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POSITIONING MATERIALITY WITHIN CLINICAL INFORMATION SYSTEMS DESIGN

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Abstract

In this paper¹ a number of transformation claims associated with the introduction of Clinical Information Systems (CIS) are explored. The paper posits that popular notions surrounding the substitution of the paper record and the elimination of human error are problematic for the way they ignore the materiality of the digital artefact. In this regard the paper highlights how the current discourse on substitution avoids the substitution of bodies, which this paper conceptualizes as a form of 'digital detachment'. The paper concludes by suggesting that research into materiality, may lead to a more 'realistic' understanding of the potential of CIS to 'transform' clinical practice, which in turn, may influence the design of Clinical Information Systems.

Keywords: Clinical Information Systems, Transformation, Digital Detachment, Materiality.

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1 INTRODUCTION

The pervasive discourse on Information Systems (IS) in healthcare is as diverse as the focus of study. Since the first administrative systems were optimistically introduced in the 1970s, many scholars have attempted to address the miscellany of contradictions emerging from practice.

In latter years, the focus of attention has evolved to encompass clinical practice through the development of Clinical Information Systems. The term Clinical Information System (CIS) is intended to denote any information system implicated in the clinical management of patients. While the information system may have an ever expanding list of functions, the core functions are clinical notes, test ordering and lab reports.

A review of the Irish National Health Strategy entitled, *Shaping a Healthier Future* and the Irish National Health Information Strategy entitled, *Health Information: A National Strategy* will suffice to demonstrate the influence of IS within healthcare in general, and clinical care in particular. The similarity with other western countries, in particular, Britain, is noteworthy.

This paper begins by outlining a number of key transformational claims attributed to CIS, specifically, the claims of reducing human ‘error’ and that of ‘substituting’ non-digital artefacts. Error and substitution claims are intrinsically interlinked. In problematising these claims, the discussion enlists the materiality of artefacts as a promising lens to examine the role of CIS in clinical practice. Indeed, in recent years there have been a number of significant attempts within the IS field to develop theoretically rich insights on the subject (see Kelly, 2005). Latterly, in a paper by Wanda Orlikowski (2007), the author states that “[d]eveloping new ways of dealing with materiality in organisational research is critical if we are to understand contemporary forms of organising that are increasingly constituted by multiple, emergent, shifting and interdependent technologies (ibid).”

This paper will claim that current accounts on CIS, especially in an Irish context, are based on problematic transformational claims. In examining these transformation claims the paper will highlight a number of recent failures, which may be partly attributed to the extent of detachment between planners and practitioners and an isolationist focus on user involvement, user education and training. While this isolationism, more broadly, sets the stage to introduce materiality, the paper will focus on the type of questions that a material approach poses when the focus of study revolves around the substitution of bodies. In this regard the notion/metaphor of Digital Detachment is introduced.

2 DESIGNING SYSTEMS FOR CLINICAL PRACTICE

It should not surprise that ICT occupy a pivotal position in healthcare strategy. While health services are diverse and complex, a common theme among practitioners, managers, patients and politicians is how to utilise and develop ICT to create an efficient, effective and value for money service (Ó Scolaí, 2003). One of the difficulties with such a vision is the propensity to believe that the concepts of efficient, effective and value for money have a common definition among the various stakeholders. In reality, each definition is dependent on the context, practices and motivations of each of the professional groupings within healthcare.

Nonetheless, it is not unusual to see governments, political entities, and international organisations such as the World Health Organisation (WHO) pursue a policy of developing health services and eliminating ‘human error’ and other inadequacies through the introduction of CIS, it is also striking that these policies appear to rest on very general assumptions, such as, the oft quoted need to eliminate the paper record (see page 58 NHIS, 2004). Indeed, in promoting such a policy each entity appears to rely on the other in an ‘uncritical cycle of assumptions’.

