Getting caught between discourse(s): Hybrid choices in technology use at work.

Abstract

Winner (1977:77), in defense of technology determinism, cautioned against 'throwing out the baby with the methodological bathwater'. His concern was that in so doing STS research would underplay, or be unable to account for, the effects that technology change *does* have on society. We similarly now find that powerful explanatory concepts like 'structural-discourse' have been largely expunged from the contemporary STS analytical lexicon; with consequences, we believe, for our ability as researchers to interpret and explain the rapid change we see in contemporary work places. In this paper we make the case for the continued use of a strong structural-discourse theory alongside other emergent forms of discourse. We show how workers, responding to conflicting and different types of discourse, produce varying hybrid responses – actions that react to and combine elements of emergent and structural discourses. Our work considers the implications of this finding for contemporary STS theory.

Keywords

Communications, discourse, sociomaterial, mobile phones, communities of practice, repair workers.

Introduction

This article builds on recent debates around the role of discourse theory in emerging post-interpretivist thinking around the relationship between the social and the material (see, for example, Orlikowski & Scott, 2015; Hardy & Thomas, 2015; Putnam, 2015). Discourse theorists, particularly Critical Discourse theorists like Hardy & Thomas (2015), are perplexed by post-interpretivism's sidelining of discourse as a means of theorizing agency. We similarly note that contemporary sociomaterial notions of the relationship between the social and the material have largely expunged a structural version of discourse (discourse as strong, subject-positioning entity) from its analytical lexicon. We argue that doing so is problematic for any attempt to explain differences in technology use-choices, particularly at a high level of granularity, such as *within* the same community of workers. Here, we draw on the work of Badham (2004;2006) to examine these theoretical challenges, and demonstrate how the use of the theoretical construct of discourse in the social studies of technology (STS) has shifted from structural to emergent and, in the process, been stripped of its power as a form of explanation.

Using mobile phones as our empirical example, we explore how a community of domestic boiler repair engineers, by using their mobile phones in contrasting ways, reveal the presence and role both of emergent *and* structural discourses in shaping their choices. The implications for progressing theory on the relationship between work and technology are then discussed. We argue that if we wish to be able to explain why different technology use-choices occur within the same community of workers, then we need to also re-

habituate a strong version of discourse in contemporary theorizing around the relationships between work and technology.

Theoretical approaches to work and technology and the role of discourse

Badham's (2004;2006) framework divides the way in which technology and work has been analyzed into: the structural-impact approach, the social-agency approach and three-dimensional approaches. Our contribution is to show how these different views also provide an alternative basis for thinking about the role of discourse in the study of work and technology.

The structural-impact approach

The structural-impact approach (Badham, 2004;2006) conceives of an unmalleable material that reflects and imports existing social structures directly into work practices. Typical of the one-dimensional version of this orientation are one-way street, macro-structural theories of technology impacts, in particular Structural Marxism (Braverman, 1974; Fernie and Metcalf, 1988; Kaplinsky, 1984 and Blauner, 1964) in which successive waves of production technology shape work and organizations in ways that directly reflect the logic and ideology of capitalism (Barely, 1990).

Softer versions of the structural-agency view (Badham, 2004;2006) do allow that organizations respond in complex ways to technologies (e.g. Barely, 1990, on the introduction of CT scanners in different hospitals and the contrasting re-forming of technician's roles in those hospitals; and Grint and Woolgar, 1997, on the also 'social' nature

of technology itself, pointing to the fact that technologies also have social assumptions built-in at source).

The structural-agency view, we suggest, gives discourse a powerful shaping role: a role reflected in what Avesson and Karreman (2000) refer to as (D)iscourse and Fairclough (2000), orders of discourse. That is, persistent discourses that shape perceptions of social and organizational reality. Leitch and Davenport (2005) point, for example, to the role of shifting national discourses in re-shaping science and innovation systems – in particular the increasing need to show economic relevance. Harmon and Mazmanian (2013) have employed discourse as a means to discuss how users are culturally read by their particular uses of technology - in this case smart-phones. Users are positioned, they argue, within binary discourses such as 'well-connected' verses 'luddites', and 'phone addicts' verses 'authentic' humans. At a societal level, Harraway (1989) has argued that the construction and framing of entities such as the immune system are bound up in conflicting framing across multiple competing discourses and narratives – showing, for instance, that conceptualizations of immune systems have moved from hierarchical orchestrated systems to being thought of as distributed systems, lacking the coherence of a single strategy or indeed any stable integrity as a bounded identifiable object – a shift that is mirrored in the post-modern destabilizing of established societal distinctions, such as those of race and gender, in Western societies. Discourses are generated she notes at concrete, real (often corporate) sites for a variety of scientific and corporate purposes.

We may also include in this structural view theories of inscription, in which discourse is understood as being inscribed into technology through design (Akrich, 1992; Woolgar, 1992; Grint and Woolgar, 1997). Technology becomes, in effect, a stand-in for discourse, a vehicle for it (the way it is materialized) and also a sign of and for it (Barthes, 1972; Winner 1980). Discourses, in this way, can often pass un-noticed and uncontested into use (Joerges and Czarniawska, 1998); technologies are, as Winner (1980) notes, never politically neutral.

The social agency approach.

The social-agency view draws on those studies that begin with 'the social' and focus on demonstrating how the social shapes technology though use (e.g. Pinch and Bijker, 1987). Here, it is the agency of users and workers, rather than technology, that is stressed (Mackenzie and Wajcman, 1985; Wajcman, 2006; Berner, 2008; Heath et al., 2000; Spicer, 2005; McLoughlin and Badham, 2005). Researchers working within this view highlight such things as shared patterns of use (Boczkowski, 2004); stabilization rituals (Grint and Woolgar, 1997), cognitive and technology frames (Orlikowski, 2000; Mazmainian, 2013) and group culture (Symon and Pritchard, 2015). Worker agency is also seen as rooted in the direct and indirect limits that the organization places on workers though: management style (Barley, 1986), management intentionality (Sewell and Wilkinson, 1992) and the skills and existing autonomy afforded to workers (Orlikowski, 2000).

