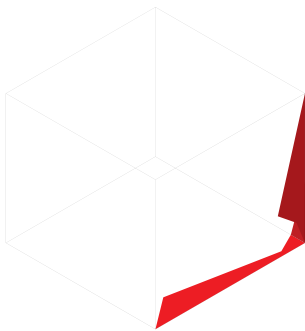


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VISUAL / TEXTUAL: DOCUMENTING THE REALITIES
OF RESEARCH THROUGH DESIGN PRACTICE.

PAPER 06

**Seeing me: the role of transparent bodies
in the medical consultation.**

Fionagh Thomson & John McGhee

ABSTRACT

The role of the somatic body as a physical and visceral object is waning within the history of medical consultations. Once holding centre-stage in the communication between doctor and patient, today this body has been transformed into disembodied artefacts, such as x-rays and magnetic resonance images (MRIs), which aim to increase an understanding of ‘what is happening’ within our bodies. However, since the interpretation of such images is restricted to the trained eye of the medical practitioner they can remain inaccessible to the patient who is being asked by the health professional to understand (potential) changes in ‘their body’ and make treatment decisions. Responding to an invitation to ‘improve the realism’ of MRIs and develop a communication tool with patients, a 3D CGI artist reframed the question and explored an alternative approach that aimed to return the poetics to the human anatomy. Through focusing on one artist’s practice, this paper explores two key questions surrounding the ‘integrity’ of these 3D images within the clinical context: 1) How far can/should the artist reinterpret the original MRI to develop a suitable communication tool for patients within the consultation? and 2) What is the role of the artist in the design process?

KEYWORDS

Embodied geographies, 3D visualisation, medical imaging, patient communication, 3D CGI, sociology of diagnosis, bodies in technology.

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Seeing me: the role of transparent bodies in the medical consultation.

INTRODUCTION: THE PATIENT'S BODY IN THE MEDICAL CONSULTATION

Historically, a patient's body 'belonged' to the doctor and the medical consultation was a one-way communication; where the patient offered up information on the 'body' only on request from the doctor. Today, in a shift towards patient-centred care, individuals are increasingly involved in their healthcare, which relies on an understanding of what is happening to their physical body, in order to make informed decisions with their health professional to develop care plans (Houts et al., 2006). However, contemporary patient consultations are highly complex situations and can be a one-off acute episode in an Emergency Department or one moment in series of consultations over years for patients living with chronic, rather than acute, conditions. The key activity within a patient consultation is the dialogue between patient and doctor (Morris, 2000), and throughout the process patients are offered different tools for communication—including x-rays, medical records, spoken words, drawings, their own somatic bodies,¹ etc. (Thomson, 2012). Depending on the relationship between the health professional and patient, the consultation is a space full of potential meaning and both parties can engage in fluid dialogue with the exchange and co-creation of knowledge (Benner, 2000; Sakalys, 2000). In the simplest terms, the health professional, who understands the medicalised body, seeks to understand the patient's everyday life (Balint, 1957; Neighbour, 1972). In exchange, the patient, who understands their everyday life, is invited to understand their medicalised body and the different options available - in order to make an informed decision about a shared treatment plan.

EXTENDING THE ROLE OF MRIs: FROM DIAGNOSIS TO COMMUNICATING WITH PATIENTS

Visual images, such as Magnetic Resonance Images (MRIs), are proposed to be a useful communication tool in bridging the gap in knowledge between patient and health professionals (Mishler, 1984; Argyle, 2013).

¹ / The word 'somatic' derives from the Greek word for the body, soma. In medicine, the term is used to differentiate between the body (somatic) and the mind (psychological). However, in anthropology, for example, the term 'somatic body' refers to the role of the whole body in meaning-making (cf. Csordas, 1993; Ingold, 2013).



Figure 1 / Original MRI scan created by Graeme Houston.

An MRI scanner uses a powerful magnetic field and radiofrequency to generate cross-sectional images of blood flow and soft tissue structures deep within the body (see figure 1). MRIs are predominantly designed as diagnostic tools for health professionals, specifically radiologists. Consequently, while MRIs are important for radiologists' clinical practices, there is a need to redesign the images to suit patients' needs. Notably, developing any diagnostic tools (such as MRIs) into a communication tool within the patient-health professional consultation will require the merging of two very different worlds of knowledge: the subjective world of the patient's everyday life (evolved through multiple experiences within wider cultural memory) and the contemporary medicalised knowledge of the body (evolved over centuries and increasingly mediated via technologies).

