Medical Technologies Past and Present: How History Helps to Understand the Digital Era

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Abstract

This article explores the relationship between medicine's history and its digital present through the lens of the physician-patient relationship. Today the rhetoric surrounding the introduction of new technologies into medicine tends to emphasize that technologies are disturbing relationships, and that the doctor-patient bond reflects a more 'human' era of medicine that should be preserved. Using historical studies of pre-modern and modern Western European medicine, this article shows that patient-physician relationships have always been shaped by material cultures. We discuss three activities – recording, examining, and treating – in the light of their historical antecedents, and suggest that the notion of 'human medicine' is ever-changing: it consists of social attributions of skills to physicians that played out very differently over the course of history.

Keywords History · Medicine · Digital technologies · EMRs · Telemedicine · Do-it-yourself

Human beings have their own goals and intentions, and products should help them to realize them in an optimal way. In many cases, though, these goals and intentions do not exist independently from the technologies that are used. [Technologies] do much more than merely function – they help to shape human existence.

Peter-Paul Verbeek (2015, 28)

Introduction

A wide range of novel digital technologies related to medicine and health seem poised to change medical practice and to challenge traditional notions of the patient-physician relationship (Boeldt et al. 2015; Loder 2017; Fagherazzi 2020). A number of recent pieces

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have explored the ethical implications of this, asking, for example, whether new means of delivering ‘greater efficiency, consistency and reliability might do so at the expense of meaningful human interaction in the care context’ (Topol Review 2019, 22). Various contributions from patients, physicians, bioethicists, and social scientists have warned that computer technologies somehow stand between the physician and the patient and that there is a fundamentally human aspect of medicine that coexists uneasily with machines (e.g. Gawande 2018; Verghese 2017). As a remedy, recent contributions call for ‘clinical empathy’ not only as a desirable characteristic trait of future physicians, but even as a selection criterion for medical students (Bartens 2019). The role history plays in these discussions is striking. Commentators often assume that current concerns about how technologies may lead to the ‘de-humanisation of care’ (Topol Review 2019, 22) are the unprecedented products of technological, social, and cultural transformations in the late twentieth-/early twenty-first centuries. When the history of medicine is referenced, it is largely in one of the following ways: first, to emphasize that today ‘[w]e are at a unique juncture [...] with the convergence of genomics, biosensors, the electronic patient record[,] smartphone apps, [and AI]’ (Ibid., 6), whereby the singularity of the digital era makes historical comparisons with antique predecessors seemingly irrelevant. Second, the history of medicine is used in a nostalgic manner to refer to past medical practices, seemingly grounded in the ability of a doctor to ‘liste[n] well and sho[w] empathy,’ as having a fundamentally human element that is threatened by the digital era (Liu, Keane and Denniston 2018, 113; see also Johnston 2018). With some notable exceptions (e.g. Greene 2016, Kassell 2016, Timmermann and Anderson 2006), historians of medicine have largely refrained from attempting to interpret recent digital developments within their broader historical contexts. The historicity of digital medicine in its various forms and the insights of the history of medicine for contextualising the patient-physician relationship in the digital era have yet to be fully fleshed out.

In this contribution, we draw on historical examples and the work of historians of medicine to highlight how all technological devices are ‘expressions of medical change’ (Timmermann and Anderson 2006, 1), and to show how past analogue objects shaped physician-patient relationships in ways that remain relevant today. Our focus is on Western European medicine since the early modern period. While acknowledging the profound differences between medicines in particular historical times and places, we argue, first, that patients and doctors have always interacted in complex relationships mediated by objects. Medical objects and technologies are not only aids for performing certain human tasks, but themselves have a mediating function and impact how physicians and patients alike perceive illness and treatment. We then contend, second, that history helps inform current discussions because it highlights the plurality of ways in which the physician-patient relationship has been conceived in different eras. In particular, the ability of the physician to listen well and show empathy seems to be not so much a historical constant but rather a social attribution of certain skills to physicians that played out very differently over the course of history. Both points help us to show that some of the hopes and fears related to digital technologies are not so entirely new after all.

We work through these hypotheses in relation to three activities in the clinical encounter that have been significantly affected by digital medical technologies, namely i) recording (Electronic Health Records), ii) examining (Telemedicine), and iii) treating (Do-It-Yourself medical devices). In each case, we begin with a specific contemporary technology and the debates around it before showing how a historical perspective can contribute to our understanding of them. First, we discuss electronic health records in the light of current criticisms which maintain that this technology cuts valuable time the doctor should be spending with the patient, thereby threatening an assumed core responsibility of the

physician, namely listening empathetically to the patient. History shows that physicians have not always seen administrative record-keeping as foreign to their main work with patients; rather, it has been a formative part of their professional identity at different times. Moreover, the value that both physicians and patients ascribed to empathic listening has varied substantially over time. Second, in the case of examining, we start from the observation that current debates about telemedicine focus on the greater distance between patients and physicians this technology brings about. The historical perspective demonstrates that these debates are but one example of how changing examination technologies affect both physical distance and reciprocal understanding in the patient-physician relationship. Our examples illuminate that physical proximity in the medical encounter is a modern phenomenon, and that it did not always imply a meeting of the minds between physician and patient and vice versa. Finally, our third section on self-treatment demonstrates that Do-It-Yourself devices have the potential to challenge medical authority and, by giving patients more power, alter those power balances between physician and patient that are constitutive of an idealised view of the patient-physician relationship. Yet here too there are significant historical precedents for thinking of doctors and patients as but two players within complex networks of people and technologies, in which patients ascribe value to a multiplicity of relationships.

Record-keeping: computers and the administered patient

Electronic health records (EHRs), that is computer-based patient records, have transformed the way contemporary medicine is practiced (see, for example, Topol, Steinhubl and Torkamani 2015, 353). While the electronic recording of patient files by individual health care providers has become common practice since the 1990s, a central virtual collection and storage of all health data relating to an individual patient is a rather new development which is currently being debated and technically introduced in various states. This virtual patient file is of secondary order because it is fed with original electronic files derived from various primary recording systems (GP, clinic etc.), and it follows a population health surveillance logic rather than the logic of the treatment of individual cases. The main idea is that both patients and health care providers have access to a corpus of health documents, which is as complete as possible, to make diagnosis and treatment more efficient, more precise and safer for patients, and less costly for the health system. While patients may make use of this possibility on a voluntary basis and are asked to distribute access rights to providers, healthcare providers are obliged to cooperate and feed the system with relevant data (for a local example see current implementation efforts in Switzerland and its pitfalls as described in Wüstholtz and Stolle 2020). One of the main premises of supporters is that EHRs will facilitate not only networking and interprofessional cooperation but also enhance communication between doctors and patients: they ‘provide health care teams with a more complete picture of their patients’ health [and] improve communication among members of the care team, as well as between them and their patients’ (Canada Health Infoway; see also Porsdam, Savulescu and Sahakian 2016).