Discourse in this view is no longer seen as exterior and powerful, but as an emergent and largely indistinct aspect of the social. Mazmanian's (2013) recent work on mobile phone use, for example, draws on the notion of 'frame of reference' and 'technological frame' (see also Barley, 1997; Orlikowski, 2000; Mcloughlin, Badham and Couchman, 2000; Darrah,

1996 and Markus, 1994). Mazmainian shows how salespeople within the she firm studied developed a very different 'technological frame' to the legal team in the same firm and so used and thought about their newly acquired mobile phones very differently to them. Orlikowski (2000) has similarly shown how the contrasting cultures in different work groups helped to shape how Lotus Notes was interpreted and used in practice. Symon and Prichard (2015), also concerned with mobile phone use, draw together identity and sociomaterial theory to argue that technology-use is shaped by existing work-group identities. Their work employs the notion of 'work culture' interchangeably with 'organizational discourses' and 'social pressure'.

Discourse in this view is understood as an emergent feature of action, and in some cases as something that is indistinct from 'the social' (see also Putnam, 2015). Choice in technology use is viewed as reflecting the emergent discourses which bind communities through stabilizing norms and emergent technology frames. The exteriority of discourse, however, is lost – or at least not explored beyond notions such as management intent.

Three-Dimensional View

Badham's (2004) three-dimensional category is reflected in notions of interacting socio-technical systems, socio-technical ensembles, Actor-Network Theory (ANT) and latterly socio-material theory as represented by writers such as Leonardi (2013), Mutch and Jones (2014), Jones (2014), and Leonardi and Rodregez-Lluesma (2012). Socio-material and socio-technical writers in this view propose a dialectical relationship between the social and the material (Faulkner and Rund, 2013; Leonardi, 2017; Carlisle, 2015; Leonardi, 2013; Mutch 2013) in which technology is partially malleable, having, for example, 'affordances'

(Leonardi, 2013) that emerge in interaction with the social of the workplace. The social and material moreover 'imbricate' with one another over time to form stable socio-material structures (Leonardi, 2011; Leonardi and Rodregez-Lluesma, 2012).

The three-dimensional view has a role for discourse but only as a 'resource' consciously used for achieving particular ends (e.g. Dawson and Buchanan, 2005), as opposed to being a shaper of cognition. Dawson and Buchanan (2005) refer to 'competing narratives' and 'political resource', showing how technology stories are actively constructed and established as 'official accounts' in order to justify particular technology choices and mobilize financial support. Discourse in this frame, thus, constitutes a resource for purposive action - in the form of compelling narratives for particular technology implementation choices, or indeed for resisting them (Mueller, et al., 2003). Discourses are thus understood as a resource in the exercise of power (Mueller, et al., 2003) and in resistance to it (Hardy, Palmer and Philips, 2000). Spicer (2005), for example, shows how different groups within an Australian broadcaster framed the value and purpose of their new website very differently in an attempt to press their version of it during implementation. Ivory and Alderman (2009) have similarly shown how different accounts of how knowledge-work is best achieved were deployed in a political struggle to resist open-plan offices at the University they studied.

Beyond the socio-technical – sociomaterial entanglement

Badham (2004;2006) was himself critical of what he saw as a 'half-way house' characterization of the relationship of social and material in the three-dimensional approach. Critically, he notes, it fails to pick up on the inherent relationality of ANT and the idea, therein, of a mutually constitutive social and material. Badham's (2004;2006) critique

was prophetic and pre-dates the emergence of what has come to be called sociomaterial theory.

Building on the ontology of practice-theory and relationality, writers such as Orlikowski (2007; 2010) and Orlikowski and Scott (2015) have developed an approach to analyzing the social and the material in which there is no assumed separation between the two; they are seen instead as wholly 'mutually constituting'. Thus, any stable properties which the technology may appear to possess, or agency which the human agent expresses through particular choices, is seen as achieved relationality and locally through emergent practice (Orlikowski, 2000, 2007; Orlikowski & Scott, 2015).

However, this post-human and post-interpretative approach is resistant to anything other than an emergent and very weak version of discourse. Within what has come to be termed 'hard' sociomaterial theory (Jones, 2017), the idea of a pre-existing structure such as a (D)iscourse, anything in fact that pre-figures social action, is roundly rejected (Mutch, 2013; Leonardi, 2013). As Orlikowski and Scott (2013:5) note: 'Studies inspired by agential realism work from the position that discourse does not exist without being materialized in some form'.

However, it is our contention that with the strong 'structural' version of discourse expunged from the lexicon of contemporary sociotechnical analysis, we find ourselves in great difficulty when seeking to explain how specific technology use-choices are arrived at below the level of the group. Moreover, how are we to discuss, for example, the influence of ideas such as New Public Management, Targets Culture, or Austerity, in the way organizations

organize, including how they employ the materials of organizing and how their workers use them? The observation that discourse must be materialized to exist, while technically true, seems trite when faced with such long-term and seemingly remorseless and pervasive change. Moreover, discourse theorists would not in any case disagree that a relationship between the material and discourse is essential for discourse to have effect (e.g. Hardy and Thomas, 2015). The constructionism that underlies critical discourse analysis stipulates, for example, that discourse cannot be taken to exist in analysis if it cannot be 'read off' from the material world. We suggest there is a need to bring a strong 'structural agency' view of discourse back into the analysis of the relationships of the social and the material. This is not to replace 'emergent' views or views in which discourses are also narrative tools, or even to challenge the idea that discourse must be materialized to have effects, but to complement those approaches.

Methodology

Data Collection

Data were collected between April 2010 and January 2012 from twenty-six unstructured interviews and observations with nine field engineers and two of their managers, operating within a single area in the North East of England. As the engineers were mobile and based out in the field, the interviews were conducted in neutral social settings such as cafes and pubs. It was felt that asking for the engineers to be 'called in' to interview at the company offices would have created the impression that research was not impartial – i.e. being conducted solely on behalf of management. Although the research was approved by the company management, we were confident that the engineers were able to offer candid

responses to our questions, and all participants were assured that they would remain anonymous within the research; names used here are pseudonyms. The research study was presented to the participants as aiming to seek a better understanding of their work and changing work experiences, and not a project seeking to achieve any particular management objectives.

The interviews were unstructured, relying only on an *aide memoir* which covered the key areas of interest, notably the experience of work, technology, organisational change and relationships with colleagues. This data collection approach was considered to be the most effective as it was able to generate rich data, reflective of how the engineers made sense of, and responded to, the changes taking place around them (Eisenhardt & Graeber, 2007; Siggelkow, 2007). The interviews were around an hour long, in many cases an hour and a half.

In addition to the interview data, supplementary observational data were collected by taking notes in two team-briefings, two safety meetings and at an after-work social gathering. An observation of one engineer's working day 'in the field' was also made. These field-notes helped capture better the daily routines and the salient issues facing the engineers (Wolfinger, 2002).

