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Taking a Good Look at Why Scientific Images Don't Speak for Themselves

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JOSEPH DUMIT, *Picturing Personhood: Brain Scans and Biomedical Identity*. Princeton, NJ: Princeton University Press, 2004. 272 pp. ISBN 069111398X (pbk).

FELICE FRANKEL, *Envisioning Science: The Design and Craft of the Science Image*. Cambridge, MA: MIT Press, 2002. 335 pp. ISBN 0262562057 (hbk).

PAUL MATTHEWS & JEFFREY MCQUAIN, *The Bard on the Brain: Understanding the Mind through the Art of Shakespeare and the Science of Brain Imaging*. New York: The Dana Press, 2003. 192 pp. ISBN 0972383026 (hbk).

ABSTRACT. This review focuses on what scientific images can do, by considering three books in which they are central. We problematize the assumption that images can simply show and that the viewer can simply see what is at hand. Images are neither self-explanatory nor transparent, but rather partake in a specific visual culture. If they are to serve as bridges (e.g. to popularize scientific results), then they are only effective insofar as cultural conventions are shared. Felice Frankel's how-to book demonstrates the complexity of making photographs transparent, while keeping these processes backstage. Joseph Dumit's anthropological analysis of brain scans focuses on tensions between uses of scans inside and outside the lab. In Matthews and McQuain's book, pairings of scans with Shakespearean

theatre stand in for neuroscientific and artistic approaches to human nature. The attempt to join these very different spheres shows the dangers of going beyond shared understandings of visual material.

KEY WORDS: brain, mediation, objectivity, representation, visualization

While scholars have decreed that the internet textualizes social relations to the extreme, others have highlighted the visual character of digital media. The sciences are also noting a renewed interest in the visual, in relation to digital technologies and electronic networks that carry these images. This renewed interest in digital images is partly due to their appeal as objective representations, but also to the particular possibilities for circulation, transformation and manipulation of digital media. Modelling is but one area where digital representations have contributed to the attractiveness of this approach, only to be helped in turn by massive investments in the development of informatics to sustain the manipulation of data for visualization purposes. The argument is also made that digital representations are particularly well suited to the integration of information from different sources. Biodiversity maps or atlases that integrate geographical, historical, economic and social information are well-known examples.

Indeed, with the help of user-friendly tools and a minimum of effort, it would seem that one's science can be enhanced with gorgeous images—as beautiful and engaging as they are accurate and precise. Images are purportedly the perfect means with which to cross interdisciplinary boundaries, the chasm between science and the arts, and between specialists and a lay public.

In our discussion of three volumes, we propose to zoom in on this supposed functionality of images, from three very different angles. Images, whether labelled analogue or digital, are not so straightforward. By tracing the production of images, we will consider how images are not so much unequivocal as they are carefully honed. We will show that the objectivity of these images is also the result of craft on the part of the makers, rather than an essential quality of these images. By drawing attention to this issue, from three different angles, we hope to sketch the importance of the contextual understanding of scientific visual culture. We further elaborate on the need to interrogate scientific images in this sense, given the importance of socio-cultural contexts for the proper configuration of viewers of these images. This is a point which will seem all the more urgent, once we have shown the high hopes of 'bridge-building' that are hoisted on these representations.

An Image of Objectivity

Envisioning Science is intended as a how-to book by science photographer Felice Frankel. Its aim is to guide scientists in the production of effective photography of their research objects. Practicing scientists, the book argues,

stand to benefit from better images of their work. By improving the visual presentation of their work, scientists, the book claims, can then better reach a broader public, composed of colleagues from other fields, journal editors, policy-makers and lay people. Frankel, Fellow of the American Association for the Advancement of Science (AAAS) and currently working as a researcher at MIT, guides the reader through a series of chapters that address the production of beautiful images. She uses several examples from her work (often featured on the covers of *Science* and *Nature*), and demonstrates the step-by-step process of image creation. She also shows how small variations in each step can alter the image, making it more or less successful.

Throughout, Frankel insists that good images can only arise from good science. She sees photos as an important element in a scientific argument. 'Including more than one sample in a single image ... contributes to the aesthetic appeal of your image through repetition, and also implies that your scientific results can be replicated' (p. 85). Again and again, she decrees that her readers must not depart from reality in their photos—manipulating photos, or improving them, is cheating. Indeed, Frankel hesitates to take on words like 'artistic' in her discourse. At the same time, she also argues for the existence of 'expertise' and individuality in making images:

If your scanning electron microscope comes with coloring software, don't always use the default color palette. Your images should not look like those of your colleagues; you should control the appearance of your image, not the computer scientist who created the algorithms. (p. 29)

These values of authenticity, virtuosity and individuality are typical of traditional discourses around artistic creation. At the heart of this book is therefore a tension between the transparency of images demanded by scientific realism and the expertise that the book is supposed to help scientists acquire.