This paper explores the role of a 3D computer-generated imagery (CGI) artist and experienced designer—in bridging these two worlds of knowledge during a two-year residency in a hospital radiology department that was also fieldwork for a design doctorate. The research evolved from an invitation from the radiology department to 'improve the realism' of existing MRIs, in order to develop an effective communication tool for patients within the consultation.

Moving beyond a description of this artist's practice, we² focus on *praxis* and seek to explain and support their role as a critical friend within the medical profession—a role that 'challenges the *voice of medicine* and establishes [alternative] means of visualising the body' (McGhee, 2009, p. 98). While the term *praxis* has multiple forms, we draw on Pablo Freire's definition as a process of 'reflection and action directed at the structures to be transformed' (1986, p. 126). Notably, this paper sits within hermeneutic phenomenology, where the method (here the artist's practice, including tacit knowledge) is held to interpret, not merely describe, the world-as-encountered. In this initial stage of the research, we state a case for the interpretive role of the artist in developing a new form of abstracted visual narrative in an attempt to bring the poetics back to the patients' bodies—a premise that is based upon 'thinking through doing' with health professionals, rather than offering up a *fait accompli* redesigned MRI as a communication tool for patients.

THE PROJECT & ARTEFACT: ARTIST-IN-RESIDENCE IN A RADIOLOGY DEPARTMENT IN SCOTLAND

At the start of the two-year residency, the artist's brief from the radiology department was to transform black and white MRI scans (designed for radiologists) into 3D CGI coloured imagery (accessible to patients). However, this exploratory stage of the project did not include patients for ethical, legal and social reasons. Clinicians follow a clear code of ethics to 'first do no harm' (the Hippocratic Oath) and, in theory, any new medical intervention is first piloted to ensure the absence of harm.³ The project also embraces the R&D approach that technological development should be carried out from the onset of the project, while being guided by clinical needs. As such, the artist spent considerable time in the field with radiologists and radiographers learning their practices and working routines (with his office next to the MRI scanning area in the hospital) (see McGhee, 2009). After 'working through' technical challenges, listening to and talking with radiologists, and reflecting through their and his practice, the artist changed his initial brief and began to explore an alternative approach that aimed to return the poetics to the human anatomy.

2 / This paper combines the research of a medical ethnographer (FT) and the research, professional practice and independent fieldwork of a 3D CGI artist (JMc).

3 / In addition, gaining ethical and R&D permission to talk with patients can take up to 6 months and involves detailing step-by-step what the research team will do, including exact wording for information sheets.

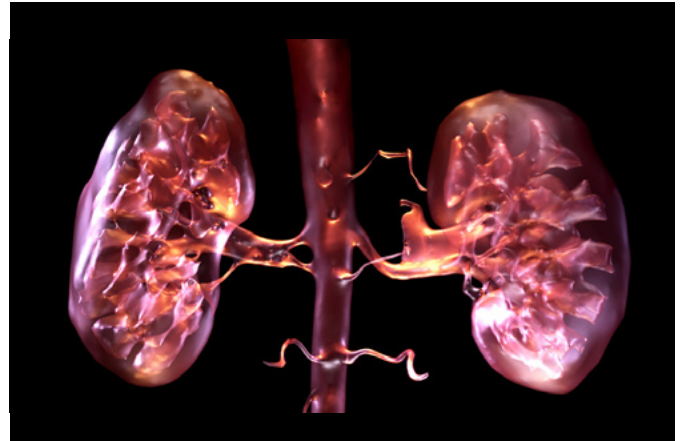


Figure 2 / 'Medulla'—visualisation 2. Final stage image: a 3D CGI rendering of human kidneys from clinical renal angiogram MRI data, represented as glass-like structure rather than soft organic tissue. Copyright by John McGhee.