Data Analysis

The analytical process began during the data collection itself. Two researchers undertook each interview, and so were therefore aware and able to discuss the growing prominence of specific themes and discourses emerging from within the data during the collection period. This approach also enabled the researchers to better explore certain phenomena as they

became illuminated, including the way in which the workers experienced mobile phone use within their new work environment, and how this was in turn shaping practices.

All interview data were transcribed and subsequently coded by each researcher independently, before being shared and a consensus reached of the dominant themes and discourses both within and between the transcripts. Following this, the data was revisited and mined for further examples to support or challenge the analytical findings as they emerged. The observational data was also drawn upon to provide contextualisation of the talk data, and to supplement the development of the analytical categorisations therein.

This approach ensured that multiple and repeated passes were made of the coded transcripts, resulting in a high level of confidence in data familiarity and processing, and so ensuring the internal validity and accuracy of the findings as they emerged (Taylor 2001). Furthermore, the use of two researchers was able to provide inter-reader reliability for the process, as well as a level of construct validity in the findings.

Findings

The case study company had been undergoing considerable re-organization and allied technological change in the years just prior to the research. It had moved from only supplying gas as a product to also supplying a range of customer services, including domestic gas central and water heating installations and domestic gas boiler servicing. The company had a strong market brand and sought to maintain its position by continuing the quality of its training, recruitment and technology support, and it employed around 8000 technical engineers in the UK. The workforce in the case study presented here were some of the skilled domestic gas boiler repair engineers employed by this organization.

Findings are presented initially through the unpacking of two dominant discourses that emerged from the data: one of organizational control and one of community. By subsequently exploring these discourses as associated with the use-choices of the engineers with specific regard to their mobile phones, we are able to explain the different patterns of technology use as found within the same community of workers. By illuminating how these two discourses were drawn upon, and indeed hybridized in different contexts to influence use-choices, we are able to better understand why such choices were made. We therefore empirically demonstrate the contribution consideration of discourse can make when theorizing the relationships between work and technology.

Productivity, Performance and Profit: the Discourse of Organizational Control

In 1997 Laptops had been introduced at the company to allow engineers to carry all boiler manuals electronically. When internet connectivity became available, the laptops were also then used to allocate jobs directly to engineers at home. This was a fundamental change to operational practices, as engineers no longer needed to come 'on site' in the morning for jobs to be allocated, the time when they would also normally meet and socialize with their co-workers in the depot. Once the engineers could receive jobs directly at home, the requirement for the depot largely disappeared. It was sold and replaced with a leased 'collection point' (CP), something more akin to a walk-in mail room. Unlike the depot there was no seating or refreshments available, and instead there was simply a counter where ordered new parts for on-going repairs could be collected. Engineers were expected to simply collect their ordered parts and then leave.

This change in operational organization not only eliminated the physical space in which workers could communicate with each other, about both work and home, but actually

actively discouraged them from doing so. Indeed the loss of the depot, which had materially supported a degree of sociability, was keenly felt by many of the engineers:

> "…when we used to have depots, you used to get so much information about jobs" (Frank, Engineer)

This alteration to the working day contributed to the dominance of a discourse of organizational control through restriction in the amount of time engineers could now spend on (seemingly) non-productive activities, specifically talking with their co-workers. Through the removal of physical space and the provision of alternative technologies that enabled the 'work' related aspects of the time that had been spent in the depot to be maintained, the organization was able to re-assert itself and its priorities over those of the engineers, and thus the dominance of this discourse in practice. This did not go unnoticed by the engineers:

> "Spending 5 hours a week in the mornings chatting, it used to be great… Course it's all about money now, sitting there doing nothing, it's not cost effective for them… Before it used to set you up for the day and now they're chasing you out the door". (Richard, Engineer).

Not only did the provision of laptops result in the loss of the depot for the engineers, management software subsequently installed on their machines also meant their performance could be much more closely monitored by the organization, using metrics automatically extracted from the laptop for use in management information systems. Engineers were being pushed to improve their productivity from around four repairs/services a day, to around ten. Targets were introduced for both the number of repairs and their effectiveness – the number of 'first fixes'. This change in the organization's

management style towards a strong targets-focus, supported by sophisticated monitoring, also contributes to a more robust discourse of organizational control as associated with performance improvement and increased profitability.

Engineers could also be easily be ranked against their colleagues on any given criteria:

> "…with an individual I will show them - here is our team and you are at the bottom, how do you feel about that? There is not one engineer who I know who would say 'I'm not bothered'. They do care and it matters how they are perceived". (Frank, Manager).

Mobilization of this discourse of organizational control was commonplace, as individual engineer's repair rates, success rates in making repairs, and sales activities were closely monitored using real-time data collected from the mobile hardware now carried by the engineers. This system was then used by management to rank engineers, rankings which were, in turn, used to discipline engineers and drive individual performance on repair rates and sales of 'up-grade' parts to customers.

A further significant operational change occurred in 2003, when the company had introduced a lap-top based mobile diagnostic system that we have called XTECH. The strategic purpose of XTECH was:

- to increase the speed and reliability of repairs;
- to allow engineers to work more independently (technical support managers were also reduced in number and then eventually dispensed with all together after the end of the study);

- to reduce reliance on ongoing-training (during the research post-qualification courses moved away from further repair training and instead delivered briefings on safety regulations only).

[Summarized from interviews with managers]

The provision of XTECH further strengthened the discourse of organizational control, particularly from managerial perspectives. It was able to validate the loss of the depot by removing the need for peer or technical support, and to reprioritize productivity through newly attainable benchmarks in the speed and reliability of repairs. It also endorsed reductions in organizational spend, or the reinvestment of profit, through reductions in training for the engineers, as the software was able to replace that knowledge in practice. Although XTECH itself was well received by the engineers, the system being highly flexible and so allowing technicians to 'jump-in' at any point, it was not always effective. Although regarded by managers as a highly reliable system, capable guiding any repair, the system was not always in fact able to do so:

> "There are errors…you might get XTECH saying it's the PCB and the manufacturer's manual saying a fan. So, it's not flawless…". (Adam, Engineer)

Despite such realized flaws in practice, XTECH still reinforced the discourse of organizational control, ostensibly supporting enhanced productivity and performance, grounded in the assumption that the technologically-advanced software could replace the engineer in all but the simple handing of tools.

