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Changes in Healthcare Professional Work Afforded By Technology: The Introduction of a National Electronic Patient Record in an English Hospital

Abstract

This paper considers changes in healthcare professional work afforded by technology. It uses the sociology of professionals literature together with a theory of affordances to examine how and when technology allows change in healthcare professional work. The study draws from research into the introduction of a national Electronic Patient Record (EPR) in an English hospital. We argue that EPR affords changes through its materiality as it interacts with healthcare professional practice. Its affordances entail some level of standardisation of healthcare professional conduct and practice, curtailment of professional autonomy, enlargement of nurses' roles and redistribution of clinical work within and across professional boundaries. The paper makes a contribution to the growing literature advocating a cultural approach to the study of technological affordances in organisations and to studies that explore healthcare professional practice in conjunction with the materiality of technology. Two main lines of argument are developed here. First, that technological affordances do not solely lie with the materiality of technology nor with individual perceptions, but are cultivated and nurtured within a broader cultural-institutional context, in our case a professional context of use. Second, that technological affordance of change is realised when healthcare professionals' (individual and collective) perceptions of technology (and of its materiality) fit with their sense of (professional) self. In this respect the paper shows the extent to which the materiality of technology plays out with professional identity and frames the level and extent to which technology can and cannot afford restructuring of work and redistribution of power across professional groups.

1. Introduction

The English NHS has seen wave after wave of centrally mandated policies intended to lead to change. In the past three decades the NHS has experienced the general pressures of New Public Management, the establishment of internal markets, the resource management initiative, the private finance initiative, the introduction of performance related payments, restructuring of the workforce, performance targets and management, the establishment of Foundation Trusts and new clinical governance structures (Ashburner et al., 1996; Currie et al., 2009; Dent, 2003; Farrell & Morris, 2003; Flynn, 2002; Gray & Harrison, 2004; Greener & Powell, 2008; Harrison, 2004; McDonald et al., 2008; Oliver, 2005). All these initiatives have been accompanied by constant realignments of organizational units and reallocation of resources and responsibility.

The NHS has also been subject to another possible means of transformation – Information and Communication Technology (ICT) (Abraham & Junglas, 2011; Barrett et al., 2011; Brennan, 2005; Currie & Guah, 2007; Fox et al., 2005; Greenhalgh et al., 2008; Hendy et al., 2007; Jones, 2003; Mort et al., 2009; Mort et al., 2003; Mort & Smith, 2009). In the late 1990s, following some unsuccessful larger scale projects, there was a broad impetus to pursue IT-enabled innovation and change at the local level (Cornford & Klecun-Dabrowska, 2003). But by the turn of the millennium such change was seen as being too slow, too piecemeal and too fragmented. Thus, in 2002 the New Labour government launched the National Programme for Information Technology (NPfIT). The NPfIT was intended to transform the NHS and improve services and the quality of patient care. The NPfIT was presented as '*a business change programme*' intended to change clinical work, management and healthcare delivery through computerisation and '*ruthless standardisation*' (Department of Health, 2002, pp.i, 8,24) – a standardisation that started with technology but, as we show, became bound into attempts at standardisation of professional practice. This paper focuses on one of the main elements of NPfIT, the establishment of a National Care Record Service (NCRS) intended to create a nationally shared electronic patient record.

The analysis presented in this paper draws from the literature on the sociology of professionals together with a theory of technological affordances. These are used to examine how and when

technology affords change in healthcare professional work, and the type of change it affords. Specifically, we draw from a theory of affordances that sees technology as being ontologically constitutive of what it offers, i.e. in the number of possibilities for perception and action it opens up, and go on to explore *when* technology affords change in the context of healthcare professional work (Bloomfield et al., 2010; Gibson, 1977; Hutchby, 2001; Kallinikos, 2008; Leonardi, 2011; Zammuto et al., 2007). The lens of technological affordances allows us to reveal the possibilities IT provides, as it becomes engaged in professionals' work practices, for re-arranging professional work and thus professional power and identity.

Theories of affordances have been used elsewhere in organisation studies as a conceptual lens to explore how an organisational environment, physical and social, can afford informal interactions (Fayard & Weeks, 2007). More specific to our purposes, Zammuto et al (2007) introduce the affordances of technology in order to argue that changes in work organisations, conditioned by technology, cannot be fully explored unless technology is considered as a significant constituent element, rather than a mere facilitator, of change. As Zammuto et al (2007) put it, technology is a part of the changing fabric of organization and they show how the intersection between IT and organisation systems affords possibilities for changing organisation forms. In contrast, we explore the intersection between technology and healthcare professional practice, and how and when this affords change in healthcare professional work. A slow change has typically been attributed, rightly or wrongly, to the existence of strong professional groups and their conservative influence on outcomes of organizational change initiatives.

We investigate changes afforded by EPR by looking into how healthcare professionals perceive and interact with technology and its main properties (seen as its materiality) (Barrett et al., 2011; Yoo, 2010; Zammuto et al., 2007). Based on our findings we argue that EPR allows some level of standardisation of healthcare professional conduct and practice, curtailment of professional autonomy, enlargement of nurses' roles and redistribution of clinical work within and across professional boundaries. We go on to show that technological affordances of change are realised when healthcare professionals' perceptions of it (and its materiality) fit with their sense of (professional) self. The paper thus contributes to studies that take a cultural approach to technological affordances (Bloomfield et al., 2010) by illustrating how a professional context of

use (a professional practice) may influence the realisation of affordances i.e. what technology can and cannot do. It also contributes to the literature that explores how healthcare professional practice comes into play as the materiality of technology is realised (Barrett et al., 2011; Oborn et al., 2011) and the implications of this for healthcare professional work.

The remainder of the paper is structured as follows. The next section reviews relevant literatures on the nature of healthcare professional work and the changes it has undergone through the introduction of technology and provides an overview of a theory of technological affordances. We then present our research methodology and findings. The penultimate section discusses our findings in the light of the literature and theory. The paper ends with some concluding remarks.

