A RESEARCH NOTE ON CAPTURING TECHNOLOGY: TOWARD MOMENTS OF INTEREST

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Abstract

The technological is often in the background of our research, despite claims of being socio-technical. *Following from Orlikowski and Iacono's call for research on the ability to theorize the technological within IS research, this research note reviews the literature on society and technology to understand how we may interrogate the technological within a discourse. This article then proposes that within a discourse there are* moments of interest *where we can observe, interrogate, and develop an understanding regarding the form of the technological. In turn, this may complement our understanding of the social, and allow for further research on how the socio-technological world takes form.*

1 INTRODUCTION

In a world where technology is often spoken of by managers, politicians, and sales staff as being deterministic, information systems research is often a source of relief. Amid noisy talk of e-commerce and e-government imperatives, Internet age, and information revolutions, information systems research generally argues against technological determinism.

In many cases, articles, and reports, IS research resolved that nothing occurs in a vacuum, social actors are always involved. Researchers brought the social

issues to the foreground, and dismissed technological accounts as overly deterministic, ignorant of context, oblivious to human agency, and blind to interpretations. Within this approach, however, some have asked: what have we done with the technological? We have pushed *it* into the background, into the shadows awaiting representation, intervention, and mobilization. This research note argues that we can, and should when relevant, endeavor to understand the technological within our research. Building from the work of Orlikowski and Iacono (2001), Monteiro and Hanseth (1996), and the ideas from the literature on society and technology, this article presents a means of capturing the technological within socio-technological discourses at *moments of interest*.

The weaknesses in IS research in giving regard to technology has been noted in the literature, and this is reviewed in section 2. Through a brief review of the society and technology literature in section 3, I will propose opportunities for capturing the technological within discourse by introducing *moments of interests* within section 4. Some potential applications and implications are discussed in section 5.

2 IS RESEARCH AND THE TECHNOLOGICAL

IS researchers realize that there is more to a given story than just speaking of technology; failing to look beyond algorithms, code, and services could be hazardous to developing a holistic understanding of a problem, and in turn cause even more problems (Walsham 1991, p. 84). As Benbasat et al. (1987) observe, "the IS field has...seen a shift from technological to managerial and organizational questions, and consequently more interest in how context and innovations interact" (p. 370). This interaction approach is often regarded as *socio-technical* and IS research argues that this socio-technical view brings more depth and value in analysis of the use of information and communications technologies.

It is an ideal to be socio-technological in our studies. The reality is often quite different, however. This symmetry, or foregrounding of the social and the technological within the context, is underrepresented in IS research (Orlikowski and Iacono 2001).

2.1 The Social Technical Discourse

Technology usually appears in the background of the context, and subsidiary to the social. Monteiro and Hanseth raise this within their 1996 article, suggesting that we are not specific enough about the technology. They argue that

we need to be able to describe in some detail how and where technology restricts and enables action. They wished to support an inquiry that

> traces the social process of negotiating, redefining, and appropriating interests back and forth between a particular, explicit form and a form where they are inscribed within a technical artefact (p. 331).

For Monteiro and Hanseth, the artefact is the outcome of a discourse of negotiating the development, adoption, and use of technology.

They apply their critique to Orlikowski's research. First they critique a research case where she discusses Lotus Notes within an organization (Orlikowski 1992b), and argue that she does not refer to its functionality. They find this disappointing due to the programmability of Lotus Notes. Then they critique another research case in the development and use of a CASE tool in an organisation (Orlikowski 1992a). There, they argue, the technology is regarded as a tool; their contention is that the CASE tool is actually the result of a long process where interests of management are translated into a heterogeneous network encompassing career paths, work guidelines, and methodologies.

Their notable critique suffers from one shortcoming, however: Monteiro and Hanseth are not specific about the technology either. They do not describe how the CASE tool interacts with other entities. Are there *unintended* uses of the tool? How can management inscribe their interests into a tool that is inherently flexible such as a CASE tool or Lotus Notes? How difficult is it to inscribe interests into the tool? How does the technology object to being enrolled? Translated? Is the technology limited to representing the interests of management, or does it represent interests of others, or have interests of its own? While they believe that we must look at the discourse, and look specifically at the technology, Monteiro and Hanseth do not offer a means for doing so, nor what we should look for.

This is a point that Orlikowski and Iacono pursue in their 2001 article. They argue that IS researchers do not generally know how to regard the technological because we often we take it for granted.