These three technological shifts in operational practice within the organization had, in turn, helped to develop and strengthen a dominant discourse of organizational control. This discourse was expressed, first and foremost, materially, through the closing of the of the sociable depots in favor of collection points, through the use of software to record metrics

to control and rank engineers according to their peers and other benchmarks, and finally through the implementation of XTECH, an essentially 'individualizing' technology the aim of which was to improve productivity, and 'discipline' repair work. This is therefore a discourse that valorizes management and organizational control, continually reinforcing the understanding that productivity, performance and profit should be prized above all, whilst belittling the role, skill and identity of the engineer. As one manager noted:

> "With everything they have to help them do their job there is no reason why everyone can't do it. (Simon, Manager).

Knowledge, Endurance and Heroism: the Discourse of Community

An identified feature of repair work, such as that undertaken by the engineers described here, is its propensity to give rise to knowledge-sharing Communities of Practice or CoPs (Orr, 1996; Hidreth et al., 2000; DeSanctis, Fayardb, Roacha & Jianga, 2003) which leads to established and stable sets of norms, typically emphasizing contribution, support and collaboration (Orr, 1996). Repair work generates a high degree of what Perrow (1967) has called 'exceptionalism', that is unanticipated problems requiring new solutions, and as such, he notes that workers rely heavily on colleagues and supervisors for support. A discourse of community, reflective of, and able to perpetuate, this CoP experience, could be readily found amongst the engineers, with shared norms of support, help and advice when it was needed by a member of the team:

> "a lot of the times we use other engineers who have had more experience with a particular type of boiler so we always bounce off each other … just to get back-up really" (James, Engineer).

Interactions within CoPs typically comprise impromptu conversations and brainstorming (Roberts, 2006), during the course of which questions are raised, problems highlighted, solutions offered, mistakes laughed at and the organization itself ridiculed (Brown and Duguid, 1991). It is through these close interactions and discursive practices that CoPs create their own internal norms - distinguishable from those of the employing organization. Respect can be earned within the CoP by demonstrating competence, trust-worthiness and commitment to the work in hand - through, for example, telling repair 'war stories' – accounts of particularly difficult and 'heroic repairs' (Orr, 1996). CoP norms typically emphasize contribution, support and collaboration and while mistakes are generally 'grist for the mill', and laziness itself is frowned upon (Orr, 1996).

The loss of the depot also contributed to the discourse of community, the loss of the physical space positioned as detrimental to operational practice:

> " …it is so valuable, talking, you don't realize just how much information you get from that" (Marc, Engineer)

The common reflection on the lack of physical contact between the engineers in their new operational structure goes some way to explain the endurance of a discourse of community. This discourse emphasized the importance of the knowledge held within the engineer community, and positioned the sharing of such knowledge as a positive and beneficial experience, rather than valorizing the various technologies and their operational benefits.

Use-Choices of Mobile Phones among Repair Engineers

The research revealed that the loss of regular face-to-face contact with colleagues was, to a large extent, off-set by the use of personal mobile phones. Over the same time period,

personal mobile phones had become commonplace among the engineers, and this technology offered an obvious means for engineers to re-connect their community after the loss of the depots. The engineers at the case study company had also previously been given radios, but they could only talk to other engineers by being routed through 'base' – which could handle only one call at a time. The radios were for allocating jobs and keeping track of engineers, not for sharing knowledge about repairs. Mobile phones however extended the functionality of the radios, by allowing mobile peer-to-peer communication that could not be monitored by management. Technical support managers were also (at the time of the research) available by phone, as were the boiler manufacturers. Mobile phones therefore offered an opportunity for engineers to informally maintain knowledge exchange, and even to maintain some personal interaction by facilitating 'meets' in local cafes for breaks or lunch and after-work gatherings in a local pub.

Yet all engineers did not use their phones in the same ways, making different use-choices of this technology within the same community of workers. As we will argue, variations in how the mobile phone was used reflects differing and hybrid responses by the engineers to the growing influence and materialization of the managerial discourse of organizational control and the discourse of community established within the workforce itself. Although these discourses remained 'hidden' to the engineers themselves, they were not for example explicitly considered by the engineers as such within the raw data; their presence and their influence emerged on analysis. Consequentially, three modes of use were identified within the data: reforming communities of practice; hero engineers; and disconnection.

Tactical Use: Reforming Communities of Practice

For some engineers, use of their mobile phones enabled them to reform the CoP on a much smaller scale, and they started working together in small collegiate friendship groups:

> "Derek and Mike, we'll work round each other –they'll come to me and I'll go to them. Usually it's this little triangle that tends to work together around jobs and this seems to work well for us…we try and stick to the three of us" (Richard, Engineer)

The nature of these mobile phone interactions was quite different from the more expansive banter of face-to-face interactions that had occurred in the depot, and remained focused on explaining and resolving the problem/repair as quickly and concisely as possible, mindful of time pressures and other considerations of performance. For some engineers, making themselves available, but only to a trusted group of colleagues proved to be a successful strategy for maintaining their own high work-rates.

The increasing performance pressures placed on engineers both practically and through the discourse of organizational control, both promoted and facilitated this emergent hybrid practice. To use their phones in this way brought a clear advantage in terms of personal productivity, being part of an experienced and responsive group enabled solutions to problems and repair fixes to be quickly identified and enacted, enhancing the engineer's individual performance. The use of a group with which the individual had strong trust-relationships also enabled social capital to be built and exchanged in a way that elicited quick and reliable reciprocity. The mobile phone is particularly adept at facilitating this exchange of capital, in the form of advice with repairs, in that it makes trusted colleagues more or less instantly available.

A further explanation for this pattern of use also lies partly in the affordances of the technology itself. Unlike a radio which broadcasts to anyone on the same channel, the mobile phone creates a single link to another phone, so in some respects it is inherently limiting, encouraging one-to-one communications. It is also more restricting than the

'group banter' one would expect to find in the 'depot'. The phone is not a medium for 'story telling' to a group of colleagues.

Yet the discourse of community was also influential. Engineers were calling the same small group of colleagues regularly, 'working together' – to share knowledge and support one another, acting, in other words, like a CoP in miniature. The basic principles of the CoP, with its attendant discourses about competence, trust and mutual support, were still in place and shaping how the mobile phone technology was used. The mobile phones therefore constituted an, albeit pale, replacement for the work the depot once did in facilitating a CoP.

