Remaking the Human Body:
Biomedical Imaging Technologies, Professional and Lay Visions

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Research summary

Technologies of visualization have a number of applications in the contemporary world, and biomedicine is a key discipline characterized by intensely visual practices. Biomedical imaging technologies transform the inner body into an array of images. As the literature on the development and stabilization of biomedical imaging technologies has illustrated, imaging processes emerge from interactions among relevant professional and non-professional groups, interpretations of data, and organizational practices. Biomedical images are situated, contingent, mediated, and strategically framed representations of the body. To produce reliable images through visual tools, biomedical staff need to develop a professional vision: a process involving learning, practising, and training eyes through direct experience. These images are used in communication with patients and then travel throughout the social world contributing to a changing understanding of what the body is and how it works. However, the relations between new visual tools, professional and lay visions remains underexplored.

Exploring the case of IVF (In Vitro Fertilization) imaging technologies, this project investigates the production of biomedical images at the interface of scientific, organizational and social practices. The innovative contribution of this study is an integrative approach (based on a simultaneous analysis of artefacts, practices and images) to understanding how biomedical imaging technologies and the development of professional and lay visions are involved in changing conceptions of the body.

Research project

Forms of representation such as diagrams, graphs and pictures have always been central to scientific and medical practice. Images, especially, seem to be particularly potent for communicating ideas easily to a broader professional and non-professional community. Images, in fact, allow complex forms of knowledge to travel among diverse scientific and medical specialities, seemingly without the need to develop professional skills. This is particularly relevant in the field of biomedicine where images travel across diverse medical sectors from bench to bedside and back again, and in the process interact with a number of professional and lay actors. The contribution of this project is to focus on the shift from bench to monitor in order to explore the role of new visual tools in the development of professional and lay visions and vice versa. Although biomedical imaging is one of the fastest growing areas within medicine at present, many questions remain underexplored. For example, are professional visions enhanced/developed with the introduction of new visual tools or do they become less important in diagnostic terms? Do new visual tools foster forms of deskilling among medical professionals? How does the attention to images affect patients and lay visions more broadly?

This investigation is particularly timely as it contributes to the exploration of the sociotechnical turn toward visualization in biomedicine (Joyce, 2006). The literature on the development of medical imaging technologies (see, for example, Yoxen, 1987; Pasveer,

1989; Joyce, 2006; Alac, 2008) shows how the stabilization of particular visual tools emerge from interactions among relevant social groups, interpretations of data, and organizational practices. Biomedical imaging innovations emerge from social interactions in situated cultural settings, where elements such as public perceived utility of the innovation, scientific interests, access to resources, professional authority, and institutional relations all participate to the co-production of the artefact developed.

Moreover, the development and stabilization of these artefacts does not explain how these new tools are used in actual professional and organizational practices. Biomedical imaging, in fact, includes both an image production phase and the uses and circulations of images among professional and non-professional networks. Some authors (Burri and Dumit, 2008) propose an analytical distinction in the study of scientific imaging: production, engagement and deployment. The study of image production deals with how and by whom an image is made (p. 302), while studying engagement means focusing on how images are used in the course of scientific work and are made instrumental in the production of scientific knowledge (p. 302). Finally, the study of deployment refers to the analysis of how images leave their production sites and travel to non-academic environments, i.e. the social world. Focusing on the field of social studies of biomedicine, these three phases have been studied separately and from different perspectives and disciplines in the literature. Image production has been explored through ethnographic research in biomedical laboratories and hospital wards (for example, Prasad, 2005; Alac, 2008; Burri, 2008). Several studies have shown the situated complexity of producing images, i.e. the importance of context in constituting their meanings and the invisible work done by researchers to produce authoritative images (de Rijcke and Beaulieu, 2014). Recent studies on image engagement (for example, Beaulieu, 2002; Roepstorff, 2009; Beaulieu et al., 2012) have explored the work that goes into presenting images as visual evidence. Once images become part of a body of knowledge, they can be used to diffuse and stabilize the knowledge and theoretical concepts it represents, although ethnographies of visual practices in biomedicine suggest that seeing is a culturally and socially situated phenomenon (see for instance, Saunders, 2010). Finally, the literature on the exploration of image deployment (see, for example, Jasanoff, 1988; Cartwright, 1995; Lie, 2012), mainly rooted in feminist and cultural studies, has shown how the spread of visual displays and representations in science communication crosses the boundaries of the scientific community and reaches, most often through the media, audiences of non-experts.