2. Changes in Healthcare Professional Work Afforded by Technology

The Nature of Healthcare Professional Work

Professionals constitute powerful occupational groups that work to protect their jurisdictions (Abbott, 1988); regulate entrance and establish closure (Abbott, 1988; Freidson, 1970; Larson, 1978; Perkin, 2002; Timmermans & Berg, 2003); define expertise (Abbott, 1988; Fournier, 1999) and set up norms, values, and standards of behaviour (Johnson, 1972; Macdonald, 1995; Moline, 1986). Professionals draw from their abstract knowledge to legitimise their power and establish their autonomy (Abbott, 1988; Brint, 1996; Freidson, 2001; Johnson, 1993; Larson, 1978; Macdonald, 1995; Moline, 1986; Perkin, 2002).

Healthcare professionals, in particular, traditionally enjoy high levels of autonomy to regulate their work i.e. the nature and volume of medical tasks, decide about the use of tools and treatments in the provision of care to patients, determine remuneration and set standards of performance (Currie & Guah, 2007; Doolin, 2002; Flynn, 2004; Timmermans & Berg, 2003). Their power is in many ways constrained however by norms and ethics that underpin their profession such as equity, patient care, confidentiality and trustworthiness (Moline, 1986; Freeman et al., 2009). These constraints are also embodied in rules and practices instilled in their professional identity during training and education (Perrow, 1979) and by the continued and active development of clinical protocols and standards that categorise diagnoses and treatments and thus also restrict professionals' decision making. Still healthcare professionals continue to

exercise discretion as to how to apply these normative and regulatory standards when they deal with individual cases/patients (Mintzberg, 1979).

Healthcare professional work is material in that it involves dealing with people and their bodies. It is also material in that it involves working with many technological devices and informational resources. The latter includes patient records with professional work needing to be undertaken for creating, updating, consulting and sharing them. Historically we see that changes in the form of patient records conditioned changes in healthcare professionals' work, specifically in record keeping practices and more generally in required professional competencies, organizational structures of care and norms of good practice. Up until the 19th century, healthcare professionals, mainly medical doctors, made diagnoses and decisions about treatments solely on the basis of the consultations they had with the patient. Consultation constituted the single source of information doctors had and used, which however was not always recorded. Doctors kept individual logs or diaries of their consultations, which they used for their own administrative, research and teaching purposes (Berg, 2000). Nurses' intervention into patient treatment was vague and undocumented despite the pioneering work of Victorian nurses, notably Florence Nightingale (Bowker & Star, 2000). Substantial paper-based patient records only emerged at the beginning of the 20th century (Craig, 1989). These paper-based records signified a first attempt to circumscribe doctor's power in that they introduced a systematic way of recording clinical practice and maintaining a history of consultations. Since they started being stored in hospitals or clinics doctors lost the exclusive privilege of owning them (Berg, 2000). Patients' health-related information became centralised and accessible by any legitimate healthcare professional group including nurses. One significant change attributable to paper-records was bringing to the fore nurses' clinical work, which was up until then invisible. This made them contributors to and users of the medical record and thus no longer invisible or untraceable (Bowker & Star, 2000, p.29). Thus, apart from enriching the amount of available clinical information, paper records also revealed the collective nature of healthcare work and the potential for realignment of power interests.

Today the provision of care is collective work but power remains unequally distributed amongst healthcare professionals. This may be seen as related to a bureaucratic division of labour and, subsequently, to the different degrees of autonomy, authority and status healthcare professionals

claim (Currie & Guah, 2007; Greener & Powell, 2008; Mintzberg, 1979; Perrow, 1979). There are at least five subgroups within healthcare professionals: doctors, nurses, allied health professionals, professionals that support clinical work (e.g. clerks and secretaries) and clinical managers, all with varied, albeit often blurred, roles (Currie et al., 2012). Nurses for instance are typically subordinate to doctors and trained to offer a more patient-centred and less technical or specialist service. They have also traditionally been excluded from the formal doctor-patient relation (Bowker & Star, 2000). Today, however, these professional roles are in flux as new policies aim to expand some jurisdictions, refocus on patient centric 'service', and thus disrupt established power relations, whilst automating more mundane tasks (Currie et al., 2010).

Thus, despite institutionalist based claims to professional dominance and stability (Scott et al., 2000), the power of healthcare professionals has been continually challenged since 1970s in many western countries due to an introduction of versions of a management ideology, patient centricity, accountability and market-driven practices (Causer & Exworthy, 1998; Currie & Guah, 2007; Dent, 2003; Greener & Powell, 2008; Hasselbladh & Bejerot, 2007; McDonald et al., 2008; Parker & Dent, 1996; Salhani & Coulter, 2009). Such programmes of change have created new forms of actorhood for healthcare professionals (Hasselbladh & Bejerot, 2007). Specifically, in the course of these changes, healthcare professionals have experienced new professional delimitations and clinical governance structures intended to devolve authority from doctors to managers and to nurses, together with the introduction of new accountability arrangements oriented towards clinical performance, health outcomes and patient satisfaction (Flynn, 2004; Greener & Powell, 2008), and intervention in clinical practice through mechanisms of auditing, benchmarking and evidence-based medicine (Berg, 1997; Greener & Powell, 2008; Hasselbladh & Bejerot, 2007; Timmermans & Berg, 2003).

Since the 1990s healthcare professions have experienced many new ICT based interventions serving as a means to restructure professional work and power even further including EPR, electronic prescribing, digital imaging and robotics (Timmermans & Berg, 2003). Technology alters how healthcare professionals organise and record their practice and how they retrieve and use information in order to make diagnoses, and decisions about treatments. These technology-based interventions also enable, at least in theory, new ways of working and collaborating and in

doing so redistribute work (and power) within and across professional boundaries for instance between doctors and radiologists; pharmacists and their technical assistants; doctors and nurses etc. (Barrett et al., 2011; Barley, 1986; Mort et al., 2009; Oborn et al., 2011; Petrakaki et al., 2012). Finally, technology may at times create more agentic roles for patients giving them greater access to personal health information and more involvement in the process of their own care, for instance through electronic booking of appointments with doctors of their choice or access to records, further challenging healthcare professionals' power (Haug, 1988; Hasselbladh & Bejerot, 2007; McKinlay & Stoeckle, 1988; Mort et al., 2009).