Yet critical discussions surrounding the introduction of EHRs doubt exactly that. They suggest that the increasing documentation, virtual storage and sharing of sensitive patient data threatens an assumed historical core value of the doctor-patient relationship, namely the possibility of physicians establishing an intimate and ‘deeper connection’ with their patients (Ratanawongsa et al. 2016, 127). From the perspective of healthcare providers,

professionals criticise the time-consuming nature of EHRs, arguing that this technology supplants the time the doctor has for direct communication and time spent ‘in meaningful interactions with patients’ (Sinsky et al. 2016, 753). That screens are coming ‘in between doctors and patients’ is a widespread notion (Gawande 2018). In addition, medicine’s increasing dependence on screens is perceived as undermining important social rituals, such as exchanges between physicians and other healthcare colleagues who used to discuss their cases in more informal ways (Verghese 2017). Last but not least, EHRs are seen as a major factor contributing to declining physician health and professional satisfaction because of their time-consuming data entry that reduces face-to-face patient care (Friedberg et al. 2013). This last point seems to be crucial as the digital interfaces of EHRs indeed require a maximum of standardisation, homogenisation and formalisation of recording styles that necessarily conflicts with more informal, individual recording techniques. On the one hand, doctors are forced to fill in fields and checkboxes that do not correspond to their own knowledge priorities, that is the things they would want to highlight in a certain case from the perspective of their specialty. On the other hand, they have difficulties in identifying relevant information when too much data on an individual patient has been entered by too many people. The desired interprofessional collaboration thus runs the risk of complicating instead of facilitating the making of a diagnosis. Surgeon Atul Gawande maintains that in the past, analogue documentation forced physicians to bring essential points into focus: ‘[d]octors’ handwritten notes were brief and to the point. With computers, however, the shortcut is to paste in whole blocks of information [...] rather than selecting the relevant details. The next doctor must hunt through several pages to find what really matters’ (2018). Together, these points of critique suggest not only a certain fear that the increasing digitisation of patient records might disturb relationships that in the pre-digital era were based on professional intuition and meaningful, trust-building face-to-face communication. The critique also suggests that what is threatened is the meaning and satisfaction a physician takes from his/her recording work.

From the perspective of patients, other concerns related to EHRs are more relevant, among them the safety of personal health data. But while notions of privacy – who has control over the data, who owns the patient history – are important for patients, a number of studies also show that patients perceive the careful digital documentation of their case as something positive (Assis-Hassid et al. 2015; Sobral, Rosenbaum and Figueiredo-Braga 2015). ‘Forced to choose between having the right technical answer and a more human interaction, [patients] picked having the right technical answer,’ reports Gawande (2018; see also Hammack-Aviran et al., 2020). It thus seems that as long as patients think EHRs are providing them with a higher quality of care, they readily accept EHRs and their doctors’ dependence on screens – hence adapting their expectations to technological change.

In order to scrutinize these purported threats and attitudes towards EHRs, the rich history of patient records provides a relevant historical backdrop. In studying patient records, historians have addressed exactly these issues: they have examined how the patient-physician relationship has changed over time and have used medical records to gain insights into how past physicians documented medical knowledge, how this influenced their perceptions of their professional identity, and their obligations vis-à-vis patients (Risse and Warner 1992). As a first step, it is important to see that even though EHRs pose new challenges because of their digital form, recording individual patients’ histories as part of medical practice and ‘thinking in cases’ as a form of epistemic reasoning are a historical continuum (Forrester 1996; Hess and Mendelsohn 2010). The patient history dates to ancient Hippocratic medicine when detailed medical records were written on clay tablets and handed down for centuries to preserve the esteemed knowledge of antiquity (Pomata 2010). Yet the

content and form of medical records, as well as the practices producing them have changed remarkably over time (Behrens, Bischoff, and Zelle 2012). In Western Europe, physicians in sixteenth-century Italy re-appropriated the ancient practice and typically recorded their cases in paper notebooks, as part of a larger trend to systematize and record information (Kassell 2016; see also Pomata 2010). As Lauren Kassell notes, the records of early modern practitioners ‘took the form of diaries, registers or testimonials, often they were later ordered, through indexing or commonplacing, by patient, disease or cure, providing the basis for medical observations, sometimes printed as a testimony to a doctor’s expertise as well as his contribution to the advancement of science’ (2016, 122). The historical perspective reveals that the rationale for a particular type of medical record-keeping always developed in tandem with the technical capabilities for its enactment, changing ideas of how diseases should be recorded, as well as with the preferences of individual physicians (ibid. 120). Crucially, as the organization of these collections of patient histories changed, so too did medical knowing and normative ideas about the physician-patient relationship (Hess and Mendelsohn 2010; Dinges et al. 2016).

As shown above, current critical discussions about EHRs tend to evoke a medical past in which patients were given time to talk about their illness, doctors listened and engaged in meaningful interactions, and record-keeping did not interfere with these processes. Allegedly, there were few concerns over misuse of data as there was less data produced and fewer players in the game. How does this popular nostalgic view correspond to research findings in the history of medicine? To some extent, the context of ‘bedside medicine’ comes close to these ideas. This model of care remained dominant in Western Europe until the nineteenth-century. One of the main ways in which physicians generated medical knowledge at the bedside of patients was to conduct ‘verbal analysis of subjectively defined sensations and feelings’ by patients (Jewson 1976, 229–230), and these patient testimonials provided the details recounted in physicians’ notes (Fissell 1991, 92). This is partly because the early modern doctor-patient relationship was based on a ‘horizontal’ model of healing (Pomata 1998, 126–27, 135) and a legally binding ‘agreement for a cure’ (ibid., 25 *passim*), which gave considerable power to patients, placing them on ‘near-equal hermeneutic footing’ with doctors (Fissell 1991, 92). Physician and patron (patient) made a contract in which the mostly upper class-patient would only pay fees after ‘successful’ treatment; vice versa, doctors were not obliged to treat a patient but would rather take on patients whose potential cure, and ability to pay fees, could be foreseen. Patients’ verbal satisfaction and willingness to conduct word-of-mouth publicity for a practicing physician were key to his reputation at that time and influenced physicians’ relationships with their clients.