THE ARTIST AS PRACTITIONER AND RESEARCHER

Initially responding to the brief, the artist began experimenting with clinical radiological data (e.g. MRIs) and Autodesk Maya (a 3D CGI software package) that, in part, led to a move away from re-creating a 'realistic representation' of the body (based on MRIs). Prior to any final visual images being created, one key start-up challenge was exporting the MRI data into the existing artisan software (MAYA) that involved extensive technical experimentation, and a new design method evolved that successfully rendered 2D MRI data into 3D visual moving images. The creation of the imagery was the combination of both technical problem-solving and extensive visual exploration of the 3D CGI aesthetic—which led to a development process that was non-linear, highly exploratory and cyclical in nature, although there were three main reference/anchor points:

1. Establishing a Pipeline. MRI clinical data had never been imported into the artist's choice of software (MAYA) and considerable time was spent working out a pathway.
2. Tumbling. Once the pipeline was established, the artist extracted a 3D model of anatomy (a wireframe), from the MRI data that had no light or colour (usually present in photographs though notably absent within the darkness of the inner body). The artist then 'tumbled' through, around and inside the 3D mesh exploring the complexity of the anatomical form and developing ideas for different visualisation techniques—for example:
 - A. CGI lighting to develop a visual quality that renders the inner body glass-like rather than soft organic tissue (figure 2).

- B. Placing the image against a dark background, with exaggerated angles of perspective—thereby evoking a feeling of space exploration or suggesting the inner body as a deep and dark oceanic place (figures 2, 3 & 4).
- C. Dynamic & hybrid approach. Once the light, colour and structure were established, the focus was on representing blood flow through the arterial structures and, for example, slowing down ‘the flow’ to offer a patient time to reflect.

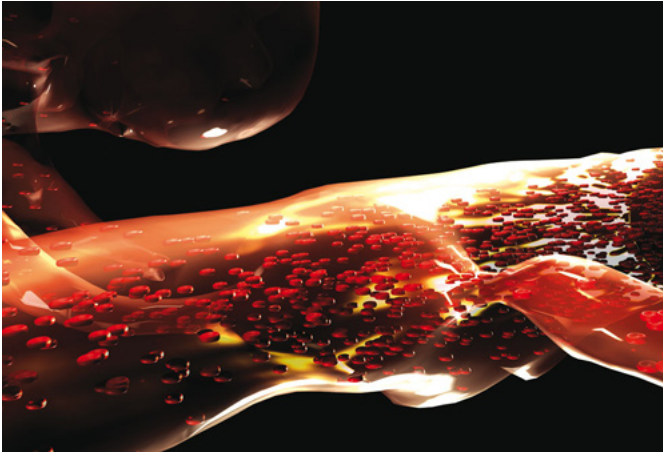


Figure 3 /
‘Stenosis’. This 3D CGI rendering is a visualization of the human left kidney, aorta and right renal artery. The animated image is derived from clinical renal angiogram MRI data visualising renal artery stenosis. Copyright by John McGhee.



Figure 4 /
‘Flow’—visualisation 2. Final stage image: a 3D CGI rendering of aorta from clinical renal angiogram MRI data. Still image taken from an animated movie sequence. Copyright by John McGhee.

Throughout the project, the technical process was interwoven with the exploration and nascent development of a visual and aesthetic language. As the process evolved the artist drew on multiple reference sources, most notably their own interpretation of ‘how

the image should look’. For example, ‘Stenosis’ (figure 3) drew on four sequential sources of ‘information’ to create the final image:

1. MRIs. The scan of an aorta was used to generate a digital wire-frame of the aorta.
2. MRI video footage. Data from several seconds of a beating heart from a test subject.
3. Drawings/verbal. The radiologist generated, and discussed, a series of drawings of a heart to communicate the rhythm/parameters of blood flow to the artist.
4. Artist’s Interpretation. Their personal vision of the inner body was influenced by the cinematic—drawing from the popular inner body aesthetics seen in feature films such as *Innerspace* (Dante, 1987) and *Fantastic Voyage* (Fleischer, 1966).

RADIOLOGISTS’ RESPONSE: FROM APPROVING NODS TO ‘BUT ... IT’S NOT REAL’

The key to success in piloting this new visual artefact within the clinical setting is inevitably the radiologists’ willingness to introduce the artefact into a real-time consultation, for which they have a duty of care towards the patient. The radiologists connected to the study responded differently to the 3D CGI moving images of the MRI, in terms of their perceived ‘accuracy’ of the final image. For example, one radiologist approved of the moving image while another colleague stated that it didn’t represent how blood flowed. In response, the artist offered one explanation behind his interpretation of the ‘original’ MRI: ‘it would look like a butcher’s shop if I represented it faithfully’ (McGhee & Thomson, 2013, p69).