> [T]he tendency to take IT artifacts for granted in IS studies has limited our ability as researchers to understand many of their critical implications—both intended and unintended—for individuals, groups, organizations, and society (p. 133).

IS researchers may be accustomed to thinking about technology; and theories may reflect technology, but often in our research there is a lack of due regard for the technological (Markus 1997, p. 16).

2.2 How to Study Technology?

In direct response to this gap, Orlikowski and Iacono make a number of recommendations for further conceptualization of the technological within IS research (p. 131). Their first recommendation is that any new conceptualization should reflect that technology is not natural, neutral, universal, or given. Second, technology is always embedded in time, place, discourse, and community; this acknowledges that there is a discourse for study, no matter how quiet.

Third, they note that artefacts are made up of multiple components with often weak interconnections that require "bridging, integration, and articulation in order to work together" (p. 131). Representations that assume that technology is whole, uniform, and united fail to show how technologies break, wear, and shut down. This is consistent with their fourth recommendation that artefacts are not fixed or independent, but rather emerge from ongoing social and economic practices. We must watch for modifications over time, how plans change, goals alter, and adoption is broadened and use is spread beyond original intentions "to accommodate a diversity of evolving interests, values, assumptions, cultures and other new technologies" (p. 131).

Orlikowski and Iacono's fifth recommendation is to acknowledge the stability of technology as conditional. New materials are invented, new features developed, functions fail, standards are set, and unintentional; these all affect the stability of the technology. We must try to consider how these technologies are altered, and identify the multiple forces, whether human or not, whose interaction influences the development and shaping of the technological.

3 UNDERSTANDING THE TECHNOLOGICAL

Making sense of the interaction between the social and the technological often means understanding the politics and influences of both the humans and nonhumans. Capturing the discourse between these actors[1] is nontrivial, but often necessary within IS research. Bowker et al. (1996) comment that information systems that are large in size, such as the Internet or global databases, carry with them

> a politics of voice and value which is often invisible, embedded in layers of infrastructure. The "politics of artefacts" of a

[1] *Actor* is used for lack of a better term, but not to be confused with the essence of the actors in actor network theory.

> nuclear bomb or a genetically re-engineered organism are more available for public debate than those of information interchange protocols or how insurance data are encoded. Yet these latter decisions and standards may affect markets, differential benefits from particular technologies, and the visibility of constituencies, among other important public goods (p. 350).

Soliciting this discourse is part and parcel of doing IS research; whether it is through laboratory experiments, surveys, documentation analysis, ethnography, or narrative interviews, discourse may arise in some form or another. In understanding the technological and its interaction with the social, according to Bowker et al., we may better understand our world.

Bringing the technological to the foreground of the analysis alongside the social gives rise to two immediate challenges. The first challenge for researchers is to avoid the problem of endowing the technological actors with interests. Such an approach may appear to place the social at the mercy of the technological or, worse yet, may make the researcher appear to be a technological determinist.

The second challenge is to avoid rendering the technological actor as some mute agent. A technological actor can be (and often is, within the social sciences [Latour 2000]) assumed to be merely an agent that is waiting to be enrolled or aligned, endowed with interests by its creators, or the powerful. In so doing, however, we continue the trend of disregarding the technological and merely considering social forces, in effect social determinism (Hughes 1994).

We therefore need a way of giving form and focus to the technological and the social simultaneously without becoming deterministic. It is my contention that looking at the technological will shed light on the social, while our understanding of the technological can arrive from many social sources. The following subsections review the literature on society and technology in an attempt to resolve the role of the technological actor in order to better understand the socio-technological discourse, and to later identify means of capture.

3.1 Anti-Essentialism: There Is No Spoon…

The greatest critique to any research approach that deals with technology in the foreground of analysis comes from the *anti-essentialist* viewpoint. Anti-essentialism rejects discussion of the technology itself, at least without proper interrogation. Technology is considered an unstable and indeterminate artefact whose significance is negotiated and interpreted, but never settled (Grint and Woolgar 1997, p. 21).

> A technology's capacity and capability is never transparently obvious and necessarily requires some form of interpretation; technology does not speak for itself but has to be spoken for. Thus our apprehension of technical capacity is the upshot of our interpreting or being persuaded that the technology will do what, for example, its producers say it will do (Grint and Woolgar 1997, p. 32).

