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Modelling Authority: Obstetrical Machines in the Instruction of Midwives and Surgeons in Eighteenth-Century Italy

Jennifer F. Kosmin*

Summary. This article takes the commission of an elaborate and life-like obstetrical machine by the Italian midwifery instructor, Vincenzo Malacarne, in 1791 as a starting point for considering the ways that medical practitioners were renegotiating the relationship between the senses at the end of the eighteenth century. In particular, it focuses on the cultivation of touch as an authoritative and professionalised source of bodily knowledge. The article argues that Malacarne's obstetrical machine reflects an important moment of transition in the way medical practitioners were trained to interact with female patients, in which the manual exploration of a woman's genitals was re-contextualised as an expression of scientific rationality and medical authority. A close examination of the use of obstetrical machines in midwifery training suggests, moreover, that women, too, whose touch had often been accused of irrationality and ignorance, had to be taught how to perform manual procedures in a rational and scientific manner.

Keywords: anatomical models; obstetrical machines; midwifery; obstetrics; Italy; childbirth; eighteenth century; enlightenment

Modelling Authority

During the summer of 1791, the Florentine surgeon and professor of obstetrics Giuseppe Galletti and the director of Florence's La Specola museum, Felice Fontana, undertook a special commission in anticipation of the opening of a midwifery school at the University of Pavia, near Milan. The director of the school, Vincenzo Malacarne, had requested from the Florentine workshop a full-sized obstetrical machine and a number of additional wax anatomical preparations.¹ After the great Bolognese wax modellers, the Florentine wax workshop at La Specola was renowned in Italy and abroad for its life-like anatomical preparations. Malacarne argued for the pedagogical necessity of the expensive models, given that many of his female students had only limited reading and writing skills and would therefore benefit greatly from hands-on training.² Despite some

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¹A collection of documents relating to the commission and transfer of these models can be found in the Archivio di Stato di Milano (hereafter ASM), Sanità, Parte Antica, carta 273, 'Ostetricia, Pavia, Macchine'.

²ASM, Sanità, Parte Antica, c. 273. Report of Vincenzo Malacarne, 9 November 1792.

miscommunication between Fontana and the Milanese chancellery, which footed the bill for the commissions, Malacarne was able to announce with delight in November of 1792 that the obstetrical models had arrived from Florence in excellent condition and that he intended to integrate them into his training of both male surgeons and female midwives immediately. While the foetal models prepared by Galletti³ would help students visualise the various positions the foetus might assume *in utero*,³ the full-size obstetrical machine, also of his design, would allow for the demonstration and practice of techniques essential to obstetrical practice, such as foetal version, breech delivery, forceps delivery, and craniotomy.

Although the machine is no longer extant, we can piece together an accurate portrait from Malacarne's and Galletti's notes on the subject. As Malacarne described it, the machine, constructed from wax and wood, was a 'complete, mostly-nude pregnant woman, situated as is most commonly desired for operations', that is, for any kind of manipulation of the foetus during labour.⁴ Galletti's description clarifies that the machine was positioned on its back upon an inclined plane.⁵ The life-like model, which had an abdomen and external genital parts that were partially elastic and could distend to a point, was 'accompanied by two foetal dolls with their placentas attached as natural'. Everything, moreover, was 'well-proportioned in volume, in measure, and in elasticity. Malacarne noted that the interior devices function[ed] very well' and would continue to do so, 'unless unskilful hands upset them'.⁶ Such devices would help to recreate as naturalistic an experience as possible for students practising on the machine, with mechanisms that caused the uterus to contract, such that a student attempting to reposition the foetal doll would feel resistance. What made Malacarne's device unique among existing obstetrical machines, however, was the model's extreme lifelikeness and beauty. In fact, Malacarne admitted that because the machine was 'so elegant and seductively naturalistic', he felt compelled by decency to cover it with a sheet when used for instruction.⁷ Most striking was the incorporation of eyes that moved when excessive pressure was applied to the genital area, producing an effect that, according to Galletti, seemed to bring the 'automaton to life'.⁸

In comparison to other eighteenth-century obstetrical machines, Malacarne's strikes us as distinct for several reasons. Referred to alternately as models, manikins, phantoms, machines, mock-women and dummies, and made from a variety of materials, including leather, bone, cloth, glass, clay and wax, three-dimensional obstetrical reproductions

³Galletti designed the foetal models, but the actual construction may have been the work of the wax modeller Giuseppe Ferrini or another modeller at the La Specola workshop. See Francesca Vannozzi and Lorenzo Marri Malacrida, 'Strumentaria chirurgica e modelli didattici', in Mara Miniati, ed., *Museo di Storia della Scienza: Catalogo* (Florence: Giunti, 1991), 302–29, 317. For more on Galletti's tenure in Florence, see Anna Maerker, *Model Experts: Wax Anatomies and Enlightenment in Florence and Vienna, 1775–1815* (Manchester: Manchester University Press, 2011), 65–67.

⁴See, for instance, Pietro Paolo Tanaron, *Il Chirurgo-Raccogliatore Moderno* (Bassano, 1774), 1, 146;

Lorenzo Nannoni, *Trattato di Ostetricia e di lei Rispettive Operazioni*, sesto tomo (Siena: Luigi e Benedetto Bindi, 1788), 114–15.

⁵Giuseppe Galletti, *Elementi di Ostetricia, del Dottore Gio. Giorgio Roederer, Tradotti e Corredati di Figure in Rame da Giuseppe Galletti* (Florence: Albizziniana, 1791), xiv.

⁶ASM, Sanità, Parte Antica, c. 273. Letter from Vincenzo Malacarne, 9 November 1792.

⁷ASM, Sanità, Parte Antica, c. 273. Report of Vincenzo Malacarne, 9 November 1792.

⁸Galletti, *Elementi di Ostetricia*, xiv.

were widely used in eighteenth-century Europe to aid the instruction of both midwives and surgeons.⁹ Obstetrical machines varied significantly in size, construction and complexity, though they were characterised by some form of mechanisation, such as 'contracting uteri, shifting fluid, and orifices that opened and closed'.¹⁰ Rarely, however, were obstetrical machines full-length models.¹¹ Instead, they emphasised a kind of focused functionality, typically consisting of no more than the pregnant torso and upper thighs and lacking the exceptional detail that marked many of the other anatomical models produced in Italy during the eighteenth century. While audiences past and present have commented on the extreme life-likeness—indeed, the uncanny effect of deceased, dissected corpses made animate and vital—of the wax anatomical models displayed in this period at popular museums like La Specola, eighteenth-century obstetrical machines could hardly be confused with real pregnant bodies. The stuffed fabric and bone machines popularised by the renowned French midwife Madame du Coudray at mid-century suggest utility over anatomical accuracy, durability over detail (Figure 1).¹² Similarly, the Bolognese midwifery professor Giovanni Antonio Galli's glass-wombed machine intentionally eschewed realism in favour of instructional capacity. In contrast, the Pavia machine seems to have been modelled with the explicit intent of erasing, or at least reducing, the conceptual boundaries between model and body. Indeed, for Galletti, the machine mimicked the movements of the human body so 'splendidly . . . that it was almost as if it were produced by the secret workings of nature'.¹³

While the machine was distinct among its immediate counterparts in important ways, it was in others a perfect exemplar of its age. Like other obstetrical machines, the Pavia model reflected the belief promoted by many eighteenth-century surgeons and physicians that childbirth was an event driven by mechanical principles. Exact pelvic

⁹Obstetrical models were not only produced in Europe. Highly technical obstetrical models and machines were constructed in Japan, for instance, from at least the mid-nineteenth century. In an earlier period, small, ivory anatomical models were used in China by female patients to point out areas of pain or discomfort as cultural prohibitions on men touching women kept male physicians from physically interacting with female patients. See K. F. Russell, 'Ivory Anatomical Manikins', *Medical History*, 1972, 16, 131–42; Harry Owen, *Simulation in Healthcare Education: An Extensive History* (New York: Springer, 2016), 151, 198–99. For models made in Italy, see Maurizio Armaroli, *Le cere anatomiche bolognesi del settecento* (Bologna: CLUEB, 1981); A. Zanca, *Le cere e le terrecotte ostetriche del Museo di Storia della Scienza a Firenze* (Florence: Arnau, 1981); Francesca Vannozi, 'Fantocci, marchingegni e modelli nella didattica ostetrica senese', in Francesca Vannozi, ed., *Nascere a Siena. Il parto e l'assistenza alla nascita dal Medioevo all'età moderna* (Siena: Nuova Immagine, 2005), 35–42; Claudia Pancino and Jean d'Yvoire, *Formato nel segreto. Nascituri e feti fra immagini e immaginario dal XVI al XXI secolo* (Rome: Carocci, 2006), 48–63; Alessandro Riva, *Cere. Le anatomie di Clemente Susini dell'Università di Cagliari* (Nuoro:

Ilisso, 2007); Rebecca Messbarger, *The Lady Anatomist: The Life and Work of Anna Morandi Manzolini* (Chicago: University of Chicago Press, 2010); Lucia Dacome, *Malleable Anatomies: Models, Makers, and Material Culture in Eighteenth-Century Italy* (Oxford: Oxford University Press, 2017).

