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Good old-fashioned ethnography of laboratory

An overview of *Handling Digital Brains. A Laboratory Study of Multimodal Semiotic Interaction in the Age of Computers*

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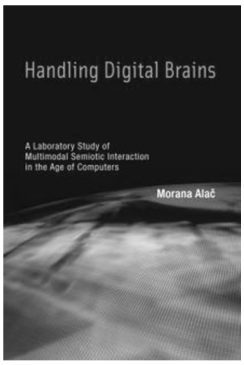

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Abstract

Handling Digital Brains proves that ethnography of the laboratory is still capable of making a significant contribution in the field of social studies on science and technology. The reviewed work presents details of interactions between researchers, as well as between researchers and their material equipment, which are key to explaining the methods of solving research problems when analyzing brain scans generated during fMRI experiments. Significantly, the reconstructed multimodal embodied practices shed light not only on the process of scientific cognition, but also on a broader spectrum of human cognitive activities. The book constitutes a challenge of a kind to neurocognitive sciences. As the author shows, cognitive neuroscientists utilizing fMRI declare that they study the embodied mind; yet, in practice, they reduce the body to the brain, and cognition – to purely internal processes. Such a model of cognition, (tacitly) assumed by experimental neurocognitive scientists, turns out to be insufficient when used reflexively in order to explain the way neuroscientists themselves solve problems.

Key words: ethnography of laboratory; fMRI; cognitive neuroscience; multimodal interactions; science and technology studies; embodiment.

The reviewed work constitutes a report from ethnographic studies conducted in contemporary neurocognitive science laboratories, in which human cognitive functions are researched with the use of technologically advanced methods of neuroimaging. Alač began her observations in the summer of 2002 in a newly opened centre equipped with an fMRI scanner, located at the University California, San Diego. However, the book is not devoted to research practices connected with using fMRI as such. While the work explains the significance of this kind of technology for the development of neuroscience and discusses the principle behind it and the course of the experiments, it predominantly focuses on what happens after the experiments are finished, when it is time to process the data, analyze the visualizations, and prepare drafts of academic articles[216].

Alač does not hide the fact that her cognitive aims changed over the course of her research. When she initially entered the fMRI centre, she was planning to comprehend the organization behind the collective work of scientists representing various research fields. At the beginning, she focused on the scanner itself (a monumental, technologically advanced and expensive device) and what was going on around it. However, during her observations over the space of two years she started to be interested less in the experimental sessions, and more in what was going on in smaller workshops, in which the scientists processed, analyzed and transformed the data generated in the course of the fMRI experiments. An experimental session lasts only a few hours, and handling the scanner requires only a handful of scientists; however, processing and analyzing the obtained data may take months and engage a much larger research team. In other words, what happens after the experimental session turns out to be decidedly more important and more interesting, as the researchers – most frequently, together – sit in front of the computer screens and devote themselves to apparently mundane interactions that require the usage of a rich set of narrative and multimodal resources. From Alač's point of view, the very room with the scanner is significant inasmuch as it plays a role in the process of training new adepts or in the very interpretation and processing of the data (see Alač 2011: 49-65).

[216] It ought to be remembered that during the last ten years neurocognitive science practices and methods may have undergone significant changes. For example, the development of such data-driven methods as multi-voxel pattern analysis (MVPA) enforces a change in research approach: if in the laboratories observed by Alač the researchers looked for regions, modules or paths with specific functions on the brain visualisations, the researchers using MVPA approach the functions fulfilled by different regional areas agnostically, assuming only that no matter how the brain processes information, it does so in a consistent and cohesive manner (Norman et al. 2006). One should also keep in mind the progress in the very field of the research instruments, including the field of mobile appliances.