There is however still contradictory evidence as to the effects of these and similar programmes of change on healthcare professional work and power (Buchanan & Fitzgerald, 2011; Doolin, 2003; McDonald et al., 2008; McNulty & Ferlie, 2004; Parker & Dent, 1996). Some commentators have suggested that such programmes of intervention prescribe and rationalise healthcare professional work and thus also delimit or redistribute professional power (albeit to varied degrees) (Berg, 1997; Dent, 2003; Greener & Powell, 2008; Hasselbladh & Bejerot, 2007; Timmermans & Berg, 2003). Others suggest that managerial and technological programmes to change healthcare professional work meet professionals' resistance, reaffirming their powerful position in the healthcare hierarchy (Adler et al., 2008; Freidson, 1970; Waring & Currie, 2009). Contradictory implications of the same technology for professional work and power have also been reported (Petrakaki et al., 2012).

Reviewing this literature suggests that the introduction of technological programmes of change do not necessarily result in alterations to healthcare professional work. In looking more closely about *how* technology reorganises healthcare professional work, it is desirable to focus not only on how technology shapes professional work and in what ways but also under what conditions it does so. We need, in other words, to consider the interactions between technology (and its material features) and practice within a context of professional use. A theory of affordances can meet this purpose.

A Theory of Technological Affordances

Studies on healthcare professional work and technology differ in scope and objectives. There is a substantial body of research that sees healthcare professionals as users of technology and ties any accompanying or consequential changes in their work to this use or the processes of technology implementation and adoption (Aanestad & Jensen, 2011; Abraham & Junglas, 2011; Cho et al., 2008; Constantinides & Barrett, 2006; Davidson & Chiasson, 2005; Greenhalgh et al., 2009; Jensen & Aanestad, 2006; Venkatesh et al., 2011). Cho et al (2008) for example show how tensions between technology and medical practice influence the implementation of a radiology network system in Sweden; Constantinides and Barrett (2006) acknowledge the implications of ICT for clinical work practice but take these to be at most significant contextual factors for the development and use of ICT in healthcare.

There are also a number of studies that examine the impact of technology on healthcare professional work *per se* but which place little emphasis on the conditions under which it enables or constrains change or the possibility of technology enactment once introduced (Aarts et al., 2007; Abraham & Junglas, 2011; Harding & Taylor, 1997; Håland, 2011; Morrison et al., 2008; Reich, 2012; Vikkelsø, 2005). For example, Håland (2011) examined how the introduction of an EPR in a Norwegian hospital affected clinical work practices and the identities of doctors, nurses and secretaries without considering explicitly the agency of technology in this process of change. Harding and Taylor (1997) focused on the consequences of pharmacies' computerisation, arguing that it rationalises pharmacists' knowledge, circumscribes their judgement and eliminates some of their tasks, without however discussing why and how digital systems condition such change. Barley's (1986) classic work on the introduction of CT scanners shows how radiologists dealt with the complexity of technology and negotiated their jurisdictions and professional boundaries as they interacted with radiology technologists. It does not however analyse what this technological complexity entailed and how it was implicated in the redistribution of expertise in radiology.

Finally, there is a smaller and more recent body of studies that aims to explore the interplay between healthcare professional work and new digital technology (Barrett et al., 2011; Oborn et al., 2011). These studies address technology not in separation from but in conjunction with

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healthcare practice examining their co-constitutive relations. For instance Barrett et al (2011) look into how the materiality of robotics is entangled with pharmacy practices, relations and boundaries and its implications for healthcare professional work, specifically in relation to jurisdictions, skills, status and visibility. It is to this last body of research that our study most directly contributes.

We do so drawing on a theory of technological affordances (Bloomfield et al., 2010; Hutchby, 2001; Kallinikos et al., 2012; Leonardi & Barley, 2008; Leonardi & Barley, 2010; Leonardi, 2011). We place our focus on how and when technology 'affords' change as it interacts with practice. Originating from Gibson's work on an ecological approach to perception and action, 'affordance' refers to the 'ontological constitution' (Kallinikos et al., 2012, p.9) of things in the sense that a thing is what it affords i.e. what it 'offers', 'furnishes', 'provides' (Gibson, 1977). The concept of affordances allows us to comprehend the enabling and constraining aspects of technology as they emerge from our interaction with it, accepting that the same technology may evoke different affordances under different circumstances (Zammuto et al., 2007).

The primary debate on technological 'affordances' concerns their origins and nature, specifically the question as to whether affordances are embodied into the technology or located in and constituted by social practice. Norman (1999) suggests that affordances are purposely inscribed into the technology. They are thus a matter of design, influenced by culture or conventions. Norman goes on to distinguish 'real' from 'perceived' affordances in order to differentiate the range of possibilities technology provides *tout court* from the range of possibilities users perceive. According to his view affordances exist independently of user perception, and, ideally, all real affordances should be perceived. Taking an essentialist perspective to affordances Volkoff and Strong (2013) suggest that affordances may or may not become actualised depending on individuals' intentionality, assuming in this way their *a priori* existence.

In contrast, Hutchby (2001, p.444) provides an interactionist approach to affordances defining them as being '*functional and relational aspects which frame while not determining the possibilities for agentic action in relation to an object*'. This view suggests that technology has certain attributes ('aspects'), physical (e.g. size) and digital (e.g. the rules inscribed into it), which

constitute its materiality, and which afford possibilities for action (Hutchby, 2001; Leonardi & Barley, 2008; Orlikowski & Barley, 2001). In this way the materiality of technology may involve its ability to perform programmable functions (e.g. processing of data), to interface and interact electronically and *en masse* and to produce representations and visibility (Yoo, 2010; Zammuto et al., 2007). Further, it is through its materiality that a technology may afford new practices, modes of collaboration, relations and skills (Kallinikos, 2010; Leonardi & Barley, 2008; Leonardi, 2011).