¹⁰Pam Lieske, "'Made in Imitation of Real Women and Children": Obstetrical Machines in Eighteenth-Century Britain', in Andrew Mangham and Greta Depledge, eds, *The Female Body in Medicine and Literature* (Liverpool: Liverpool University Press, 2011), 69–88, 71.

¹¹One of the few examples of a full-length model of which there is evidence comes from a much later period. The Philadelphia obstetrician Theophilus Parvin published pictures of his full size manikin, which included the mammary structures, in the 27 December 1890 issue of the *New York Medical Journal*. J. Clifton Edgar, 'The Manikin in Teaching Obstetrics', *New York Medical Journal*, 1890, 52, 701–9.

¹²On Coudray, see Nina Ratner Gelbart, *The King's Midwife: The History and Mystery of Madame du Coudray* (Berkeley: University of California Press, 1998).

¹³Galletti, *Elementi di Ostetricia*, xiii.



Fig. 1 Obstetrical phantom designed by Madame du Coudray, Musee Flaubert et d'Histoire de la Medecine, Rouen.

measurements could predict whether a birth would be difficult; the uterus could be understood as a pump that functioned in a larger hydraulic system. Moreover, Galletti's reference to the Pavia machine as an 'automaton' was no accident. Although automata of various sorts had existed as technical marvels since antiquity, eighteenth-century automata were, according to Jessica Riskin, 'philosophical experiments, attempts to discern which aspects of living creatures could be reproduced in machinery . . . and what such reproductions might reveal about their natural subjects'.¹⁴ In other words, the project of making a life-like obstetrical model was intended not simply as a kind of referential simulation but as a true recreation of the mechanisms that guided and animated physiological processes. At the same time, the incorporation of responsive eyes and aesthetic touches remind us that contemporaries were also deeply interested in questions about sensibility and sensitivity, particularly with respect to sexuality and sexual pleasure and their relation to generation. Darren Wagner, writes, for instance, that in this period, even mechanist medical writers often accepted the idea of 'nervous fluids' or 'animal spirits' that coursed through the body and were essential to 'mental and physical sensitivity, awareness, impressions, and responses'.¹⁵ Sexuality was therefore

¹⁴Jessica Riskin, 'The Defecating Duck, or, The Ambiguous Origins of Artificial Life', *Cultural Inquiry*, 2003, 29, 599–633, 601.

¹⁵Darren N. Wagner, 'Body, Mind and Spirits: The Physiology of Sexuality in the Culture of Sensibility', *Journal for Eighteenth-Century Studies*, 39, 3, 2016, 335–58.

'understood and represented through the movement and influence of animal spirits between the body and mind – or, more specifically, between the salacious, sensitive genitalia and the rational, thinking brain'.¹⁶ The Pavia machine thus embodied the late eighteenth century's fascination both with the mechanical recreation of life and with the enigmatic physiological processes that produced sensation, desire, passion, and pleasure.¹⁷

Keeping in mind this broader cultural landscape, my aim here is to take Malacarne's obstetrical machine as a point of entry into how and with what aims such objects were used in the instruction of midwives and surgeons in late eighteenth-century Italy. The efforts made to render the Pavia obstetrical machine as life-like as possible—the machine was modelled partly in wax;¹⁸ it was full-length; it included eyes that responded to genital touching—suggest that by the end of the eighteenth century, some Italian midwifery professors were concerned about the transferability of skills learned in the classroom to their application on real women and babies. I would like, then, to consider the Pavia machine in the context of a concurrent reimagining of the relationship between practitioners, in particular male practitioners, and female patients. Indeed, in the same year that Malacarne commissioned the Florentine wax modellers for a life-like obstetrical machine, he published the first manual in Italian devoted to a new medical procedure: the gynaecological examination.¹⁹ *La Esplorazione Proposta come Fondamento dell'Arte Ostetricia* argued that what was called 'the exploration' (*l'esplorazione*) or 'the touching' (*il toccamento*), performed by either a midwife or obstetrician, would provide valuable information regarding a woman's health, reproductive state and problems related to sterility. Not only would such an examination determine with certainty whether a woman was pregnant, but it could illuminate months ahead of delivery whether there might be problems during childbirth due to the size or shape of a woman's pelvis. Although there is clear evidence that early modern women often consulted physicians with gynaecological problems, rarely did such encounters involve a physical examination, though one might

¹⁶*Ibid.*, 336.

¹⁷Corinna Wagner suggests that eighteenth-century anatomical wax models, particularly the so-called Anatomical Venuses, and obstetrical machines influenced literary constructions of female automata in the nineteenth century, at a time when there was a growing distaste for the spectacle of the dissected, fleshy, opened body. See Corinna Wagner, 'Replicating Venus: Art, Anatomy, Wax Models, and Automata', 19: *Interdisciplinary Studies in the Long Nineteenth Century*, 2017, 24. doi: <http://doi.org/10.16995/ntn.783>

¹⁸Wax, while generally agreed to most closely mimic human flesh, also produced more delicate models than other, more durable materials. Renato G. Mazzolini, 'Plastic Anatomies and Artificial Dissections', in Soraya de Chadarevian and Nick Hopwood, eds, *Models: The Third Dimension of Science* (Palo Alto: Stanford University Press, 2004), 43–70, 59–62.

¹⁹Vincenzo Malacarne, *La Esplorazione Proposta come Fondamento per dell'Arte Ostetricia* (Milan: Giacomo

Barelle, 1791). Although early modern midwives had certainly performed (indeed, they were often requested to do so by legal authorities during cases where a woman's reproductive state was central) gynaecological examinations to determine pregnancy, to verify a woman's virginity (or violation) and to determine potential causes of sterility, the examination outlined by Malacarne and others in this period was intended to be both diagnostic and preventative. In addition to verifying virginity or pregnancy, the examination could indicate non-reproductive problems with a woman's genitals and could fortell in advance complications that might arise during childbirth. In this way, the examination proposed by Malacarne anticipates the modern pelvic examination that understands the regular inspection of women's genitals as necessary for the maintenance of good health. On the modern pelvic examination, see Terry Kapsalis, *Public Privates: Performing Gynecology from Both Ends of the Speculum* (Durham: Duke University Press, 1997).

be performed by a midwife who would then relay information to the doctor for diagnosis.²⁰

The significance of the reimagined relationship between practitioner and patient outlined in Malacarne's text thus rests on the physical intimacy of the gynaecological examination, where male hands might touch women's most private parts. Touch but preferably not see. Malacarne writes that the examination was so important precisely because 'touch must substitute for sight', the latter of which is almost always rendered 'useless because of women's natural or feigned modesty'.²¹ Conditioned by a hierarchy of exposure that placed the male gaze at the top, women might be more likely to submit to physical examination if it was done under the covers of dress skirts or sheets.²² These concerns were especially acute in Italy, where contemporaries were convinced that Italian women's 'irrational modesty' and overdeveloped sense of shame made them more resistant than women in other countries to interacting with male obstetricians.²³ This article argues that Vincenzo Malacarne's commissioning of an intentionally life-like obstetrical machine in 1791 reflects an important moment of transition in the way medical practitioners were trained to interact with female patients. Although much scholarship on the ascendancy of obstetrics has concentrated on visual and textual methods of establishing authority, such as anatomical investigation, the publication of midwifery manuals and obstetrical atlases, and, indeed, the production of three-dimensional visual representations of the womb's interior, this essay focuses on the cultivation of touch as an authoritative and professionalised source of bodily knowledge. Moreover, it was not just men who had to relearn how to touch. Women, too, whose touch had often been accused of irrationality, rashness and ignorance, had to be taught how to perform manual procedures in a rational and scientific manner. A close examination of the use of obstetrical machines in midwifery instruction during the late eighteenth century sheds light on how the relationship between the senses, especially sight and touch, was being renegotiated, with touch emerging as a critical medical skill that could be taught and refined in students.²⁴

Discussions of obstetrical machines have typically taken one of two directions. First, historians of science and medicine have explored the importance of such models in the

²⁰Michael Stolberg, 'Examining the Body, C. 1500–1750', in Sarah Toulalan and Kate Fisher, eds, *The Routledge History of Sex and the Body: 1500 to the Present* (London: Routledge, 2013), 91–105, 97–99; Roy Porter, 'The Rise of Physical Examination', in W. F. Bynum and Roy Porter, eds, *Medicine and the Five Senses* (Cambridge: Cambridge University Press, 1993), 191–94; Katharine Park, *Secrets of Women: Gender, Generation, and the Origins of Human Dissection* (New York: Zone Books, 2006), 179–97, 189.

²¹Malacarne, *La Esplorazione*, 48.

²²Stolberg, 'Examining the Body', 98–99.