The radiologists’ responses towards the artist’s interpretation raise a question of *praxis* around the ‘integrity of the image’ in the design process: How far can/should the artist reinterpret the original MRI to develop a suitable communication tool for patients within the consultation? This question raises a second question: what is the role of the artist in the design process?

BACKGROUND: THE CHANGING NATURE OF THE BODY AND TECHNOLOGY IN MEDICINE

To consider both questions, there is a need to demystify or at least destabilise the concept that the MRI is a ‘real’ image, meaning-making is inherent to its existing ‘pure’ form, and the artists’ role is merely to add colour, depth and movement to the ‘original’ image. First, we present MRIs as already abstracted visual narratives evolved within a complex and long history of medical, political and technological developments—a history that has led to our medicalised bodies becoming fragmented, then made transparent and increasingly mediated and interpreted through technologies (cf. Thomson & McGhee, 2014). Second, we frame meaning-making of bodies mediated through technologies that influence patients, health professionals and artists’ practices.

HISTORICAL DEVELOPMENT OF MRIS: FROM WHOLE BODY TO TRANSPARENT BODY PARTS

The United Nations designated 2015 as the year of light and light-based technologies. Within healthcare the focus rests on clinical 2D and 3D visualisation of medical scan data (e.g. x-rays, ultrasound and MRIs) that have been designed to render the body increasingly transparent, thereby allowing medical science to 'see' and 'map' the inner body (Dijck, 2005). These technologies have been moulded by the history of western medical knowledge that originally framed the body as a biological material entity (tissue, bone, nerves) that was then transformed into technological images (Rifkin & Ackerman, 2011), and has led to a significant reduction in anatomy and hands-on-training for contemporary medical students (Kevles, 1997). These images are part of a long historical process that has seen the patient's body in medicine change from the enclosed flesh to the transparent images that we see today (Ibid.).

Until the mid-sixteenth century, knowledge of a patient's body and the formal practice of medicine was a scholastic pursuit, drawing on ancient Greek texts, with any physical interventions being 'left' to the barbers (the early surgeons) (Moore, 2006). Until the mid-eighteenth century, the patient often continued to be examined, not by touch, but by the eye or ear of the physician (Porter, 1993). During the Industrial Revolution, medical knowledge, along with many aspects of our social world, became fragmented (Waddington, 1984). This fragmentation led to the patient's 'whole body' becoming 'body parts' through the rise of medical specialists. With the discovery of x-rays in 1895, the patient's 'body parts' moved into the technological world of transparency (Kevles, 1997). Today our bodies, when we are patients, are no longer only flesh but multiple material and technological objects for both health professional and patient (Waldby & Mitchell, 2006). It is how we, as health professionals, patients and/or artists, interpret these contemporary 'representations' of the human body that makes meaning within the patient consultation or within medical or design practice.

BODIES IN TECHNOLOGY: MULTIPLE MEANING-MAKING IN THE CONSULTATION & DESIGN PRACTICE

Within the wider field of hermeneutic phenomenology, where this study sits, technological development and social relationships are held to coexist (Brey, 2000) since humans are, in essence, technological beings solving problems through technological solutions (from fashioning a flint to inventing cloud computing). While phenomenology is a complex area of contrasting and competing concepts, one shared view is that, in order for we humans to make sense of 'what is happening around us' (the foreground) we draw upon our existing knowledge, memories, skills and attitudes (the background) to make sense of (interpret) what we encounter (people, dialogue, the layout of a room, the MRI scan, etc.). This research sits within hermeneutics phenomenology that recognises the world as interpretable (Moules, 2002) and, for us, frames the 'visual' as the gateway to all our bodily senses, not only sight. Here meaning-making differs from visual semiotics that locates the dominant meaning-making within the image (see Kress & van Leeuwen, 1996). However, hermeneutic phenomenology does not inherently reject the importance of the materiality of the world as encountered. Instead the material world is considered to offer potential meanings that influence, but do not automatically dictate, what these meanings will become.

Our focus is on making-meaning (moving beyond cognition and sight) that recognises the French philosopher Maurice Merleau-Ponty and his seminal work on the importance of the corporeal (material) body in interpreting the world.⁴ In 1945, he wrote: 'the body is our general medium for having a world' (1945/62, p. 161). As such, our research is framed by the concept that healthcare professionals and patients interpret continually, and dynamically, what is happening within the consultation space through the knowledge, experiences and attitudes that they bring into the consultation space—mediated through the material world in which they inhabit - in that moment in time.

