Book Review

Magnetic Appeal: MRI and the Myth of Transparency
by Kelly A. Joyce
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The cultural and clinical dominance of magnetic resonance imaging (MRI) is thoroughly troubled in *Magnetic Appeal: MRI and the Myth of Transparency*, a skillful investigation into what has arguably become the most important and pervasive biomedical imaging technology of the 21st century. Based on seven years of archival and field research, author Kelly Joyce offers a fascinating and expansive ethnography of MRI users (both practitioners and patients) that questions how and why MRI has come to symbolize a window-into-the-body and subsequent expectations of its ability to reveal objective truth about bodies, health and illness. Questioning both the substance and the appeal of 'the magnet', Joyce's work represents a substantive contribution to feminist STS studies of imaging technologies against the backdrop of biomedicalization (Clarke et al., 2003). Though Joyce is not opposed to MRI in any kind of fundamental sense, this book (her first) promotes a critical stance toward MRI and its pictures of the human body. Indeed, she concludes: 'The promise of visibility is, perhaps, not as remarkable as it has been made to appear' (p. 165).

Joyce's project is situated within and contributes to at least two major and intersecting literatures: Adele Clarke and her students' feminist, ethnographic explorations of the shifting politics of health, illness and technology in the United States; and the diverse STS work on visualization, which is exemplified by scholars such as Joseph Dumit (2004). Transformations in medical imaging are an integral part of what Clarke et al. (2003) have called 'biomedicalization', which captures the multidimensional ways in which technology and science (i.e. 'technoscience') have transformed medicine in the United States and in the global marketplace of healthcare. MRI, like positron emission topography (PET) and other emergent imaging strategies, is a quintessential example of biomedicalization, because it relies on advanced technoscience; is produced and consumed in the stratified, late-capitalist 'Biomedical TechnoService Complex, Inc.'; and is used not only to

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diagnose illness, but to symbolize and promote normative concepts of healthy bodies and identities (p. 110). MRI, as Joyce argues, is as much a biomedical commodity – one that signifies access to high-quality healthcare – as it is a diagnostic tool. If the x-ray was the visual apparatus of medicalization, then MRI is the tool *du jour* of biomedicalization: the new frontier of technoscientific sight.

As Joyce explains, the biomedical turn toward visualization is representative of the more general cultural turn toward visualization in the latter part of the 20th century that others have chronicled in visual culture studies (Mirzoeff, 1998; Sturken and Cartwright, 2001); feminist critiques of biomedicine (Haraway, 1988, 1997; Balsamo, 1998); and across the field of STS. Whereas much STS and medical sociology research has focused on the patients and consumers of technoscience, the domain of imaging technologies offers a fruitful opportunity to open up the concept of 'users' to include, as Joyce describes, 'the professionals who create, interpret, and use MRI scans' (p. 15). Joyce asserts that MRI is a technoscientific manifestation of Foucault's (1975) 'clinical gaze'; accordingly, attention must be paid both to its consequences for patients and to the ways in which otherwise invisible practices in laboratories, research communities and examination rooms are productive of ideas about healthy, 'normal' bodies, and assumptions and cultural expectations about MRI images to be able to access those bodies (pp. 8–9).