²³Italian medical writers both during and after the eighteenth century believed Italian women's modesty was a central factor in retarding the develop-

ment of Italian obstetrics. See Sebastiano Rizzo, *Della Origine e dei Progressi dell'Arte Ostetrica, Prolusione Recitata il giorno 17 Settembre 1776* (Venice: Carlo Palese, 1776), xxix–xxx; Alfonso Corradi, *Dell'ostetricia in Italia: dalla metà dello scorso secolo fino al presente* (Bologna: Gamberini e Parmeggiani, 1877), 792–93; Giuseppe Giglio, *L'Ostetricia attraverso i secoli. Prelezione* (Palermo: Fratelli Marsala, 1901), 17.

²⁴For a discussion of the relations between smell, gender and early modern medical practice, see Jennifer Evans, 'Female Barrenness, Bodily Access and Aromatic Treatments in Seventeenth-Century England', *Historical Research*, 2014, 87, 237, 423–44.

development and professionalisation of obstetrics. Some of this scholarship, oriented around feminist concerns, has pointed to the models' role in facilitating the entrance of male practitioners into the management of childbirth by distancing midwifery instruction from actual labours.²⁵ Male practitioners, often limited by social convention and sometimes by law from attending women during normal labours, could use obstetrical machines to gain familiarity with reproductive anatomy and key obstetrical manoeuvres. As the critique goes, obstetrical machines sanitised delivery of its unpalatable fluids and tissues and rendered unnecessary the presence of an actual, embodied woman in labour.²⁶ The fact that obstetrical machines often consisted only of torsos and amputated thighs has been taken as further evidence of the decreasing importance of women's testimonials of their own bodies and the objectification of patients associated with the emergence of a masculinist, clinical gaze. Pam Lieske, argues, for instance, that British man-midwives' use of obstetrical machines both reflected and contributed to their treatment of 'female patients in a mechanised and often dehumanised way'.²⁷ Bonnie Blackwell has suggested, furthermore, that there is a straight line between eighteenth-century midwifery instruction on machines, which she argues valorised haste and masculine bravado, and the medicalised childbirth of the twentieth century, with its preference for surgical birth.²⁸

Recent scholarship, presented in a more nuanced and less polemical light, has suggested that strictly viewing obstetrical machines through a gendered lens is misleading and reductive. Indeed, as the example of Madame du Coudray demonstrates, women were both producers and users of obstetrical machines during the eighteenth century. Moreover, many male professors instructed both female midwives and male surgeons on machines, meaning that the scene of seedy male-bonding-over-female-genitalia often associated with Smellie's use of obstetrical models is hardly representative of the entire spectrum of their instructional use. Margaret Carlyle thus argues that not only did the use of obstetrical machines help to assuage, 'concerns over [male] trainees' titillating interactions with real women's bodies', but that they embodied in important ways the shift towards the mechanistic view of the human body that dominated during much of the seventeenth and eighteenth centuries.²⁹

In a second line of inquiry, cultural historians have associated obstetrical machines with a broad array of anatomical models produced during the eighteenth century and displayed for public consumption in new museums of natural history. In Italy, life-like,

²⁵For an especially critical view of obstetrical machines, see Bonnie Blackwell, 'Tristram Shandy and the Theater of the Mechanical Mother,' *ELH*, 2001, 68, 81–133.

²⁶Some machines did include fluids. Madame du Coudray's models incorporated sponges that released dyed fluids to represent blood and amniotic fluid. In England, some of William Smellie's obstetrical machines may have been capable of accommodating a fluid-filled amniotic sac. Bonnie Blackwell writes that Smellie's students would often sneak into the operating room before lessons and fill the machine's bladder with beer. If a student practising forceps delivery applied the instruments incorrectly,

it was common to puncture the bladder (a serious and life-threatening mistake). Blackwell, 'Tristram Shandy and the Theater of the Mechanical Mother', 92–93.

²⁷Pam Lieske, 'William Smellie's Use of Obstetrical Machines and the Poor', *Studies in Eighteenth-Century Culture*, 2000, 29, 65–86, 66.

²⁸Blackwell, 'Tristram Shandy and the Theater of the Mechanical Mother', 68, 81–133.

²⁹Margaret Carlyle, 'Phantoms in the Classroom: Midwifery Training in Enlightenment Europe', *KNOW: A Journal on the Formation of Knowledge*, 2018, 2, 111–36.

full-size models of reproductive women, known as the anatomical Venuses, often featured as centrepieces of public displays aimed at awing Grand Tourists and cultivating enlightened populaces at home. Scholars have reconstructed the rich cultural genealogies of which such representations, particular those modelled in wax, were a part.³⁰ Visitors were encouraged to use anatomy to reflect on the magnificence of God's creation and to marvel at the potential for scientific knowledge to advance the public good. In Florence, La Specola's director, Felice Fontana, argued that anatomical models presented for public consumption would promote the public good by loosening citizens' reliance on medical charlatans and other questionable sources of competing knowledge. Convinced of the instructional power of sensation, Fontana even believed that audiences would be able to intuit the information about the body being displayed without any kind of docent or explanatory text.³¹

Fontana's belief in the inherent didacticism of the anatomical models and their role in cultivating viewers' bodily self-knowledge underscores an important point that is sometimes lost when various kinds of anatomical models are considered together. That is, that although there was certainly overlap between models displayed publicly and those used in medical training, the particular setting in which a model was situated determined its relation to knowledge production. If anatomical models available for public display aimed at educating and enlightening audiences with valuable knowledge about their own bodies, obstetrical models and machines incorporated into medical training functioned to demarcate boundaries of knowledge and render the female reproductive body necessary of management by those with a specialised medical knowledge. Thus, while Malacarne was clearly aware of the aesthetic appeal of his obstetrical machine, he was adamant that under no circumstances was it to become a 'spectacle for the curious', even if they offered to pay for a visit to the mechanical woman. Likewise, Malacarne's assertion that the internal mechanisms of the Pavia machine would function well *unless* upset by 'unskillful hands' marked it as an object whose secrets could only be understood by those with the appropriate training and knowledge. In this case, a kind of knowledge that was explicitly manual. This article expands upon both of these strains of scholarship by taking Malacarne's concerns about different kinds of model users

³⁰An eighteenth-century Italian visitor to an anatomical display might have noted, for instance, the aesthetic and material parallels between anatomical models and artistic representations of the nude body, wax votives, saints' preserved bodies, nuptial dolls and wax *agnus dei* medallions used by women in childbirth to ensure a safe delivery. See Ludmilla Jordanova, *Sexual Visions: Images of Gender in Science and Medicine Between the Eighteenth and Twentieth Centuries* (Madison: University of Wisconsin Press, 1993), 43–65; Lucia Dacome, 'Women, Wax and Anatomy in the "Century of Things"', *Renaissance Studies*, 2007, 21, 522–50; Dacome, 'Waxworks and the Performance of Anatomy in mid-18th-Century Italy', *Endeavor*, 2006, 30, 29–35; Martin Kemp and Marina Wallace, *Spectacular Bodies: The Art and Science of the*

Human Body from Leonardo to Now, Exh. cat. (London: Hayward Gallery, 2000), 32–68; Rebecca Messbarger, 'Waxing Poetic: Anna Morandi Manzolini's Anatomical Sculptures', *Configurations*, 2001, 9, 65–97; Messbarger, 'The Re-Birth of Venus in Florence's Royal Museum of Natural History and Physics', *Journal of the History of Collections*, 2013, 25, 195–215; Roberta Panzanelli, ed, *Ephemeral Bodies: Wax Sculpture and the Human Figure* (Los Angeles: Getty Publications, 2008); Joan Landes, 'Wax Fibers, Wax Bodies, and Moving Figures: Artifice and Nature in Eighteenth-Century Anatomy', in Panzanelli, ed, *Ephemeral Bodies*, 41–66; Joanna Ebenstein, *The Anatomical Venus: Wax, God, Death, and the Ecstatic* (New York: D.A.P., 2016).

³¹Anna Maerker, *Model Experts*, 120, 123.

as a starting point for exploring the role of obstetrical machines in the production of particular, sense-based skills and knowledge.

Making Birth Visible in Eighteenth-Century Italian Midwifery Schools

During the second half of the eighteenth century, Italian civic authorities concerned with dire reports of high infant and maternal mortality opened public midwifery schools in cities such as Turin, Florence, Verona, Milan, Rovereto, Venice and Padua.³² One of the main aims of such schools was to use the resources and personnel of major hospitals and universities in the cities to train midwives from the hinterlands, who would ultimately transport the most advanced childbirth knowledge and practices back to their home communities.³³ In line with Fontana's hope that visits to anatomical displays would advance the public good by educating citizens with natural knowledge directly relevant to their own lives, Italian reformers were reimagining the role of the state in promoting and preserving public health.³⁴ Natural knowledge, seen increasingly as the preserve of a select body of professionalised experts, could be harnessed to serve the interests of the state, in this case to grow and protect the health of the population.