2.1 ‘Value for Money’—an Irish Experience

Within the Irish Department of Health and Children, the policy that facilitated the development of separate diverse systems across the health sector needed to come to an end. The motivation behind this move was based on a perceived urgency to access important information concerning the health of the nation, and, to access data to examine the processes within hospitals so as to identify and promote ‘best practice’ and ‘value for money’ in a range of clinical and administrative areas.

The seed of this approach was sown in the Irish government’s 2001 policy, *Quality and Fairness: A Health System for You*, otherwise known as the National Health Strategy. The 2001 policy calls for a “seamless service” (2001) and clearly sets the agenda for the introduction of ICT as a ‘means’ of creating an efficient, effective and value for money service. This agenda was entrusted to the National Health Information Strategy (2004). A central pillar of this strategy is outlined in Chapter Ten where the author(s) discuss the development of a “national, integrated and coordinated approach” to the development of an Electronic Healthcare Record (EHR).

The espoused role and functions attributed to the national EHR system are not unique to Ireland’s strategic approach. In Britain, for example, the National Health Service (NHS) is pursuing a similar policy entitled *Delivering 21st Century IT Support for the NHS*. As Jones (2004) points out, this document is the latest in a series of policy documents that, while promoting some confusion around the definition of an Electronic Patient Record System (EPR), pursue a “ruthless” policy of a single standardized digital health record across the health service.

In Ireland, implementing the “national, integrated and coordinated approach” to system development has, and is, proving problematic. In 1998 the Department of Health and Children decided to purchase and implement a human resource information system for the entire health service known as the Personnel, Payroll and Related System (PPARS). The total cost of the project was originally estimated at Euro 8.8mn and national implementation was expected to last three years. In 2005 PPARS erupted into a national controversy when it was revealed that the project was behind schedule and had overspent to the tune of Euro c. 150mn (40% attributed to outside consultancy fees), with an estimated Euro 100mn needed to complete the project. The newly established Health Service Executive (HSE) took over the project in 2005 and two years later, in 2007, officially abandoned it, with an estimated cost to the taxpayer of over c. Euro 150mn (Ó Scolaí, 2007).

Admittedly, PPARS is an administrative system, however there is a similar system earmarked for the clinical environment. In 2005 the HSE purchased the software for iSoft’s patient management system for Euro 56mn; this system is intended to be the national EPR. As of late 2007 iSoft have managed to implement parts of the system in a small number of hospitals, while many hospitals including the main hospitals in Dublin are “holding out”. The extent of this rollout is debatable, as is the extent of clinical use. Moreover, the source(s) of resistance are as diverse as the number of stakeholders. In trying to understand the range of problems encountered by the vendors, a senior iSoft representative stated: “[w]e know that computers can do anything, the technology is not the stumbling block!” Suggesting that the problem lay with a number of IT people scattered through the country’s main hospitals.

2.2 More Cautionary Tales

Despite the popular panacea-type claims regarding the capability of healthcare systems innovations (Anderson, 1997), the above examples, somewhat support the view of significant failure in system development and implementation. While the term ‘failure’ needs to be carefully defined, it is used in this paper when the system outcomes differ significantly, and in a negative way, from that which was reasonably expected.

A review of the literature from 1979 – 2002 inclusive, published in the *International Journal of Medical Informatics*, identifies two main areas which contribute to the current high rate of ICT project failure (Ball, 2003).

Ball states, “[t]he two main problem areas identified in 1979 persist today. First, the need for user involvement and the allied need for user education and training are, if anything, more acute.” According to Ball, the key issue with education and training is, “[t]he need to acknowledge human factors and to provide for them in system design and informatics training.”

One weakness with this otherwise comprehensive analysis is its over-emphasis on end-users as the problem and the subsequent focus on education and training as *the* solution. This approach presumes that designers and change managers hold the key to successful implementation and use. It is deterministic in its assumptions about technology; reducing individuals to objects that can be trained to perform in a particular way. It ignores the insight that “[t]he potential and power of a technological device to shape an interaction is not pre-given but realised in practice” (Timmermans and Berg, 2003) and it supports the accusation that, “[a]ll the topics traditionally of interest to sociologists [and others] are projected on to medical technology, but what is typical of the technology is left under-explored” (Timmermans and Berg, 2003). As Monteiro points out (p. 73 in Ciborra, 2000) accounts of the relationship between IT and organisation transformation are lacking, in particular, accounts which focus on the specifics of the technology.