This reasoning has discourse-observation implications: looking at the technology specifically is a problematic process since only interpretations will emerge. We have to settle for listening to the various interpretations, and note how the technology is spoken for (Grint and Woolgar 1997, p. 35). Anti-essentialists are thus skeptical about arguments that discuss the *essential* features of technology. Capacities, according to anti-essentialism, are only agreed upon.

Anti-essentialists accept there is a limit to human interpretations and constructions, however: not just any construction is possible. In turn, anti-essentialism does not advocate social determinism or ignoring the opening of the black box.

> Importantly, this does not entail a policy of eradicating all accounts which mention or implicate technological capacity. Even if it were possible, this would be tantamount to concentrating only upon issues "outside the black box," a form of social determinism which is as unsatisfactory as the technological determinism....Instead we need to find a way of "taking the technology seriously" without having to depend on uninterrogated notions of technical capacity, and to account for the intermingling of technical and social without merely nurturing the view that these are essentially independent variables conjoined through "interaction" (Grint and Woolgar 1997, p. 10).

However, this viewpoint does not discuss in detail how we can make sense of the technological beyond collections of interpretations, how we can identify which speech to capture, and how we can understand the implications of a technology resisting interpretation.

3.2 Social Involvement in Technological Interests

The general theme of the social construction or shaping of technology literature is that of alignment of various agents in the development and diffusion of a technology. Interests, politics, economics, and other *social* issues are every-

where in this alignment process, sometimes constructing technologies, other times shaping them.

The social *construction* of technology literature views technology and society as human constructs. Accordingly, we must study how technologies are shaped and acquire their meanings in the heterogeneity of social interactions (Bijker 1995, p. 6).

Bijker provides a selection of case studies to elaborate the theory. After discussing the technology of light bulbs and fluorescence, he argues that General Electric's high-intensity fluorescent bulb was a social construction as opposed to the more *readily developed* high-efficiency bulb. The high-intensity bulb was created on a conference table by the utility companies and General Electric (GE). The utilities viewed the high-efficiency bulb as a threat to their interests, that is, as a cause for the redistribution of funds to their detriment. Making use of technical constraints to support their arguments (load on electricity networks and the power-factor issue), the utilities lobbied the U.S. government. These constraints of the technology were treated as facts, but Bijker proposes that they were *interpretively flexible,* in that they could be used within the discourse as both a means of supporting the high-intensity bulb or opposing it. That is, the experts disagreed with one another over these constraints, and in a U.S. Congress hearing it was admitted that **no one** really understood the specific issues.

Bijker's interests are temporarily stabilized outcomes of interactions. The stabilization partly occurs in the form of artefacts—so technology is in some form the inscribed interests of a temporary stabilization (Bijker 1995, p. 266).

Technology is not a subject awaiting construction and interpretation, however.

> [S]ome artefacts are more obdurate, harder to get around to change than others....Exploring the obduracy of technology offers one way to gain understanding of the role of power in the mutual shaping of technology and science (Bijker 1995, p. 4).

This point is not elaborated in further detail, however; it appears that it is assumed that by being specific about the details of construction, down to periodic elements and capacities, obduracy is established. Like anti-essentialism, there is no additional detail about how we may understand how technology refuses interpretation, or becomes obdurate, resisting changes.

The social *shaping* of technology approach takes a more objective view of technology, where localized social groups and interests play a vital role in *shaping technology* (MacKenzie and Wajcman 1999). A useful example is the study of how the AR-15 machine gun was refused to U.S. Soldiers and Marines in Vietnam, and how they were rather provided with a *poorer* technology, the M-16 (Fallows 1999). The lesser technology was due to techno-political

decisions made by the U.S. Army and its traditional supplier of gunpowder, which in turn affected the gun's performance. Although an interpretative viewpoint would deny a value statement on the relative *goodness* of a technology, the study concluded that individual Marines agreed that the M-16 was inferior, and this inferiority was later confirmed through Congressional reviews. Technological actors arose in the form of constraints and failure because of the poor choice of gunpowder, bullets were not shot; the M-16 did not work.

From the social shaping of technology perspective, technology appears more obdurate. A consensus was reached within Congressional reviews and surveys of Marines on the *capacity* for failure. Perhaps the M-16 was the congealed interests of its developers (and thus did not work), but it was not only the fault of the social actors; it was also because the technological actors resisted alignment with each other (the bullets and the gunpowder).

3.3 Technological Momentum

According to Hughes (1994), systems are socio-technological in nature. Often they are born technological, but they grow over time and become larger and involve more and more actors, social and technological. As these systems grow, *technological momentum* increases.