Midwifery schools foregrounded the study of anatomy, seen increasingly as the foundation for advancing medical knowledge, even though it struck many long-practising midwives as an unnecessary component of training. The Venetian midwife Bortola Marchesini, for instance, petitioned the Venetian health board for a release from the licencing requirement of attendance at a dissection. Marchesina wrote that she was confident that she could pass any licencing examination without difficulty, but that she had been unable to attend a dissection of the uterus because she was 'continually in company with my mother [an approved midwife] at births' and had 'been present at many, many cases, both unusual and difficult ones ... and ... had occasion to learn all that the abovementioned dissection could show me'.³⁵ Although midwives like Marchesina were unconvinced of the practical advantages a formal knowledge of anatomy would offer, male practitioners considered anatomical study the cornerstone of what distinguished their professional expertise from the age-old practice of midwives. When a midwifery school opened in Milan in 1767, the director, Bernardino Moscati, presented a 'theory of childbirth' that was designed to elevate the 'practices' of midwifery into the 'science' of obstetrics.³⁶ This kind of language reflected not only the contemporary value placed on anatomical learning but also an understanding of childbirth as a mechanical process that obeyed certain rules and yielded a predictable set of circumstances.

Indeed, seventeenth- and eighteenth-century physicians and naturalists were fascinated by the question of whether and to what extent bodily functions could be reduced to mechanical processes.³⁷ While the complexities of embryological and foetal

³²Claudia Pancino, 'La comare levatrice: Crisi di un mestiere nel XVIII secolo', *Società e Storia*, 1981, 13, 593–638, 630.

³³Jennifer F. Kosmin, 'Embodied Knowledge: Midwives and the Medicalization of Childbirth in Early Modern Italy' (PhD thesis, University of North Carolina at Chapel Hill, 2014), 192–93, 264–65.

³⁴Maerker, *Model Experts*, 52–62.

³⁵ASV, Sanità, b. 589, Supplica of Bortola Marchesini, December 1719.

³⁶ASM, Sanità, Parte Antica, c. 268, 'Riflessioni di Bernardino Moscati intorno allo stabilimento della nuova Scuola pe' Parti', 1767.

³⁷Jessica Riskin, 'The Defecating Duck', 601–06; Eve Keller, *Generating Bodies and Gendered Selves: The Rhetoric of Reproduction in Early Modern England*

development troubled mechanistic thinking from the beginning, childbirth itself seemed to fit more comfortably within such an explanatory framework.³⁸ Eighteenth-century writers described the womb as a mechanical apparatus and understood labour as a process defined by a set of prescribed, geometrical relationships. Eighteenth-century midwifery education reified this type of thinking, exposing students to anatomical precepts through the study of detailed charts, diagrams, and illustrations, all of which aimed to quantify and delimit the totality of potential birth presentations and outcomes. At the same time, male practitioners often encountered an exaggerated number of pathological presentations in their own practice, especially given the kinds of bodies available for them to study. This emphasis carried over into instruction. Moscati, for instance, desired the Milanese school be located in the city's large general hospital, not because it would allow students to gain repeated experience with natural births but because it would expose them to the greatest variety of cases, including 'the *mole* [false conception], mutations . . . the various position of the foetus in different births . . . as well as the dissection of many cadavers'.³⁹ Training for both midwives and surgeons thus drew attention to difficult labours requiring skilled manual operations or surgical intervention.⁴⁰

The professors at Italy's first midwifery schools employed a combination of methods, including dissection, to familiarise students with female reproductive anatomy. Although many midwifery students were only semi-literate, midwifery manuals composed in dialogue form, often similar to a catechism, proved effective in capitalising on the abilities of those students who could read. Such texts began with lengthy discussions of the anatomical structures, both internal and external, related to childbirth.⁴¹ Actual anatomical demonstrations on cadavers often occurred only one or two times per year, but an emphasis on visualising the body's interior and exterior structures served as a central organising principle across the midwifery curriculum. In Milan, Bernardino Moscati recommended displaying the drawings of the gravid uterus as depicted in the well-known obstetrical atlases and midwifery manuals of male practitioners like William Smellie, William Hunter and Johann Georg Roederer. These were to be displayed 'on the walls of the school, attached with simple explanations of the images beneath, suitably adapted to the need of the students'.⁴² Obstetrical atlases like Smellie's and Hunter's, which were rendered in more precise detail than any of their predecessors, aimed at representing birth as authentically and close to nature as possible. While Smellie's atlas featured difficult births and introduced the hands of the forceps-baring man-midwife in its drawings, Hunter's intention was to condense the varieties of childbirth into a representative

(Seattle: University of Washington Press, 2007), 128–32. On the history of the categories of 'mechanism' and 'vitalism', see John Zammito, 'Reill's *Vitalizing Nature in the Enlightenment* and German *Naturphilosophie*', in Keith Baker and Jenna Gibbs, eds, *Life Forms in the Thinking of the Long Eighteenth Century* (Toronto: University of Toronto Press, 2016), 70–94.

³⁸Mary Terrall, 'Material Impressions: Conception, Sensibility, Inheritance', in Helen Deutsch and Mary Terrall, eds, *Vital Matters: Eighteenth-Century Views of Conception, Life, and Death* (Toronto: University of Toronto Press, 2012), 109–29.

³⁹ASM, Sanità, Parte Antica, c. 268, Letter from Bernardino Moscati to the Milanese Chancellery, 10 April 1768.

⁴⁰Massey, 'Pregnancy and Pathology: Picturing Childbirth in Eighteenth-Century Obstetric Atlases', *The Art Bulletin*, 2005, 87, 73–91, 85–87; Allison Muri, *The Enlightenment Cyborg: A History of Communications and Control in the Human Machine, 1660–1830* (Toronto: University of Toronto Press, 2007), 219–21.

⁴¹Kosmin, 'Embodied Knowledge', 106–7.

⁴²ASM, Sanità, Parte Antica, c. 268, Letter from Bernardino Moscati, 1767.

ideal.⁴³ Both sets of images, however, relied upon a 'highly refined pictorial link between dissection and the practices of midwifery' that fashioned 'pregnancy as an illness that is fully exposed only to the trained eye and hand' of expert practitioners.⁴⁴

In the absence of bodies available for dissection, midwifery students could observe various models and specimens, both wet and dry, in the medical collections that were increasingly central to the identity and reputation of eighteenth- and nineteenth-century universities and medical schools.⁴⁵ In such collections, students might view clay, wax or terracotta models of the gravid uterus, as well as preserved fetuses at various stages of development. Both wet and dry specimens depicted normal and pathological development, the latter of which might include fetuses in non-natural positions *in utero*, fetuses with spina bifida and so-called 'monstrous' births—fetuses lacking eyes, nose or other body parts.⁴⁶ Models served as three-dimensional teaching aids to accompany professors as they lectured to midwives and surgeons. The collection of wax and terracotta fetal models that accompanied Vincenzo Malacarne's obstetrical machine to Pavia gave equal attention to unnatural foetal positions, such as breech births and fetuses with umbilical cords wrapped around their necks, as they did normal development. In Bologna, Giovanni Antonio Galli's extensive collection included a series of 12 models representing breech births at progressive stages of delivery, not to mention three separate models featuring the mis-attachment of the placenta to the fundus, a complication about which Galli was especially concerned.⁴⁷ His collection also included examples of errors that practitioners might commit, including the perforation of the uterus during a manual extraction of the placenta, highlighting the disastrous impact of an unskilful touch (Figure 2).⁴⁸

These sets of practices and instructional tools were united in their reliance on anatomical investigation and their investment in rendering visible the inner workings of the female body. Emphasising the dangers of birth, they paradoxically instilled in students a sense of childbirth as at once a mechanical process—reducible to a set of relations between pelvis shape and foetus size—and a pathological event requiring medical supervision. Together, these instructional materials reflect what Lyle Massey has called the '*obstetric gaze*', that is, a mode of viewing the female body that constructs it as a 'carrier of a particular sex-defined pathology', in need, ultimately, of regulation by medical experts.⁴⁹ As early modern obstetrical atlases, midwifery manuals, and foetal models have all tended to feature prominently in studies of the development of modern obstetrics, scholars have often pointed out the juxtaposition between these visual-based modes of knowing and the allegedly more tactile knowledge traditional midwives gained through apprenticeship and practical experience.⁵⁰ Yet, the incorporation of obstetrical

⁴³Massey, 'Pregnancy and Pathology', 83.

⁴⁴Massey, 'Pregnancy and Pathology', 73.

⁴⁵Hieke Huistra, 'Adieu Albinus: How the Preparation in the Nineteenth-Century Leiden Anatomical Collections Lost their Past', in Rina Knoeff and Robert Zwijnenberg, eds, *The Fate of Anatomical Collections* (Abingdon, OX: Routledge, 2015), 113–28.

⁴⁶Felice De Billi, *Sulla I.R. Scuola di Ostetricia ed Annesso Ospizio* (Milano, 1844), 66–67; Kosmin, 'Embodied Knowledge', 217.

⁴⁷Messbarger, *The Lady Anatomist*, 83.

⁴⁸Owen, *Simulation in Healthcare Education*, 119.

⁴⁹Massey, 'Pregnancy and Pathology', 89.