However, it is problematic to project today’s vision of a desirable empathic relation between doctors and patients back into the past. Although upper-class patients clearly had some power in their relationship with physicians, the dominance of patients’ speech in medical records as such should not be interpreted as proof that doctors cared about their patients in the modern sense of showing understanding. With respect to nineteenth-century bourgeois medicine, Roy Porter noted that flattery and attention in the medical encounter were calculated practices of physicians concerned to secure clients and that ‘solemn bedside palaver[,] a grave demeanour, an air of benign and unflappable authority’ were all part of the prized ‘art of never leaving without a favourable prognosis’ (1999, 672). In a similar vein, Iris Ritzmann has emphasized that eighteenth-century doctors were eager to adhere to a certain ‘savoir faire,’ that is rules of conduct that would allow them to obscure the fact that in many cases, their abilities to heal were very limited (1999). And in Paul Weindling’s assessment of German medical routines, physicians’ desires to satisfy the patient subjectively were even purely instrumental: ‘[s]ympathy with the feelings of the sick was

an economic necessity owing to the competition between practitioners' (1987, 409). In all these cases, the value ascribed to direct physician-patient dialogue was very different from today's ideas about an empathic encounter between physicians and patients; an engaged bedside manner often had more to do with calculated support for an upper class and sometimes hypochondriac clientele.

Similarly, as concerns the careful documentation of a patient's medical condition and history, historical evidence shows that doctors did not do it primarily for their patients' needs but for purposes of professional standing. This was important at a time when physicians' scientific authority still needed to be established. The fact that in many cases there were several physicians involved in the treatment of the same case made documentation and communication between physicians (and sometimes for the public) especially relevant – and especially conflictual. Eighteenth-century case histories reflecting the context of bedside medicine indeed suggest that doctors were sometimes eager to publish case histories of patients that would bespeak their ability to heal by highlighting the misfortune of their competitors in order to enhance their own reputation. This shows how misleading the popular nostalgic view of a past intimate and unbroken bond between physicians and patients is, and that analogue paper technology did not necessarily strengthen this bond but could also be used in ways that were not beneficial for patients. Unlike today, this was an era in which practices of record-keeping mirror multiple, local and highly individual ways of documentation; the formalisation and standardisation of patient files which 19th-century hospital medicine would trigger was yet to come.

As hospitals and laboratories became important institutions for medicine in the century roughly between 1770 and 1870, they also changed the practices of record-keeping, as the customary interrogation of patients' accounts of the course of their disease did not coincide with changing understandings of disease, scientific interests and cultural expectations (see Granshaw 1992). For instance, French anatomist and pathologist Xavier Bichat (1771–1802) dismissed note-keeping based on patients' narratives as an obsolete method for knowledge-making. He observed in his *Anatomie générale* (1801), 'you will have taken notes for twenty years from morning to night at the bedside of the sick [and] it will all seem to you but confusion stemming from symptoms that fail to coalesce, and therefore provide a sequence of incoherent phenomena' (1801, xcix, our translation). The kind of medicine favoured by Bichat and like-minded physicians focused on gaining anatomical and physiological insights directly from the body, using both physical examination and remote techniques in the laboratory. One way in which record-keeping changed to accommodate these interests was in the use of a more technical language to describe the experiences and expressions of patients. Mary Fissell argues that with the rise of hospital medicine, 'doctors begin to sound like doctors, and patients' voices disappear' because doctors interpret patients' words and replace them with medical equivalents (1991, 99). More generally, historians have shown that during the nineteenth century, medical culture changed in a way that gradually diminished the importance of patient narratives in medical writing (Nolte 2009).

How did these changes in recording practices play out for patients in the medical encounter? From the historical perspective, the fact that physicians adopted a more technical language in their interactions and records should not be taken as evidence for a loss of human interaction or as something that patients necessarily disliked. On the contrary, the more systematised and formalised type of record-keeping was considered state of the art and was in accordance with a rapidly growing belief in the natural sciences among both patients and the general public (Huerkamp 1989, 64). This is related to the emergence of a specific concept of scientific reasoning that, in turn, fostered a sense of 'scientific

objectivity’ that called for dispassionate observation and accurate recording (Daston and Gallison 2010; Kennedy 2017). By the end of the nineteenth century, academic physicians had managed to create such professional authority that the ‘horizontal model of healing,’ in which the physician courted his upper-class clients, was replaced by a vertical model, in which the patient subjected himself to the authority of the physician. A Berlin doctor advised his fellow colleagues in 1896 that they should communicate their medical prescriptions to patients in a way that ‘prevents any misunderstandings and so that no further question can be addressed to him’ (cited in Huerkamp 1989, 66, our translation). For patients, this growing scientific authority and paternalism meant very different things, depending on class and social status. While medical services became accessible to more people, in particular thanks to the introduction of obligatory health insurance for workers, lower classes often experienced medicine as an instrument of power rather than benevolence (Huerkamp 1989). But even for the well-to-do, who undoubtedly benefitted from newly developed medical techniques, in particular in the realm of surgery, the acceptance of medical paternalism, male rhetoric and heroic cures came with high costs. This is suggested, for instance, in a famous letter by the court lady and writer Frances (Fanny) Burney who underwent a mastectomy in 1811, a rare document offering a patient’s perspective on these matters (Epstein, 1986).

From the perspective of doctors at the turn of the nineteenth century, record-keeping was associated not only with professional obligations but also with personal fulfilment. In many European countries, physicians were asked to provide expert opinion for juridical and administrative regulations as the state was increasingly interested in tracking its population’s health (Ruckstuhl and Ryter 2017; Schmiedebach 2018). In her study of Swiss physician Caesar Adolf Bloesch’s private practice (1804–1863), Lina Gafner shows the extent to which he perceived medical practice documentation as constitutive of his professional role and self-understanding as a medical expert. Bloesch’s patient journal ‘constitutes one single gigantic research report’ (2016, 265) because it was key for allowing him to generalize from the experiences gained in his practice in order to produce knowledge to contribute to contemporary scientific discussions. Gafner notes that the ‘format he gave his journals [leads] us to assume that scientific or public health-related ambitions were part of Bloesch’s professional self-image’ (263). In contrast to this historical example, where patient care and journal keeping were combined in the light of professional ambition, it stands out that healthcare providers of today tend to see their administrative work as opposed to patient care, even as separate and conflicting tasks; it is assumed that for physicians ‘seeing patients doesn’t feel like work in the way that data entry feels like work’ (Amenta 2017). This is probably related to the fact that many physicians experience the requirement of working with a given software as a limiting restraint, which they are not really able to control, while they experience working with patients as something they have learned to master. As Gawande admits: ‘a system that promised to increase my mastery over my work has, instead, increased my work’s mastery over me’ (2018). It thus seems that it is primarily the question of ownership that distinguishes past recording styles from today’s recording systems: it is difficult to individually appropriate something which is designed to harmonize if not eliminate individual recording styles.