This momentum can be broken, often involving other forces, sometimes exogenous. In his presented case regarding a large power system, EBASCO, the Great Depression broke its momentum (Hughes 1994, p. 108). The Strategic Defense Initiative (Star Wars) became larger as U.S. Congress Representatives latched on to the idea through lobbying for contracts for their constituencies—the system became so large and the momentum so great that only the demise of the Soviet Union brought the system to a halt (Hughes 1994, p. 112), for the moment. The technological system of the petrol-guzzling American automobile required the oil embargo of 1973 and the rise of petrol prices to turn competitive forces against the Detroit manufacturers as consumers began purchasing imported compact automobiles. The exogenous forces were not the only persuasive factors, however. With the environmentalists persuading the public, the public persuading the politicians, who then would enact legislation for anti-pollution technology and gas-mileage standards, engineers and designers within the Detroit manufacturers began to respond with innovations and technical developments (Hughes 1994, p. 113).

The forces are, therefore, both social and technological. The factors that affect technological systems may be structural and informal, endogenous and exogenous, social and technological. As researchers, we must try to identify the socio-technological environment that leads to technological shaping, construction, and change.

3.4 Being Deterministic for a Moment

Few people today support technological determinism outright; in fact there is little evidence of academic literature to support this view explicitly (Grint and Woolgar 1997, p. 14; Winner 1977, p. 76). Classic notions of technological determinism involve two prevailing components. First, technology is autonomous as it naturally emerges and propagates itself, i.e., the inventor loses control of the technology (if he or she ever truly had control). Second, technology determines society and societal institutions.

Pitt (1987) softens the determinist approach, arguing that the notion of autonomous technology is a simplistic account of unintended uses and consequences: no one can foresee all of the consequences of any act. It is also trivial, Pitt continues, to consider autonomy as the moment that the technology is made available and the inventor loses control of his invention; this is arguably true of all aspects of our society (Jones 1999). Even if we assume that the interests of the creator are embedded within a technology, the unforeseen consequences and unintended uses, by definition, involve uses and consequences that the inventor had not intended; unless the inventor is omnipotent and foresaw all applications and consequences. A follow-up assumption is that the technology can be shaped once beyond the grasp of the creator; but even as the technology is shaped by others, the shapers cannot account for all of the possible applications, uses, and further developments on the technology.

Technological determinism is then fragmented in the work of Bimber (1994). Bimber offers three distinct types of deterministic accounts: *normative* accounts (claims that technology is an important influence on history only where societies attach cultural and political meaning to it), *nomological* accounts (positive descriptions of an inevitable technological order based on laws of nature rather than norms), and *unintended consequences* accounts. Bimber states that true technological determinism is where the laws of nature determine the technology that determines society. Anything else is not technological determinism; as normative accounts deal with cultural norms, then they cannot be deterministic.

The concern of technological determinism in this sense can be put to rest. The greater danger is that we oversocialize the technological by ignoring it and placing it at the mercy of the creator by ignoring how it can be used and shaped in ways that are unintended to the creator. This is in line with the anti-essentialist viewpoint, surprisingly. Anti-essentialists claim that the social must interpret the technological; the unintended consequences accounts claim that the technological is interpreted by the social in ways that are unforeseen by the creator. The difference in the two is that the former view mentions that some interpretations are not possible, and humans inflict interpretations upon the technology; the latter argues that the technology is an object in its own right,

which inflicts effects upon others. However, we do not have an understanding of what kind of object it is, or what kinds of interpretations are not possible.

4 FOREGROUNDING THE TECHNOLOGICAL

The schools of thought reviewed in section 3 all perceive the social and the technological in different ways, giving differing levels of agency, control, granularity, and obduracy to each. Each of these approaches has a different perspective on what to look for within discourse.

Anti-essentialists believe that researchers must listen to the social interpretations of the technological; the technological does not speak. Social constructivists would argue that we must open the discourse and look at the granular details of the construction of the technological to see that it is a social and technological construction. Those who support the social shaping approach say that social actors may affect the construction of the technological; although the technological may refuse to work. Technological momentum notices that systems may radically change due to social and technological shifts in the environment. Finally, technological determinism proposes that the social may be determined either by nomological properties of the technological; the social attributing meanings to the technological and then being determined; or the technological always being used and seen in different ways by the social. We may gather any or all of these approaches from within a discourse. As a result, we may regard the technological in any of these of ways.