⁵⁰Ludmilla Jordanova, 'Gender, Generation and Science: William Hunter's Obstetrical Atlas', in William F. Bynum and Roy Porter, eds, *William Hunter and the Eighteenth-Century Medical World*



Fig. 2 Obstetrical models, Palazzo Poggi, Bologna, Copyright © Elena Manente.

machines into midwifery instruction suggests that touch, in addition to sight, featured prominently as an epistemological category in eighteenth-century Italian midwifery schools.⁵¹ Perhaps because so few eighteenth-century obstetrical machines are extant, they have received less attention from scholars than have other instructional tools, such as midwifery manuals.⁵² The remainder of this article aims to fill in some of these gaps

(Cambridge: Cambridge University Press, 1985), 385–413, 396; Lynne Tatlock, 'Speculum Feminarum: Gendered Perspectives on Obstetrics and Gynecology in Early Modern Germany', *Signs*, 1992, 17, 725–60; Adrian Wilson, *The Making of Man-Midwifery: Childbirth in England, 1660-1770* (Cambridge: Harvard University Press, 1995), 24–38; Doreen Evenden, *The Midwives of Seventeenth-Century London* (Cambridge: Cambridge University Press, 2000), 6–12, 182–85; Laura Gowing, *Common Bodies: Women, Touch, and Power in Seventeenth-Century England* (New Haven: Yale University Press, 2003), 40–51.

⁵¹On the attempts by early modern British man-midwives to cultivate touch as a marker of expertise, see Eve Keller, 'The Subject of Touch: Medical Authority in Early Modern Midwifery', in Elizabeth D. Harvery, ed., *Sensible Flesh: On Touch in Early*

Modern Culture (Philadelphia: University of Pennsylvania Press, 2003), 62–80. Lianne McTavish also raises this question in her study of French man-midwives' self-representational strategies: Lianne McTavish, *Childbirth and the Display of Authority in Early Modern France* (Aldershot and Burlington, VT: Ashgate Publishing Company, 2005).

⁵²A notable exception, discussed further, is Lucia Dacome's recent work on wax modelling in Bologna, *Malleable Anatomies*, esp. chapter 5 'Blindfolding the Midwives'. See also, Messbarger, *The Lady Anatomist*, esp. chapter 3. For discussion of British machines see Lieske, 'Made in Imitation of Real Women and Children', 69–88; Bonnie Blackwell, 'Tristram Shandy and the Theater of the Mechanical Mother', 81–133. Whereas Lieske and Blackwell both note the importance of obstetrical machines for British men-midwives still struggling to gain



Fig. 3 Giovanni Antonio Galli's obstetrical machine, mid-eighteenth century, Palazzo Poggi, Bologna.

by reconstructing the everyday context in which obstetrical models and machines were incorporated into the training of midwives and surgeons in eighteenth-century Italy.

Obstetrical Machines and the Instruction of Touch

As Susan Lawrence has pointed out, 'teaching about sensations is fraught with ambiguities. Words serve uneasily to reify experience'.⁵³ The following discussion highlights some of the challenges that eighteenth-century midwifery instructors faced in their attempts to

legitimacy and stave off claims of impropriety, in Italy, obstetrical machines were used just as frequently to instruct female midwives as they were male surgeons. A similar situation existed in France, where Madame du Coudray taught hundreds of midwives on her obstetrical machines.

⁵³Susan C. Lawrence, 'Educating the Senses: Students, Teachers and Medical Rhetoric in Eighteenth-Century London', in W. F. Bynum and Roy Porter, eds, *Medicine and the Five Senses* (Cambridge: Cambridge University Press, 1993), 154.

(re)define touch as a legitimate medical practice and source of embodied, scientific knowledge. In addition to the difficulties of verbalising the sense of touch, instructors had to work against at least two opposing tendencies. First, critiques of both midwives and man-midwives in this period often constructed such practitioners' touch as dangerous and harmful.⁵⁴ Women's touch was uneducated and impatient. Man-midwives' and surgeons' was aggressive and clumsy, made especially perilous by the incorporation of unwieldy surgical instruments. In both cases, touch was destructive; hands delivered babies that were misshapen, broken, or scarred. Secondly, the early modern period increasingly saw touch, long associated with eroticism and carnality, 'subordinated to the senses that support a greater distance between bodies'; that is, to sight and hearing'.⁵⁵ In *The Birth of the Clinic*, for instance, Michel Foucault suggests that eighteenth-century visual representations of pathological anatomy functioned to redirect the sensory knowledge derived from touch and smell into a multisensory gaze in which sight is the predominant mode of knowing.⁵⁶ Obstetrical machines resisted these impulses and provided a controlled space for both male and female practitioners to cultivate touching as a legitimate and scientifically rational mode of knowing the body that was as (if not more) important as seeing.

The most extensive collection of three-dimensional obstetrical models in mid-eighteenth-century Italy belonged to the Bolognese obstetrician and professor of surgery, Giovanni Antonio Galli.⁵⁷ By the early 1750s, Galli could boast that he owned some 170 anatomical models, which he used to instruct midwives and surgeons privately out of his home. Looking back on Galli's collection a century later, Giambattista Fabbri wrote that the addition of three-dimensional obstetrical models had been necessary because of the limitations of the drawn figures that existed at the time (especially those available prior to the major artistic achievements of William Smellie and William Hunter).⁵⁸ The models, at least 20 of which were produced by the renowned wax modelling husband-wife team of Giovanni Manzolini and Anna Morandi Manzolini, were instead based directly from drawings made during the dissection of female reproductive structures.⁵⁹

⁵⁴Keller, 'The Subject of Touch', 64–65.

⁵⁵Elizabeth D. Harvey, 'The "Sense of All Senses"', in Elizabeth D. Harvey, ed. *Sensible Flesh: On Touch in Early Modern Culture* (Philadelphia: University of Pennsylvania Press, 2003), 1–21, 8. Harvey is following Norbert Elias here.

⁵⁶Michel Foucault, *The Birth of the Clinic: An Archaeology of Medical Perception* (Abingdon, OX: Routledge, 1989), 202–04.

⁵⁷On Galli's collection of obstetric models in Bologna, see Marco Bortolotti, 'Insegnamento, ricerca e professione nel Museo Ostetrico di Giovanni Antonio Galli', in *I materiali dell'Istituto delle Scienze: Catalogo della mostra* (Bologna: CLUEB, 1979), 239–47; Olimpia Sanlorenzo, *L'insegnamento di ostetricia nell'Università di Bologna* (Bologna: Alma Mater Studiorum Saecularia Nona, 1988), 27–37; Marco Bortolotti et. al., *Ars obstetricia bononiensis: catalogo ed inventario del Museo Ostetrico Giovan Antonio*

Galli (Bologna: Editrice CLUEB, 1988); Viviana Lanzarini, 'La Scuola Ostetrica di Giovanni Antonio Galli', in Francesca Vannozi, ed., *Nascere a Siena. Il parto e l'assistenza alla nascita dal Medioevo all'età Moderna* (Siena: Nuova Immagine Editrice, 2005), 25–34; Dacome, *Malleable Anatomies*, chapter 5; Lyle Massey, 'On Waxes and Wombs: Eighteenth Century Representations of the Gravid Uterus', in Roberta Panzanelli, ed., *Ephemeral Bodies: Wax Sculpture and the Human Figure* (Los Angeles: Getty Research Institution, 2008), 83–105.

⁵⁸Giambattista Fabbri, 'Antico Museo Ostetrico di Giovanni Antonio Galli, restauro fatto alle sue preparazioni in plastica e nuova conferma della suprema importanza dell'ostetricia sperimentale', in *Memorie dell'Accademia delle Scienze dell'Istituto di Bologna, serie III, tomo II* (Bologna: Gamberini e Parmeggiani, 1872), 129–66, 130.

⁵⁹Messbarger, *The Lady Anatomist*, 80.

In addition to wax and clay models, Galli also incorporated at least one obstetrical machine in his teaching.⁶⁰ Distinct from the clay and wax models, which tended to be limited to disembodied wombs, Galli's machine comprised a torso with legs cut abruptly at the upper thigh. The machine's pelvis was composed of wood, while its uterus, sized to a full-term pregnancy, featured a glass womb. This most distinctive feature of Galli's machine allowed for students to view a fetal doll in various positions in the womb and observe as Galli performed the proper procedures to manage various situations. In time, the students themselves would practise these manoeuvres as Galli observed and corrected. While various accounts mention a stuffed leather fetal doll that Galli could easily manipulate in the glass womb, Fabbri, the nineteenth-century custodian of the collection, proposed a different possibility. Suggesting that the choice of expensive glass for the womb was not entirely for the purposes of visualisation, Fabbri questioned whether the glass represented an easier surface to clean when instruction involved an actual foetal corpse, which might begin to decay after repeated operations (Figure 3).⁶¹

As Lucia Dacome has eloquently described, the most spectacular aspect of Galli's obstetrical instruction was his practice of testing midwives on the machine blindfolded. These moments, Dacome writes, 'combined training and surveillance with a striking performance. By blindfolding the midwives, Galli could downplay their visual skills and, at the same time, subordinate their tactual expertise to his own visual control'.⁶² In this way, the use of the obstetrical machine validated touch as essential to obstetrical practice, yet maintained a (gendered) hierarchy that placed sight at the pinnacle of the senses. Galli was also recreating the drama of birth with new protagonists. While the mother herself had been subordinated and silenced—reduced to nothing more than a torso—the midwife became the figure under scrutiny, acting strictly by touch and memory, the professor the protagonist guiding events to their successful conclusion.