Yet even as Bloesch and contemporaries embraced the administrative tasks associated with medical note-taking as an opportunity to become a medical expert, other nineteenth-century physicians had different views of its value. But their criticisms of record-keeping were not motivated by the inherent value they saw in interactions with patients. Rather, their critiques were linked to a notable shift during the nineteenth century as scientific interest, triggered by administrative requirements as well as different disease conceptions

and methods (e.g. in epidemiology research), changed its focus from the individual case study to population studies (see Hess and Mendelsohn 2010). In Nikolas Rose's words, 'the regularity and predictability of illness, accidents and other misfortunes within a population' became 'central vectors in the administration of the biopolitical agendas of the emerging nation states' (2001, 7). Bound up with a new emphasis on tabulation, as well as 'precision and reliability,' various German-speaking hospitals instigated a new tabular format designed to enable physicians to compile their observations of patients into ward journals organized into columns and, eventually, generate an annual account of the course of disease (Hess and Mendelsohn 2010, 294). Yet in response some physicians rejected what they saw as excessively confining recording requirements. Volker Hess and J. Andrew Mendelsohn describe how the chief physician at a Berlin clinic ranted about the 'inadequacy of our [tabular] journals' and their inability to produce medical knowledge (295). While Mendelsohn and Hess themselves remark that such tabular ward journals were very 'far from the patient history as observation, as prose narrative' (293), the physicians' rejection of the use of columns to record cases was not motivated by a concern to recover patients' own narrations of their ailments or the feeling that record-keeping prevented them from properly attending to their patients' needs. On the contrary, these physicians were concerned with producing an annual disease history and were frustrated that 'the ultimately administrative format's own rigid divisions blocked the writing of a synoptic history' (296). Rather than recovering a face-to-face encounter with patients, they were interested in finding a recording format that would allow them to present a more compelling and sophisticated general description of disease, relying on mass information.

The current consensus among historians of medicine is that we should neither conceive medical records as 'unmediated records of experiences of illness and healing' (Kassell 2016, 126) nor as disentangled from the medical encounter itself. Rather, 'processes of record-keeping were integral to medical consultations' because 'as ritualised displays and embodied knowledge, case books shaped the medical encounters that they recorded' (122; see also Warner 1999). In relation to how 'computerization' is shaping contemporary medical encounters, three main points are of note. First, physicians have not always seen time spent writing and recording patient histories as in competition with interacting with patients themselves. At various times in history, the careful documentation of individual cases was perceived as a fundamental resource for generating medical knowledge and time spent doing so as part of the self-identity of physicians. Against the repudiation of digital record-keeping by today's physicians, historical evidence shows that to the extent that physicians saw record-keeping as coinciding with their overall knowledge objectives, they accepted and even embraced it. This is linked to a second point, namely that prolonged time spent listening to the patient talk was not historically seen as evidence of good medical practice. For example, in an era when listening at length to patients was associated with the obsequious physician catering to the ego of the upper-class patient, the sober inscription in a nineteenth-century casebook noted that 'too much talking showed that little was wrong' with the patient (Weindling 1987, 395). Finally, patients too accepted administrative work by doctors as a sign of expertise and not necessarily as something that reduced the doctor's attention to them. While the power balance changed in favour of doctors and ascribed less epistemic value to patients' words, this was not necessarily negatively received by patients. History therefore shows that we should not view technological changes as isolated from the broader medical culture surrounding them but rather as shaping and co-constructing this culture. Today's fear that the introduction of EHRs might change the communication and relation between physicians and patients for the worse tends to blame technology for a broader cultural and medical change of which it is just one tiny aspect, that is the growing

belief in data and the logic of gaining stratified knowledge to provide relevant information about any one patients' condition. Given that patients' expectations exist in a dynamic relationship with how physicians learn, make decisions and interact with them, EHRs are themselves bound up with creating new conditions for the physician-patient relationship.

Examining: telemedicine and the distant patient

A further way in which digitalization has influenced the medical encounter is that it has emerged as the new virtual consulting room, thereby radically transforming the settings and procedures of physical examination. Although most people still go to 'see the doctor,' medical encounters today no longer *have* to take place in physical spaces but can occur via telephone or internet – what is broadly referred to as telemedicine, literally healing at a distance (from the Greek 'tele' and Latin 'medicus') (Strehle and Shabde 2006, 956). According to the World Health Organization, as a global phenomenon, telemedicine is more widespread than EHRs with more than half of responding member states having a telehealth component in their national health policy (WHO 2016). In the context of the COVID-19 pandemic, telemedicine has been overwhelmingly seen as '[a]n opportunity in a crisis' and has further gained in popularity (Greenhalgh et al., 2020; see also Chauhan et al., 2020). A senior NHS official cited by *The Economist* called the widespread adoption of remote care (viz. telemedicine) a 'move away from the dominant mode of medicine for the last 5,000 years' (2020, 55). In the virtual examination room, patients can ask a physician for a diagnosis, a prescription and a treatment plan and send information about diseased body parts via digital media. When inquiring about the health conditions of their patients from a virtual consultation room, physicians sometimes need to ask their patients for certain practices of self-examination and self-treatment (Mathar 2010, section III). Advocates of telemedicine emphasize that there is no risk of mutual infection, advantages of cost savings, convenience, and better accessibility to medical care generally and for people living in rural and remote areas in particular. In Switzerland, for instance, the Medgate Tele Clinic promises to 'bring the doctor to you, wherever needed' (2019) while the U.S. Doctor on Demand characterizes itself as '[a] doctor who is always with you' (2019). Patients, meanwhile, appreciate the greater availability of physicians, less travel time and better overall experience (Abrams and Korba 2018). However, telemedicine also raises various critical questions about the effects of physical distance on the physician-patient relationship. In particular, can the quality of the examination and diagnosis be high enough if a physician only sees his/her patient via screen but cannot smell, palpate and auscultate him/her? Furthermore, how can a trusting doctor-patient relationship be established virtually and at a distance? (see Mathar 2010, 13). While some of these critiques are based on the assumption that a fitting medical encounter between physician and patient should be a 'good, old-fashioned, technology-free, dialogue between physician and patient' (Sanders 2003, 2), we show below that all encounters inevitably 'pass through a cultural sieve' (Mitchell and Georges 2000, 387). Not only has the perceived need for the physical proximity of physician and patient varied substantially over history, but historical physicians and patients have not seen physical distance as preventing them from achieving emotional understanding. Whether physical examinations took place in-person or remotely, at each point in history doctors relied on their knowledge and its applications, that is a cultural lens through which s/he gazes on, over or into the human body. Regardless if examined remotely or

closely, changes in examination procedures always challenge the established sense of the emotional bond between patient and physician, which therefore needs to be defined anew.

