showcases. On the other hand, this urge to touch could be framed as a natural and positive response to the displays, a more immediate and productive way of learning that should be supported by developing robust, tactile models.

At the same time, the ability to touch also potentially served as a marker of social distinction. The touch of the vulgar was discouraged, while the most elevated visitors were permitted to touch models, or at least to witness a demonstration of model "dissection", on personal guided tours. This distinction became especially salient when collections were opened to the general public – such as La Specola, but also for instance of the British Museum, where Constance Classen has observed a similar distinction between vulgar or sensual touch versus elite or rational touch. As Classen has highlighted, touching could be considered acceptable at early modern museum, and was motivated by several reasons such as hospitality, closer inspection, or empathetic identification with past users (Classen 2012, 136-46, 176-8). Such divisions were also seen in medical education – the ability to touch dead bodies was a privilege that singled out the medical professional. This medical privilege was put on display in public dissections, and embodied in miniaturized models of the human body for display by physicians (Klestinec 2010; Buckley 2013).

3. Experimenting with New Materials

While at La Specola the museum's display responded flexibly to the available space, the interconnected suites of rooms of the palazzo, it was also an experiment in departing from earlier traditions of display. The *Wunderkammer* displays of delightful juxtapositions and princely displays of authority made way

[7] Modellers were very aware of the senses, and frequently produced series of models specifically devoted to a depiction of the sensory organs (see e.g. Dacome 2007).

for a uniform, systematic arrangement designed to foreground universal natural laws and their accessibility through reason and the senses. However, other important anatomical modelling enterprises reversed the relationship between objects and spaces by changing the material properties of anatomical models such as Fontana's attempt to use wood to create "dissectible" models. His experiment failed, as the wood warped with changes of humidity and temperature. However, other model makers were more successful. From the very beginning of the nineteenth century the French government, in particular, supported the development of anatomical modelling, and it was a French modeller who eventually succeeded in creating "artificial dissections." The physician Dr Auzoux developed a paper paste which enabled him to produce detachable anatomical models in series in a factory in the countryside of Normandy (Davis 1977; Pain 1991; Olszewski 2009; Maerker 2013). The paste was robust when dried, but sufficiently pliable fresh to allow for serial production using moulds. The models were brightly painted, and extensively labelled. The life-sized human male displayed over 2,000 different anatomical details.[8]

The Auzoux models configured spaces in their own ways. They turned the industrial space itself into a place of learning: Auzoux provided his workers, recruited from the local peasantry, with anatomy lessons to support the models' claims to accuracy, and to demonstrate the models' potential as teaching tools (Maerker 2013). The factory became a "production utopia" where education could lead to social harmony and upward mobility (Markus 1993). Contemporaries praised the space of model production "not only for the wholesome moral and economical discipline which marks it, but also for the artistic education it gives to a number of the people in the district in anatomy, modelling, and painting" (Walford 1862, 29-30). Changes in the materiality of models from wax to paper paste thus created the development of new spaces of model production, and turned factories into places of learning.

Their robustness made the models mobile – Auzoux soon suggested that they could be used in the colonies where high temperatures and humidity made the lengthy dissection of actual corpses for teaching purposes impractical. The medical entrepreneur considered the models a form of "immutable mobile" (Latour 1987) – an object which embodied the knowledge gathered in the hospitals and medical school of the metropolis, and could circulate this knowledge to the provinces and colonies (Garnot 1827, 272).

The models thus had the ability to reconfigure spaces. The most striking example was the models' role in Egypt. In the 1830s, the French doctor Antoine Clot created European-style medical teaching institutions at the invitation of Pasha Mehemet Ali. He hired one of Auzoux's factory workers, a young man

[8] For online exhibitions of Auzoux models see e.g. Smithsonian Museum <http://americanhistory.si.edu/anatomy/index.html>; Whipple Museum <http://www.hps.cam.ac.uk/whipple/explore/models/drauzouxsmodels>.

called Bouché, to come to Egypt and act as anatomical instructor. Faced with local opposition to the use of dead bodies in teaching, the instructor used anatomical models for basic teaching. Contemporary witnesses report that with the models, Clot and Bouché were able to turn even a local mosque in Cairo into a space for anatomical instruction (Maerker 2013).

