Man-Machine Metaphorical Couplings in Electrocardiographic Theory and Practice
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Abstract

Western medical sciences have been under the scrutiny of sociologists and anthropologists for a long time. Social scientists have provided valuable insights into the social aspects which help make some claims more scientific than others while at the same time showing that changing vocabularies could have a major social impact. Researchers like Emily Martin (2001) or Susan Sontag (1978) have focused on the scientific and popular language that is in use when talking and thinking about certain medicalized aspects of the human body such as bodily functions and diseases. By deconstructing the meaning of the words found in medical textbooks, everyday conversations and many other instances they have argued that science is built on strong metaphors which have become so entrenched in present reality that their metaphorical function passes unobserved allowing them to act like cognitive scripts with a great influence on what individual human beings experience when confronted with embodiment (Csordas, 1999). The paper is concerned with electrocardiography, a science which investigates the workings of the human heart in order to identify abnormalities in the cardiac rhythm. Starting with writings coming from the beginning of the 20th century when the practice was invented and perfected and ending with present day medical textbooks and scientific articles, the paper presents a periodization of the metaphoric language associated with electrocardiography and the human body. In the beginning the human heart was seen writing its own story through the electrocardiograph, but nowadays images talk about TV cameras registering from multiple angles the game that the body is playing. The principal argument is that medical science is based on metaphoric thinking that relate man and machine, the relation being biunique and that the analysis of its vocabulary can help discover how both body and machine are constructed in the social imaginary.

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Keywords: medical anthropology; social constructivism; electrocardiography; scientific practice; metaphor; body.
1. Introduction

This is an account of how medical scientists involved in electrocardiography have portrayed their practice throughout the twentieth century by using metaphoric language and how these metaphors evolved and influenced the social construction of human body and device agency in man-machine couplings. The first recording of the electrical activity of the human heart is attributed to Augustus D. Waller, who, in 1887, used a capillary electrometer to measure the electrical currents moving through the heart without opening the chest as it was habitual at the time. However, it was Willem Einthoven who managed to get electrocardiography recognized as a practice useful not only in the physiology laboratories, but also in clinical settings (Burch and Depasquales, 1990). This article chronicles the use of metaphors used in electrocardiography from 1910 (the year in which Einthoven published his seminal article which introduced the electrocardiogram to the medical world) to 2013 by analyzing the contents of articles addressed to the scientific community, medical textbooks and popular science magazines.

The context built around the medical practice of electrocardiography allows for an exploration of the performative function of the bodily organs or, more exactly, the ways in which the heart’s doings in the world are captured by medical texts. Klaver (2005) talks about the body being insubordinate in relation to culture and “capable of ‘performing’ on its own, responding to or simply ignoring social constructs in its own material and often unpredictable ways” (p. 56). By presenting a brief and thematic history of the electrocardiographic practice, this paper presents two different conceptualizations of the heart: as author and as object, the former being a much stronger presence in contemporary English medical writings than the latter. Although these two different metaphorical settings allow for the presence and absence of the heart’s agency in various degrees, the main conclusion of the article is that the body always has at its disposal ways to act as a disruptive force that asks to be heard.

As a narrative of the body, the electrocardiogram is constructed inside a network of human and non-human actors in which the balance of power helps to highlight some of the actors while shadowing others. The most prominent absence that medical textbooks and scientific articles help to establish is that of the patient as an embodied being, a realization that has been the subject of many philosophical and sociological writings (Scheper-Hughes & Lock, 1987). As a consequence of the absence of the patient, this article is concerned with the dynamics of power and intentionality observed in the triangle formed by the human heart – the focus point of medical vision in the case of electrocardiography, the electrocardiograph – the technical mediator, and the medical practitioner – the interpreter of the investigative results.