The work begins with a reconstruction of one of the many data interpretation sessions that the author witnessed (Alač 2011: 1-5). This short presentation already shows that interpreting brain scans does not consist solely in passive staring at them. In order to comprehend the visualized results, not only do the scientists change virtual perspective – switching between various kinds of images of visualized brain, changing the colour spectrum utilized to mark the levels of stimulation in various areas of the brain – but also they transform the visualization itself, doing so in a similar manner to how they would handle a material, plastic object, which can be cut into layers or flattened. One of the methods described consists in flattening a creased, three dimensional surface of the visualized brain in order to be able to see simultaneously the surface of sulci and gyri covering the organ on a two dimensional screen. The scientists do not limit themselves only to using software functions. They also utilize other available resources to facilitate sustaining visual attention on significant elements, recognizing particular neural paths of information processing or regions, or to retain awareness of spatial relations between analyzed areas[217]. It turns out that it is not only the mouse cursor that can be helpful, but also a researcher's gesturing hand (which allows one to focus visual attention), or a piece of paper with a hand-drawn scheme constituting a map of important areas (which allows one to divide the observed scan into important regions forming 'a map'; see Alač 2011: 105-109), held next to the screen at the level of the researcher's eyes. In the aforementioned situation, one researcher uses his hand in order to explain to the other researcher how the program functions are used to flatten the creased surface, transforming a three dimensional representation into a two dimensional one.

Alač refers to many other research practices of this kind that she registered and analyzed in detail. It ought to be added that her analyses include not only the behaviours of individual researchers, but also of pairs of scientists working and discussing a brain visual displayed on a single screen. The author takes the position that such prosaic, and yet commonplace activities are indispensible for comprehending the process of interpreting visualized scientific data. Within science and technology studies (STS), very much attention has been paid to inscriptions (Latour & Woolgar 1979; Latour 2009) and visualizations (see e.g. Henderson 1998; Lynch & Woolgar, eds. 1990) as basic tools for solving scientific problems; however, understanding how a record on paper or an image displayed on the screen take part in the process of problem solving requires taking into account how the researchers use their bodies, as well as senses different than sight. For example, in the third chapter the author devotes her attention to a modality that is generally overlooked by the STS re-

[217] Importantly, the scientists observed by the author focused not on the whole scans, but on (as they called them) regions of interest. Accordingly, an important research ability lies in fast and accurate identification of a region of interest and sustaining attention upon it.

searchers, that is sound[218]: it turns out to be key while training young neuroscientists, who, in order to become competent fMRI users and data interpreters, at the very beginning take part in the experiments as subjects[219].

The author devotes significant attention to the very status of visualization with which the neuroscientists work. What is, then, a visualization generated as a result of fMRI experiments for the neuroscientist who works with it? A partial answer lies in the title of the book: brain scans are not simply images or photographs that we look at, or windows that enable us to take a look at the organ hidden behind membranes, bones and skin; they are something plastic, susceptible to such transformations as flattening or cutting, something that one should *handle* as they would a physical object. Brain scans are not "mirror" representations of the brains of the study subjects. The final version of the scan is shaped by a number of theoretical decisions taken during its processing, which are far from obvious for the whole research community. For instance, the scientists have to manually "retouch" scans: transform a fragment of the visual that they consider an artifact (see chapter six[220]). It should be added that the scans printed in journals or displayed on screens are two dimensional, even though they represent a three dimensional, rich structure; this is why the journals present various views at the same time, between which the research can easily switch while interpreting data. Optical metaphors (a photograph, a mirror reflection) turn out to be deceiving also due to the simple reason that one scan captures changes spread over time (represented with the use of distributed colours), while certain details are shown in a distorted manner, inconsistent with brain anatomy (e.g. the "furrows" are smoothed). Although the changes that a scan undergoes result in its being increasingly less similar to the original, at the same time they facilitate drawing conclusions by the scientists.

In order to conceptualize the status of brain visual, Alač refers to the differentiation of iconic signs into images, diagrams and metaphors, introduced by Charles Sanders Peirce. As Alač argues, it is easy to consider signs ordinary images, but it is much better to think of them as Peirce's diagrams. In Peirce's concept, a diagram has a much broader meaning than today; it consists not

[218] One of the few STS texts on the subject of the significance of sound and hearing in research practice is Cyrus C. M. Mody's "The Sounds of Science: Listening to Laboratory Practice" (Mody 2005).