2.3 Making Sense of CIS

In this maze of complexity, this paper focuses on the transformation claims associated with CIS. It does so in the belief that an examination of these claims may reveal important clues that will assist in the design and development of CIS and contribute to a more modest understanding of ICT innovation and transformation within clinical settings, which may in turn contribute to our understanding of system ‘failure’. In aiming towards this goal, the paper purposively locates itself within the area of techno-materiality on the basis that “what is typical of the technology is left under-explored (Timmermans and Berg, 2003).” In so doing, the intention is not to relegate one aspect of life in favour of another, it is simply an attempt to begin an examination in one specific location while explicitly acknowledging that such a focus “...posits materiality as constitutive of everyday life” (Orlikowski, 2007).

Hence, while this approach may appear to treat mutually constitutive concepts as dichotomies. This is not the intention. In all processes of reflection and description we necessarily introduce separations, we separate the perceiver from the perceived, the subject from the object. It is necessary and legitimate to engage in such ways of conversing, however, the central point is that this way of conversing should not then be interpreted as attributing a Cartesian-like dualism—attributing essence to each aspect of a described experience.

In a previous paper (Ó Scolaí, 2007) the term ‘Detachment’ was introduced to classify a tension that exists between management’s understanding of clinical practice and the author’s conversations with, and observations of, clinical practice *in situ*. In developing this notion of detachment the paper suggests that one such discussion, the substitution of the paper record, should be extended to conceptualise the substitution of bodies, so central to contemporary approaches to CIS. To this end ‘digital detachment’, is introduced to examine the implications of clinical practice at a distance through a focus on the materiality of the digital artefact. This strategy is intended to overcome the perceived isolation of technology identified in recent literatures (Berg, 1997; Kelly and Jones, 2006; Orlikowski, 2007; Zaloom, 2003).

The next section examines the transformational claims associated with the introduction of CIS and the contradictions inherent in such claims emerging from the field. Three transformational claims are identified and discussed, in part because they are ubiquitous in the cases cited, and in part because there is a side to these claims, which warrant further analysis and investigation.

3 THE MANTRA OF TRANSFORMATION

In healthcare, the more popular transformation benefits attributed to the introduction of ICT include, better communication and collaboration between healthcare providers (Anderson, 1997), improved clinical decision making and decision support (Cabitza, Sarini, Simone and Telaro, 2005; Grimson, 2001; Grimson, Stephens, Jung, Grimson, Berry and Pardon, 2001), more efficient work processes including reducing redundancy and duplication (Papazafeiropoulou, Gandechea and Stergioulas, 2005; Snyder, Weston, Fields, Rizos and Tedeschi, 2005), reduced human error in a range of areas including medication (Houghton, 2001), greater access to information for management that will increase standards in population health and surveillance (Goodman, 2005; Raghupathi and Tan, 2002; Wang, Middleton, Prosser, Bardon, Spurr, Carchidi, Kittler, Goldszer, Fairchild, Sussman, Kuperman and Bates, 2003), reduced hospital costs (Perlin, Kolodner and Roswell, 2004; Szolovits, Doyle, Long, Kohane and Pauker, 1994) and improved flow of information to patients (Grimson, Grimson and Hasselbring, 2000).

Many of these espoused benefits are based on the claim that a lack of integration across hospitals and the inability to access and share information across systems is a major impediment to creating an efficient and cost effective service and a contributing factor in hospital related mortality (see Ellingsen and Monteiro, 2003 for a critique of aspects of this argument)."