That a choice was being made to work with a limited number of trusted colleagues, rather than making themselves available to all of their colleagues, suggests mobile phone use that can be viewed as a hybrid response to the dominant discourses shaping the organization. Being available to all colleagues would not find fit with the discourse of organizational control which sought to shape the work of each engineer through their individual performance and productivity. The investment of time in such an approach would be too great for too little reward, as engineers are generally working on short time-limited jobs, requiring 'then and there' problem solving, so the need for a reliable and trusted network that can be quickly contacted is very important, not least to respond to the management practice of tracking the numbers of 'first fixes' on an individual basis. It was, in effect, a hybridized technology-use response to the influence of both discourses.

It should also be noted, however, that while this mode of mobile phone use maintains knowledge-sharing in a way which makes strategic sense to the individual, it potentially damages the knowledge-sharing basis of the CoP itself. That is, knowledge-sharing in smaller friendship groups risk 'corralling' knowledge, making it unavailable to others.

Although 'story telling' in a physical shared space offers the potential for new relationships and trust-building, this cannot be replicated by one-to-one phone contact. The materiality of the mobile phone, and the influence of the discourse of organizational control may therefore be seen to be slowly pushing back the discourse of community, and so eroding the CoP itself in the long term.

Always Available: Hero Engineers

The second pattern of mobile phone use identified within the data reflected a far stronger and more assertive commitment to the discourse of community, and a greater rejection of, or resistance to, managerial discourses.

Engineers like Derek occupied a special role as experts within the community, and indeed, such a role in this guise could be powerful:

> "I leave my phone on 24/7, I don't mind the lads phoning me up even on my day off, it doesn't bother me, but if they don't phone I cannot help them" (Derek, Engineer).

The 'constant availability' referred to here was deployed voluntarily, and can be interpreted as a high-level of commitment to the discourse of community, but also without obvious expectations of reciprocity. Thus, an 'always available' choice in mobile phone use, with respect to colleagues rather than managers, enabled certain engineers to use their mobile phones to create and perpetuate an identity of 'expert', able to contribute to other's repairs even when they were not at work, as supported by the discourse of community. This is similar to Symon and Prichard's (2015) concept of the phone as an intermediary in the performance of 'contactable and responsive', 'involved and committed' and 'in demand and authoritative' work identities – all of which find expression here. However, in this instance

knowledgeability appears to be an end in itself or at least a 'performance' reserved for the limited audience of the community of practice.

Such patterns of use, both by the 'experts' in the constant use of their personal mobile phones for work, and the community of engineers who contacted them when a problem arose in their field of expertise, is firmly grounded in the discourse of community. Despite the technological dominance of XTECH as espoused through the discourse of organizational control, managers still realized that engineers' personal knowledge remained central to the job:

> "Dave is the Isar whisperer – he has one himself and it's one of the first ones. He tinkers and keeps a stock of spares. So, if one of the guys has a problem with an Isar they call [Dave] and he can usually work out what is wrong straight away". (Walter, Manager).

Managers recognized that vital organizational resources included those found in the deep experiential knowledge of the individual engineers, such as Dave. Such an acknowledgement demonstrates recognition that the stock of knowledge held by the engineers was considered important to the job, and so valorizes the discourse of community, albeit as associated with specific individuals within that community. Indeed, the managers themselves were not isolated from the community's norms and history, as many were also themselves once also part of it and had been promoted 'through the ranks'. They too , we noted, were keen to tell stories of 'heroic' winter repairs to restore heat and hot water to single mothers and even one instance of an engineer putting up shelves for an 'old dear'. The mangers were therefore able to hold in contradiction the discourse of organizational control that positioned XTECH as a flawless system that could support

engineers working in isolation, alongside the competing discourse of community, which instead valued and placed importance on the engineers' experiential knowledge. Managers' tolerance of, and even praise for, the dominance of the discourse of community in this approach to mobile phone use is interesting, given that it runs counter to their obligations to prioritize the discourse of organizational control, and support the claims of the effectiveness of the diagnostic technology in supporting individual working. In part, this approach by managers can be explained by their close historical relationship with the engineers. However, it also reflects a necessary pragmatism with regards to the need to meet productivity targets, leading to the acceptance of a mixed economy of working practices. In other words, whilst a community discourse and notion of 'expert engineers' did not fit comfortably with the modernizing and work-disciplining discourses surrounding the deployment of the diagnostic technology, it did find fit with the demand for improved productivity. In choosing to recognize the value of more varied and CoP-inspired work practices, including the constant availability of some engineers through their individual mobile phone use, it is clear that managerial practice is flexible in its response to competing discourses.

Disconnection: Withdrawing from the Community

The data also revealed that not all engineers missed spending time with their colleagues. Here we observed a very different pattern of phone use: that of non-use, influenced less by the discourse of community and much more by that of organizational control and the primacy of personal productivity and efficiency. For such engineers, connectivity with their peers was not seen as vital for their own personal work, and so they chose not to use their mobile phones to either contact or encourage contact from other engineers:

> "They'll ring me up and say have you had this fault before, well an apprentice out of his time a week could tell me about a fault I've never seen before." (Steven, Engineer).

The value of colleagues in being able to provide reliable support and knowledge, a prominent understanding within the wider discourse of community, was also not universally held as a truth by all the engineers, who instead used their mobile phones to contact other non-engineers as required:

> "I prefer to deal with the manufacturer's technical guys because literally you can go to a boiler they can tell you what's wrong with it in minutes which saves you the time of going through the fault-finder yourself…it saves you a massive amount of time". (James, Engineer).

This use pattern of mobile phones finds good fit with the discourse of organizational control, as the engineer prioritizes speed and efficiency in their repair work, seeking out the most, in their opinion, reliable sources for information. Instead of placing value on the CoP, or even a small group of colleagues, the non-use of mobile phones for inter-organizational communications around repairs to a great extent reflects the organizational ideals of worker behavior.

It was also noted that for those new to the engineering trade, the non-use of phones was a cause for concern:

> "A lot of the young lads I feel sorry for because if they haven't got the confidence to phone people up, they are going to struggle because they don't basically see anybody from one day to the next, because they are getting chased out of the collection points in the morning and it's put them under immense strain". (Derek, Engineer).

Without the depot, and so potential to meet those happy to be always available through their mobile phones, and the tactical-use of mobile phones by many of the engineers within closed groups, new engineers were unable to integrate themselves within the community. They are therefore exposed to the discourse of organizational control without the tempering discourse of community and its practical support network, and so become adopters of non-use of their mobile phones almost by default. In many respects, this reflects Mazmanian's (2013) finding that workers who are less secure in their contribution to the organization will use their mobiles differently to those that are. In the case of the Legal team referred to by Mazmanian (ibid) it meant more contact with managers, in the case of the less secure engineers in our data, it could mean reduced contact with both the community and their managers and so create potential issues for their future development.