[219] Let us add that by participating in the fMRI experiments as their subjects, the students of neuroscience learn, among other things, how important and difficult to achieve it is for the body of the subject to remain immobile during the study.

[220] Alač describes also an interesting situation in which the research team, according to the suggestion of reviewers, changed the threshold value over which neural activity marked with colors appeared on the scan: as a result, it was possible to clearly "bring out" the most important regions, and many local, small regions of neuronal stimulation, which constituted a kind of visual "noise," disappeared from the corrected scan (Alač 2011: 154-155).

only of elements fulfilling representational functions, but also of the rules of manipulating these elements (Alač 2011: 41). A distinguishing characteristic of a diagram is that it retains a certain structure, which the designation has. After Peirce, Alač provides a map of a battlefield as an example of a diagram. Not only does the map visually resemble the represented area, but also it enables the strategist to perform certain manipulations. The strategist – no matter whether he knows the represented terrain or not – can stick pins into the map in order to mark the distribution of armed forces. The pins on the map remain in the same spatial relation with respect to one another as the forces in the field are – a certain geometrical structure is retained here. This fact facilitates cognitive embracing of the situation on the battlefield, creates conditions for foreseeing the development of incidents, and experimenting with represented relations. It is not difficult to imagine other iconic signs representing the battlefield that would not allow for such procedures. One such example might be pictures taken at any position on ground level – they would be only images, not diagrams. fMRI scans are diagrams in that they do not mirror the brain hidden in the skull as much as they represent it in such a format that, despite transformations, certain significant relations between areas and points are retained. The scans allow also for procedures similar to those that a strategist can perform on a map. This is one of the reasons why Alač describes scans as *fields of interaction*.

When discussing *Handling Digital Brains*, it is difficult not to refer to certain deficiencies of the book. The work contains a significant number of repetitions: certain statements recur in various chapters. While reading, one may have the impression that the book could be more "condensed": in the present form the work counts fewer than 200 pages, including the index, illustrations and transcripts. With better editing, it would be possible to find place for a larger number of suggestive examples in the work without increasing its size: other than provide a general discussion of laboratory practices, the author limits herself to in-depth analysis of only a few transcripts, which, together, amount to – as it seems – up to thirty minutes of interactions.

Another surprising feature of the book is the lack of references to embodiment and embodied cognition literature , which constitute a significant context for the author's considerations. The references section contains only a few contemporary overviews other than classic phenomenological works. It would have been good if the author had referred to a wider set of works, as she might have been able to find there some concepts that would have aided her in explaining cognitive functions of the procedures that the described scientists follow in their work. However, I assume that the author decided, following the example of ethnomethodologists, that a good description is the best explanation for the observed phenomena.

Since we have pointed out some shortcomings of the book, we can move on to the most important issues, that is the question how *Handling Digital Brains* should be read and why the book is worth reading at all.

Handling Digital Brains can be deemed an example of good old-fashioned ethnography of laboratory. In Poland, social studies of science or the anthropology of science are usually associated with time-consuming, meticulous field research, whose aim is to reconstruct or explain scientific practices. Thanks to the overviews that have been published in Poland, STS is automatically associated with reports from "classic" ethnographic research, carried out in laboratories by Karin Knorr Cetina (1981), Michael Lynch (1985), or Bruno Latour (Latour & Woolgar 1979)[221]. The aforementioned pioneer research has opened the way for further studies over science. Among contemporary ethnographic studies one can mention such texts as Doing 2009, Merz & Knorr-Cetina 1997, Mody 2001, Myers 2008, Roth 2005, Roth & Bowen 1999, 2001, Sims 2005, as well as Alač's own work. However, as Alač notes, the sense of the productivity of such research and excitation connected therewith have significantly weakened in the STS research community. It does not seem to be the trend typical only for the last years. It was already twenty years ago that such an attitude was described by Michael Lynch:

> Rather than undertake the difficult, time-consuming, and epistemologically suspects tasks of ethnography, many sociologists of science have preferred to take refuge in offices and libraries. There they can act as if they are observing "science in action" while engaging in more respectable academic pursuits: sifting through historical archives and secondary sources, composing scholarly syntheses of the diverse literatures in the sociology of science and related areas, and performing close textual analyses (Lynch 1993: 105)

This conclusion may seem surprising from the perspective of Polish science studies. However, we mostly encounter STS by the means of research results published in journals and presented during international conferences (and from such a standpoint ethnography may still appear as a lively research approach), and what Alač (and, earlier, Lynch) writes pertains to the organization of work and optimal paths of research career within STS, which a review of literature would not reveal.

It seems that at present there are no additional institutional incentives for researchers who engage into ethnography, while those doing field research are convinced that it is very difficult to write anything meaningful after

[221] Although the publication dates of these works were separated in time, in fact the three aforementioned books resulted from research carried out in similar time, in the late 1970s. Michael Lynch, whose book was released last, actually started anthropological research in laboratory a few months before Latour (see Latour 1986: 541).

Latour, Lynch and Knorr-Cetina. In such a situation, the appeal of other, less expensive (in terms of time or data generating effort) strategies of career development grows. One can go even further and risk a statement that a retreat from ethnographic research is a result of the general conviction that field research has fulfilled its historic role. If we take a look at Latour's field studies (including that at Boa Vista – Latour 1999: 24-79), it can be seen that it was subordinated to the achievement of certain philosophical goals, rather than strictly empirical ones. When entering a neuroendocrinology laboratory, Latour wanted to aid a certain philosophical approach, and he used the ethnographic materials from Boa Vista to reconceptualize an epistemological relation (and, again, make a contribution to epistemology rather than to anthropology or sociology). It is difficult to treat Lynch's *Art and Artifact in Laboratory Science* as a voice in a philosophical debate (Lynch 1985; see also Latour 1986), but Knorr-Cetina in her *Epistemic Cultures* (Knorr-Cetina 1999) does not hide such aspirations: although the publication can defend itself as an excellent empirical work, the Austrian researcher for a certain reason has made the criticism of philosophical thesis regarding the unity of science the core of her argument. Perhaps in the opinion of a large part of the STS community field research made sense as long as it provided arguments in the debate with the philosophy of science; however, now the debate is over, and thus ethnography may appear to many as useless. Perhaps it is only the enthnomethodologists represented by Lynch that did not allow themselves to be involved in the debates with philosophers; on the other hand, they did not declare that they were in a particular way interested in science as a particular subject of research.

Let us, however, go back to *Handling Digital Brains*. When describing Alač's work as good, old-fashioned ethnography, it should be kept in mind that the book is free from the burden of philosophical ambitions in the sense that it does not enter into epistemological debates. The work can be read in (at least) three ways.

The first, weakest reading consists in that Alač offers us another case study about science, thus paying "entrance fee" necessary to become considered a competent member of the STS community. Her book sends the message: I know the following body of works, I can design and conduct a study with the use of the tools I have mastered, finally, I can prepare a publishable report. In such a framing, the book should be considered simply decent, although I do not know if I would recommend it to people beyond a narrow group of specialists. Such a reading of *Handling Digital Brains* is, however, unauthorized for at least two reasons. The first is that Alač still conducts research such as that presented in the book[222], while the general tendency is for researchers

[222] With what success, the readers may see for themselves, reading the text "When a robot is social" (Alač 2013), published in this issue of *Avant*.

who have paid the "entrance fee" to abandon the toil of field research and devote themselves to activities more worthy of an academic, that is, analysis and synthesis of texts. Another reason is that in many places Alač points out how her work enriches the STS body of work.