More often, the IT artefact is interpreted, implicitly and/or explicitly with an aura of neutrality and/or inevitability (Timmermans and Berg, 2003). The more optimistic accounts define technology in terms of its conditions of possibility, its presuppositions, and its espoused functions (Anderson, 1997; Grimson et al., 2000). When technology is defined as such, "aspects of the picture drop out which can only appear in more empirically orientated approaches (Verbeek, 2005)."

The results from some of these more restricted empirical studies highlight the contradiction of developing systems detached from their context of use (Jones, 2003; Littlejohns, Wyatt and Garvican, 2003; Thompson and Walsham, 2003), others demonstrate how clinical practice is complex and underestimated by those vested with the responsibility of designing and implementing systems (Jones, 2004; Malvey, 1981; Southon, Sauer and Dampney, 1999), more discuss the persistence of local social practices, the persistence of the paper record and the detrimental effect changes in communication patterns and workflows can have on clinical practice (Campbell, Sittig, Ash, Guappone and Dykstra, 2006).

On closer examination, much of the transformational literature is based on a number of problematic assumptions: 1) The management of clinical practice is inefficient, disjointed and somewhat messy (Berg and Toussaint, 2003), 2) Modern ICT and other 'technical' innovations can significantly reduce current inefficiencies by 'substituting' existing artefacts, in particular, the process and form of paper record keeping (Wang et al., 2003), 3) ICT can significantly enhance the quality of care for patients, *eo ipso*, reduce medical error (Ellingsen and Monteiro, 2003).

In sum, substitution, integration and human error are central to the current transformational discourse. In a sense, error reduction, integration, and substitution are cogs on the wheel of transformation. There is no error reduction without substituting the paper record and there is no substitution unless you can integrate systems.

Of concern, many of the popular benefits attributed to CIS and their role in global healthcare transformation, are articulated in a context where "[t]here exists to date little systematic, comprehensive and critical assessment of the experiences with practical EPRs. What exists are more restricted studies of particular projects and prototypes" (see Kelly and Jones, 2006; Latour, 2005; Miller, 2006; Timmermans and Berg, 2003; Verbeek, 2005).

3.1 Exploring Contradiction

It is reasonable to presume that CIS can play an important part in improving the organisation of health and patient care, but, this is not predetermined or predestined and unlikely to be realised while the pervasive viewpoint underestimates the role and sophistication of paper medical records while at the same time overestimates the ability of technology to address the common accusations directed at the paper medium (Berg and Toussaint, 2003; Luff, Heath and Greatbatch, 1992). Moreover, the uncritical way in which duplication is posited as inefficient and costly, especially with regard to medical error, is overly simplistic.

Landau highlights how duplication and/or overlap has, as a positive effect the ability to suppress error and the ability to generate alternative strategies within an organisation; Kohn and Corrigan demonstrate how high levels of redundancy can play an important role in hospitals by reducing the occurrence of accidents; Hutchins' cockpit study demonstrated how having more people perform the same task at the same time can 'add value' in creating a robust mechanism for error detection and correction. Hutchins went on to state that certain kinds of redundancy facilitates the robustness of work since if "one [...] component fails for lack of knowledge, the whole system does not grind to a halt" (in Cabitza et al., 2005). Ironically, multiple representations of data may have the unacknowledged effect of increasing the fault tolerance within a clinical environment.

Indeed, clinicians have more than a 'habit' of duplicating questions to the patient, even when the answer is staring up in the clinician's face from the file (Ó Scolaí and Kelly, 2006). Oftentimes, clinicians appear to sense that something is amiss. In the aforementioned study, on more than one occasion, the duplication of investigation and persistence of clinical 'interrogation' uncovered discrepancies, especially in the area of medication.

Moreover, research is emerging which highlights a new range of 'system-associated' errors (Campbell et al., 2006). Joan Ash (also see Hanseth and Aanestad, 2003; Munch, Engelmann, Schroter and Meinzer, 2004) in particular has drawn our attention to a range of emergent errors associated with practices that are mediated by ICT, including 'juxtaposition errors'; the latter point bringing claims of eliminating 'human error' into sharp focus.