4. A Taxonomy of Touch and Space

A focus on objects' materiality, then, can provide us with more nuanced accounts of the relationship between the museum space, its objects, and its visitors. In particular we might ask how practices of touching were informed by these constellations of materials and spatial contexts. However, not all analytical approaches are equally illuminating for investigations of historical cases of bodies as epistemic objects. A recent overview of semiotic analyses of museum spaces, for instance, understands visitor engagement purely in visual terms, asking how the "visual fields" of visitors change as they move around the built environment (Hillier and Tzortzi 2006, 283). In addition, this analytical framework captures the movement of visitors only, not that of objects. But, as recent historical studies remind us, medical collections are not static – preservations may travel between storage, display, and lecture theatre, for instance. In her case study of medical collections in Leiden, Hieke Huistra has shown how anatomical preparations frequently travelled beyond the walls of the cabinet to be used in lectures and demonstrations (Huistra 2013). Anatomical models such as Fontana's wooden model and the papier-mâché models by the Auzoux Company were designed precisely to enable mobility by making models more robust than the traditional anatomical waxes. Thus, looking at objects such as models and preparations at the intersection of space and materiality highlights that the concept of the "immutable mobile" might usefully be extended beyond two-dimensional objects such as maps, texts and images (Latour 1987).

What is required, then, for an analysis that foregrounds actual historical practices of touching at the museum is first of all a nuanced understanding of touch which can in turn help enrich our understanding of choices of materials. Given the long dismissal of touch as an inferior sense there is a danger to characterise it as simple and straightforward due to the immediacy of physical contact. More recently, this assumed simplicity has been used to argue for haptic engagement as a way to enable widening participation in museums. While giving a positive value to touch, this simplification may be equally misleading. As Fiona Candlin has pointed out, analysts need to question the assumption that touch is "an accessible and inclusive way of engaging with museum collections," and work against prevalent ideas of touch as an unmediated and uncomplicated mode of learning" (Candlin 2010).

A first heuristic for a nuanced historical conception of touch, then, requires a differentiation of purposes and effects of touch. In her recent book *The Deepest Sense* (2012), Constance Classen has surveyed a range of contexts and purposes of touching, from healing and religious practice to domestic and institutional settings. The specific example of bodies as epistemic objects may be illustrated by returning to the historical example of La Specola in Florence. At the late-eighteenth-century museum, visitors would have been familiar with a wide range of other contemporary practices of touching. They would have observed, or even practiced, the touching of relics and effigies as part of religious and civic ceremonies (Classen 2012, chapter 5). Many were familiar with object-based theories of learning informed by enlightenment pedagogy. Connoisseurs and collectors practiced the tactile appreciation of sculptures. Lay visitors would have been familiar with displays of waxworks for entertainment, a form of display which invited audiences to touch to confirm the quality of the illusion. Medical practitioners, in particular, would have been used to touching bodies not just in medical practice, but also medical education. Anatomical theatres seem to be quintessentially visual spaces (Cunningham 2010, 29ff; Ingham 2008), and anatomists trained to be able to perform dissections for maximum visibility (Cunningham 2010, 57). But at the same time in this space body parts were made available for the audience to be touched (Knoeff in preparation). Touch was an important component of eighteenth-century anatomy teaching (Lawrence 1993). Finally, medical and religious touch combined in evaluations of candidates for sainthood, as the incorruptibility of holy bodies was demonstrated through touch (Pomata 2008).[9]

This brief set of examples indicates that visitors could understand the touching of bodies in different ways. Rather than being signs of disobedience or lack of discipline, attempts to touch bodies can be reframed by the historian to indicate a complex range of behavioural repertoires and frameworks for understanding bodies as epistemic objects. To capture this complexity, historians need to differentiate uses of touch more generally. Among the possible categories, examples such as the wax anatomies at La Specola suggest the following:

- The sensual touch: This category contains the touching of objects (and bodies) for the purpose of enjoyment.
- The sceptical touch: This entails touching for the purpose of verification or falsification. Touch may be used when we do not trust our own eyes (exemplified in the figure of Doubting Thomas, a popular subject of early modern paintings (Most 2005)).

[9] Pomata shows that all senses were important for medical diagnosis, but also for instance for evaluating candidates for canonization, whose bodies were expected to be incorruptible after death.

- The connoisseurial touch: This form of physical contact is used to judge the quality of material, and/or the skill of the maker.[10]
- The learning touch: This category describes the use of physical interaction with objects to increase one's understanding and knowledge.
- The controlling touch: Touch may be used for the purposes of claiming or reinforcing social hierarchy. Among individuals the toucher usually has a higher social status than the touched. If touching objects, privileged access denotes social privilege or authority (such as that of the curator: Candlin 2004).
- The healing touch is exercised in encounters between healers and patients, but also potentially in religious settings where sacred objects are imbued with curative properties.

Of course this is by no means an exclusive list, and these categories have permeable boundaries: Herder's physical encounter with the statue of the Sleeping Hermaphrodite, for instance, could be framed both as a moment of sensual enjoyment and as a connoisseurial practice. A healer's touch might be simultaneously of therapeutic value and at the same time reinforce the social hierarchy between practitioner and patient (Buckley 2013).