Discussion

Discourses are influential theories, assumptions and ideologies that persist across specific periods of time and so play a role in constructing social and organizational realities (Alvesson & Kärreman, 2000; Locke, 2004; Mueller, Sillince, Harvey & Howorth, 2003).

From Badham's (2004;2006) characterization of theories of technology and work, we can see that in the structural-agency frame, discourse has as powerful role as ideology and inscription. In other words, discourse is something which is present in shaping technology design and is exterior to, but also influential over, the shaping of its implementation and use. The emergence of the social-agency approach led to a re-framing and re-positioning of discourse as a phenomena largely indistinct from 'the social' – as norms, culture and

cognitive frames. In the three-dimensional approach, discourse takes on a new guise again, that of rhetorical tool deployed as part of the political struggles between different parties within the organization. Social actors are no longer subjects of either structural or emergent discourse, but instead consciously deploy discourses as persuasive narratives in pursuit of their own interests with respect to how technologies should be deployed and used by themselves and others.

Post-human theorizing, what Badham (2004;2006) refers to as 'moving beyond' the three-dimension approach, has squeezed structural discourse as a distinct concept out of the analytical frame altogether. Post-humanism is a response to concerns with the over-interpretivism of discourse theory, the 'rush to explanation' (Latour, 2007), and a perceived over-commitment in theorizing through discursive analysis in general. Such concern was not unfounded, as the material has been viewed by some critical discourse analysts as little more than a symbolic expression of discourse (Carlisle and Langley, 2013). It followed, moreover, that when drawing on the relational and post-interpretivist ontology of ANT, in which humans and technologies are viewed symmetrically as 'actants' defined *only* by the network of relations of which they are a part, that discourse must also be seen as an emergent feature of that relationality. To treat it as a pre-existing, exterior 'shaping force' makes little or no sense ontologically. Moreover, choices around technology use and conscious planning around how others should use technology must logically also be seen as emergent features of the mutual constitution of the social and technological. Discourse, in this view, has no distinct theoretical contribution to make.

However, as our empirical material suggests, changes in organizational operations and strategy, and the adoption of technology to facilitate these changes, can readily be seen as rooted in a stable taken-for granted managerial discourse, the discursive logic underpinning and normalizing targets culture, increasing performance demands, independent working, increasing control and to an extent, de-skilling. It was clear, in other words, that the technologies employed within the firm and other choices made around space, were deeply inscribed with stark managerialist discourses on how the organization should be run and work performed. Technologies like XTECH were designed with the explicit intention that they should materially enact the logic of these discourses. As Winner (1980) argued of the the Moses Bridges in New York, to think otherwise would be politically naïve.

Tempering a strong structural-agency view, we acknowledge that organizational discourses are not hegemonic; rather, they exist within organizations in a competitive 'textscape' of other discourses (Keenoy & Oswick, 2003). Discourses such as empowerment, customer orientation, teamwork, managerial control, HRM, strategic-decision making, and so on, may all vie for attention (Keenoy & Oswick, 2003). In our case, for example, managerial (D)iscourses had to compete with the emergent community discourse, sustained by the engineers themselves. As Orr (2006:1817) noted of the Xerox technicians he studied: "Apart from the intrusions of management through documentation, parts supply and policy, the technicians were a relatively self-contained community". However, our empirical work reveals practice in this instance to be a site where competing managerial discourses and emergent community discourses are brought into conflict with one another. The presence and influence of these discourses can be read in the hybrid practices we observed. That is, the specific choices made about technology-use that emerged out of various engagements

with, mobilizations of, and subject positions in relation to, competing discourses. The removal of the depot for the engineers resulted, for example, in the establishment of mobile phone technology as a mechanism through which community discourse continued to valorize shared knowledge and experience over the use of the XTECH system, as proscribed by a management thinking. Mobile phones were employed by some technicians in a way that allowed them to continue to sustain community practices and thus enact community-shaping discourses, by maintaining smaller groups. However, this practice also found some measure of compatibility also with managerial discourses of efficiency and productivity. Similarly, being 'available 24/7' demonstrated strong adherence to the discourses that shaped behavior in the community, whilst being available to a more limited group, thus enabling an enactment of *both* managerial and community discourses.

Hardy and Thomas (2015) rebuke the claim that discourse theory does not sufficiently take account of the material. Like sociomaterial theorists, discourse theorists see no necessary separation between discourse and the material, the two are enmeshed together through skills, knowledge, the workers themselves and the technology (Hardy and Thomas, 2015). Thomas and Hardy (2015) demonstrate, drawing on existing studies, how discourse shapes the materiality of the (military) body, how discourse shapes the apprehension of material objects through their naming and categorization, how space is shaped by discourse and how spaces, once in place, subsequently shape discourse. Our work adds to this perspective by showing how 'hybrid practices' emerge at the confluence of competing discourses and by illuminating the role played by the material in transmitting, instantiating, reinforcing and reflecting the tenets of these discourses.

However, we also contend that it is not possible to accept, from a structural discourse theory perspective, that discourse and the material are always equal partners in this relationship, or indeed that discourse is little more than an aspect of 'the social'. To make sense of use-choices as anything other than indeterminate outcomes of 'enmeshed' social and material elements, discourse must be understood as pre-figuring choices – in some way structuring choices into identifiable patterns. By paying attention to discourse in all of its forms, we also remain able to say something about the differential technology use-choices made by engineers at a high level of granularity, in particular *within* the same community of practice.

Orlikowski and Scott (2015), from a sociomaterial perspective, argue to the contrary that "material-discursive practices are thus constitutive; they configure reality, or put another way, they are performative" (p.6). Orlikowski and Scott (2015), also stress the importance of disavowing the distinction between the discursive and the material and that "the strength of this position is that it allows for a multiplicity and indeterminacy of outcomes" (2015:5). This is a problematic position for us, and one that does not accord with empirical reality as we see it.