In a study of the use of EPRs in a number of large hospitals in Norway, Ellingsen and Montero conclude: "Counter-intuitively for many, they [two elements of their findings] underscore how collaboration is undermined by centralised, 'seamless' integration (p. 91 2003). In this context the authors (Ellingsen and Montero) placed a high degree of reliance on the concept of 'perspective taking' developed by Boland and Tenkasi (1995). Ellingsen and Montero concluded that the standardisation required to develop a fully integrated seamless EPR would remove what they termed 'related but not identical information' which is essential to 'perspective taking' and without which the practice of mutual understanding which underpins collaboration, communication and coordination would erode.

Developing integrated information systems for the clinical environment on the basis of substituting the paper record and reducing medical error is problematic. It is problematic because it appears that the complexity of clinical practice, and the attendant unawareness of the materiality of the digital artefact and how it is implicated in mediating clinical practice, is underestimated. Ignorance of this 'constitutive intertwining' may be one important factor, which sustains the simplistic notion of 'substitution' so prevalent in the popular CIS accounts.

It may come as old news that there is a detachment between the main actors concerning the complexity of clinical practice and what actually takes place on a day-to-day basis. However, there is another face to this detachment, which, for simplicity, is titled Digital Detachment. While it is disputed that CIS will substitute the paper record, it is less controversial that CIS will substitute bodies. This substitution of the body while central to intellectualist inspired beliefs in knowledge as abstract, disembodied, and uncomplicatedly exchangeable, raises many questions about the role of

systems in the practice of diagnosing a patient. In this context it begs the question of how the materiality of the digital artefact shapes and is shaped by this evolution in treatment.

The following discussion encompassing materiality is intended to provide a useful starting point from which to approach these, and similar questions.

3.2 Digital Detachment

One emergent observation from previous and ongoing engagement with clinicians in the Irish health service is the gap between the practice of clinical practice and the perceived understanding of that practice by senior healthcare management in general, and local hospital based IT managers in particular. Surprisingly, while many unsupported assumptions emanate from senior managers, local IT managers are not immune (Ó Scolaí, 2007).

Conversations with clinicians regularly begin with, “senior management at the top do not know what is happening on the ground; in the wards, clinics and emergency rooms”, and “[t]hese people [local IT management] don’t know what’s going on. These guys come to us with projects in which they are interested in and then disappear (Ó Scolaí and Kelly, 2006).”

The level of perceived detachment between health management and clinicians, while not unique is a contributing factor to some of the simplistic transformational claims regarding CIS found in, for example, government documents.

One could argue that while planners are cognisant of their local knowledge limitations, this knowledge is not as persuasive as the vendor accounts of successful implementation, the government’s policy for ICT integration and the unquestioned rationale behind the international drive to transform healthcare through the introduction of CIS. Furthermore, such rationale betrays a belief in the capacity of management to create an environment in which these systems can be successfully embedded, normally through the guise of a change management programme. Any difficulties can be dealt with during the design and implementation stage—and a dash of local tinkering.

Shades of this argument are contained in Ball’s earlier analysis of problems associated with system failure and the need to “acknowledge human factors” (2003). This approach needs to avoid the ‘isolation of technology’ into separate domains and its attendant relegation from our palette of considerations. A more fruitful approach is to ‘acknowledge materiality’ and its constitutive role in the evolution of materially mediated clinical practice. This approach directly addresses Berg and Timmermans’ finding that “[w]hat is typical of the technology is left under-explored (2003)”.

Much of the focus of this paper examines the substitution thesis central to the promotion of EPRs and similar systems (which I have grouped under the heading of Clinical Information Systems). The substitution thesis, however, needs to evolve past the traditional discussion surrounding the substitution of the paper record and other artefacts and encapsulate the substitution of bodies. It is in this sense, the substitution of bodies, that the notion of Digital Detachment is manifest. Digital Detachment both signifies the way in which we ignore the materiality of the CIS and the way in which the CIS facilitates our bodily detachment from co-present interaction between patient and clinician.