The second possible reading is that *Handling Digital Brains* constitutes an *update*, or a supplementation of the existing studies on laboratory science. Alač's work disperses doubts: the classics of the ethnography of laboratory did not describe all possible research disciplines. As has been mentioned, there are few works that would focus on the role of modalities other than visual for scientific practice. Similarly, there are few works that show the significance of the embodiment of the researchers for the problem solving process in science[223]. It is worth to take Michael Lynch's *Art and Artifact in Laboratory Science*, that is the first of the classic, long term laboratory field studies, as a reference point that evidences the value of the book. Lynch also conducted observations in neurobiological laboratory, but the research practices described by him and Alač seem to be separated by centuries. In contrast to Alač, Lynch reconstructs works with representations from the age before personal computers have become common in science. Moreover, Lynch describes typically two dimensional representations, while Alač writes about representations that are partially three dimensional. It is worth noting that in a sense, Lynch reveals to the contemporary STS researchers practices that at present have been automatized with IT tools, and, thus, "black boxed". Significantly, in both Alač's and Lynch's accounts we can see the importance of situated, embodied research practices as meaningful factors in the process of solving scientific problems. Manual operations that we find in *Handling Digital Brains* which the researchers perform when gesturing in front of the computer so as to highlight certain transformations of the visual, or, possibly, "superimposing" handwritten notes on the computer image, bring to mind the procedures utilized by the researchers in the laboratory Lynch observed, when it was necessary to prepare an electron photograph, repeat a difficult experiment or calculate the ratio of certain neuronal surfaces shown in the picture[224]. Both books demonstrate that no technique is too trivial or prosaic if it facilitates scientific problem solving. Interestingly, both Alač and Lynch write about visualizations that are prepared in such a way that they code certain changes spread over

[223] Natasha Myers' "Molecular Embodiments and the Body-work of Modeling in Protein Crystallography" (Myers 2008) contains an interesting analysis that shows how scientists use their own bodies as a cognitive tool.

[224] The method referred to is termed *paper doll* in the laboratory (Lynch 1985). It consisted in the scientists cutting out the shape of a certain neuronal region pictured in a sketch with scissors rather than calculating its surface. They would then weigh the shape and, based on the weight of the clipping and the weight of the whole sheet of paper they could calculate the approximate surface of the area.

time (see Lynch 1986; cf. Abriszewski & Afeltowicz 2007). It is regrettable that Alač did not make Lynch's book a reference point for her narration.

A reading of Alač's book as a supplementation or an update of science studies works already makes it worth the attention of people interested in STS. There is, however, a third reading, as a result of which *Handling Digital Brains* should be read also by social researchers from beyond STS. The book can be seen as a challenge to cognitive sciences. Let us begin with the fact that although Alač does not state that as her aim, she *de facto* disenchants neuroscientific studies with the use of fMRI: she demonstrates the problematic aspect of the procedures of "gazing into the brain," which evoke sensation in the popular culture and public discourse and are considered "a mirror of nature." Not only does Alač reveal the areas of uncertainty and kludge-like methods of the researchers, the incredibly limited applicability of the used methods, lack of standardization and debates surrounding the techniques used, but, above all, she criticizes the specific understanding of embodiment in the fMRI experiments. Let us elaborate on this issue. In the 1990s – described as the decade of the brain (Alač 2011: 5) – cognitive neuroscience, equipped with the new technologies of neuroimaging, became the dominant approach to studying human mind and cognition, superseding the approaches collectively termed *cognitivism*, for which the analogy between a mind and a computer program was constitutive. The 1990s were also the decade during which the concepts of embodied cognition developed within cognitive science, assuming that in order to comprehend cognition, it is necessary to account for the interactions between cognitive processes, the body and its environment (some approaches included also the social world and the material culture). Such an approach means that if we want to understand cognition and the mind, we should not study brains in dishes or write AI programs, but study biologically embedded minds. It should be emphasized that when writing about the body, the cognitive scientists representing this approach did not mean solely the central nervous system. However, as Alač notes:

> The turn to embodiment, shaped by the availability and constraints of fMRI technology, presupposes an equation between the brain and the body; when talking about embodiment, cognitive neuroscientists refer to the brain (Alač 2011: 6).