Materiality of technology is, in other words, the condition for a (indeterminate) range of possible actions (Hutchby, 2003) and that which shapes the possibility and degree to which technology is negotiable and malleable (Kallinikos, 2008). In looking into how the materiality of technology relates to the context of its use, Kallinikos (2008, p.78) suggests that we consider the '*twin strategy of functional simplification and closure*' that underpins any technology. Functional simplification entails a detailed prescription of work tasks; closure or 'enframing' provides a clear delineation of boundaries for each operation or business process, which reduces complexity and disruptions from contingencies. Kallinikos (2008) also adds a third aspect, the entrustment of technology to carry out tasks in an automatic manner. We show in our analysis that simplification, closure and entrustment are revealing of affordances of the technology studied.

In this way affordance is not understood as deterministic or essentialist, nor as narrowly interactionist; affordances enable human agency (e.g. in individual and collective enactment), opening up space for interpretations and thus for new or different practices that would not otherwise be possible (Hutchby, 2001; Leonardi, 2011). For instance, computerized medical imaging allows healthcare professionals to exchange medical images (such as X-Rays, MRI scans etc.) and make different and perhaps more collective, information rich and interactive/iterative decisions about diagnosis and treatment in real time; a possibility (not an inevitability) that is less afforded by the previous film-based technology (Leonardi & Barley, 2008). This view suggests that although the materiality of technology is given, its affordances (what it offers in specific contexts) are contingent upon perceptions and uses and thus differ among individuals or groups.

Some commentators have problematised the nature of technological affordances further arguing that perceptions of affordance are shaped by a cultural context of technology use (Bloomfield et al., 2010; Rappert, 2003). Bloomfield et al. (2010) suggest that we should depart from a narrowly interactionist approach to affordances and the individual-technology dualism it presupposes. Rather, perceptions of affordances are influenced by the co-presence of other individuals and artefacts and by meanings shared within a cultural context that extends well beyond technology use. Our study contributes to this literature that takes a cultural approach to the study of technological affordances. It shows that technological affordances of change are neither inherent in the technology nor are they principally individual constructs but they are cultivated and nurtured within a professional context of use. A cultural-professional approach to affordances can help explain how the materiality of technology (revealed through simplification, closure and entrustment) plays out with professional identity (doctor; nurse; radiologist) and frames the level and extent to which technology can and cannot afford change in work across professional groups.

3. Methodology

3.1. The Context of the Study

The findings we present here are part of a larger evaluation of the National Care Record Service (NCRS) of the National Health Service (NHS) in England (References to be added), the largest civil computer programme in the world (Brennan, 2005). The NCRS's overall purpose was to create an EPR to be shared across hospitals in the English NHS. The purpose of the evaluation was to explore the changes the NCRS brought about to healthcare professional work and business process; to the quality of clinical data from the digitisation of patient records and to organisational learning and re-skilling. A multidisciplinary team from four UK universities conducted the study. Each university team studied a number of secondary healthcare settings (Acute Trusts, Mental Health Trusts and Community Hospitals), 12 in total. The hospitals we studied were those that had begun implementing or would start implementing the NCRS during our evaluation. The different implementation processes we encountered during our research invited the development of a set of twelve studies, diverse in their conceptualisation and focus, one of which is presented here (Yin, 2008).

In 2008 Alpha, the Acute Trust where we conducted our research, was one of the first hospitals in the country to implement this particular software which embodied the NCRS system. Alpha granted us early access to its site and as a result we could conduct a longitudinal study, following the implementation of the NCRS over a 13-month period. The NCRS system used at Alpha was developed by a multinational software house and was provided to the Trust through a local service provider. The process of implementation was overseen by Connecting for Health, a directorate of the Department of Health responsible for the management and supervision of the NPfIT, a regional strategic health authority, and the software supplier, and was locally managed by the Trust's implementation team. The latter consisted of Programme and IT managers, clinical advisors, trainers, testers and business change analysts. At the beginning, the implementation team numbered only a few members; it then expanded as implementation gradually grew in both scale (number of users) and scope (number of departments implementing the system).

The NCRS system was not fully functional during the course of our study. It was being developed in collaboration with early adopter hospitals such as Alpha, so that it would become tailored to the needs of its NHS users. The findings presented here reflect the period between the third and thirteenth month of the implementation at Alpha. During this period, Alpha implemented basic functionality of the system, electronic requesting and reporting of X-Ray requests for hip and knee joint replacement, and became involved in digitalization of clinical data forms. Implementation took place initially in three (inpatient and outpatient) clinics and involved two departments, Orthopaedics and Radiology. The plan was to then expand electronic requesting and reporting to all clinical pathways within Orthopaedics and then on across the hospital.

3.2. Research methods

To achieve these aims we conducted qualitative study following an interpretive epistemology (Alvesson & Skoldberg, 2000; Crotty, 1998). We gathered information through semi-structured interviews and documents. We conducted 23 interviews in total with 24 individuals (one interview was conducted with two nurses) in two periods. The first period was between May and August 2009, a few months after the implementation of the NCRS first started, and the second period was between March and June 2010. These research periods were negotiated and mutually agreed between the researcher and the Chief Information Officer and Programme Manager from

Alpha. Interviewees included project managers (3), training manager (1), programme managers (3), product specialist (1), IT manager (1), configuration architect (1), testing lead (1), business analyst (1), business change leads (2), doctors (4) and nurses (6). Of these interviews seven were conducted with implementation team members in the first period. This was because of the limited implementation of the NCRS technology and the small number of users at the time. The remaining 16 interviews were conducted in the second period when the number of users had increased and the Trust had taken its implementation further. In the second research visit we conducted two follow-up interviews with key members of the implementation team. Apart from one interview that was held over the phone, all other interviews were conducted in person, were recorded, lasted between 30 and 90 minutes and were transcribed verbatim.

Interviewees from each stakeholder group were selected purposively, depending on their role and involvement in the implementation of the NCRS, and also in a snowball manner based on recommendations from previous interviewees. Due to the small scale of implementation of the NCRS there was similarly a small number of users of the NCRS.