This tension is played out in a number of ways. While images are to do no more than convey objective information, Frankel also speaks of the 'x-factor' of good photos, showing pairs of successful/disappointing images. Furthermore, she motivates the reader to improve his or her skills, by insisting that good photographs can be the way to obtain lots of attention for one's work, and bring one's results beyond the article, and onto the cover of the journal. These photos can also help in 'popularization' and even in obtaining grants.

Yet Frankel insists on the primacy of objectivity, on the role of photos as representations of reality. But in order for the photographed objects to speak for themselves, much expertise must be deployed. To give but one example, the setting in which they are photographed must itself be the object of a careful *mise-en-scène* (see Figure 1). All traces of the use of cameras or lighting must be erased, so that no shadows or reflections betray the presence of the photographer and his or her technologies of representation. Indeed, this book is so filled with these kinds of instructions that they reveal, as much as the end result means to hide, the arduous construction of photographic transparency.



FIGURE 1. Magnoferic fluid, by Felice Frankel. This image was used widely, including in a science education campaign. The book demonstrates how the use of a mundane yellow post-it as background revealed the beauty of this sample.

If photographs are so convincing, it is because of their assumed immediacy (de Rijcke, in press). Yet Frankel's book gives the lie to this claim of lack of mediation by showing the series of decisions and procedures that go into making this immediacy and transparency. Nevertheless, the book remains an engaging account of photography, if one that is heavily invested in objectification—just like the natural and life sciences to which it is addressed.

Snapshots of the Brain

Beyond these objects that live in laboratories, there is a clear trend towards the objectification in representations of other types of concerns for science. Entire experiments, or even human behaviours and 'types', have also become increasingly present as visual manifestations. A well-known case is the American anti-drug campaign from the late 1990s, which showed two hemispheres, presented as brains with and without drugs, under the label 'plain brain/brain after ecstasy'.

It was presented as a photo, a snapshot witnessing the condition of the brain at a moment in time. The twin images clearly invoked the 'before' and 'after' photos we are used to seeing (see also Beaulieu, 2000; Dumit, 1994). We are invited to read the images as though they followed the conventions of photography. Yet the images invoked positron emission tomography (PET) scans, which are far from resembling the immediacy of the snapshot invoked in the campaign poster.

By collapsing these two different modes of representation, this further hides the process of representation, and that these scans are the result of very different processes than photographic ones.

In the production of a PET scan, researchers use a small amount of radioactive material in the blood-stream of a subject. This material (tracer) can be detected by the scanner, so that for 10 to 40 minutes (depending on the tracer), various metabolic activity can be traced in the brain. These measurements involve the use of models to calculate the decay of radioactivity, algorithms to reconstruct the spatial origin of the signal produced by the tracer and to correct for 'noise' detected by the scanner. By getting the subject to perform various tasks while in the scanner, patterns of activity can be related to the traces of metabolic activity detected, as averaged over groups of subjects. Various types of correlations and comparisons are involved in these associations of patterns of activity in the brain and tasks performed. Clearly, even this sketchy description indicates that scans are different in many ways from the common notion of the photographic snapshot. Scans are the result of statistical manipulations performed on complex measurements. As such, they are the prerogative of teams of neuroscientists, radiographers, physicists, cognitive psychologists and mathematicians in high-tech laboratories, who pool their expertise to make sense of these scans. But, much along the lines argued and demonstrated by Felice Frankel, this context of the subject's body, of the lab and of this high-tech expertise is removed in any concrete sense. It is at best evoked, and what remains are rainbow colours superimposed on a floating brain. If this anti-drugs poster is an example of the removal of technological and media context, this is but the beginning of the travels on which brain scans can embark, as we will discuss in relation to *The Bard on the Brain*.

There is more at play in the use of these images than correct application or senseless misrepresentation. The complex cultural web that subtends the generation, circulation and veneration of these images is the subject of *Picturing Personhood*, in which the American cultural anthropologist Joseph Dumit problematizes the strategies of objectification that subtend brain scans. Dumit describes the social issues that arise through the routine presentation of scientific brain scans as 'snapshots' of the brain in action, and the concomitant adumbration of the set of procedures necessary to create a scan. To build his argument, Dumit embraces the brain scan as an historical, experimental, popular, mediatized and clinical object, and provides valuable insights into each of these understandings. Throughout these discussions of brain scans, Dumit takes issue with the association made between brain scans and types of people. The centrality of the critique of this collapse, between human sorts and representations, is illustrated in the cover illustration, which he created from 'real' scans obtained in the lab (Figure 2). Dumit's pastiche evokes the illustration that has become iconic of brain imaging studies and the labelling of scans as indicative of types, while collapsing the purported differences (all scans are visually similar) and the typologies used (the labels used by Dumit are both idiosyncratic and reflexive).