The standard physical examination as we know it today was considered less important in Europe up to roughly 1800 because of the conventions governing the relationship between physician and patient/patron, and also because of the conventions governing the relationship between male doctor and female patients. Many physicians considered physical examination morally inappropriate and saw it as dispensable for making a diagnosis. Physicians of upper-class patients generally considered their task more to advise than to examine and treat (Ritzmann 1999, 203). From his close analysis of a casebook by a seventeenth-century English physician, Stanley Joel Reiser concludes that the ‘maintenance of human dignity and physical privacy placed limits on human interaction through touch’ (1978, 4). Given the desirability of maintaining physical distance, physicians relied on and developed other sources of knowledge than their own sense of touch. The physical examination was ‘the method least used’ by the seventeenth-century physician who rather favoured ‘the patient’s narrative and [his] own visual [outward] observations’ of the patient’s body. In her study of a manuscript authored by a surgeon-apothecary of the same historical period, Fissell singles out blood-letting as one ‘of the few occasions on which a professional [...] might routinely touch a patient’ and notes that it was necessarily ‘transformed into a careful ritual, one which attempted to compensate for the transgressive nature of the encounter. The blood-letting’s courteous attention to returning the patient to his or her un-touched status underlines the mixture of courtesy and technique which made good medical practice’ (1993, 23). In ways now unfamiliar to us, manners and morals interacted to make physical examination and touching patients an ancillary part of the desirable patient-doctor encounter at that time.

Regular in-person physical examination as a routine practice and diagnostic technology is a rather recent development that came along with a new anatomical understanding of disease during the course of the nineteenth century, namely that diseases can be traced to individual body parts such as organs, tissues and cells, rather than unbalanced bodily humours (Reiser 1978, 29). It was at this time that the doctor’s examination skills no longer depended on the patient’s word and the surface of the (possibly distant) body, but started relying on what the doctor could glean from the patient’s organic interior (Kennedy 2017). In order to ‘get’ to the physical conditions of the body’s interior, a number of instruments were developed to facilitate the new credo of examination. The most famous example of such a nineteenth-century examination technology is the stethoscope, invented by French physician René Laennec (1781–1826). ‘By giving access to body noises – the sounds of breathing, the blood gurgling around the heart – the stethoscope changed approaches to internal disease,’ wrote Roy Porter, ‘the living body was no longer a closed book: pathology could now be done on the living’ (1999, 208). Crucially, technologies like the stethoscope brought the physician and patient into the examination room together but by providing physicians with privileged access to the seat of disease did not necessarily bring them closer in terms of understanding. Doctors now heard things that remained unheard to the patient, and this provoked a distancing in terms of illness perceptions. In Reiser’s account, the stethoscope ‘liberated doctors from patients and, by doing so, paradoxically enabled doctors to think they helped them better. [...] Listening to the body seemed to get one further diagnostically than did listening to the patient’ (2009, 26).

The result is visible in the resistance surrounding some examination technologies that allowed physicians to delve into the body’s interior in order to gain new anatomical and pathological insights but that proved too transgressive for some existing physician-patient contacts. The vaginal speculum, introduced into examination procedures in Paris

in the early-nineteenth century, may have fitted well with physicians' new commitments to empiricism and observation. But at the time of the speculum's introduction, female genital organs, in contrast to other organs, were regarded 'as so mysterious and so sacred that no matter how serious the disease that afflicted them might be, it was no justification for an examination either by sight or touch' (Murphy 1891, cited in Moscucci 1990, 110). Although the speculum was in line with pathological disease concepts and close, interior observation, moral considerations continued to undermine its suitability in the clinical context. At a meeting of the Royal Medical and Chirurgical Society, chronicled in the *Lancet*, commentators associated the speculum with both female and physician corruption, and the loss of moral virginity and innocence caused by its insertion into the body (Anon. 1850). In Margarete Sandelowski's estimation, the vaginal speculum 'required physicians not only to touch women's genitals, but also to look at them, and thus imperiled the relationship male physicians wanted to establish with female patients' (2000, 75). Here was a case in which technology challenged the socially accepted relationship between (male) physicians and (female) patients of a particular class because its application demanded increased physical closeness, and therefore was seen as undesirable and transgressive. As Claudia Huerkamp notes, it took a long time to establish a specific 'medical culture' in which the physical examination of female parts by a male physician was not perceived as breaking a taboo (1989, 67).

In other instances, the use of the speculum and the unprecedented access it provided to women's anatomy mirrored existing power structures. The first uses of the speculum were justified in reference to and tested on the most vulnerable members of society. Deirdre Cooper Owens (2017) has demonstrated that in the U.S., racist arguments helped to defend the speculum's application and experimentation on black, enslaved women as they were deemed to have a particularly 'robust' constitution, high tolerance of pain, and so on. Medical men such as James Marion Sims, who by his own account was the inventor of the speculum, combined his privileged access to enslaved women's bodies with intrusive forms of examination in order to gain new knowledge crucial for the emerging field of gynaecology. This was also true for Irish immigrants in the U.S. (Owens 2017) and in the case of prostitutes in France and Germany, where the speculum was used as an instrument of the medical police (Moscucci 1990, 112). Prostitutes were screened using this new instrumentation as supposed carriers of venereal disease, whereas male clients did not need to undergo any screening. This highlights how intrusion into the body in the name of more accurate examination was frequently bound up with power and control, especially of marginalized groups.

Even as the seat of disease became increasingly associated with specific locations inside the body, this coexisted with the notion that medicine could still be conducted 'at a distance.' The example of the telephone demonstrates how tele-instruments worked alongside close examination devices that adhered to the principle of disease as located in particular interior body parts. In fact, the potentiality of the telephone for the medical profession was apparent from its invention in 1876;⁴ as Michael Kay notes, the first inter-connected users were doctors, pharmacists, hospitals and infirmaries (2012). Practitioners used the technology, which enabled the clear transmission and reproduction of complex sounds for the first time, to improve existing instruments, or to devise entirely new examination methods. For instance, in November 1879, the *Lancet* published the case of an American doctor who,

when phoned in the middle of the night by a woman anxious about her granddaughter's cough, asked for the child to be held up to the telephone so that he could hear it (Anon. 1879). A group of physicians predicted in 1880 that home telephones would allow a new specialty of long-distance practitioners to 'each settle themselves down at the centre of a web of wires and auscult at indefinite distances from the patients,' potentially replacing the traditional stethoscope (cited in Greene 2016, 306). The telephone was also lauded for its potential to uncover foreign objects lodged in patients' bodies, for example by acting as a metal detector (see Kay 2012). In line with the belief that a 'good examination' required a physician having access to the body's interior in order to discover the seat of disease according to the localisation principle, the telephone was seen as an extension of the doctor's ear that could improve examination and diagnosis.