It turns out, however, that how we talk about MRI has little to do with what MRI actually is. Through archival research into the history of the technology, as well as personal interviews with the creators of MRI, Joyce crafts a critical genealogy of nuclear magnetic resonance (NMR) that reveals how a line of research in nuclear physics became the proverbial cameraphone of contemporary biomedicine. Drs Paul Lauterbur and Peter Mansfield were awarded the Nobel Prize in 2003 for developing MRI technology, but their contributions can be traced back to research that began early in the 1930s when physicist Isidor Rabi developed the concept of NMR, which 'describes how nuclei of atoms absorb and release energy in response to specific frequencies when placed in a magnetic field' (p. 25). The ability to detect and measure these atomic responses evolved over decades and was motivated by some scientists' personal and professional interests in the application of this measurement technique to the human body. Throughout the 1970s, Lauterbur, Mansfield and others independently worked to apply NMR clinically, and their work was shaped (literally, funded) by cultural contexts in which curing cancer was a national priority of Nixon's United States. Scientists soon discovered that cancerous and non-cancerous cells sometimes have distinct properties that can be assessed by NMR. It was Lauterbur, a chemist, who first thought to transform the numerical data produced by NMR readings into visual form; Joyce attributes this decision to his 'professional vision', which refers to the disciplinary practices of chemistry and its emphasis on visual representation of data and other forms of chemical information (p. 32). Unlike x-rays, but similar to ultrasound, NMR did not involve any camera or lens. Lauterbur's proposed name for this visualization technology was 'zuegmatography', from the Greek word *zeugma*, which means 'that which is used for joining' (p. 33).

Most scientists rejected the name *zeugmatography*, continued to use 'NMR' and published their findings as both an array of numbers and an anatomical image. These early images, explicitly acknowledged by scientists as thoroughly *produced* representations of otherwise numerical data sets, were initially color-coded and reflected the influence of Warhol and Lichtenstein on 1970s American and British

aesthetics. By the end of the 1970s, according to Joyce, *NMR imaging* was the standardized name for the technology, which produced both numerical arrays and multicolor images that represented the human body. Excitement over the imaging component of NMR ultimately resulted in the technology's location in radiology departments, because of radiology's emphasis on the interpretation of images (as opposed to numbers). Joyce argues that radiologists had a profound influence on the ongoing development of NMR. Radiologists were trained to analyze black and white images, so the practice of producing multicolor NMR images stopped. Perhaps most importantly, the output of numerical data from NMR machines ceased, because radiologists were completely unconcerned with anything but images. Ultimately, public concern (even fear and hysteria) over any and all nuclear technology resulted in the American College of Radiology's decision to adopt the term *magnetic resonance imaging* or *MRI* in the 1980s. With that linguistic shift, the stage was set for the full-scale deployment of MRI throughout US healthcare, and the consuming public welcomed it with open arms – and eyes and wallets.

MRI pictures carry immense cultural power in part because of their sheer visual appeal. In Joyce's interviews with radiologists and technologists who produce these images in their everyday professional lives, people frequently described the images as magical and mesmerizing. The so-called magical properties of MRI are derived from its ability to access the body without breaking the skin, according to Joyce, even though MRI causes temporary atomic changes within the body. Similarly, journalists and science writers began to revere MRI as soon as it became part of the public imaginary in the 1980s. In analyzing popular media texts, science exhibits and textbooks, Joyce found three rhetorical tropes that constitute the discourse of MRI: (1) MRI reveals the body and produces health; (2) MRI is superior to other technologies; and (3) MRI is portrayed as an agent that both speaks and acts. This rhetoric is not reflective of the science behind MRI or the substance of its products, i.e. the images. 'The images do not *reveal* the inner body, but instead *produce* the body, bringing together aspects of physical bodies, technology, and cultural, social, and economics factors in ways that both include and exceed the physical body', explains Joyce (p. 48). Consequently, popular knowledge about MRI equates these images alone with the truth about the body, despite physicians', researchers' and technologists' knowledge to the contrary.

Joyce's multi-sited ethnography, which includes in-depth interviews with 48 technologists and radiologists at three MRI units in the north-east United States, explains how producing an MRI is not a perfect or objective process. Multiple human actors, including patients, referring physicians, technologists and radiologists, play significant roles in the production of knowledge that makes the images meaningful. Technologists actually perform MRI scans and help patients physically and emotionally negotiate intimidating machines that are typically confining, loud and dangerous: the magnet within MRI machines sounds like a freight train when in operation, and can turn many common forms of metal into projectiles. Software translates the numbers produced by MRI machines into pictures; the machines are hardware created by companies such as Siemens and GE. A radiologist analyzes the image, and he or she then prepares a report for the original referring physician, who develops a treatment plan if one is deemed necessary. The interpretation of images is a highly subjective process that is informed by patient history, image quality and the radiologist's training and expertise. The presence of