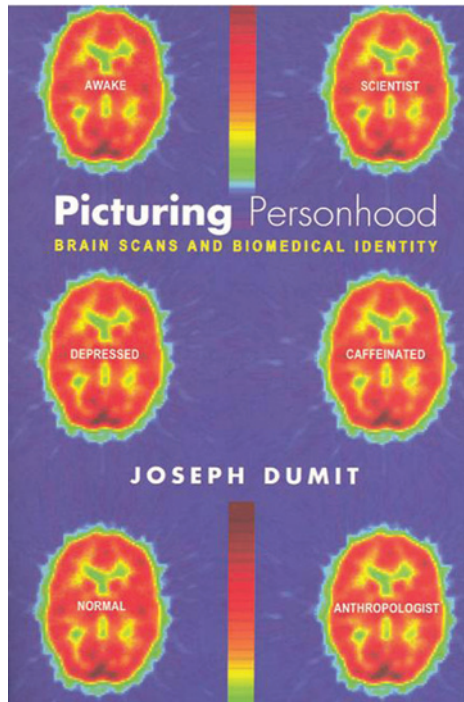


FIGURE 2. The cover of *Picturing Personhood*: the brain scans are labelled with various 'types' (awake, scientist, depressed, caffeinated, normal, anthropologist), while the rainbow stripes purport to provide us with the key to decoding these activations.

Dumit offers up his critical analysis of the creation of PET scans as a counterweight to their indiscriminate circulation, as a qualification to the powerful presence of scans as snapshots, in debates about types of persons. His book explicates the impact of these scans by showing the relations created between types of persons and contrasting images.

The book's broad-ranging first section explores the assumptions built into neuroscientific and psychological experiments. Dumit also juxtaposes three versions of the development of PET, thereby problematizing any claims to a foundational moment in the development of this technique and of its application. Dumit uses this lack of a basis to sow doubt in the mind of the reader, who should then find it hard to believe that unequivocal meanings can be attributed to these scans, following such uncertain origins of the technique. The scene is therefore set for Dumit's interrogation of the relation between the divergence in views on practices around PET scans and what they represent, and the presentation of these scans as univocal statements about behaviours and conditions.

Dumit attributes the power of scans to the presentation of pairs of images (subject with eyes closed and subject with eyes open), a strategy that sets up a visual rhetoric that highlights difference. This strategy is used to present functions, such as sight, but also serves as a proof that the difference between conditions (healthy subject vs. patient with schizophrenia) is visible in the brain.

The researchers interviewed by Dumit do not see this labelling as problematic. They are fully aware, and all too happy to explain, that the scans are not snapshots and that significant expertise is needed to understand the meaning of the scans. When pressed by Dumit, they will also problematize the contrasting pairs of images they present: extremes are usually selected to emphasize the point, they say, but there are also 'normals' who look like 'depressed'. Dumit posits that this strategy is loaded with consequences as these images are presented to non-experts. When extreme cases are presented, and types of people come to be associated with types of brains via these scans, important shifts in the understanding of these conditions are set in motion. These shifts may be towards a greater stigmatization of patients, but may also have positive consequences, where patients distinguish a subjective self from an objective brain that is visibly malfunctioning.

In another chapter Dumit is less nuanced. His analysis of scans in American courts of law emphasizes the possible dangers of the greater circulation of scans, which risk losing their layered meaning. How can a jury consider PET scans, wonders Dumit, when even experts have difficulties disambiguating their meanings? Dumit's worries are also, admittedly, fed by his own response to these seductive scans. Again, this leads him to argue for care and awareness in the choice of images, the aesthetic of colour palettes chosen and the contexts of presentation. This focus is in some ways very close to the points of attention identified by Frankel. What distinguishes them is the shift in reflexivity, scale and implications. Whereas Frankel addresses the scientist as practising scholar whose chief need is to communicate his or her science, Dumit's exploration is effectively a call for recognition of the social and cultural implications of these decisions about images, and for the involvement of experts in such consequences—anthropologists among others. This call has been recognized as crucial by a number of constituencies across the sciences and humanities, as evidenced by the awards garnered by the book (winner of the 2005 Diana Forsythe Prize from the American Anthropological Association and of the Rachel Carson Prize 2006 from the Society for Social Studies of Science) and the prompt review of the book in *Science* upon its publication (Kevles, 2004).