Collapsing the distinction between discourse and the material and indeed not distinguishing between emergent and structural discourse, makes it difficult to account for the persistent and transformative effects on work, technology and organization of entrenched discourses. While these discourses must, as Orlikowski and Scott insist, be performed, thus co-producing any actual 'effects' through practice, it seems to us that those interests able to

persistently mobilize the greater concentration of 'discursive-material' resources will have the greater influence over work practice in the long-term. Harraway's (1989) notion that powerful (structural) discourses emerge from particular sites is important; in the case of management discourse (e.g. business schools, think-tanks, economic fora, consultancies and from 'other' industries) are the external source of much management thinking (i.e. discourse). Moreover, the hybrid practices we observed suggested that, in the longer term, the effects of managerial discourses *are* in fact 'determinate', not indeterminate – that structural discourses, in combination with the material, are persistent and durable forces that both shape and mobilize various materials in the ongoing 'management work' of unpicking and re-composing existing (community) discursive-material practices over the long-term. The material, in this framing, is a key ally of structural discourse – giving it what Latour (2005:67) has referred to as the 'steel' it needs to have effects. While community discourses of course act as bulwark against their own erosion, in this case shaping mobile phone use in ways that sustain such discourses, the more limited control the COP has over the material-discursive resources that matter (diagnostic technology, space, job tracking, Management Information Systems) place it in a demonstrably weaker position. The CoP, in other words, is overly reliant on the social, it does not enough have enough material – not enough 'steel' - to sustain itself in the face of successive discursive-material intrusions of management thinking.

In the study of work and technology, we need, in our view, to be able to explain choice and to account for the forces that shape the use of technology in one way rather than another over time. We find discourse, in all of its forms, indispensable in this role. This does not mean that we ignore emergence and relationality, or indeed the notion that the material

also has agency in these relations, but it does require that we remain interpretative and critical and the concept of structural discourse helps us achieve this - even if it is at the risk of 'rushing to explanation' and getting it wrong. Post-interpretivism carries the ontological risk, we would argue, of a slide a slide toward a new form of descriptive Functionalism that, in our view, does not well serve us in an era of rapid change, in which technology and managerial discourse are deeply implicated in challenges to the nature and quality of work.

Conclusion

In the empirical material presented here, we focused on a clash of different discourses: those pre-existing in the community of workers, and in some cases shared with managers, and those being imported into the organization and expressed through new technologies, targets culture and new views of how work should be done. We paid attention to the functions and affordances of the technologies in question - buildings, diagnostic technology, and mobile phones - in order to explore and explain the choices made. The explanations offered were made possible only by paying attention to discourse. Grounded in our findings from this empirical case study, we argue that discourse should therefore be a constitutional part of sociomaterial and socio-material models of the relationships between practice and the organization.

References

Akrich, M. (1992), 'The de-scription of technical objects', in W. Bijker and J. Law (eds), Shaping Technology Building Society: Studies in Sociotechnical Change, 205-224, Cambridge, MA: MIT Press.

Alvesson M. and Kärreman D. (2000), 'Varieties of discourse: On the study of organizations through discourse analysis', Human Relations, 53, 1125-1149.

Badham, R (2004) Technology and the transformation of work, 'revised proof' in The Oxford Handbook of Work and Organization (2006) eds. S. Ackroyd, R. Batt, P. Thompson, and P. Tolbert, Oxford University Press, Oxford. Pp115-137.

Barthes, R. (1972), Mythologies, London: Cape.

Barely, S. (1986) Technology as an Occasion for Structuring: Evidence from Observations of CT Scanners and the Social Order of Radiology Departments, Administrative Science Quarterly, 31(1): 78-108.

Barley, S. (1990), 'The alignment of technology and structure through roles and networks', Administrative Science Quarterly, 35, 1, 61-103.

Berner, J. (2008), 'Working knowledge as performance: On the practice understanding of machines', Work Employment and Society, 22, 2, 319-336.

Brown, J.S. and Duguid, P. (1991), 'Organizational learning and communities-of-practice: toward a unified view of working, learning, and innovation', Organization Science, 2, 1, 40–57.

Blauner, R. (1964), Alienation and freedom: The factory worker and his industry, Chicago: University of Chicago Press.

Braverman, H. (1974), Labor and Monopoly Capital: The Degradation of Work in the Twentieth Century, New York: Monthly Review Press.

Boczkowski, P.J. (2004), 'The processes of adopting multimedia and interactivity in three online newsrooms', Journal of Communications, 54, 2, 197–213.

Carlile, P. R., & Langley, A. (2013). How matter matters: Objects, artefacts, and materiality in organization studies (Vol. 3). Oxford University Press.

Darrah, C.N. (1996), Learning and Work: An Exploration in Industrial Ethnography, New York and London: Garland Publishing.

Dawson, P. and Buchanan, D. (2005) The way it really happened: Competing narratives in the political process of technological change, Human Relations, 58(7):845-865.

DeSanctis, G. Fayardb, A-L., Roacha, M. and Jianga, L. (2003), 'Learning in on-line forums', European Journal of Management, 21, 5, 565-577.

Eisenhardt, K.M. and Graebner, M.E. (2007), 'Theory Building from Cases: Opportunities and Challenges', Academy of Management Journal, 50, 1, 25-32.

Fairclough, N. (2000) Discourse, social theory and social research: the discourse of welfare reform, Journal of Sociolinguistics 4: 163-195.

Faulkner, P. and Runde, J (2013), 'Technological Objects, Social Positions, and the Transformational Model of Social Activity', MIS Quarterly, 37, 3, 803-818.

Fernie, S. & Metcalf, D. (1988), (Not) hanging on the telephone: Payments systems in the New Sweatshops, London: Centre for Economic Performance, London School of Economics.

Foucault M. (1982), The Subject and Power. Afterword to Dreyfus HL & Rabinow P. Michel Foucault: Beyond Structuralism and Hermeneutics. Brighton, Harvester.

Grint, K. and Woolgar, S. (1997), The Machine at Work, Cambridge: Polity.

Hardy, C. and Thomas, R. (2015), 'Discourse in a Material World', Journal of Management Studies, 52, 5, 680-696.

Hardy, C. Palmer, I. and Phillips, N. (2000), Discourse as a strategic resource, Human Relations, 53, 1227-1248.

Heath, C., Knoblauch, H. and Luff, P. (2000), 'Technology and Social Interaction: The Emergence of "Workplace Studies"', British Journal of Sociology, 51, 2, 299-320.

Hildreth, P., Kimble, C., & Wright, P. (2000). Communities of practice in the distributed international environment. Journal of Knowledge Management, 4(1), 27-38.

Hsiao, R.L., Wu S. and Hou, S. (2008), 'Sensitive cabbies: Ongoing sense-making within technology structuring', Information and Organization, 18, 4, 251-279.