In this context, reactions to the increased physical distance between physician and patient varied. The benefits of using a telephone instead of the more traditional speaking tube, which allowed breath to pass from one speaker to another, when communicating with patients with contagious diseases were recognised very early (Aronson 1977, 73). A testimonial letter, written by the Lady Superintendent at the Manchester Hospital for Sick Children in 1879, stated: '[The recently installed telephone] is of the greatest value in connection with the Fever Ward, enabling me to always be in communication without risk of infection' (cited in Kay 2012). Yet some physicians worried that telephone technology had effectively 'shrunk' perceived social distance between them and the working classes, making them liable to be overly contacted by the general public. As one doctor complained in the *Lancet* in 1883: '[a]s if the Telegraph and the Post Office did not sufficiently invade and molest our leisure, it is now proposed to medical men that they should become subscribers to the Telephone Company, and so lay themselves open to communications from all quarters and at all times. [...] The only fear we have is that when people can open up a conversation with us for a penny, they will be apt to abuse the privilege [...]' (cited in Kay 2012). Not only were doctors concerned about the telephone invading their 'leisure,' they worried that they might be overrun by the public, and their medical expertise would be needlessly exploited. Because of the inherent fear of doctors that an excessively frequent use of the telephone could flatten the social order and their standing within society, it is not surprising that the public use of the telephone came under critical medical scrutiny. This is visible in the way that telephones themselves came to be seen as seats of infection. At the end of the nineteenth century when most telephones were for public use (Fischer 1992), the *British Medical Journal* cautioned there was a need to curtail 'the promiscuous use of the mouth-pieces of public telephones' (Anon. 1887, 166). In general, the use of the telephone was informed by insights from bacteriology, which transformed individual disease 'into a public health event affecting communities and nations' (Koch 2011, 2), and placed new emphasis on the need to keep potentially infectious bodies as well as social classes at clear distance from one another (see Peckham 2015).

In relation to the pitfalls of today's telemedicine and the fundamental questions of physical distance and emotional rapprochement in the medical encounter, these historical findings demonstrate that what was perceived as the 'normal' setting and procedure of medical examination could change remarkably within a rather short time. Before the nineteenth century, close physical examination generally played a less prominent role while patients' illness accounts had a greater weight in the medical encounter. Indeed, in some contexts physical distance was seen as the prerogative of good medical practice. Post-1800, by contrast, is characterized by the standardisation of physical close examination, but also by the introduction of new technologies into the patient-physician relationship that themselves challenged socially-accepted degrees of physical closeness. However, this does not

necessarily mean that such technologies disturbed a former unbroken bond, rather, various technologies became players in the game and could (or not) be appropriated by patients and doctors alike. Technology did not simply affect the physician-patient relationship, rather, existing societal and moral understandings influenced how technologies came into being and how they were used (Peckham 2015, 153). Our historical examples suggest that rather than seeing telemedicine as something fundamentally new and potentially threatening because it seemingly undermines a personal relationship, it may be more useful to acknowledge that technologies and cultural understandings always govern the degree of physical closeness and distance in medical encounters, and that this has had manifold implications for the emotional doctor-patient bond. The success of telepsychotherapy during the Covid-19 pandemic is perhaps a case in point. Even as it is unique among medical specialities because of the extent to which it considers the human relationship as fundamental for healing, psychotherapy via phone or video link has increased dramatically during the public health crisis, and also had good results (Békés and Aafjes-van Doorn 2020). This points not only to how physician-patient closeness and emotional understanding can exist in times of physical distance, but also to the constantly variable ways in which both the cultural imagination and experience of distance manifest themselves (Kolkenbrock 2020).

Self-treatment: do-it-yourself medical devices and the expert patient

The third field of digital medicine that we would like to put into historical perspective is one of the fastest growing fields of eHealth, namely do-it-yourself (DIY) health technologies. Such technologies broadly refer to the mobile devices that ‘now allow consumers to diagnose and treat their own medical conditions without the presence of a health professional’ (Greene 2016, 306). Silicon Valley firms sell ‘disintermediation,’ that is the possibility of cutting out middlemen – physicians – and allowing consumers to better control their health via their devices (Eysenbach 2007). Significant private investments have been driving these changes which, in the forms of smart devices and wearable technologies, often imply purchasing a product (e.g. a smartphone) and related applications and tools (see Greene 2016; Matshazi 2019). The website Digital Trends 2019 ranking of ‘the 10 best health apps’ range from Fitocracy, a running app that allows you to track your progress and that promises a fitness experience with a ‘robust community of like-minded individuals’, to Carbs that transfers the meals you have eaten into charts of calories, to Fitbit Coach that promises you the experience of having a personal trainer on your smartphone (de Looper 2019).⁵ Health systems have bought on and increasingly ask patients to observe and monitor themselves with the help of these technologies, and in some cases, the use of apps to measure blood pressure, pulse and body weight such as Amicommed and Beurer HealthManager are closely connected to the possibilities of sharing one’s data remotely with a physician. In terms of reception, the delegation of tasks to digital devices is associated with patients having new options and new knowledge of their own health. In the estimation of one hospital CEO, this dramatic ‘democratization’ of technology and of knowledge signals ‘a true coming of age of the patient at the centre of the healthcare universe’ (Rosenberg 2019). In the words of chronic patient and patients’ rights advocate

Michael Mittleman, while there may be benefits for patients when technologies take over certain tasks that were previously the prerogative of physicians, such technologies nevertheless pose a fundamental challenge to the ‘golden bond’ that previously characterized the patient physician-relationship, for example in the age of the house call (conversation with the author, 2019). It is clear from these statements that DIY devices – because they suggest that the more beneficial relationship is that between the patient/consumer and his/her devices – challenge previous assumptions about the inherent value of the physician-patient relationship as well as the balance of power between those two actors (see Obermeyer and Emmanuel 2016).