artifacts ('forms or shapes that appear in an image … and are not perceived as useful for understanding the condition of the body') and UBOs ('unidentified bright objects') may distort the reading of an image (pp. 62–3). These social *practices* are embedded in the creation of the images, but must remain hidden and invisible for the absolute authority of MRI to be sustained, according to Joyce. Interestingly, technologists and physicians are generally complacent regarding the production of the MRI as agent of objective truth, which Joyce links to a pervasive fear of malpractice litigation in the medical community. In other words, it is perceived as easier to blame a machine than the physician if the machine is the one supposedly producing the image.

Additional field research at the Radiological Society of North America's (RSNA) annual meeting helps Joyce situate MRI within the political economy of biomedicine, though her cultural and economic focus is primarily isolated within the United States. Her description of RSNA's mega-summit in Chicago, Illinois, paints a picture of the annual meeting as a kind of frenetic auto show, with MRI manufacturers hawking the newest – and presumably *best* – models to radiologists from around the world. Free lunches and networking abound in the conference of over 60,000 people, effectively creating a capitalist marketplace with material influence on consumer-patient experiences with MRI in their local communities. The multibillion-dollar industry of MRI offers huge financial incentives both to producers of MRI machines and the physicians who use them. Radiologists are among the very top-paid physicians in the United States, with a full-time salary range of anywhere from $150,000 to $800,000 (p. 98). Predictably, the capitalization of MRI means an increasing emphasis on productivity in hospital-based and private MRI units, which are expected to churn out images as quickly as possible. Joyce offers intricate details about how pressures to produce vast quantities of images shapes daily life in the 'image factory', and how some radiologists and technologists think this may negatively affect patient care.

Readers may find themselves waiting for Joyce's big reveal: the moment when she finally exposes the vast conspiracy behind MRI and the secret, apocalyptic danger of 'the magnet'. Joyce does satisfactorily discuss some potential health ramifications of MRI machines and the differential access to MRI that is framed by intersecting dimensions of identity, such as race, class, gender and age. Her explication of how MRI is often not the 'best [diagnostic] tool for the job' is informative and illustrative of some over-dependence on MRI, particularly in cases when a more thorough clinical exam could have identified the patient's problem. Ultimately, however, there is no shocking revelation, per se. Though some people are beginning to purchase elective MRI scans in shopping malls in Florida, such practices are not common. There is a social class-based rift between radiologists and technologists, but it sounds quite similar to the relationships between doctors and nurses in most hospitals. This was one topic that could have been explored with a more explicitly feminist lens; I was left wondering how gender, race and class co-constitute radiologist–technologist relations, and how members of marginalized identity groups negotiate the social politics of the MRI unit.

The book is at its best when Joyce is interpreting the social practices that constitute MRI, and the cultural and biomedical implications of the technology. The concluding chapter is exemplary of her skills as a social theorist and critic. As the book title indicates, the target of Joyce's critique is the 'myth of transparency', which she constructs as the power that MRI holds within radiology departments,

the healthcare industry, popular culture and the doctor's office. By the conclusion of *Magnetic Appeal*, such a myth is left in a shambles. Just as I felt when first exposed to Joyce's work on MRI in her 2005 article from *Social Studies of Science*, I left this book unsettled and impressed. By taking such an uncontroversial topic and asking the relatively simple question of how this technology came to be, Joyce has uncovered a fascinating biomedical phenomenon. Joyce transforms the MRI machine from static technology to dynamic practice, and the MRI image from 'Truth' to meanings. In turn, she has contributed to an important conversation on the role of medical imaging in biomedicalization *and* everyday life, which are increasingly one and the same.

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