For our interviews we used thematic guides for each stakeholder group. Our research was designed and conducted according to NHS research governance frameworks and was approved by an NHS Research Ethics Committee. We received informed consent from all participants.

Findings were analysed manually following an iterative thematic process informed by our theoretical and empirical interests (Strauss, 1987). Analysis followed an inductive approach. Interview transcripts and field notes were continuously read and compared and contrasted with the literature leading to the creation of themes and sub-themes (Alvesson & Skoldberg, 2000). Our initial themes included interviewees' interpretations of the NCRS implementation in relation to conditions, rationale and process of implementation, evident and projected changes in healthcare professional work and business processes and perceptions of the NCRS technology both as an artefact and as technology-in-use. These themes were then elaborated, developed and refined, by linking them with each other and with our theoretical assumptions as outlined above. To ensure coherence of data analysis, our analytical themes were reviewed by the authors and presented for discussion with the larger project team at dedicated workshops. At these meetings

findings were discussed across hospital cases within the overall project, drawing upon a set of 431 interviews, 590 hours of observations, 234 field notes, 809 NHS documents, and 58 national and regional documents (Reference withheld, to be added). Interim findings and analysis were presented, reviewed and discussed with the Chief Information Officer at Alpha. The sections that follow present our findings.

4. Introduction of the National Care Record Service (NCRS) in Alpha
4.1 Healthcare Professionals' Perceptions of NCRS Affordances

Healthcare professionals - nurses, orthopaedists and radiologists – perceived and spoke to us about a number of changes in their work from the introduction of the NCRS. The NCRS was seen to inform change in clinical decision-making by affording legible clinical notes and requests, fast exchange of information, instant capture and access to data and increased visibility of diagnoses, procedures and test results. Up until the introduction of the NCRS clinical information was scattered, kept in both paper and electronic form, and often unavailable.

> *'This is a system which should allow clinicians to keep a much closer handle on the care of their patients and audit their activity much more easily than they have been able to do to date, because it is a much more clinically rich system…Lots and lots of units have lots and lots of computer systems to record activity related to patients and this system potentially offers you the ability to capture that data simply as part of the clinical consultation process. So, potentially it is a more efficient way, because you don't have to enter it again. This data is captured in a retrievable form and not a whole load of sheets paper in the medical record'* (Consultant Radiologist)

Healthcare professionals and managers believed that the NCRS could lead to the diffusion of some best clinical practices in NHS organisations. For instance, the system mandated the right type and amount of data that is necessary to perform a particular clinical task, such as to order a scan. In doing so, it reduced differentiation among specialties and wards and encouraged the adoption of standard ways of working such as, according to a radiologist, '*a better standard of note keeping and processing of patients*'.

> *'There are variations on joint replacements and that's absolutely fine, but the information that's relevant to that joint replacement is the same. … the same type of prescribing and*

the same surgery documentation, surely that would lead to a safer environment for a patient. I think electronic records is the lever that we needed to start that process'.(Senior nurse)

Computerisation of clinical practices and processes would also render clinical outputs tractable and visible creating, according to a consultant Orthopaedist, an electronic 'audit trail' that did not exist before as data were not recorded consistently. Other healthcare professionals also received this affordance positively.

'...we needed a clinical information system, because we've been monitored more and more closely now on what we do. A lot of data that we need to be providing, we are having to collect manually. So it's within everybody's interest to have that done electronically.' (Senior nurse & Ward manager in Orthopaedic)

In this way, NCRS was seen to afford transparency and monitoring of hospitals and healthcare professionals. The project manager argued that the system had the potential to provide aggregated information about various performance indicators such as costs, outputs or performance profiles of each hospital and clinical unit across the country. This could then be used as a way to compare results and performance and make decisions. A radiologist also echoed this:

'Things weren't as tight before, now is much tighter, because you are in an electronic world and everything is kind of monitored and kept. They might object to that, so I think definitely it's not just a system, it is an actual NHS agenda to change things' (Radiologist).

The hospital implemented the NCRS system gradually by introducing different clinical functionality in sequence. At the time of our research Alpha was implementing electronic X-Ray requesting and reporting functionality, which enabled electronic filling and transfer of requests, electronic reporting of results and subsequently electronic viewing, re-ordering and cancelling of requests. The NCRS system interfaced with the existing Patient Administration and Radiology systems. It was not a fully functional system as the intention was to customise it to hospital's needs. Customisation included testing and re-designing parts of the system so that they were more in line with the hospital's processes and practices.

'... I'm trying to bring it into line to practices we already use within the organisation... we are trying to make it more efficient and effective for the way that we work within the organisation...'. (Configuration architect)

Customisation included mapping healthcare professionals' work practices in order to illustrate 'how things are done here'. During this process some clinical practices and processes (or parts of them) were computerised or eliminated and some new practices were created.

'...we spent a lot of time with the users and ...we do quite a lot of shadowing. We follow them around and sit with them in Outpatient clinics and follow them into theatre and see what they do and what they use and how they do it and why they do it. If they could possibly do it a different way, so we try and see if we can improve the system at the same time. Rather than just replicating and we will try and clean it up a little bit if we can' (EPR manager)

Another more hidden intention behind this process was to bring current healthcare professional practice in tune with clinical protocols and standard operating procedures. Customisation was thus not only a process of representing onto the technology what healthcare professionals did but also a way of prescribing what they were supposed to be doing. The project manager of NCRS implementation said the NCRS was '*A solution that's robust enough to restrict people from doing what they are not allowed to do.*'

4.2. NCRS affordances of change in healthcare professional work
This section describes how and when the NCRS afforded change in healthcare professional work. It focuses on the Orthopaedics and Radiology departments in which the NCRS was implemented and on involved professional groups, orthopaedists, radiologists and nurses.