5. Conclusion

This brief taxonomy of touch highlights that visitors' physical interactions with epistemic objects are highly dependent on the spatial context of the encounter, and that touch and space are mutually constitutive. Bodies both artificial and natural have been displayed as votives in churches and as effigies in public ceremonies; they could serve as dolls in shop windows, but also as anatomical models and specimens in medical schools and fairgrounds. A fruitful avenue for future research would be a systematic comparative analysis of how such spaces have influenced the development of museum displays since the early modern period. This would align historical scholarship more closely with contemporary museum practice, which has long recognised parallels with other kinds of spaces where audiences encounter objects such as shops. The modern concept of "experiential spaces" is most commonly applied to commercial spaces such as shopping centres. This is reflected in the emergence of new disciplines such as "experiential interior design" (EID), which highlights multi-sensorial experiences of the built environment. Both commercial spaces and museums now employ these methods, as indicated for instance in the title of the recent edited volume *Exhibi-*

[10] Ian Wardropper, curator of European sculpture and decorative arts at the Metropolitan Museum, has referred to this as a"diagnostic touch" which is used by the curator, but also by shoppers (see <http://www.metmuseum.org/connections/touch#/Feature>).

tion and Displays: Museum Design Concepts – Brand Presentation – Trade Show Design (Schittich 2009).[11] Historians have started to point out parallels between changing modes of commercial display and museological display. Charlotte Klonk for instance highlights the similarities between commercial bazaars and art exhibitions in the early nineteenth century (Klonk 2009, 26-8). Similarly, historians have shown parallels between the features of churches and nineteenth-century natural history museums, designed to represent "cathedrals of science" (Sheets-Pyenson 1988; see also Yanni 2000).

But how can such historical analyses of touch be achieved in practice? We need to use a wide range of sources to try to capture past audiences' interactions with medical collections. At the public museum La Specola, administrative sources such as records of repairs and expenses documents have proven useful as they capture audience actions beyond the programmatic pronouncements of exhibition makers and the idealised accounts of Grand Tour travellers. Hieke Huistra has mined administrative reports and diaries of medical students and teachers to reconstruct medical students' everyday learning experiences, and to show the importance of handling anatomical preparations in nineteenth-century Leiden, and at the Royal College of Surgeons in London (Huistra 2013, 23-4). This deep level of analysis can also open up information about the relationship between touch and configurations of collection space: as Huistra shows, the Leiden anatomy cabinet was set up to serve simultaneously as a display space and as a storage facility; to do so, spaces between shelves were made wide enough to enable visitors to observe preparations (Huistra 2013, 15). In general, histories of touch in a museum context may benefit from close attention to the material culture of the space in question, as indicated by recent analyses of the spatial arrangements of the medieval household in relation to the use of touch (Classen 2012). Beyond the traditional close reading of primary sources, and research into the material culture of the museum, more experimental analytical techniques including site visits and active engagement with the material culture of medicine may provide new perspectives on touch in museums (Jardine 2001). For such forms of engagement, taxonomies of forms of touch and spaces of engagement through time will enable scholars to contextualise historical re-creation.

To gain a richer understanding of museum audiences we need to develop a taxonomy of historical practices of touching, and a comparative history of spaces of display. Such approaches will enable us to investigate how different spaces created specific sets of expectations and physical encounters between epistemic object and subject. Comparative analysis will enable us to ask to what extent such repertoires of touching behaviours transferred from one spatial context to another.

[11] Even before the emergence of the new discipline, developers of commercial spaces created multi-sensorial experiences: see e.g. on American supermarkets in the twentieth century Smith (2007, 126-8); also Howes and Classen (2014), especially chapter 5, "Sense appeal: the marketing of sensation."

Such analyses can help us reframe touch not as a lack of discipline or understanding on the part of the visitor, but rather as different ways to make sense of bodies as epistemic objects. A comparative approach also draws attention to a wider range of spaces of knowledge production which go beyond not just the laboratory, but also beyond the museum. Of particular interest for future investigations will be past industrial and commercial sites which, like Auzoux's model factory, became sites of learning as well as of industrial production.

Historical studies remind us not only of the ongoing presence of touch in museums and collections, but also provides us with a more nuanced understanding of the ambivalence of touch – as a compulsion of the vulgar or a distinction of the elite, as an inferior sense or a privileged access to reality. The focus on touch presented here entails an exclusion of other senses which does not fully capture visitors' multi-sensorial engagement with objects. However, as a heuristic device this move enables us to trace a diverse range of different forms of interactions and their relationship to spatial contexts, and thus affords insights into the complex relationship between objects, materials, and spaces.

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