Prominent CIS, such as telemedicine systems, are implicated in the reconfiguration of clinical practices. In all of these cases the traditional mode of diagnosis and treatment is radically altered and too few studies exist which question how the materiality of the specific system is implicated in these practice re-configurations, and, the consequence of such re-configurations for the practices in question.

Section four focuses on materiality and identifies a number of aspects to materiality as a starting point for further research. The section concludes, relying exclusively on Verbeek (2005), by providing one important reason why materiality is relevant for system designers.

4 POSITIONING MATERIALITY

This paper's focus on materiality is partly influenced by Kelly and his suggestion that the subject is: "... a promising avenue for the development of new ways of understanding the role of technology in general, and ICT especially..." (Kelly and Jones, 2006). It is an anti-isolationist approach that seeks to redress "the isolation of technology and human beings in whose existence it plays a role, into two separate spheres" (Verbeek, 2005) within the context of health informatics.

Within IS and related disciplines there appears to be a resurgence of activity surrounding the role of "things that we have long rendered invisible (Kuchler, 2008)". In quoting Barad, Orlikowski sums up the lack of consideration given to the material artefacts implicated in organisation practices:

"Language matters. Discourse matters. Culture matters. But there is an important sense in which the only thing that does not seem to matter anymore is matter (in Orlikowski, 2007)."

This is a theme echoed in certain corners of academia and most notably by Bruno Latour. Latour similarly remarks, "[w]ho and what participates in the action is not thoroughly explored" (Latour, 2005).

Orlikowski believes: "[d]eveloping new ways of dealing with materiality in organisational research is critical if we are to understand contemporary forms of organising that are increasingly constituted by multiple, emergent, shifting and interdependent technologies (2007)." The first point of call in such an approach is to understand 'how' the materiality of the digital artefact is implicated in practice before developing new ways of dealing with it. Central to such an approach is understanding how artefacts co-shape the 'materiality of mediation.'

4.1 Technological Intentionality

Don Ihde has attempted to develop a philosophy on the mediating role of artefacts. One of Ihde's contributions is the development of the concept of Technological Intentionality. Technologies, for Ihde, have a directionality, inclination or trajectory that shape the flow of practice. Ihde is careful to point out that they do not have a determining influence but an "implicit users manual" or script (in Verbeek, 2005).

Verbeek painstakingly demonstrates how the ability of an artefact to co-shape the relations between human beings and the world must not be conceived as an intrinsic property of the artefact itself. For Verbeek, this would give rise to a kind of realism in which properties would be assigned to objects independently of the subjects for whom these objects exist. "To say that technologies possess intrinsic properties which can themselves influence the relationship between human beings and the world supposes that technology can be spoken about independently of the humans that engage with it (ibid)".

For Verbeek, the implication that technologies cannot be divorced from their use in practice is to demonstrate that they have no 'essence', "they are what they are only in their use." This results in the same technology having different identities in different use contexts. Ihde describes this phenomenon as Multistability. The identity of a technology is determined by the technology itself and the way in which it becomes interpreted. A technology is many things at once – "it is stable in multiple ways". One implication for design is that Multistability negates anticipation and in this sense the design process is not capable of anticipating, in an explicit way, the character of mediation (ibid).

Ihde goes on to develop his notion of mediation using Merleau-Ponty's work on the phenomenology of perception. Ihde posits that there are two basic sets of mediated relations, Embodiment Relations and Hermeneutic Relations. The former refers to the way in which our bodies in encountering the world are extended or stretched, a kind of spatially extended perception mediated by technology. The latter refers to the way certain artefacts provide a representation in need of interpretation. Verbeek

points out that in hermeneutic relations the world is not perceived through the artefact but by means of it.

One key insight from Ihde's approach, which is very relevant within a clinical environment, is the transformation of perception. Mediated Perception and 'Naked Perception' (unmediated by technology) are not identical pointing to the non-neutrality of technology and posing the question of how such perception differs (not necessarily contradicts) from the other (ibid).