The complex relations between image production, engagement and deployment have only been marginally examined by previous studies. An exploration of these three phases in biomedical imaging is particularly relevant, as it offers a comprehensive understanding of that imaging in relation with the development of professional visions. Moreover, the mutual shaping of professional and lay visions is underexplored and it is timely and important to explore this relation and its consequences. Answering these questions can foster a mutual understanding between medical professionals and lay people, supporting informed debate and enabling public perspectives to inform policy and practice in biomedical science. Placing biomedical imaging within a cultural, social, political and organizational context, this project engages with significant questions related to the current understanding of the human body for both professionals and lay people.

In particular, to explore how technological, organizational and social aspects are entangled in changing conceptions of the body, this project will explore the case of IVF imaging technologies.

The field of reproductive medicine has been a prime example of how visual technologies (such as ultrasound) have had a central role in the changing understanding of the pregnant body and in the public perception of the unborn. Since the 1960s the possibility of viewing the foetus has allowed its dissociation from the female body (Duden, 1993), fostered the emergence of an "unborn patient" (Casper, 1998) and affected the public debate on abortion (Petchesky, 1987), shifting the balance of legal rights from the woman to the foetus (Franklin, 1991). The advancement of IVF imaging technologies is refocusing the discussion on the unborn patient at the cellular level (i.e., moving back from the stage of the foetus to that of the embryo). IVF fostered a new understanding of the reproductive process (Franklin, 1997, 2013; Thompson, 2005), where images at the cellular stage (embryos and gametes) play a central role in contemporary imaginations of reproduction (Lie, 2012; 2015).

This project, therefore, will investigate biomedical imaging in IVF, with a focus on Time-Lapse Photography (TLP). TLP is an old imaging technique, where a camera is set to record a series of images at regular intervals. TLP is now available for monitoring the development of embryos in IVF cycles before they are transferred into the womb. TLP is used as a support in deciding which embryos to transfer, but it could also become a revolutionary instrument as it might foster the production of knowledge in embryo development (Kaser and Racowsky, 2014; Gleicher et al., 2015).

There are a variety of TLP tools (such as Embryoscope, Primo Vision EVO, Eeva) that are currently used in IVF cycles, in addition to other types of IVF imaging technologies. These tools have been selected to focus on the relations between professional vision, the production of knowledge about the body and how these processes affect patients and lay vision. The example, in fact, highlights various contextual differences in image production and use that will allow a better understanding of how image production, employment and deployment interact in different contexts.

The investigation of how different TLP tools used in IVF emerge in situated cultural settings will allow the study of how artefacts crystallise through stabilization processes in which a variety of elements are involved (such as the interest of IVF clinics and developers, as well as the mundanity and commercialization of infertility treatments and the willingness of patients to pay to view their embryos at an early stage).

Moreover, this case allows for an exploration of how these new tools are entangled in the changes in the professional practices involved in the fertility treatments, and of the relations between the new visual tools and the changes in professional identities and roles (for instance, how the new knowledge available is involved in the practice of selecting embryos; how the role of embryologists changes in the IVF procedure; and how the communication with couples changes when TLP images and videos are used).

Finally, the diffusion of embryo imaging allows new kinds of perspectives for non-experts, as they interact with the images outside of the context of their production. Therefore, the points of view of various professionals, patients and caregivers involved will be taken into account to explore how diverse meanings are attributed to embryos' images. The case allows for an examination of how new meanings emerge and how these images mediate the creation of knowledge about the body and its understanding (for instance, how these decontextualized images – often distributed for commercial and personal uses – are reinterpreted in the pro-life discourse about the rights of the embryo; and how the visualization of embryos changes the experience of pregnancy, bringing it forward to an earlier point, and transforms the social understanding of the pregnant body).

Research approach

The project will consist of a qualitative case study on biomedical imaging in IVF, through detailed, in-depth data collection. In this project, these will mainly include - but not be limited to - focus groups, in-depth interviews, ethnographic observations, visual data and document collection.