Both the notion that patients inherently benefit from circumventing physicians and taking their health into their own hands, as well as the idea of a close, almost familial bond that characterized the physician-patient relationship prior to contemporary DIY practices can be nuanced if we acknowledge that do-it-yourself medical practices have a long and varied history. As Roy Porter has noted, in the eighteenth-century, ‘ordinary people mainly treated themselves, at least in the first instance[,] “medicine without doctors” [was] a necessity for many and a preference for some’ (1999, 281). Only in the nineteenth-century did the medical profession establish a monopoly in health care and have the official power to determine what was ‘health’ and ‘sickness’. In the previous centuries, local and pluralistic ‘medical markets’ embraced far more providers of health services and their varied tools, including barbers, surgeons, quacks and charlatans, so that patients chose among the options that most convinced them or that were affordable to them (Ritzmann 2013, 418). But patients also had the option to help and treat themselves using the means at their disposal – Fissell argues that a person who fell ill in 1500 and still in 1800 almost always first sought medical treatment in a domestic context: ‘[h]e or she relied upon his or her own medical knowledge of healing plants and procedures, consulted manuscript or printed health guides, and asked family, neighbors, and friends for advice’ (2012, 533). As Fissell points out, the enormous diffusion and importance of self-therapy at the time meant that the ‘boundary between patients and practitioners was hard to pin down’ (534). While current depictions of an idealised interaction between physician and patient assume a physician who through his/her knowledge examines, advises and treats the non-knowing patient, history shows that the presumed boundaries between the expert and lay person are far more blurred than is usually assumed.

The presumed novelty of a de-centralised market for DIY devices that potentially threatens the dual relationship between physicians and patients can be put into perspective when considering historical examples. Due to a fairly unregulated medical market in the early modern period, competition was high and the business of medicinal recipes lucrative. In this context, profit-motivated apothecaries benefited from offering new recipes made from exotic products: as of the fifteenth century European pharmacies stocked many wares with medicinal properties – including spices, elements such as sulphur, and plants, for example-mastic and sundew – and these were bought by people who gathered and dealt in medicinal plants (or ‘simples’) and other apothecaries, who made them into medicines. In the wake of the European voyages of discovery, the range of products became ever wider and more expensive, and apothecaries were a very profitable business branch for a long time (Ehrlich 2007, 51–55). King and Weaver have used evidence from remedy books in eighteenth-century England to show how families purchased recipes for remedies, and resold both the recipes and the medicines they brewed to other local people (2000, 195). Until the nineteenth century the medical market flourished and was accessible and lucrative for many participants, while the demand for ‘medical’ services was high, particularly in towns and cities. Access to the technologies of healing – whether domestic medical guides or healing

herbs – allowed patients to control their health and treatments according to a wide range of scientific explanations. In contrast to other European countries that meanwhile had developed some restrictions for apothecaries and their suppliers, in Britain the market-place was remarkably varied in the light of the free-market principle *caveat emptor* (let the buyer beware). ‘In English conditions,’ wrote Porter, ‘irregulars, quacks and nostrum-mongers seized the opportunities a hungry market offered’ (1995, 460). In these conditions of market-oriented healing, both patients and healers alike believed, sometimes fervently, in the effectiveness of the remedies on offer. Moreover, the network of relationships in which such transactions took place was remarkably fluid, with patients using the services of several health professionals in succession or simultaneously.

In the following centuries, medical practice and science would change dramatically due to the rise of academic training as a prerequisite to enter the medical profession, a development seen across Europe, as well as the integration of physicians into national health agendas. A growing belief in science and a paternalistic ideal of the academic physician attributed to him the sole power over medical practice and technologies. It became more difficult for other healers to participate in the health market, and the knowledge of the self-treating patient was diminished as well. As part of the attempt to counteract competition from non-educated or apprenticed healers, in the United Kingdom only registered doctors could hold various public posts, such as public vaccinator, medical officer and the like (Bynum 2006, 214). Yet ‘alternative’ medicine, a term that contained all those healers not licenced and accepted by the respective medical registers, continued to satisfy patients’ needs, although to a lesser extent. In Weindling’s assessment of the prospects of university-educated physicians to attract clients in nineteenth-century Berlin, ‘[f]ierce competition from a range of unorthodox practitioners must be assumed’ (1987, 398). The popularity of hydropathic doctors and water cures, mud-bathing and vegetarianism are but some examples of how alternative medicines co-existed alongside official ones and were increasingly popular treatments even though they did not meet the contemporary academic criteria of standards regarding safety and efficacy (Ko 2016). Thus patients often looked beyond qualified physicians to other practitioners, and their own sensibilities played a considerable role in which relationships they chose to develop.

A look into twentieth-century history shows that DIY practices were integrated into official medicine as well (Timmermann 2010; Falk 2018). The significant rise of chronic diseases and life-long treatment, for instance, required the co-operation of patients in the form of self-tracking and observation of their bodies since it could not be done by medical experts alone. In the first decades of the twentieth century, DIY methods and technologies for measuring blood pressure or sugar became particularly vital, transforming the roles of ‘patient’ and ‘doctor’ and relationship between them. Examining the history of self-measuring blood pressure, Eberhard Wolff notes that patients doing so in the 1930s required both patience and training, and also were pushed into a more active and participatory role during medical treatment: it was not the doctor anymore but the patient who produced and controlled relevant data that were decisive for further medical decisions and treatment (2014, 2018). With the rise of the risk factor model in mid-twentieth century – the identification of factors in patient’s behaviour and habits that were suspected of contributing to the development of a chronic disease – DIY practices grew ever more important and so did its technologies. From this moment, the idea of preventing disease shifted towards individual, possibly damaging behaviours such as smoking and diet that could trigger a number of different diseases. As a consequence, the patient received more responsibility in order to live up to the new credo of maintaining his or her personal health (Lengwiler and Madarász 2010). Optimizing a personal

healthy life style hence did not necessarily occur in direct consultation with a doctor but rather in conjunction with health products available on the market. In the words of sociologist Nikolas Rose, in the course of the twentieth century:

[t]he very idea of health was re-figured – the will to health would not merely seek the avoidance of sickness or premature death, but would encode an optimization of one's corporeality to embrace a kind of overall "well-being" ... It was this enlarged will to health that was amplified and instrumentalized by new strategies of advertising and marketing in the rapidly growing consumer market for health (2001, 17-18).

According to Rose, by such developments, 'selfhood has become intrinsically somatic – ethical practices increasingly take the body as a key site for work on the self' (18). But he also argues that by linking our well-being to the quality of our individual biology we have not become passive in the face of our biological fate. On the contrary, biological identity has become 'bound up with more general norms of enterprising, self actualizing, responsible personhood' (18-19). By considering ourselves responsible for our own biology as key to our health, we have come to depend on 'professionals of vitality' (22) whether they be purveyors of DIY devices, genetic counsellors, drug companies or doctors.