The NCRS system afforded some changes in healthcare professionals' work in the Orthopaedics department. The system computerised the requesting process for X-rays and allowed automatic population of requests with data from the patient administration system, reducing in this way manual data entry. It also standardised healthcare professionals' requesting behaviour by mapping electronic requesting forms against the clinical protocol and by requiring filling-in of

many fields on the form. As a result, the system prevented healthcare professionals from skipping fields and dispatching half complete requests to the radiology department (a common practice when paper forms were used). As a nurse said: *'Now the system's been set up so that we can only request what's in our protocol, so you can't make mistakes on it…'*. Healthcare professionals needed to go through a number of screens to add necessary information, making the use of the system cumbersome for them. As a doctor argued '*One of the issues with* [name of the system] *is the time that it's taken to get anywhere with it. It's ridiculously long'.* The system also rendered doctors responsible for writing and dispatching X-Ray requests, a practice they would previously displace to nurses with doctors only authorising them.

The result was that doctors in the Orthopaedics department were reluctant to continue using the system because they saw it as being a time-consuming and unchallenging task that failed to match their perceptions of their work and role as doctors.

> *'…doctors are relatively egocentric. Most of us have got where we are because we are high achievers and we are busy and we like to be busy and we like to be team leaders and something which actually gives us a mundane task to do, we resist..'* (Orthopaedist)

Doctors also saw that the NCRS did not fit in with their professional values and ethics. Healthcare professionals have a particular work ethic, which revolves around patient treatment, safety and due clinical practice. Technology use is outside of their scope unless it is compliant with this ethic.

> *'We are not averse to changing practice changing the way that we do things. We are not averse to that. But we won't do that unless there is a very good reason for doing so. The way that we work is done in a specific way for a reason, usually and it's usually around clinical practice, patient safety; it's done in that way because of those issues. What we can't do is change to less safe practice'* (Orthopaedist)

Also, doctors in the orthopaedics department saw the NCRS as an intervention in their practices, as a criticism of what they currently did and as an attempt to curtail their autonomy.

> *'…clinicians would need to change the way they do it for the greater good. So if you like, it's a threat to their autonomy and it's a threat to the way they've done it before. It's*

almost like a criticism. We want you to change because we want you to conform because
what you are doing is not best practice'. (Orthopaedist)

Due to doctors' resistance to use the system, nurses in the Orthopaedics continued completing electronic requests on behalf of doctors. This was despite their belief that the new system questioned their performance and challenged their work. A senior nurse said that the new system created:

> *'...a lot of fear around that nurses wouldn't be able to do it at all or that they wouldn't do*
> *it correctly ...* [It] *really challenged what they were doing... It just challenged them a*
> *little bit. Why did they need to do it, because actually everything is fine as it is.'* (Senior
> nurse)

Although the NCRS system standardised the requesting process it also opened up some space for exercising discretion. This was particularly the case when clinical decisions had to be made based on either incomplete or ambiguous information NCRS provided. For instance, nurses reported that on some occasions they had to input a patient allergy that was not included in the system's drop down list and on other occasions allergies were broken down into their specifics about which nurses were often not knowledgeable. This meant that they needed to order clinical tests under situations of uncertainty. The potential of making life-threatening mistakes contributed to nurses' reluctance to use the system.

> *'..say somebody has an allergy to something, then that allergy might be broken down into*
> *specific parts of an allergy and a lot of the nursing staff wouldn't have the knowledge to*
> *be able to ...I think a lot of the nurses just wouldn't do it. I think it was acknowledged that*
> *it was quite a risky thing'* (Nurse)

The NCRS system also provided nurses with more visibility and control over their work. They could track the status of requests dispatched electronically and monitor pending requests, saving considerable time. As a nurse said '*…on* [NCRS system] *I can check and see whether the patient,*
you know, whether they've had the x-ray or not and I can keep bringing it up on the screen all the
time and going back to it…'. However some nurses would still call staff in the Radiology Department in order to ensure the timely arrival of their requests. Further, computer errors and

the, often, slow speed of the system would bring delays in completing requests or getting patient lists, slow down processes, increase patient waiting times and cause patients' dissatisfaction. Under such circumstances, nurses were held accountable to patients for errors they did not make. As a nurse said '…*if patients are waiting, … they're not going to see it as the computer they're going to see it as your fault'*.

Despite their concerns nurses were perceived by managers and doctors as being less resistant towards the use of the system because their low position in the professional hierarchy made them more responsible for doing '*what they are told*' and thus more submissive towards change. This was despite the fact that, as nurses said, the use of technology was never a part of their caring role.

Radiologists saw as beneficial that they received through NCRS complete and legible orders reducing the risk of mistakes due to wrong reading of a request or missing information. Before the introduction of the NCRS radiologists would often receive half-complete or illegible requests for X-Ray scans.

> '*request cards will have to be filled in otherwise the request will be bounced electronically … with paper they* [healthcare professionals working in the Orthopaedic department] *can cut corners. Now they won't be able to cut corners'* (Radiologist)

Perhaps more importantly, the system rendered visible, at least in theory, who authorised and thus who was responsible for each electronic request radiologists received. In the past they had to assume that request cards were filled-in by the doctor who signed and authorised them.

> '[with] *the paper …we get a request card that's signed. We don't actually genuinely know that that person filled out the request card. We would look at that request card and make the assumption it's come from that doctor. …Whereas electronically… It's recorded more accurately. For instance, when you log onto the NCRS system, the idea is that NCRS system knows who you are. When you make that request, the system knows who has made that request. The receiving system kind of also knows that'.* (Radiologist)

The system however took away some of radiologists' professional autonomy. Under the paper system radiologists would scan the request card, read and add extra pieces of information, if and when needed. With the introduction of the NCRS however requests came in electronically and were not amenable to further change.

5. Technological Affordances of Change in Healthcare Professional Work

In this section we analyse our findings in line with relevant literature on transformations in professional work afforded by technology. Specifically, we look into how the affordances of technology are realised as technology interacts with professional practice and show how and when technology affords change in healthcare professional work and the type of changes it affords. Our analysis in this section is concerned with a strategy of functional simplification, closure and entrusting (Kallinikos, 2008), as revealing of technological affordances and as a foundational element of technology. We argue, however that it is also at the foundation of the ways in which affordances are identified, perceived and enacted by healthcare professionals as they use technology and respond to its attributes (its materiality).