According to the American philosopher of technology, Don Ihde:

...we are our bodies—but in that very basic notion one also discovers that our bodies have an amazing plasticity and polymorphism that is often brought out precisely in our relations with technologies. (2002, p. 137)

4 / More recently, Merleau-Ponty's work has found form within design studies as 'thinking through doing' (Klemmer et al, 2006).

Idhe (1990) proposes four types of relationships between humans and technologies in how we make meaning from our immediate environment:

Alterity: the technology is different from me, and not part of my everyday world. Example: the image may represent the disease, the emotional/sensory experiences that the patient does not want to take home with them.

Background: the technology is in the background and remains there unless there is a specific need. Example: a patient perceives the medical image to belong to the healthcare professional, whom they trust to explain through the spoken word their options, and may not pay close attention to the image except to feign interest to ensure the doctor feels 'appreciated'.

Hermeneutic: the technology is a reference or lens into a different world. Example: a healthcare professional and a patient both view the same image of the kidney but create different scenarios. The radiologist imagines inserting the micro-kit into the femoral artery in the groin to access the kidney, while the patient remembers her last pregnancy, preeclampsia and learning of her high blood pressure for the first time.

Embodied: the technology is perceived as an extension of the somatic body.⁵ The classic example often evoked is Merleau-Ponty's description of the relationship between a blind man and the white stick that he uses to guide him. (1945/1962). He argues that the stick is not an external object but an extension of the man's arm and sense of touch that enables him to move through the world. In this research, an embodied technology focuses on the internal body. For example, the MRI for a female patient with uterine fibroids may look upon the MRI of her uterus as being 'part of her'.

Patients will interpret an MRI of their body in various ways within the consultation, although arguably the most empowering interpretation in this context is an embodied meaning where the image becomes an extension of themselves (a

complex discussion to leave for another day). However, while the final interpretation of the MRI by patients is beyond the control of the health professional (or 3D CGI artist), the health professional can facilitate understanding through dialogue (spoken, visual, embodied) and is often considered to be the essence of a good patient consultation (Hurwitz, 2000).

MOVING BEYOND THE MEDICALISED IMAGE: VISUAL & AESTHETIC LANGUAGE(S) FOR PATIENTS

While the 'mechanical-medical eye' (Dalton, 1989) allows the body to be exposed in ever-increasing transparency, an ability to see more detail does not automatically equate with increased knowledge. Radiologists, for example, employ the MRI as a tool in diagnosing or monitoring a patient's disease and predominantly engage with MRIs as hermeneutic devices. However MRI scans are not readily accessible to all health professionals. For while specialists can 'make sense' of MRIs that relate to their field of medicine (e.g. haematologists viewing spinal MRIs for bone marrow cancer), the legal and trusted interpretation remains with the imaging specialist (the radiologist) or subspecialist (e.g. the neuroradiologist for brain scans). In addition, MRIs are only one of a number of sources of information that are interpreted and employed by a team of relevant health professionals to make decisions about a patient's diagnosis, prognosis and treatment plans—often within weekly multidisciplinary meetings in NHS hospitals. Here the MRI acts as a communication tool between health professionals enabled by a shared visual, aesthetic and spoken language (interpreted through a specialist body of knowledge), and framed by mutual trust in each other's knowledge (Brownlie et al., 2008).

⁵ / Idhe's distinct demarcation is challenged by Introna (2009). For example, a patient viewing an MRI of their kidneys may view the image as both an extension of their somatic body (embodied) and a portal into their everyday life (hermeneutic).

For patients, however, these visual narratives of the body are based on protocols that describe the patient's disease in the language of medical science—a language that is abstract, specialist and distinctly separate from the 'body' as experienced by patients within their everyday lives. As a result, while MRIs are highly useful to radiologists they are embedded in an abstract visual narrative less accessible to non-medically trained patients (Hartswood et al., 2001).