2. The heart begins to write its own tale

In its infancy, electrocardiography was clearly seen as a subset of graphology and most of the medical publications at the beginning of the twentieth century borrowed expressions from the semantic field of writing. Thus, we encounter the heart as the author, writing its history on a piece of paper in a never before seen language. As the human organ began to tell its own tale, we find physiologists rejoicing at the thought that human intervention had been eliminated from clinical investigations. E.J. Marey said in 1878: “There is no doubt that graphical expression will soon replace all others whenever one has at hand a movement or change of state – in a word, any phenomenon. Born before science, language is often inappropriate to express exact measures or definite relations.” (Daston and Galiston, 1992, p. 81) However, even though the new measuring instrument offered the viewer drawings of lines on pieces of paper, medical practitioners and experimenters still referred to it as representing a language that they had to read. Geometry and language thus become combined, and as Baruch (2012) says: “The normal heart speaks in rhythmic, lean geometry.” (p. 241)
From the beginning, it was generally accepted that electrocardiography brought with it a new form of writing that came with its own vocabulary. Thus, what the electrocardiograph did and still does is to “chart the language of the heart” (Jones and Finn, 2007, p. 20). This language was, at first, strange and undecipherable, but the acquisition of reading comprehension seemed to proceed in a rather fast pace: “The writings of the electrocardiograph are still in an unknown language to many practitioners, yet the reading of it is easily acquired, for its alphabet is confined to five letters, and one of these, Q, is little used.” (Gosse, 1935, p. 172)

The agent that acts as author of the electrocardiogram can be either the pen or stylus which is a component of the modern electrocardiograph or the heart itself: “All eyes watch the telltale wiggly line (below) the patient’s heart writes on a long graph spewing from the EKG” (italics in original, Life, 18 February, 1964, p. 58). When the writing instrument appears to be in control, the language suggests that the mechanical instrument is divulging some of the hidden activities of the heart, an idea supported by article headlines such as “[r]adio tells secrets of heart” (Popular Science, August, 1955, p. 238). Nonetheless, it is evident that this is also indicative of the way in which the heart behaves when it is the writer-agent, the electrocardiogram working in both cases as a revelation of someone’s medical condition.

Through the use of this semantic field, the heart appears to have a sort of intentionality in relation to its self-expression and is thus an important participant in the process of recording the electrocardiogram. As such the heart, the blood-pumping mechanism that puts the whole body into motion is not conceived as a passive object, but rather as capable of its own action, of telling a story and enticing scientists to learn a new language. Although in this view the body has agency and is prominently present in the act of diagnostic, this does not imply that there does not exist a level of abstraction that distorts the nature of the bodily workings. The use of this generic language became so entrenched that Blake (1994, p. 65) deemed it necessary to comment that “an electrocardiographer works with a symbol of a concept. Electricity generated in the heart is just as real as tissues and pictures, but more abstract. Any information it contains must be converted to words to have meaning, and the nomenclature used for this is so well known that it may take conscious effort that a symbol is not the thing symbolized; there are no Q waves in the heart.” This is a warning signal that was supposed to remind fellow medical practitioners that all languages are arbitrary and all symbols are signifiers and should not be mistaken for the signified reality. From the perspective of the heart as agent, the warning shows that the social acceptance of the language created a false image of the actual electrical activity of the heart, in which the graphical expression came to be divorced from its physical meaning.

3. The heart becomes an inanimate object

Almost a century later, the language of the heart has been revealed and no secrets remain hidden from the omniscient eye of the medical practitioners who are now capable to watch the heart’s activity as they would watch a ball-game. As the technique progressed, the semantic field of the metaphors got reoriented towards visual recording: today we find the heart playing a game while being recorded by the electrocardiograph and the medical practitioner has to learn how to see the game from multiple angles.

The dynamics of agency have shifted: the heart has lost its agency in favour of the mechanical device which now appears to be in control. When the heart was writing its own story, the electrocardiogram was the direct product of the heart’s activity and thus it had a clear agent with enough agency to voice its own opinions. However, in this metaphoric landscape, the human heart has no agency as it is simply playing a game (Bayes de Luna, 2012) or acting like an elephant in a box (Blake, 1994) or as a car involved in an accident which looks fine from one side and damaged from another (Schutt, Brady & Mitchell, 2012), subject to the view of multiple visual recording devices. As the machine gains intentionality, the electrocardiographic leads become similar to devices
for vision such as “an eye of a camera: it has a narrow peripheral field vision, looking only at the electrical activity directly in front of it” (Norris & Clark, 2009, p. 773). The leads are able to ‘see’, they are positioned in such a way as to ‘look’ at the heart from different angles and what they capture becomes permanently imprinted on paper. The medical practitioner acts as the bricoleur responsible for piecing the images together and producing a 3d image from several 2d representations: “Just as it is necessary to photograph a monument or a person from various angles in order to obtain comprehensive information about its size and shape, the electrical forces generated by the heart need to be recorded from different places (leads) to obtain a good electrocardiographic image of the heart.” (Bayes de Luna, 2012, p. 54)

Watching something unfold suggests an unmediated access to the object of the medical gaze, in which case the electrocardiogram behaves just as a train window that allows travellers to see the scenery they are passing by. The mediated nature of the recording process is absent from the metaphoric landscapes that talk about events happening somewhere and then being revealed. During the incipient period, the electrocardiogram was clearly seen as a medium through which something natural become expressed in a new form, one which was celebrated for the lack of human subjectivity.