Some of the changes the NCRS afforded were conditioned on its ability to perform certain programmable functions. Programmability was a two-way process. First, it required translating and simplifying actual clinical practice, i.e. how things are done, so that it can then be represented into a computer programme. Second, it presupposed inscribing into the technology clinical protocols and due practices, bringing in this way closure to how work needs to be done. The NCRS was entrusted to take over manual work such as data entry giving to healthcare professionals automatic access to existing demographic and clinical information. The NCRS may thus be seen as a form of Neo-Taylorism that dissociates (a part of) clinical work practice, for example the full completion of an X-Ray request form, from healthcare professionals and embodies it in a newer form, into the technology. Computerisation also took away some of the physical-material aspects of healthcare work, the paper (Vikkelsø, 2005; Zuboff, 1989). As we have shown, paper-based records have accompanied doctors since the 19th century as memoir of patient cases (Berg, 2000) and since the 20th century as a significant component of the clinical process and as a basis to estimate patient progress (Timmermans & Berg, 2003). The substitution of paper-based patient records by electronic patient records signifies an important change in

healthcare professional work as it dissociates it from its most material aspect (the paper) and makes it more intangible and screen-oriented (Zuboff, 1989).

The ability of the NCRS to interface and interact with healthcare professionals brought some level of standardisation (enframing) of professional conduct. For instance, the NCRS prescribed nurses' and doctors' requesting behaviour, by standardising X-Ray request forms and obstructed radiologists from adding information to them post hoc. In this way, the NCRS curtailed healthcare professionals' autonomy to exercise judgment as to what information is necessary for a decision to be made and made their work less reliant on their abstract knowledge and experience and more dependent on the information embodied in the system (Harrison, 2004; Reich, 2012). This reflects the significant role technology may play in reducing clinical work from an art to a technical activity (Timmermans & Berg, 2003).

The NCRS afforded virtual and *en masse* inter-professional collaboration as it allowed electronic requests and clinical information to travel across clinical boundaries (Zammuto et al., 2007). As the NCRS mediated inter-professional collaboration it took away some of nurses' unnecessary work, such as chasing up the timely arrival of X-Ray requests to the radiology department. It was also entrusted to transfer electronic requests instantly, eliminating in this way any need for reliance on human memory. More importantly its ability to process and produce information about use offers an example of how EPR can constitute a form of an Electronic Panopticon in healthcare (Barrett et al., 2011; Foucault, 1991; Zuboff, 1989). The NCRS rendered visible many of the, up to then, invisible aspects of clinical work (Bowker & Star, 2000). It could for example keep track of the changes that have been made on each electronic request and render visible who authorised each of them. It thus created an electronic historical log of healthcare professionals' work both individual and collective. In doing so it brought about three consequences.

First, it maintained a central record of nurses' work, which remained invisible in paper-based forms (Bowker & Star, 2000). Second, it rendered healthcare professionals both subjects and objects of electronic control, as they could simultaneously monitor and be monitored by their peers and by hierarchical superiors (Reich, 2012). By establishing horizontal visibility it also afforded conformity to due clinical process from fear of making errors or omissions visible to

peers (Zuboff, 1989). The system for example kept track of the professionals who authorised tests and could thus allocate responsibility respectively. Clinical record keeping practice has always been associated with some form of peer-control as records have been taken to be an objective representation of events and thus a basis for making judgments about the appropriateness of clinical interventions (Timmermans & Berg, 2003). In making patient records electronic and thus available, peer control expands in scale allowing professionals to access electronic records and thus observe colleagues' practices instantly and *en masse*.

Third, it reordered work and redistributed (intentionally or unintentionally) clinical responsibility within and across healthcare professional groups (Cho et al., 2008; Timmermans & Berg, 2003). In this way, orthopaedists, nurses and radiologists, were held accountable for their practices and responsible for complying with clinical standard operating procedures. For instance, the NCRS re-allocated the activities that nurses would previously often undertake on doctor's behalf (such as completion of a requesting form) to doctors. Similarly, it re-allocated responsibility for the quality and completion of electronic requests from radiologists (who would previously add information as they saw fit) to doctors. By re-distributing clinical work (Håland, 2011; Vikkelsø, 2005), the NCRS distinguished more firmly the professional boundaries between nurses and doctors (Barrett's et al.,2011). Yet, as we show below although more distinctive, professional boundaries did not become less porous since doctors continued delegating screen work to nurses and nurses would still undertake tasks that were not formally within their remit.

The EPR system we studied had the ability to collect, store and display up to date and legible information affording not only automation but also 'informatisation' (Zuboff, 1989) of healthcare professional work. As we showed the NCRS was neither an exhaustive nor an unambiguous repository of clinical information (Greenhalgh et al., 2009). By offering sometimes very specialised information and other times more generic and abstract information (for instance about allergy categories) the NCRS system opened up space for nurses to reflect on this information, interpret it and exercise discretion. Nurses for instance had to look into the information the system provided and make judgements before completing an X-Ray request. The interpretive work nurses needed to undertake constitutes a demonstration of technology's informative capacity. It also shows the potential of technology to afford transformations in professional roles

due to its ability to decentralise information (Barley, 1986). In this way, the NCRS created new responsibilities for nurses such as responsibility for embedding technology in their work, monitoring data quality and ensuring minimal computer errors (Barrett et al., 2011). This is a way of delimiting and bounding nurses' work in a new way and shows the possibility of EPR to afford some enlargement of nurses' professional roles, a significant issue in contemporary health policy agendas (Currie et al., 2010; Jensen & Aanestad, 2006).

The changes described above were afforded by the materiality of EPR, revealed through simplification, closure and entrustment (Kallinikos, 2008), as it interacted with healthcare professional practice. As we have shown technological affordances of change were an outcome of simplification of healthcare professional work; of enframing of professional conduct and autonomy and of entrustment of technology to automate and produce representations of aspects of clinical work and to trace it electronically. Through its materiality the EPR afforded changes in how healthcare professionals work, what they work with, how they collaborate and how they make decisions.