The fame of Galli's obstetrical machine was such that obstetrics professors from across the Italian peninsula travelled to Bologna in hopes of a first-hand demonstration.⁶³ Indeed, a visit to Galli's obstetrical collection was the inspiration for Giuseppe Galletti to finance a similar collection in Florence. Jacopo Bartolommei (1708–82), Professor of Obstetrics in Siena, also sought out Galli, meeting him in Bologna in May of 1762 in order to observe how he trained students on his obstetrical machine. The demonstration apparently proved impressive, as Bartolommei soon ordered some 40 terracotta models of his own and a duplicate of Galli's obstetrical machine. Six years later, Bartolommei featured the latter in a speech he delivered to Siena's *Accademia delle Scienze dette dei Fisiocratici* (Academy of Sciences). During the talk, the professor demonstrated how a crystal uterus (like Galli's), or one modelled from cowhide with the top opened, could be used to instruct blindfolded surgical and midwifery students as they manoeuvred the foetus within the womb into a more favourable position for birth.⁶⁴ Again, the glass obstetric machine provided for a spectacular demonstration of scientific ingenuity and mastery

⁶⁰Fabbri mentions two machines, though it is possible that one was designed but never actually realised. See Dacome, *Malleable Anatomies*, 174.

⁶¹Fabbri, 'Antico Museo Ostetrico di Giovanni Antonio Galli', 143. Unfortunately, surviving evidence makes it difficult to confirm Fabbri's hypothesis, though the

use of maternal and fetal corpses in obstetrical instruction was widely discussed during the late eighteenth and nineteenth centuries, as discussed below.

⁶²Dacome, *Malleable Anatomies*, 174.

⁶³Vannozzi, 'Fantocci', 37.

⁶⁴*Ibid.*, 38.

over the reproductive body, embodied in the person of the obstetrics professor who oversaw the entire drama.

Also inspired by Galli's success, Bernardino Moscati featured models and machines as part of the midwifery curriculum he helped develop in Milan.⁶⁵ As mentioned above, the Milanese school combined theoretical instruction with clinical practice at the bedside of the poor and/or unmarried women who gave birth at the adjoining maternity ward. Apart from the school's proximity to maternity patients, Moscati favoured a hospital setting because it facilitated instruction on cadavers and access to fetal specimens.⁶⁶ Perhaps because of the ready availability of organic material from the hospital, the Milanese government argued in the initial planning stages of the midwifery school that a collection of obstetrical models and machines as complete (and expensive) as that in Bologna was not necessary. Even so, Moscati advocated strongly for their use.⁶⁷ Sceptical of the capacity of 'coarse', rural women with little or no formal educational experience to succeed in the face of a rigorous academic programme, Moscati petitioned the government for a more limited number of models on which students could safely practise techniques and operations learned in the classroom.⁶⁸

Moscati was also well aware of the extremely limited training most provincial Italian surgeons could claim to date in the area of obstetrics.⁶⁹ As such, not only would the instruction provided to midwives and surgical students be the same, but midwives—especially those serving in remote areas—would need to be able to handle difficult births on their own. Even if the law technically forbade midwives from undertaking operations requiring surgical instruments, Moscati argued that they should nonetheless be familiar with the nature of such procedures in order to be able to ascertain quickly when a situation required special intervention by a trained surgeon.⁷⁰ Given the perceived limitations of both his male and female students, Moscati employed the obstetrical models and machines for repeated and regular exercise of skills that it would be either impossible or inhumane to practise on live patients. Moscati's colleague, the surgeon, Giovanni Battista Monteggia, argued similarly that because in practice surgeons typically saw only difficult labours and their operations often took place in haste, it was hard to gain the ability, 'to reason scientifically on individual cases and operate composedly behind the true principles of the art, without rushing to deliver the woman as quickly as possible with a blind touch, dictated as often as not by instinct, rather than by a wise and rational theory'.⁷¹

It was thus on machines or cadavers, rather than at the bedside of living patients, that the professor could unhurriedly 'exercise the hand[s] of the students to know' the shape and contours of the gravid uterus and the placement of the foetus within. Under careful scrutiny, the professor could instruct students on how to 'turn, and extract' the fetus

⁶⁵In fact, the government in Milan consulted Galli during the planning stages of the midwifery school. ASM, Sanità, Parte Antica, c. 268, 'Riflessioni di Bernardino Moscati intorno allo stabilimento della nuova Scuola pe' Parti', 1767.

⁶⁶*Ibid.*

⁶⁷*Ibid.*

⁶⁸*Ibid.*

⁶⁹*Ibid.*

⁷⁰*Ibid.*

⁷¹G. B. Monteggia, 'Osservazioni Preliminari', in *Arte Ostetricia di G.G. Stein*, vol. 1, G. B. Monteggia (trans) (Venice: 1800), 5–6.

according to a particular situation. The flexibility and repeatability of the obstetrical machine allowed for students to gain, most critically, a sense of 'the natural situation of the foetus [in the womb], in order to then understand to what extent difficult births had moved away from the norm, and with what easiest means could the problem be resolved'.⁷² Most importantly, students could reflect on their progress calmly, 'far from the commotion caused by the screaming of the pregnant patient and the consternation of onlookers'.⁷³

In Pavia, Vincenzo Malacarne also advocated for the necessity of both theoretical and practical midwifery training, including on the obstetrical machine described at the opening of this article.⁷⁴ In order for students to receive an official licence to practice midwifery, they were required to pass a comprehensive examination at the conclusion of a four-month course. The examination consisted of two parts, one verbal, the other practical. The first, delivered in equal parts by Malacarne, the Dean of Faculty at the University of Pavia, and two professors of surgery, covered a wide range of topics, including female anatomy, the indications of virginity and defloration, the signs of pregnancy and of false pregnancy, the signs and progress of labour, normal foetal presentation and various kinds of mal-presentation and what to do in such circumstances, what to do after the birth, and how to perform a baptism. For the practical examination, the student midwife would select three tickets from a large container indicating a particular foetal presentation or other labour-related situation. Possibilities included a breech presentation, the delivery of twins, or the execution of foetal version.⁷⁵ The professor would then, out of sight of the candidate, prepare the obstetrical machine according to each ticket, and the student would have to perform the necessary operation to correctly manage the delivery while at the same time verbalising the manoeuvres and their justification.

During their training, moreover, all students were encouraged to attend the professor's 'exploration' (*esplorazione*) of a pregnant women, in which he would explain to the students how to determine the stage of pregnancy and how to look for signs of abnormalities or potential problems.⁷⁶ As mentioned earlier, Malacarne wrote a lengthy treatise championing this new kind of internal examination and its potential to help predict difficulties that might arise during birth, especially because of a misshapen pelvis.⁷⁷ Called '*il toccamento*' (the touching) or '*l'esplorazione*' (the exploration) in Italian,⁷⁸ this examination included

⁷²ASM, Sanità, Parte Antica, c. 268, 'Riflessioni di Bernardino Moscati intorno allo stabilimento della nuova Scuola pe' Parti', 1767.

⁷³Monteggia, 'Osservazioni Preliminari', 6.

⁷⁴ASM, Sanità, Parte Antica, c. 273, 'Istituzione della Scuola Pratica d'Ostetricia nella Regia Università di Pavia al Leano', 3 October 1792.

⁷⁵*Ibid.*

⁷⁶*Ibid.*

⁷⁷Malacarne was following the Dutch obstetrician Hendrik van Deventer whose 1701 work, *A New Light for Midwives*, was the first to fully and accu-

rately describe the relation of pelvic size and shape to childbirth. On Deventer, see Adrian Wilson, *The Making of Man-Midwifery: Childbirth in England, 1660–1770* (Cambridge: Harvard University Press, 1995), 79–87.

⁷⁸Malacarne, *La Esplorazione*, 47; Tanaron, *Il Chirurgo-Raccogliatore Moderno*, 145–58; Giuseppe Nessi, *Arte ostetricia teorico pratica di Giuseppe Nessi dottore in filosofia, e medicina, e professore di ostetricia, e di operazioni chirurgiche nella regia università di Pavia* (Venice, 1797), 43–46.

the introduction of one, or two Fingers into the *Vagina* of the Woman, after greasing them with oil, or butter, in order to touch the mouth of the Womb . . . and to discover by this method that which certainly could not be identified otherwise.⁷⁹

Malacarne advised students to begin learning this technique by exploring 'the state of the genital parts of various cadavers, of different ages, and body types'.⁸⁰ Only after considerable practice might students seek out opportunities to examine, 'with the greatest integrity and decency possible,' live, non-pregnant women. Critically, students needed to gain familiarity with the feel of these parts in their 'natural' condition in order to make necessary distinctions and assessments later on. Students therefore needed to know

the normal volume, weight, and mobility of the Uterus; the expanse, depth, and normal roughness (*rugosità*) of the Vagina; the toughness, the lubricity of the inner and outer labia of the Vulva; the shape, the direction, and position of the neck and opening of the Uterus.⁸¹

In this way, Malacarne was not only affirming the importance of touch to the practice of midwifery but also vastly expanding and redefining the kinds of touching that might take place between a (male) practitioner and (female) patient.