MOVING BEYOND THE OBJECTIVE RESEARCHER: THE EMBODIED PRACTICE OF THE ARTIST

As outlined earlier, the artist's technical process was continually interwoven with the exploration of a visual/aesthetic language for patients. Here the artist's practice of re-interpreting the MRI image into a 3D CGI image highlights different potential interactions with the body-as-technology as he moved through the reflective process. As outlined earlier, the artist began with technology as *alterity* (using the scan of the aorta to create a digital wire-frame) moving onto *hermeneutic* (watching MRI video footage of a beating heart), then to *background* (working with the radiologist through pencil sketches and dialogue). Finally, he engaged in an *embodied* (some may argue *hermeneutic*) way with the MRI data and multiple reinterpretations within the wider social and historical context. He openly reflected upon and interpreted the images through life experiences, including feature films such as *Innerspace*. This embodied engagement returns us back to our two questions, as discussed below: 1) How far can/should the artist reinterpret the original MRI scan to develop a suitable communication tool for patients within the consultation? and 2) What is the role of this artist in the design process?

DISCUSSION

The history of art and medicine is long and winding and their relationship has changed over the centuries. Artists, such as Leonardo di Vinci, were once the artists and the anatomists using pen and ink. Andreas Vesalius, the great sixteenth-century anatomist and teacher, created detailed and startlingly beautiful depictions of the internal soft tissue and bone structure displayed as flayed bodies assuming classical poses within fashionable landscapes, common within paintings of that period.⁶ In the eighteenth and nineteenth centuries, as the world was carved up into colonies, the world of knowledge was divided into academic disciplines (Harvey, 2000). Subsequently, misunderstandings and, at times, distrust developed between scientists and artists, which in certain fields continue today. This distrust reflects a much older academic debate around the role of the artist in truth-making—often attributed to Plato, the Greek philosopher and mathematician (c. 428-328 BCE). Plato wished to expel all artists from the Republic (his concept of a perfect citizen state) for their practice of *mimesis* (the re-presentation of reality) that he believed tricked the viewer (Plato, trans. 1894, 1941 publication). Today applied artists are merging back into partnership with health professionals and designers have been working with imaging technologies since the mid-1950s (Prentice, 2012).

One starting point for this discussion is a paper by R. S. Downie entitled 'Literature and medicine' (1991). While he focuses on the role of literature in medicine, his key points, albeit simplistic in nature, can be applied to other art practices. Downie proposes four beneficial relationships that: 1) enrich the practice of literature, 2) provide entertainment value, 3) offer insight into public perception of the medical profession, and 4) support the practice of medicine through 'whole person understanding' (ibid.). This 3D CGI artist sits within the fourth category; although what marks him out is the significant time (two years) spent in the field, with radiologists and radiographers, and the knowledge he acquired and the trust developed.

⁶ / To help his medical students understand the illustrations, he created a new way of describing the internal workings of the body and compared the digestive system to city streets, the ligaments to horses' reins and the sinuses to a winepress (Rifkin & Ackerman, 2011).

QUESTION 1: HOW FAR CAN/SHOULD THE ARTIST REINTERPRET THE ORIGINAL MRI SCAN?

The radiologist's challenge to the artist's reinterpretation of the MRI, into a 3D CGI that misrepresented how blood flowed, appears to reflect Plato's criticism of artists. However, the philosopher Bruce Aune (1998) argues that Plato's objection to mimesis was not that artists re-presented reality but that they confused their role as the maker of the medium of the knowledge with being the holder of the knowledge (e.g. drawing on his famous analogy, a painter may create an image of a bed but he does not know how to build the bed). In contrast, in this research the artist outlines each step in the evolution of the prototype image that incorporates and builds upon the radiologists' professional knowledge. Moreover, this knowledge is not held to be embedded within the MRI scan itself but evolves through the health professional's specialist knowledge, experience and their ability to make meaning from the image.

Importantly, the 3D CGI image is no longer intended as a diagnostic or surveillance tool, but as a communication tool within the (face-to-face) patient consultation; and in order to achieve its intended purpose, its form (colour, light, material) will need to morph accordingly to fit the knowledge and language of patients. Here, the role of the artist is in *facilitating* the redesign (and shift in purpose) of the MRI image that begins as a diagnostic tool, designed for health professionals, and evolves into a communication tool, designed to support patients in making treatment decisions (Graeme Houston, personal communication, January 9, 2014). Decisions made complex, as they will affect their everyday lives beyond the hospital walls. This iterative design process will also be defined and inevitably confined by the technical knowledge and kit available to the artist, a process similar to the evolution of MRIs. In addition, the image as a tool for dialogue (communication) relies upon and requires a form of language to transform an inert object, filled with potential meaning, into an effective tool, brought into the consultation space by the health professional that the patient may engage with, if they wish.