We can now accept the inclusion of the technological in the foreground of analysis alongside the social without fears of technological determinism. Now the challenge is to identify a means of capturing the technological within a discourse. Can the technological actors actually speak within the cacophony of social actors' speech? Can we identify an intentionality for the technological, a set of interests? If the interests of a technological actor were inscribed by the creator, then we fail to acknowledge interpretive flexibility and unintended consequences of the creation based on the conception by the creator. Moreover, if the technology's intentions, abilities, and capacities do not match the creator's intent, then whose intentions are represented? Can the technological actor become obdurate, delinquent, and actually refuse or object?

4.1 Articulations

Understanding the interests, intentions, or speech of the technological may be appreciated first by understanding the speech of the social. Latour offers the notion of articulations to allow us to listen to the discourse, to monitor its

transformation. Latour (1999) argues that science, as a practice, is a discourse based on *articulations*, not laws. These articulations become reduced as time goes on; Latour explains how a statement about "Joliot's concept of neutrons" is reduced as time goes on to be just about neutrons and a purely *scientific* statement:

> A little later, this sentence, without a trace of qualification, without author, without judgment, without polemics or controversies, without even any allusion to the experimental mechanism that made it possible, will enter into a state of even greater certainty. Atomic physicists will not even speak of it, will even stop writing it—except in an introductory course or a popular article—so obvious will it have become (Latour 1999, p. 94).

What once required a number of alignments to be accepted, the neutron now stands on its own in the discourse.

Similarly design constraints are merely articulations within a discourse. Capturing these articulations does not infer that we are offering technological determinist accounts; we must interrogate these articulations, possibly through intentionally incorporating opposing views (Sørensen et al. 2001). This is not to say that the technological is merely social; rather, once we have interrogated a negotiated settlement of facts and laws, we may have a situation where anti-essentialism leads to a form of technological determinism's objectivity. In effect, the technology hardens and becomes more obdurate to interpretations. Divergent interpretations may always exist, however.

Opening the black box of articulations is, therefore, similar to interrogating capacities. In the messy world, we must accept that there will be many interpretations of what some would consider being basic laws, or objects. To understand the technological actors, therefore, we may listen to the articulations of others.

Consider the case of technology-policy discourse. Various social actors interpret the Internet very differently, and articulate the *nature* of the Internet differently—as a set of protocols as spoken by engineers, as a broadcast medium by the regulators (Australian Broadcasting Authority 1999), as a global village by the U.S. courts (ACLU 1997), as a threat to sovereignty by some states (Rapporteurs sans Frontieres 1999). Eventually, all the actors may agree. Or recalcitrance may continue; and this may be a property of the social and the technological.

From this varying speech we may see conflicts, agreements, and even the reduction of articulations. Who speaks authoritatively when so many speak differently on the technological actor?

> Given that accounts of technical capacity are not a reflection of an inherent property of the technology, why do we believe some people's accounts but not others'? How is that some accounts are so convincing that we end up treating them as a direct reflection of the "actual capacity" of technology, finally, and ironically, convinced that we never have been convinced? (Grint and Woolgar 1997, p. 10)

Latour (1999, p. 179) responds that there may be moments where the technology can in fact *speak* for *itself*. Even the anti-essentialists do not say that we must not discuss capacities; they merely state that we must be skeptical of what we hear. Latour recommends that we amass interpretations to see how actors agree about one another; anti-essentialists say that we should amass interpretations to see how interpretations differ. Either moment in a discourse is when our understanding of the technological may emerge.

Something may also be learned about the social in this process of articulating the technological. That is, as social actors speak on the technological actors, we learn something about the social actors' interests and strategies. Pouloudi and Whitley (2000) found that when the other actors spoke for the technological actor, the various human actors would seek to legitimize their view of the technological by undermining those of the alternative representatives. The articulations of the human actors are political acts, often, and political motivations may emerge.

We may also appeal to the epistemic community (Haas 1992) for their articulations. This is the community of specialists and experts; we may compare and contrast their articulations to the articulations of the other actors. How each speaks on the technological, in the least, adds to our understanding of their own interests, and at best, leads to a further understanding of the technological actor.

4.2 Objectivity

How do we resolve the interests and goals of the technological? Will this involve social determinism, where they are resolved by the *intended* function as opposed to the interpreted applicability? Latour (1998) states that "technical artefacts never simply transport a function, or play a role, they always modify our intentions, our roles, our interests." Technologies may not have clear intentions, but Latour would say that neither do humans. "Purposeful action and intentionality may not be properties of objects, but they are also not properties of humans either" (Latour 1999, p. 192) .