As they advocated for touching as an essential practice in obstetrics, male practitioners had to work hard 'to counter the cultural norms that aligned touch with at best manual labour and at worst –given what they were touching – with outright lechery'.⁸² The manual exploration of a woman's genitals had to be re-contextualised as an expression of scientific rationality and medical authority, all while maintaining decorum. In this case, touch conceived of scientifically entailed subdividing tactile sensations into conceptual categories like shape, texture, resistance and wetness, from which expectations and norms could be defined. Monteggia argued that touch of this kind provided a knowledge that could not simply be conveyed through lectures or textbooks. Recalling a case where he explored a deceased woman who had had complications during labour involving a uterine laceration, Monteggia was surprised that the practitioner who had delivered her wasn't aware of the injury. That was because, he concluded, the laceration occurred near the top of the vagina rather than on the uterus proper (as was typically taught in textbooks), but more specifically because practitioners too often based their diagnoses on the 'uncertain meanings of the . . . signs deduced from symptoms', rather than the direct understanding of the situation that touch provided.⁸³

It may have been Malacarne's concern over just these kinds of issues that compelled him to request an obstetrical machine rather unlike those of any of his contemporaries. Quite distinct from the machines described earlier, which all, while life-sized, reproduced the pregnant woman only from the mid-thigh to the lower torso, the Pavia obstetrical machine featured a wholly embodied woman.⁸⁴ Giuseppe Galletti, who designed the

⁷⁹Pietro Paolo Tanaron, *Il Chirurgo-Raccoglitore Moderno*, 145–46.

⁸⁰Malacarne, *La Esplorazione*, 49.

⁸¹Malacarne, *La Esplorazione*, 49.

⁸²Keller, 'The Subject of Touch', 169.

⁸³G. B. Monteggia, 'Osservazioni Preliminari', 29–30.

⁸⁴The closest examples to the Pavia machine may be a series of eight obstetrical models produced by the Roman anatomist and wax sculptor, Giovanni Battista Manfredini, who was active in Bologna in the 1770s. The models, produced in coloured terracotta for instructional use at the midwifery school in Modena, feature full-size women from the head to

machine, emphasised the importance of its interior devices. Teaching students about the various positions a foetus might assume *in utero* could not, he wrote, accustom them to feeling, and learning how to negotiate, the strong resistance the uterus might exert at its opening or around the foetus or the innumerable ways it might furrow.⁸⁵ Even the foetal dolls were constructed so as to mimic nature as closely as artificial means would allow. They were elastic, bendable at the joints 'as natural' and contained internal structures that provided an accurate feel and sense of the resistance of bone. According to Galletti, the foetal head 'presents its membranous spaces, the interstices of the skull, and is susceptible to elongation and compression'.⁸⁶ Thus, the obstetrical machine in Pavia did not encourage haste or excessive force as Blackwell argues William Smellie's did; instead, it cultivated a touch that was sensitive to the natural feel of the foetus and aware of the delicacy of newborn skin and bone.

The unique inclusion in the Pavia machine of eyes that responded to pressure applied to the genital area, while at first glance an eccentric or farcical addition, seems to have been made in earnest.⁸⁷ Although this feature clearly rendered the machine a potentially sexual and sexualised object—one that Malacarne felt compelled to cover in the name of modesty—it also reconnected the ostensibly mechanical processes of birth to the rational, embodied subject of the mother. At least in theory, the machine's responsive eyes reminded practitioners of the vital fluid that connected purely physical sensations to an individual's rational brain. Was the womb just its own kind of automaton, independent of the larger automaton in which it resided and responding in a predictable way to external stimuli?⁸⁸ What were the pathways by which sensation, emotion and imagination coursed from the mother to the fetus? Obstetrical writers in this period devoted countless pages to these questions. The Pavia machine, produced amidst these debates, combined mechanism with attention to sensitivity and sensibility, though in a body that nonetheless responded mechanically and could be managed with the proper knowledge and skills.

Still, as men like Malacarne endeavoured to appropriate touch as a legitimate modality and mechanism of expertise, they may have sought novel means of cultivating compassion and sensitivity in their students, particularly young, male surgeons. Encouraging students to be aware of how their touch was received by the women they were delivering suggests the opposite of the dehumanising effect Lieske has described for British machines. Moreover, unlike the anatomical Venuses or similar wax models that had become quite popular in travelling shows in cities like London, the obstetrical machine in Pavia was explicitly *not* intended as an object of entertainment of prurient curiosity.⁸⁹

mid-thigh, such that seated on a table they appear standing. The models move from an intact full-term pregnant belly to greater and greater penetration into the womb, often with the woman holding open her own skin (as was a familiar convention in Renaissance anatomical drawing). These models are not, however, machines. They have no internal mechanisms and were not intended to be practised upon. On Manfredini, see Owen, *Simulation in Healthcare Education*, 125; Thomas Schnalke, *Diseases in Wax: History of the Medical Moulage*, Kathy Spatschek (trans) (Carol Stream, IL: Quintessence Publishing, 1995), 38–9.

⁸⁵Galletti, *Elementi di Ostetricia*, xiii.

⁸⁶*Ibid.*, xiv–xv.

⁸⁷ASM, *Sanità, Parte Antica*, c. 273. Letter from Vincenzo Malacarne, 9 November 1792.

⁸⁸Darren Neil Wagner, *Sex, Spirits, and Sensibility: Human Generation in British Medicine, Anatomy, and Literature, 1660–1780* (unpublished PhD thesis, University of York, 2013), 116–22.

⁸⁹On travelling wax exhibits, see Richard D. Atlick, *The Shows of London* (Cambridge: Harvard University Press, 1978), esp. chapters 4 and 24; Pamela Pilbeam, 'Madam Tussaud and the Business of Wax: Marketing to the Popular Classes', in Roy Church

Nor could the knowledge it represented be conveyed to a lay audience through simple observation, as Fontana had believed the models at La Specola had the power to do.⁹⁰ For Malacarne, obstetrical machines were the reserve of those with specific qualifications and expertise.⁹¹

It is clear from these examples, furthermore, that obstetrical machines were not simply tools by which male practitioners might displace their female counterparts. Although obstetrical machines and models helped effect a gendered shift in the authority surrounding the management of childbirth, the main beneficiaries of this kind of training, at least in Italy, were women, who continued to handle the vast majority of births during the eighteenth century. In fact, at least one Italian woman capitalised on the great interest in obstetrical machines in this period. Lucia Landi, a midwife from Siena, petitioned Grand Duke Pietro Leopoldo in 1774 for permission to sell two obstetrical machines of her own invention that aimed to instruct students in how to perform operations 'to extract the foetus from the womb'.⁹² Although Landi's petition languished for years before finally being approved in 1786, her designs were apparently so well received in Siena that even male surgical students pushed for the machines to be made available as soon as possible. According to Francesca Vannozi, Landi's machine may have indeed had a great impact on obstetrical training in the city, if it is the same to appear in the 1862 inventory of the school's *Gabinetto di Chirurgia Operatoria* (Cabinet of Operative Surgery). The inventory describes a machine consisting of 'a woman without legs or chest, but with a pelvis lined with hide [*pezze al naturale*], and with a foldable foetus also of skin [*pelle*].'⁹³ In any case, Landi's example shows that women, too, could embrace the possibilities presented by obstetrical machines to practise skills repeatedly in calm and non-life threatening situations.

Critiques of Simulation

It is clear that the use of obstetrical machines was widespread in Italy by the end of the eighteenth century. As observers like the German public health expert, Johann Peter Frank (1745–1821), noted, in Italy in particular, a combination of entrenched custom and female modesty meant that male professors were limited in their opportunities to instruct students at the bedside of living patients. Even at the largest public maternity homes, frequented mainly by the most desperately poor and/or unmarried women, the number of live births per year would fail to support a robust instructional programme. Models and machines could fill in the gaps and, in areas without public maternity hospitals, might comprise the majority of practical instruction.⁹⁴ Yet, while they deemed models necessary, Frank and others also warned practitioners of their limitations.

and Andrew Godley, eds, *The Emergence of Modern Marketing* (New York and Abingdon: Routledge, 2003), 6–22; Maritha R. Burmeister, 'Popular Anatomical Museums in Nineteenth-Century England' (PhD thesis, Rutgers University, 2000).

⁹⁰Maerker, *Model Experts*, 120.

⁹¹Anna Maerker has shown that anatomical models' association with middle-class public consumption was a major factor in their rejection by both surgeons and physicians in Vienna after Joseph II ordered an extensive collection from the Florentine workshop in the early 1780s. Maerker, 'Florentine Anatomical

Models and the Challenge of Medical Authority in Late-Eighteenth-Century Vienna', *Studies in History and Philosophy of Biological and Biomedical Sciences*, 2012, 43, 730–40; Maerker, *Model Experts*, chapter 5.