The materiality of NCRS also opened up opportunities for multiple interpretations as to what an EPR can (and cannot) afford. Often, for example, the closure designed into an EPR does not 'fit' with professional practice. Concern over this is the basis for the enduring search for 'clinical engagement' in the early stages of EPR projects. Our analysis below is concerned with this question of fit set against professional practices and roles. We show that affordances are not determined by design but are contingent upon the way in which healthcare professionals perceive and appropriate the materiality of EPR. Thus, technological affordances of change are realised when healthcare professionals' perceptions of technology fit in with their sense of (professional) self.

Doctors in Orthopaedics rejected or resisted the NCRS because they saw it as interfering with their primary responsibility, which they framed as being about the diagnosis and treatment of patients in a safe and confidential manner (Håland, 2011). Doctor's refusal to use the NCRS is thus associated with their view that it interfered with the main values that underpin their professional role (as doctors) namely that of patient safety. They also perceived the use of NCRS

as engaging in an administrative and lower status activity that was beyond their remit and duties. NCRS contradicted the way in which doctors made sense of who they are and what they do i.e. their professional identity. It challenged their power to regulate their work and their autonomy to make clinical decisions drawing from their abstract knowledge and expertise (Aarts et al., 2007; Barley, 1986; Håland, 2011). Their resistance was a necessary activity taken to maintain a sense of their professional self and reproduce their powerful position in healthcare's professional hierarchy.

By rejecting the use of NCRS doctors differentiated themselves from other healthcare professionals such as nurses (Doolin, 2002; Venkatesh et al., 2011). In creating an 'us and them' distinction, doctors protected their professional boundary by defining what is and what is not high status clinical work (Håland, 2011). In defining clinical work this way, doctors projected the use of NCRS as care work rather than clinical work, and thus as a responsibility of nurses. EPR technology may thus allow reclassification of inter-professional jurisdictions. Doctors' resistance may be seen as a way to protect the nature and the volume of their work, maintaining in this way too their clinical autonomy (Doolin, 2002; Flynn, 2004; Jensen & Aanestad, 2006; Salhani & Coulter, 2009; Timmermans & Berg, 2003). As other commentators have noted resistance needs to be anticipated when EPR technology affords redistribution of work responsibility, and threatens the professional status of doctors, by potentially placing more administrative tasks within their workload (Håland, 2011; Lapointe & Rivard, 2005; Vikkelsø, 2005).

Doctors' resistance to using the system meant that nurses continued undertaking doctors' tasks, circumventing some of the changes NCRS could potentially afford (Davidson & Chiasson, 2005; Håland, 2011). Nurses' consent to this does not necessarily derive from a submissive profession or sense of self, as was often suggested by research participants, but could also be seen as a strategy that maintains and even enhances nurses' professional identity, built around and extending their caring role to being patient data custodians and curators. Acquiescing to their delegated role could be seen as a way to address concerns and fears induced by EPR's affordances of new responsibilities (e.g. technical tasks) and jurisdictions. In reproducing their invisible work, nurses protected it from being reduced to a number of simple tasks and from being taken over by technology (Bowker & Star, 2000). By maintaining their 'role in undertaking

invisible' work, nurses also kept it abstract and richer; resisting the 'enframing' affordance of technology. A consequence of this was a re-reproduction of the dominant power relations within the healthcare professional hierarchy that sees nurses in a subordinate position compared to other healthcare professionals (Currie et al., 2012).

6. Conclusions

Our study explored changes in healthcare professional work afforded by the materiality of EPR. The paper contributes to studies that take a cultural approach to technological affordances (Bloomfield et al., 2010) by illustrating how professional context of use shapes the realisation of affordances. It also contributes to a strand of recent studies that examine the way in which the affordances of technology intermingle with healthcare professional practice (Barrett et al., 2011; Oborn et al., 2011). In this respect the paper shows the extent to which the materiality of technology plays out with professional identity and frames the level and extent to which technology can and cannot afford restructuring of work and redistribution of power across professional groups.

The study shows that EPR affords, as it interacts with healthcare professional practice, some level of standardisation of healthcare professional conduct and practice, curtailment of professional autonomy concerning clinical decision making, enlargement of nurses' roles and redistribution of clinical work within and across professional boundaries. Such changes however are not deterministic; we acknowledge that identical technologies afford different changes in professional roles and structures depending on how technology is interpreted in the context of its use (Barley, 1986). Neither does technology directly condition significant alterations in healthcare professional work. While EPR renders professional boundaries more distinctive (Barrett et al., 2011) it does not necessarily make them less porous. With the introduction of EPR doctors may recast the boundaries of clinical work by defining the screen work of EPR as care work and thus as a responsibility of nurses. Also, by distinguishing between filling-in and authorisation of electronic order requests they rendered radiologists accountable for checking the accuracy and completion of clinical orders dispatched through EPR. Doctors' resistance can be fundamentally understood as driven by a desire to maintain their position in healthcare hierarchy

and to protect their professional values by carefully retaining and distributing tasks and responsibilities.

This illustrates our argument that the materiality of EPR is not sufficient to afford change in healthcare professional work. Affordances of change in professional work are not principally embodied into the technology (Norman, 1999) neither do they constitute solely a matter of individual perception (Leonardi, 2011). Rather, perceptions of affordance are cultivated and nurtured within a cultural and institutional context of technology use, in our case within healthcare professional practice. This argument has implications for our understanding of technology-led organisational change, suggesting that continuity does not occur because of undesirable, inappropriate or incomplete affordances (Volkoff & Strong, 2013) but by a lack of correspondence between the design of technological properties and the culture of professionals. Our study does not suggest that professional work does not or will not change. In the future the clinical import of 'administrative' work may become acknowledged, and aspects of materiality, such as clinical auditability, may become in time translated into healthcare professional identity.

It suggests that for this to be achieved, what a technology can and cannot do, its affordances, needs to fit in with professionals' perceptions as to who they are and what they do as professionals. The question of technological affordances of change is thus in play with long established debates concerning clinical autonomy, medical ethics and abstract knowledge, the constituent features of healthcare professional work.

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