Harraway, D. (1989) The bio-politics of post-modern bodies: determination of self in immune- system discourse. Difference, A Journal of Feminist Cultural Studies 1(1) 3-43.

Ivory, C.J. and Alderman, C.J. (2009) The imagined user in projects: articulating competing discourses of space and knowledge work, Ephemera, Theory and Politics in Organisation, 9(2): 133-151.

Joerges, B. and Czarniawska, B. (1998) The question of technology, or how organizations inscribe the world, Organization Studies, 19(3): 363-385.

Jones, M. (2014), 'Untangling sociomateriality', in: P. Carlisle, D. Nicolini, A. Langley and H. Tsoukas. *How matter matters,* 197-226), London: Oxford University Press.

Kaplinsky, R. (1984), Automation: Technology and Society, London: Longmans.

Keenoy, T. and C. Oswick, (2003), 'Organizing Textscapes', Organization Studies*,* 25, 1, 135–142.

Latour, B (2007) Reassembling the Social: An Introduction to Actor-Network-Theory, Oxford: Oxford University Press.

Leitch, S. and Davenport, S. (2005)The politics of discourse: Marketization of the New Zealand science and innovation system, Human Relations 58(7): 891–912.

Locke, T. (2004), Critical discourse analysis, London; New York, Continuum.

Leonardi, P.M. (2017), 'Methodological Guidelines for the Study of Materiality and Affordances', in M. Raza and S. Jain (Eds), Routledge Companion to Qualitative Research in Organization Studies, 279-290, New York: Routledge

Leonardi, P.M. and Rodregez-Lluesma C. (2012), 'Sociomateriality as a lens for design: imbrication and the constitution of technology and organization', Scandinavian Journal of Information Systems, 24, 2, 79-88.

Leonardi, P.M. (2014), 'The emergence of materiality within formal organisations', in: P. Carlisle, D. Nicolini, A. Langley and H. Tsoukas (Eds.), How Matter Matters, 142-170, London: Oxford University Press.

Leonardi, P.M. (2011) When Flexible Routines Meet Flexible Technologies: Affordance, Constraint, and the Imbrication of Human and Material Agencies, MIS Quarterly 35(1):147-167.

Leonardi, P.M. (2013), When does technology use enable network change in organisations, MIS Quarterly, 37, 3, 749-775.

Mackenzie, D. and Wajcman, J. (1985), The Social Shaping of Technology, Milton Keynes: Open University Press.

Markus, M. (1994), 'Electronic mail as a medium of managerial choice', Organizational Science, 5, 4, 502-527.

Mazmanian, M. (2013), 'Avoiding the trap of constant connectivity: When congruent frames allow for heterogeneous practices', Academy of Management Journal, 56, 5, 1225-1250

McLoughlin, I. and Badham, R. (2005), 'Political process perspectives on organization and technological change', Human Relations, 58, 7, 827-843.

McLoughlin, I. Badham, R. and Couchman, P. (2000) Re-thinking political processes in technological change: socio-technical configurations and change, Technology Analysis & Strategic Management, 12(1): 17-37.

Mueller, F. Sillince, J., Harvey, C., and Howorth, C. (2003), 'A rounded picture is what we need': rhetorical strategies, arguments, and the negotiation of change in a UK hospital trust', Organization Studies, 25, 1, 75–93.

Mutch, A. (2013), 'Sociomateriality: Taking a wrong turn?', Information and Organization, 23, 28-40.

Orr, J. (1996), Talking about machines: An ethnography of a modern job, New York: Cornell University Press.

Orlikowski, W.J. (2007), 'Sociomaterial practices: Exploring technology at work', Organization Science, 28, 9, 1435–1448.

Orlikowski, W.J. (2010), 'The sociomateriality of organisational life: Considering technology in management research', Cambridge Journal of Economics, 34, 125-141.

Orlikowski, W.j. & Scott, S. (2015), 'Exploring material-discursive practices', Journal of Management Studies, 52, 5, 697-705.

Orlikowski, W.J. (2000), Using technology and constituting structures, Organization Science, 11, 4, 404–428.

Perrow, C. (1967). Frame work for comparative analysis of organizations, American Sociological Review, 32, 194-208.

Pinch T. P., and Bijker W. E. (1987), The social construction of facts and artefacts: or how the sociology of science and the sociology of technology might benefit each other', in Bijker, W. E., Hughes T. P. and Pinch T. J. (eds) The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology, Cambridge, MA: MIT Press.

Putnam L. (2015), 'Unpacking the Dialectic: Alternative Views on the Discourse–Materiality Relationship', Journal of Management Studies, 52, 5, 706-716.

Roberts, J. (2006). Limits to communities of practice. Journal of Management Studies, 43(3), 623–39.

Sandiford, P. and Seymour, D. (2007), 'The concept of occupational community revisited: analytical and managerial implications in face-to-face service occupations', Work, Employment & Society, 21, 2, 209-226.

Sewell, G. and Wilkinson, B. (1992) Someone to watch over me: Survielance, Discipline and the just-in-time labour process, Sociology, 26(2): 271-289

Spicer, A. (2005), 'The political process of inscribing new technology', Human Relations, 58, 7, 867-890.

Siggelkow, N. (2007), 'Persuasion with case studies', Academy of Management Journal, 50, 20–24.

Symon, G. and Pritchard, K. (2015), 'Performing the responsive and committed employee through the sociomaterial mangle of connection', Organization Studies, 36, 2, 241–263.

Taylor, S. (2001), 'Locating and Conducting Discourse Analytic Research', in M. Weatherell, S. Taylor, and S.J. Yates (Eds.), Discourse as Data: A Guide for Analysis, 5-48, Sage Publications Limited in association with the Open University: London.

Wajcman, J. (2006), 'New Connections: Social Studies of Science and Technology and Studies of Work', Work Employment and Society, 20, 4, 773–786.

Winner, L. 1977. Autonomous Technology. Cambridge, MA: MIT Press.

Winner, L. (1980) Do artefacts have politics, Daedalus, 109(1). Modern technology problem and opportunity, 121-126.

Wolfinger, N.H. (2002), 'On writing field notes: collection strategies and background expectancies', Qualitative Research, 2, 1, 85-95.

Woolgar, S. (1992), ‘Configuring the User: The Case of Usability Trials’, in J. Law (ed.). A Sociology of Monsters: Essays on Power, Technology, and Domination, Routledge: London.