It is worth asking the question what precisely is being studied during an fMRI experiment? The body of the subject must remain immobile (in order to achieve that, various devices are used, such as, for instance, a bite bar), and so we cannot study human mind while the body is moving, while taking part in multimodal social interactions: we can only study the subject's reactions to imagined movement or pictures representing bodies in movement, or possibly pictures of other people and their behaviour, displayed on a screen inside the

scanner. Generally, the conditions in the scanner make it difficult to study other modalities than the visual one.

Due to such limitations and a trivial approach to embodiment, which characterizes neurocognitive studies, Alač makes us wonder how neurocognitive studies could explain how neurocognitive scientists themselves solve research problems. Alač's book demonstrates that researchers using the fMRI technology during experiments and data interpretation solve problems by the means of actions radically different from those that are studied during experimental sessions in the scanner. When analyzing scans, they do not only look at the objects on the screen, but manipulate them, they do not work only on internal mental models, but also on a number of external representations, they utilize various material objects, including their own bodies, and, finally, they enter into rich, multimodal interactions with other researchers (see Alač 2011: 164). It can be said that ethnography of laboratory of cognitive neuroscience enforces a significant change in approaching the method of research, and of framing mind and cognition. Alač's book can be treated not as much a work on the subject of processes of communication or problem solving in a specific field of science, but, more generally, as a work on the subject of communication and problem solving by humans, no matter whether these problems are scientific, technical, bureaucratic, literary, or related to engineering or craftsmanship, etc. One can attempt to apply what Alač shows to many other human practices that involve working with digital visualizations displayed on screens and making use of a rich spectrum of "semiotic resources." This makes her work similar to *Art and Artifact in Laboratory Science*, in which Lynch does not deal with the practices of neurobiologists in order to say something about science, but, rather, he treats the laboratory and neurobiologists as any other workshop and craftsmen working therein. As Latour summed it up, Lynch could be just as well analyzing the practices of butchers, bankers, judges, social workers or grocers (Latour 1986: 542). The same thing pertains to Alač's work.

The herein described challenge to the cognitive neuroscience is significant due to the fact that at present studies are entering the areas traditionally belonging to social researchers. When Alač was finishing her work on *Handling Digital Brains*, fMRI technique was beginning to be used in order to answer some questions in the field of social sciences. This was connected with the development of two research fields: social neuroscience and neuroeconomy, whose aim is to attempt to reduce the decision-making processes and social behaviours to neuronal processes. *Handling Digital Brains* appears at an appropriate time, as it undermines the assumptions on which both aforementioned subfields of science are founded: the assumption that cognition is an internal process and the statement that embodiment comes down to the brain.

It is at this point that Alač's book leaves the reader with a certain feeling of dissatisfaction: it does not open a front line between STS and neurocognitive studies. It does not offer a suggestion for approaching cognitive processes that would be extensive and alternative to the ideas of neuroscience as much as it refers to a certain set of positions and demonstrates time-consuming methods by the means of which one could study embodied, collective cognitive processes. It is worth confronting Alač's work with another of similar structure, that is Edwin Hutchins' *Cognition in the Wild* (Hutchins 1995). He starts with an analysis of a specific set of cognitive practices – maritime navigation – to move on to formulate a new general conception of cognitive processes, commonly known as distributed cognition, and, thus, poses a challenge to almost the entirety of cognitive science of his times. We will not find traces of such ambitions on the 199 pages of Alač's book. It seems that her analyses (conducted partially in cooperation with Hutchins himself; see Alač & Hutchins 2004) constitute a starting point for considerations that could result in an interesting theoretical approach. However, that is a problematic objection, if the researcher herself does not hide her attachment to ethnomethodology: a research approach that puts emphasis on detailed analyses of practices that are specific, situated, local, event-driven, that avoids any attempts at generalization, questioning the possibility of saying something about science as such or society in general.

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