The flexibility offered by this methodology is particularly relevant for the aim of this study. The innovative contribution of this study is an integrative approach to understanding how biomedical imaging technologies and the development of professional and lay visions are involved in the changing conception of the body, through the case of IVF imaging technologies. Drawing on the theoretical framework presented above, the case will be investigated by focusing on three main intrinsically entangled analytical dimensions of medical imaging: the artefacts; the practices; and the images.

The *artefacts*, i.e. the new visual tools, will be examined from the point of view of their development and stabilization processes. The history and development of TLP in IVF will be explored taking a performative and processual perspective, which will include a reconstruction of how they have been developed so far. This reconstruction will analyse all the actors (human and non-human) that have contributed to their evolution, including an investigation of alternative IVF imaging technologies (for instance, the role of different kinds of microscopes in the production of embryo images). The history and development of TPL will be investigated through document analysis and 25 in-depth interviews (with devices' developers and producers; technicians and engineers; medical professionals and other experts involved during the design and prototyping stage; and other key stakeholders).

The *practices* to be investigated are the biomedical and organizational practices in which IVF imaging technologies are used and that are the loci of professional vision development. TPL and other IVF imaging technologies will be investigated in situation, focusing on the relation between the new tools and professional practices in order to explore ongoing changes in professional visions. The analysis of the biomedical practices in which a variety of IVF imaging technologies are involved will allow an exploration of their situated uses. The role of TLP tools and their relations with other IVF imaging technologies will be explored through focused ethnographic observations (Knoblauch, 2005). The ethnographic observations will be conducted in IVF centres where different TLP tools are in use and will include shadowing the embryologists who are in charge of these tools. The observations will also include the investigation of how embryologists use embryo images in their communication with patients. The duration and typology of each observation depends on the characteristics of each centre, and a flexible logic will be adopted. The focused ethnographic approach has been chosen as it is very suitable for healthcare research (Cruz and Higginbottom, 2013; Higginbottom et al., 2013). This is a pragmatic and efficient way to address specific aspects of fields in highly differentiated organisations (Knoblauch, 2005). In addition, 25 in-depth interviews will be conducted with staff members in IVF centres where the new devices are in use with different configurations.

The *images* are the visual outputs that are co-produced in a certain community of practices and then travel beyond that community, especially among patients and caregivers. How professionals and lay people see and make sense of various IVF images will be explored through focus groups and interviews. 50 in-depth interviews will be conducted with couples who went through IVF cycles. In addition, 30 focus group interviews will be carried out with professionals (embryologists, gynaecologists, nurses, and other reproductive professionals)

and groups of patients and caregivers involved. Some of the focus groups will include only professionals, others will include only patients and finally some mixed focus group sessions will be conducted, including different professionals and some of the more expert patients. Both interviews and focus groups will be conducted using photo-elicitation techniques (Harper, 2002; Oliffe and Bottorff, 2007) with informants asked to comment on the images. Finally, a cultural analysis of the use of IVF imaging outside its context of production will be conducted. This will involve the examination of patients' blogs, patient groups and company websites, advertisements (in print and video) and other forms of public and scientific communication.

Public engagement

In the last phase of the project a short documentary video (around 15 minutes) on the main results of the project will be realized with the support of the Public Relations and Media Support team from QMUL. Being a project based on biomedical images, the documentary video form seems to be the most appropriate for public engagement. Documentaries can be an excellent engagement tool for this kind of project. The main findings of the project will be translated for the general public with the aid of media professionals. The short documentary will be presented at the final workshop and then made available online via the QMUL website. In order to foster the diffusion of the documentary, this will be freely distributed among relevant networks of academics for educational purposes and special "forum" screenings will be organized for students and lay public.

Lay summary

The development and diffusion of biomedical imaging technologies allows medical professionals to explore the human body in new ways. Images of bodies and internal organs and cells are common in medical practice. Biomedical staff need to develop new skills to interpret images of the inner body. Images are used in the communication with patients and then travel throughout the social world contributing to a changing understanding of what the body is and how it works. However, the relations between new visual tools, professional and lay visions remains underexplored.

The project investigates the case of IVF imaging technologies, which allows patients to see embryos at a very early stage. The aim of this research project is to explore the role of biomedical imaging by looking at the artefacts that produce it, at how it is used in medical practice, and how it is received by patients and caregivers who are involved. In particular, the project will explore how these images are involved in changing conceptions of the human body.

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