With respect to contemporary debates over DIY practices, some have argued that they allow both doctors and patients to be 'experts' and call for 'a relationship of interactive partnership,' not only because patients today are often informed but also because ideally they know best their own bodies and ailments (Kennedy 2003). Against this idealising assessment, the historical perspective makes us aware that while self-help and self-treatment have been an important dimension of past medical cultures, it appears that historically, patients have not relied as much on a face-to-face empathetic encounter with any one physician as today's debates suggest. Moreover, today as in the past, the mere existence of markets for medical devices influences how consumers/patients decide whether to resist or embrace the various possibilities of self-treatment as well as their relationships with those who provide it. As Porter has argued, purveyors of 'alternative' medicines rationalised their therapeutic effects in ways that differed from official scientific methods and using arguments that likewise changed over time. Depending on the perspective of whose model of evidence users deemed most credible, the co-existence of diverse models for practicing medicine must be assumed throughout history and despite nineteenth-centuries attempts to eliminate unorthodox medicines (Timmermann 2010). The result was a diverse network of fast-changing relationships in which no single one was ascribed the ultimate power to heal. Reflecting on this history, historian of medicine and physician Jeremy Greene has stated that contemporary DIY devices therefore appear 'neither wholly new nor wholly liberating' (2016, 308). Our analysis corroborates Greene's, in that it shows how those who use new DIY technologies may free themselves from their traditional relationship of dependence on physicians, while also creating new relationships with those actors who produce apps or conduct marketing. Yet our study also suggests that there is no one ethical conclusion about whether DIY or physician-dominated care is a better way of living up to a more humane medicine. Ethical arguments and the grounds on which we are supposed to resolve them are complex and variable. As seen in these historical examples, they have changed profoundly over time with each technology and medical concept challenging and refashioning the doctor-patient bond anew. Furthermore, there is no such thing as a 'timeless' doctor's healing presence, or even medical expertise, or an ill person/patient. As shown above, as health and illness are defined, redefined and challenged throughout history, this process creates both expert and patient, as well as shapes the relationship between them.

Conclusion

An oft-heard concern about ‘computerization’ in medicine is that digital objects are changing human interactions. While various representatives from the tech side are optimistic about the effects of increasingly dynamic and intelligent objects in the medical encounter, some patients and physicians are more skeptical and see their social relationships as disturbed by new technologies. ‘Doctors don’t talk to patients’ is the most common complaint the CEO at a Montreal hospital recounted hearing from current patients (conversation between the author and Lawrence Rosenberg, 2019). Fears that increasing digitization of medicine will disturb the relationship that can potentially make the patient ‘whole’ again are not without foundation (King 2020). However, without a clear baseline for assessing changes we have limited scope for drawing conclusions about present day realities or long-term trends. Given the appeal of using the past to suggest a more ‘human’ but lost era of medical practice, a less nostalgic but more sophisticated understanding of the past as provided by historical research would serve us well. In this sense, history can counteract a characteristically modern myopia, namely, as intellectual historian Teresa Bejan has put it, our ‘endearing but frustrating tendency to view every development in public life as if it were happening for the first time’ (2017, 19).

As we saw in the examples dealing with record keeping, examining and self-treatment, trends that consider the patient as an object – a diseased lung, or a malfunctioning heart valve – and the concomitant use of technologies to record, examine and treat physical symptoms were necessarily in tension with patients’ own accounts of how they became ill and of the symptoms they experienced. In fact, concerns about the loss of meaningful personal contact in the medical encounter are incomprehensible without reference to a historical trend dating back to the beginning of the nineteenth century which seems to undermine the patient’s perspective by focusing on increasingly specialised processes within the body. Yet neither before nor after that time is there an unmediated patient’s voice that we are able to recover: the medical record as historical source has its own distinct material history, and patients’ expectations were always bound up with broader societal views about acceptable standards of healing. The historical perspective also shows that we should not take for granted the linear narrative of the technological as adverse to human relations and reducing empathetic understanding in the medical encounter – to paraphrase Lauren Kassell, the digital is not just the enemy of the human (2016, 128). Rather, it makes us aware that our understanding of the doctor-patient relationship and of its role in healing are themselves historically contingent. The idea of ‘a friendly, family doctor “being there”’ and the association of medicine with a ‘desirable clinical relationship’ (as opposed to e.g. perfect health) is an idea that has played out very differently in the course of history (Porter 1999, 670). There were times in which listening to patients was bound up with completely different expectations from both sides, and there were times in which physical examination was not seen as an indispensable part of medical practice. Moreover, while the monopoly of the physician in matters of health care and the focus on the (exclusive) healing potential of the clinical relationship is of relatively recent origin, we have seen that the popularity and economy of DIY devices has a much longer history, one that resists a linear account of DIY devices as something purely liberating. Hence, in contrast to idealised and simplified historical narratives that lament the loss of human relationships, more sophisticated accounts should acknowledge that medical objects and technologies are not the strange and disturbing ‘other’ in the medical encounter but rather integral players therein. As Frank Trentmann has put it, ‘things and humans are inseparably interwoven in mutually

constitutive relationships' (2009, 307). While the authors of a recent study suggest that 'the traditional dyadic dynamics of the medical encounter has been altered into a triadic relationship by introducing the computer into the examination room' (Assis-Hassid et al. 2015, 1), it seems more likely that the dyadic relationship has never existed.

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Endnotes

¹ We rely on a definition used by science and technology scholars whereby the term 'technology' operates on three levels (see Bijker, Hughes and Pinch 2012, xlii). First, there is the physical level, referring to tangible objects such as a smartphone, wellness band, or stethoscope. The second level of meaning concerns activities or processes, such as 3D printing or creating X-rays. The third level refers to knowledge people have in addition to what they do, for example the knowledge that underpins the conduct of a surgical procedure. This approach shows the extent to which specific tools and techniques, knowledge, and rationales for intervention are intricately bound together. Our use of the term 'digital,' that is involving computer technology, in relation to medicine 'includes categories such as mobile health (mHealth), health information technology (IT), wearable devices, telehealth and telemedicine, and personalized medicine' (U.S. Food and Drug Administration).

² As a rule, while systematic reviews of telemedicine generally portray it as effective as in-person consultation or promising, evidence is limited and fast-evolving (Ekeland, Bowes and Flottorp 2010; Kruse et al. 2017; Lee et al. 2017).

³ In Germany, legislators have reacted to these concerns by limiting video consultation to cases in which physician and patient have physically met before, and primarily using it for monitoring the course of disease, including chronic ones, or the healing of an injury (Heinrich 2017).

⁴ Scottish-born US inventor Alexander Graham Bell was the first to be awarded the U.S. patent for the invention of the telephone in 1876 (Fischer 1992).

⁵ Interestingly, and probably most important for their users, nine out of ten among the ranked apps are available as free downloads (<https://www.digitaltrends.com/mobile/best-health-apps/>, June 16, 2019).

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