The Brain as a Cultural Object

Picturing Personhood is a timely book, since we seem to be reaching the heights of the circulation of brain scans as visual icons. They abound in neuroscience,

heralding new developments for a wider and wider public. Books in this trend have been appearing every few years for two decades: beginning with *Images of Mind*, sponsored by *Scientific American* in 1994 (Posner & Raichle, 1997; Raichle, 1994), *Mapping the Mind* (Carter, 1998), *Phantoms in the Brain* (Ramachandran & Blakeslee, 1998) and *The Executive Brain* (Goldberg, 2001), to name but the most popular. We focus here on Paul Matthews and Jeffrey McQuain's *The Bard on the Brain*.

If images for Frankel are objects produced by a given scientist to convey a specific result, this book posits brain scans foremost as cultural objects, humanistic testimonies to art and life itself. As the title hints, this book takes the coupling of Shakespeare and imaging neuroscience as narrative device. It links these in each section, by presenting an excerpt of a play and a brain imaging study. Why use Shakespeare in a work that is meant to popularize science? Why use brain scans to discuss the work of Shakespeare? The authors link Shakespearean drama to contemporary neuroscience through their shared object: that which makes us human. Just as Shakespeare could convey the depth of despair, the heights of love and the darkness of guilt through theatre representations, cognitive neuroscientists are able to evoke these human experiences and represent them in colourful scans.

Clearly, such a juxtaposition neglects countless cultural and historical boundaries, and collapses categories that may be even further apart than brain scans and kinds of persons. These collapses are effected in a number of ways: the association of one brain activation with one passage from a play, or the one-to-one matching of a photographic shot of actors on stage, and a framed set of floating brains. Furthermore, in *The Bard on the Brain*, Shakespeare's texts take on a literality that is at times extreme. It is fascinating to witness the way the authors posit that the very phenomenology of seeing a Shakespearean performance can also be cast in terms of localizable areas in the brain: 'Although he would not have been aware of it, Shakespeare's choice of plots, literary techniques and statecraft all manipulate activities in this region of the brain of his audience' (p. 156). Though this case is noteworthy because extreme, the recasting of phenomena in terms of the brain is not unique. Childcare, drug addiction, learning and gender differences have all been the subject of accounts that position these activities in relation to the brain (Beaulieu, 2003).

Last but not least, historians will worry that the book lacks any analysis of theories of brain function in 17th-century England. The reader should be informed that the cortex was not ascribed any function in Shakespeare's day, that the ventricles were the seat of the soul, and that when Shakespeare referred to the brain, this meant something completely different than when we do so nowadays. Besides, the link between behavioural symptoms and changes in the brain did not exist until Thomas Willis wrote *Cerebri Anatome* in 1664 (de Rijcke, 2006). Yet, beyond these anachronisms, this book testifies to the investments made in visual culture, and to the aspirations of Matthews and

McQuain to bridge any distance between the approaches of neuroscientists to those of the theatre via this visual material.

Building Bridges

In *The Bard on the Brain*, photographs of actors on a stage and experimental digital scans are made into two sides of the same coin, as two representations of human nature. For Matthews and McQuain, the pairs of images that matter are those of the theatre and those of the scanner. The book aims to reach an audience that may be more artistically than scientifically inclined, and to do so via the visual representations that can bind these two cultures, and gain a new audience for neuroscience.

The Bard on the Brain, like the two other volumes discussed here, calls into question for us both the value of building these bridges, ‘à coup d’images’, and the cost associated with the crafting of such bold rhetoric. While scientists may seek to build bridges between disciplines, between past and future, between art and science, and between the laboratory and the public sphere, these images do not maintain their meaning across all these contexts. If images are to be successful as bridges, this success depends on the circulation of representational conventions, which are always only ever partially determinant (van Dijck, 2005). Brain scans may be claimed to seduce, to show the brain in action, but by presenting these images as attractive snapshots, the qualifications on their meaning originating from their context of production are also lost and the conditions of their reception are assumed.

It is also striking that all three books deploy the strategy of using pairs of images (good/bad photographs, sick/healthy brains, artistic/scientific images). This visual presentation invites the viewer to behold and judge, to compare and contrast the evidence, and thereby reify what it means to be an observer of scientific images. All three publications highlight a different aspect of the prevalence of the role given to visual material in doing and communicating science. Juxtaposed, this trilogy points to the complexity of current visual culture—specialized but popular, universal but meaningful to individuals’ lives. They affirm the relation between aesthetics and empiricism, a relation too often denied, and increasingly in need of scholarly attention.

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