⁹²Vannozi, 'Fantocci', 40.

⁹³*Ibid.*

⁹⁴Johann Peter Frank, *Sistema Completo di Polizia Medica di G.P. Frank traduzione dal Tedesco del Dottor Gio. Pozzi*, vol. 15 (Milan: Giovanni Perotta, 1827), 293–94.

Frank, who not only devised the most complete public health system in Europe at the time but also, as health inspector general of Austrian Lombardy, oversaw the implementation of the Milanese and Pavian midwifery schools, favoured training on live patients and cadavers where possible.⁹⁵ Though Frank conceded the need for obstetrical models to assist training, he also argued that it was difficult for students to gain an accurate sense of the feel of the foetus *in utero* with bulky dolls. Nor was it possible for surgical students to practise procedures like embryotomy on cloth or leather dolls. He advocated instead for the use of recently deceased foetal cadavers in conjunction with pelvic simulators (ideally made with a pelvis from a woman who had died during or soon after childbirth) even if the organic material would begin to flake and decay after a certain number of operations.⁹⁶ In Macerata around 1770, the Professor of Surgery and Obstetrics Antonio Santimorsi developed an obstetrical machine with just this kind of instruction in mind. Santimorsi's machine featured a stuffed leather uterine cavity lined with waxed silk to make it waterproof. In this way, students could practise on foetal cadavers, including performing embryotomies, without damaging or staining the machine itself.⁹⁷

Frank's position on simulated training came from his firm belief in the primacy of touch for the practice of midwifery and obstetrics. 'What does the eye have to do with obstetrics?' he asked rhetorically, referring to the tendency of some professors and man-midwives to demonstrate techniques and point out reproductive structures to rooms filled with young surgeons. How could one expect students to comprehend what a professor was doing with his hands while they were moving *inside* the uterus? Or understand how to manoeuvre forceps from watching at a distance? It was learning by touch, Frank argued, 'that should be the only pursuit that has a place in obstetrics'.⁹⁸ Recalling his own experiences practising the art, Frank cautioned that performing fetal manoeuvres only on immobile models poorly prepared him for the actual sensation of turning the foetus in the face of uterine contractions.⁹⁹ Galli's glass simulator was thus arguably of less value, despite its potential for visual theatrics, than Malacarne's obstetrical machine, the mechanisms of which allowed for simulated contractions and resistance to the practitioner's touch. Neither, however, could perfectly recreate the sensations the foetus *in utero* and the impressive force of a contraction might yield.

In fact, the Milanese surgeon Monteggia contended that it was largely a waste playing around with padded dolls and pelvises. As an alternative, Monteggia outlined in 1800 his own method for preparing cadavers for practical training. First, the intestines and bladder should be removed from a recently deceased female cadaver, then the vagina and rectum above the flexor muscles of the anus should be cut out from the inside (alternately,

⁹⁵Frank was nonetheless acutely aware of the detriments and moral dubiety of subjecting pregnant women, poor and/or unmarried, in public hospitals to the endless ministrations of unskilled surgeons and students. According to Frank, 5, 10, or 15 students practising the 'exploration' of a pregnant woman would cause the poor woman not only shame and fear but also negative physical effects, such as inflammation. In fact, he warned against turning pregnant patients into veritable 'rope dancers' (*ballerina da corda*), particularly in cases

where a professor was paid per student instructed. Frank, *Sistema Completo*, vol. 15, 271–72.

⁹⁶*Ibid.*, 292.

⁹⁷Fabbri, 'Antico Museo Ostetrico di Giovanni Antonio Galli', 143; Giovanni Calderini, 'Come si deve imparare a fare le diagnosi e le operazioni ostetriche', *La Clinica Moderna: Repertorio delle Cliniche Italiane*, 1895, 7, 185–87.

⁹⁸Frank, *Sistema Completo*, vol. 15, 267–68.

⁹⁹*Ibid.*, 274–75.

the rectum could be left intact and attached with a cord to the last lumbar vertebrae).¹⁰⁰ At this point, a deceased foetus could then be introduced into the woman's empty abdominal cavity and positioned as desired for whichever skills or procedures were being taught. Monteggia noted that initially the progress of the foetus might be blocked by the prolapse of any remaining parts of the peritoneum, vagina or intestine, which would act as a strong bridle on the foetus' head, though this would resolve with additional 'deliveries' as the tissues stretched. Implicit in Monteggia's critique of artificial models is the understanding that the human body cannot be recreated with materials that themselves have not once been alive and which lack intrinsically human qualities. As Elizabeth Harvey has discussed, a number of thinkers from the seventeenth to the twentieth century have considered tactility 'foundational to the instantiation of the subject' and the 'earliest, fundamental, and most definitive aspect of human development'.¹⁰¹ The absence of any possibility of tactile reciprocity when practising on machines made of inert materials seems to negate their instructional value for critics like Monteggia.

Looking back on the development of theoretical and practical obstetrics from the nineteenth century, the Ferrarese physician Augusto Ferro articulates just this kind of distaste for mechanical aids. At a speech delivered at the *Accademia Medico-Chirurgica* in Ferrara in 1852, Ferro spoke passionately on the subject. Obstetrics, he argued, is learned

in the dark, [and] he who is a practitioner must have eyes on his fingers, and fingers exercised on parts that resist, and that move with their own force; and not from some mechanical impulse they receive from shapeless dolls, placentas made of rags, stuffed pelvises, and uteruses of wire!!!! Oh, tragic blinding of the mind! Oh, most disastrous hardening of the heart!!¹⁰²

This impassioned plea may reflect changing understandings after 1800 of what animated living beings. Although the mechanistic understanding of the body had been challenged already during the eighteenth century, vitalist conceptions of nature strengthened by the end of the century and became prevalent in the next. Vitalism, 'the theory that life is generated and sustained through some form of non-mechanical force or power specific to and located in living bodies', opposed the notion that living beings could be defined by mechanical laws.¹⁰³ Enlightenment discussions about vitalism had particular relevance for the field of embryology, as a range of interested parties, from medical practitioners to theologians to jurists, debated whether foetuses developed in discrete stages (epigenesis) or grew from preformed parts (preformationism).¹⁰⁴ Ferro's objection to the possibility

¹⁰⁰Monteggia, 'Osservazioni Preliminari', 7–9.

¹⁰¹Elizabeth D. Harvey, 'The Touching Organ: Allegory, Anatomy, and the Renaissance Skin Envelope', in Elizabeth D. Harvey, ed., *Sensible Flesh: On Touch in Early Modern Culture* (Philadelphia: University of Pennsylvania Press, 2003), 81–102, 85.

¹⁰²Augusto Ferro, 'Sulle Presenti Condizioni dell'Insegnamento Teorico Pratico di Ostetricia in tutte le Università e Ginnasi Comunali del Nostro Stato', speech read at the *Accademia Medico-Chirurgica* di Ferrara, 15 October and 19 November 1852.

¹⁰³Catherine Packham, *Eighteenth-Century Vitalism: Bodies, Culture, Politics* (New York: Palgrave Macmillan, 2012), 1. See also Peter Hanns Reill, *Vitalizing Nature in the Enlightenment* (Berkeley: University of California Press, 2005).

¹⁰⁴On the debates between preformationists and epigenesists, see Shirley A. Roe, *Matter, Life, and Generation: 18th-Century Embryology and the Haller-Wolff Debate* (Cambridge: Cambridge University Press, 1981).

that mechanical devices could ever recreate the intrinsic force that animated pregnant bodies and fetuses suggests a rejection of mechanical thinking about the body. In this view, obstetrical machines would never sufficiently simulate childbirth precisely because they lacked the unique vital forces that constitute living things but which are absent from inert ones. Although obstetrical machines continued to be used in the nineteenth century, it is clear that some practitioners had begun to question whether wax and wood bodies, even those as ingeniously constructed as Galletti's obstetrical machine, could truly instil students with the human compassion and manual sensitivity required to attend real women.

Conclusion

Despite certain differences of opinion with respect to simulated practice, all of these male professors were united in their conviction that the management of childbirth required a specialised knowledge and mastery of practised technical skills. They were all also engaged in a reevaluation of touch. These men extricated touch from its traditional connotations with unskilled manual labour and bodily impurity and imbued it with scientific rationality and expertise. Yet, even though practitioners like Malacarne, Frank and Ferro all agreed that first-hand experience with living patients was the optimal method of instruction, none considered the apprenticeship and bedside training traditional midwives had long practised sufficient. Rather, it was practice joined with theory, with an exact knowledge of anatomy, which rendered a practitioner qualified. Obstetrical machines provided a needed space where students could observe and practise manual skills in a scientific and controlled setting, guided, of course, by the watchful eye—and hands—of professors. Distinct, then, from the anatomical models on display at public museums, the models and machines used in obstetrical training were not self-explanatory or self-revelatory. Instead, they required the professor's learned expertise to guide the hands of novice surgeons and midwives.