As outlined earlier, the current language around medical images has evolved within western medicine (Kevles, 1997) and, while not all health professionals are party to interpreting the MRI image in detail,

through their training and professional work they share the medicalised language that underpins diagnosis, prognosis and treatment plans. Language that is frequently, though not exclusively, inaccessible to many patients (Carel, 2013). As a result, the primary intention in the creation of all these images (e.g. figures 2, 3 & 4) was the nascent development of a language that describes the body more holistically and focuses on the visual aesthetic of the image as a whole, rather than highlighting the aspect of the human anatomy that is diseased (McGhee, 2009). The aim in this case was to create an image with a degree of sensibility in an attempt to bring the viewer closer to the nature and beauty of inner kidney structure, and also as a means to penetrate, in these examples, the complexity of arterial disease. For example, in 'Stenosis' and 'Flow' (figures 2 & 4), the moving particles inside the vessel were not intended to 'accurately' replicate the way in which blood moves through the arterial system. The movement of blood in the human body follows a cycle, one that bursts, twists and pumps through the arterial system of the vessels, providing an aesthetic of movement that is absent from static MRI (McGhee, 2009).

QUESTION 2: WHAT IS THE ROLE OF THE ARTIST IN THE DESIGN PROCESS?

In summary, MRIs begin as abstracted narratives that have evolved within, and been led by, the intended and changing purpose of the image, the language required by the users and the technological knowledge and materials available. The development of the medical 3D CGI image has followed a similar trajectory and, moreover, the intention of these images is not to offer a 'realistic' view of the mechanical processes of the body. Consequently, the artist unapologetically re-interprets the data as they start to re-create/re-design a new visual image that can fulfil its potential as an effective communication tool within the patient consultation (McGhee, 2010; Thomson, 2012). Importantly, the artist in our discussion worked with the radiologists in order to incorporate their knowledge and experiences. However, while the role of the 3D CGI artist is to work with clinical colleagues it is not as a conduit for, or servant to, medical knowledge. Instead we propose the role of a critical friend: one who challenges existing visual narratives of the patient's body that currently appear to offer only the health professional a transparent view.

Notably, the change in the artist's brief did not occur by cognitive reflection in isolation but by 'thinking through doing' (as in Klemmer et al., 2006) with health professionals—an important offering from the design to the research world. The importance arises not from the practice itself (which is common, for example, in all science laboratories), but because the design world openly embraces this approach as a valid research method and discusses in detail its practices. Finally, the practice of the 3D CGI artist in our discussion also offers health professionals an alternative way of visualising the body within *their* clinical practices.

CONCLUDING REMARKS AND CAVEAT

Observing the world with rigour and curiosity is an act of both art and science. Artists scrutinize the world around them for its beauty, its contradictions and its signs of human experience. (Thomas et al., 1997, p. 76)

With the rise in the role of the patient in the healthcare, there is an increasing need to describe the inner body in a more accessible and holistic way for patients. Here we have presented only one potential design solution to this complex social challenge: a visual communication tool that can be used by both clinicians and patients within a medical consultation. We propose that 3D CGI artists have a key role in the interpretation process both as critical friends and in their ability to tell stories through their chosen medium (in an attempt to increase access to anatomical clinical imagery for patients). Consequently, our next step will be to invite patients to explore and redesign these images within a hospital setting.

Patients, however, represent a diverse group of human beings with different everyday lives, experiences and attitudes towards healthcare; and a shared medical condition does not equate with a shared response to the consultation or treatment decisions that directly affect their everyday lives— now and in the future. As such patients will engage with, and make meaning from, the 3D CGI image in a variety of ways, from the alien (alterity) to an extension of their somatic bodies (embodied). As a result, co-creating suitable visual images with patients and radiologists that offer both medical clarity and alternative ways of viewing disease and anatomy, through a whole body approach, will prove challenging. However, to quote Margrit Shildrick (2008, p. 36), 'What constitutes the normative body is always and everywhere open to challenge and disruption, particularly in the era of postmodernity when contemporary forms of technological practice intervene directly in our bodies.'

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