There is no doubt that artefacts mediate and shape our understanding of the world. In the clinical setting, the paper record shaped the clinicians world a certain way—it carved up the body into parts and represented the important areas for observation—it shaped the flow of practice. Similarly, CIS shape the flow of practice, although this time the paper chart and body have been substituted by technologies that radically alter the relationship between the patient and clinician. Doctor and patient are digitally detached.

4.2 Digiscribing

While many identify the absence of materiality in IS research, there are few attempts in the IS tradition which apply this concept to an empirical setting. Digiscription is one such attempt.

Digiscription attempts to theorize the role of the digital artefact by paying attention to the material features but not to the exclusion of the underlying social relations (1990). Akin to Ihde, digiscription "emphasises the embodied nature of our engagement with the world. Kelly suggest that digiscribing may be very effectively interwoven with other more traditional forms of interaction which instead of replacing [substituting] direct modes of interaction/engagement between staff, supplement/complement them.

Kelly argues that these "**modes of engagement with the lifeworld [reifications in the form of a digital text]** should not be seen as alternatives that are, in any sense, substitutable for one another. Rather, they are better viewed as **complementary** modes of learning/knowing, with the challenge being to maintain an appropriate balance between them in any given situation. Thus, we might be better conceptualising **digiscription as a means of mediating our engagement with the lifeworld** so as to facilitate the development of *alternative/complementary*, as opposed to *superior*, visibilities."

In Ihde's discussion on mediation he focuses on transformation and its underlying structure, which he refers to as amplification and reduction. It is a theme reflected in the work of Latour, and Kelly's development of Digiscription. One notable difference is the way Kelly positions digiscription as something complementary and alternative rather than superior. If we accept that 'things' enable and limit certain bodily and mental activities, the question arises as to what exactly is enabled and limited for the clinician and patient in a relationship where the body has been substituted and new technologies join the network of relations that mediate our perception.

Indeed, both Ihde and Kelly identify how in technologically mediated engagement, the subsequent transformation can both reveal and restrain our perception of the world. As more and more systems become embedded in clinical practice, it is essential to develop rich insights that will provide clues as to how systems may be designed to reveal more than they may otherwise conceal by focusing on how the materiality of mediation is implicated in how clinicians and patients perceive their engagement.

5 CONCLUSION

This paper demonstrates how current accounts of CIS, especially in an Irish context, are based on problematic transformational claims. In examining these transformation claims the paper highlighted a number of recent failures partly attributed to the extent of detachment between planners and practitioners and an isolationist focus on user involvement, education and training. While this isolationism, more broadly, set the stage to introduce materiality, the paper focused on the type of

questions that a material approach evokes when the focus of study revolves around the substitution of bodies. The substitution of bodies was tentatively conceptualised under the title of Digital Detachment where mediation and perception took centre stage.

In the rush to introduce new technologies and systems to 'support' clinicians in their work, few researchers are focused on understanding how these new technologies and systems are implicated in the mediation of practice and the attending transformations. Such an approach does not surrender to notions of particular technologies having particular effects, but it does attempt to identify how the materiality of CIS is implicated in shaping perception.

Moreover, focusing on materiality does not negate other very important question, such as, how these technologies conceal or reveal relevant social issues like inclusion or exclusion or the reconstruction of patients or professionals identities and inter-professional power relations.

Acknowledging the intrinsic relationship between technology and organisation, human and artefact, must be the first step in developing a mature understanding of the materiality of mediation. Paying particular attention to understanding how the materiality of the digital artefact is implicated in mediation will supplement our understanding of the social world of clinical practice leading to a more 'realistic' understanding of the potential of CISs to 'transform' clinical practice.

Within this context this paper claims that it is legitimate and imperative to explore how the materiality of the digital artefact is implicated in the reconfiguration of clinical practices that substitute the body. The implications of such an approach are varied, but in the context of design we should embrace Verbeek's conclusion that, "[b]ecause products by definition co-shape the existence and experiences of people, their design is unavoidably a moral activity."

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