The turn to a more disengaged participation on behalf of the human body can be linked with the emphasis placed on the non-invasiveness of the technique: electrocardiography is said to leave the body as it was before, to leave no marks and to be painless. In this paradigm, the body does nothing for the production of the electrocardiogram, the machine performs all the recording work and we get an image of the heart staying on a pedestal to be photographed from multiple angles, or being engaged in its usual activities and being video-recorded by multiple cameras. Either way, the body appears to be unaware of the seeing eyes of the electrocardiograph.

The old metaphors have not been completely replaced, and we still encounter instances of expressions such as “the heart writes” or “the heart says”, but their presence is overwhelmed by the numerous metaphors related to visual recording such as picture, image, snapshot. Thus, in this semantic field, the medical practitioner “sees” an image, “views” a recording. The ECG is compared to a picture album which allows the medical practitioner to construct a three dimensional view of the heart with the information provided from the various leads.

4. Concluding remarks

In this article I have reviewed the main two metaphors encountered in the medical literature referring to electrocardiography: the heart as author and the heart as object. The shift from text to picture was brought about by the development of the field. When the pioneers of electrocardiography were debating the lettering of the electrocardiogram’s peaks and valleys it was clear to them that these were arbitrarily chosen signs and that the underlying nature of the heart looked nothing like the lines their machines drew on paper. In present times, electrocardiography is a mature science, with a well-established vocabulary and a large number of practitioners that are not involved in any experimental settings. Thus, everything seems natural, and the heart’s electric activity is now recorded as a picture, a concise representation of its true nature. As one medical textbook puts it: “the ECG is an electrical snapshot or picture of the heart. However, as any single photographic representation of an individual’s features can give us a distorted picture of the person’s overall appearance, a full representation of the electrical ‘photograph’ of the heart can only be obtained by taking multiple ECGs from many different perspectives. […] This is equivalent to 12 electrical ‘photos’ of the heart, which lets us ‘see’ the heart from an electrical standpoint more clearly”. (Brown, Miller & Eason, 2006, p. 490)

When the electrocardiogram is seen as text, there is usually a pen or a stylus which writes it. The direct writing machines gained popularity among medical practitioners in the 1950s, which made obsolete the need to develop a photographic image as it was during the initial stages of development of the technique. Thus, there is a
lack of coordination between the nature of the inscription technique and the type of metaphoric language chosen to describe it. When the electrocardiographic recording was obtained by photographic methods, the vocabulary used by medical practitioners was borrowed from the semantic field of writing, whereas when the machine started to actually write, the metaphors belonged to the field of video recording. This indicates a discrepancy between the underlying methods of recording information and the metaphoric language that medical practitioners use in order to understand the mechanism and the outcome.

The power of the metaphor electrocardiogram – heart that speaks is visible in the way in which we interact today with the graphical recording and how practitioners try to deal with the loss of hearts’ agency. As the electrocardiogram turned into a picture and the body became a mere object to be recorded, some authors have tried to give back its voice by appealing to auditory metaphors: “Think of the heart rate monitor as a metronome and the electrocardiogram as the sheet of music that your heart is writing.” (Edward, 1993, p. 29) Others went one step further and transformed the electrocardiogram into a sheet of music that can be interpreted by musical instruments. In this new configuration, the recording regains some of its expressivity for lay persons: “Without any knowledge of the disease process or background in ECG interpretation, one can imagine the sense of urgency this medical condition possesses through the very noticeable dramatic and sharply pointed peaks. When the written music interpretation of this ECG is played on an instrument, the attacking notes and dramatic pitch changes actually portray a sense of urgency to the listener” (Nagasheth, 2010, p. 11). Thus, irrespective of the metaphoric field, the human body demands attention and discovers ways of acting as a disruptive agent.

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