Pouloudi and Whitley extend this indeterminacy to interests. They argue that if we thought understanding the interests of nonhumans was a challenge,

understanding the interests of humans is no easier. This is consistent with Pitt's view of intentionality and design, and Latour's point that society is not stable enough to represent itself in technology (1991), and Giddens' approach on the unobtainability of intention and control (Jones 1999, pp. 109-110).

We may fall back upon articulations instead. These articulations, given by social actors, are important to collect and analyse, but the technological actors are not just proxies, representing what is said about them; they are still objects, or at least have the *ability* to object to what is said about or done to them.

This what Latour (2000) refers to as *objectivity*: the "presence of objects which have been rendered 'able' to object to what is told about them." This recalcitrance is a natural state for objects, as "the last thing that one scientist will say about [nonhumans] is that they are fully masterable." (Latour 2000) In fact they resist our attempts to control, unlike the human actors:

> Contrary to microbes and electrons who never abandon their capacity to object since they are not easily influenced by the interest of experiments, too remote from their own conatus (not to say interest), humans are so easily subjected to influence that they play the role of an idiotic object perfectly well, as soon as white coats ask them to sacrifice their recalcitrance in the name of higher scientific goals (Latour 2000).

Humans can be mastered, but perhaps technologies can not; we can embed our interests into people, but not so easily into technologies. When we see these capacities of the technological, either through articulations or through objections, the anti-essentialist interpretive limit is reached: nonhumans object to interpretations and alignments (an exploded laboratory is exploded [Latour 2000], a gun that we thought would work but that doesn't work, in fact doesn't work [Fallows 1999]). Obduracy can be found, but it may require some pushing and prodding.

5 MOMENTS OF INTEREST IN DISCOURSE: RESEARCH IMPLICATIONS

The preceding review of the society and technology literature presents us with a situation where the technological is emerging as a phenomenon for further research. The technological actor, in fact all actors, *may* resist interpretation and can resist shaping. The social or the technological can also object to being spoken for, while other articulations are accepted and reduced. These are all among the *moments of interest* within a discourse: points of interest to research and analyze in the formation of an understanding of the context and of the actors.

As researchers we may wish to try to capture the actions and interests of the actors, even the technological, within a discourse. This was the mandate set by Orlikowski and Iacono, outlined in section 2. While we can treat technology in the background as part of the context, or in the foreground as deterministic upon the social actors, the review of the literature in section 3 indicated that it is possible to look at both the social and the technological in the foreground. In fact, the differences in the literature only help to highlight opportunities for capture.

In the process of capturing and representing a discourse, volumes of data can be compiled. Placing both the technological and the social in the foreground can lead to an unbearable amount of data (Walsham 1997). Specific points of interest need to be identified that are important for collection and analysis. Rather than looking only for capacities and intentions, we must interrogate interests and actions, particularly objection (Latour 2000), resistance to interpretation (Grint and Woolgar 1997, p. 10), or obduracy (Bijker 1995, p. 4). These are the moments of interest: moments within a discourse where the actors take form, both social and technological.

A review of the traditional literature provided some insight. The literature recommended that the technology be focussed upon, and its black box opened to find a discourse within (Monteiro and Hanseth 1996). There may also be a discourse throughout, where actors are negotiating a technology already in existence, interpreting, shaping, and using it. Interpretations of these technologies need to be analyzed, particularly notions of capacities (Grint and Woolgar 1997, p. 10). Therefore we must listen for how the technologies are spoken for (Grint and Woolgar 1997, p. 35) with scepticism, e.g., utilities and the power-factor issue (Bijker 1995); and note the strategies, the articulations, and their reduction as may occur. However there may be occasions when the capacities will be agreed upon, a general consensus reached, e.g. the M-16 doesn't work (Fallows 1999). Other times, the lack of settlement only heightens the importance and value of the discourse, e.g., Internet policy, or protocols (Bowker et al. 1996).

The proposed *moments of interest* are among key points in the interaction between actors. The discourses tend to be centered on controversy or change (Bijker and Pinch 1987, p. 27). The moments are points where capacities of actors are discussed and articulations are presented (Latour 1991, p. 128) by other actors. Black boxes are opened and actors speak of one another, and actions occur, and objections arise. These statements by actors must be interrogated, regardless of whether the actors are social or technological (Pouloudi and Whitley 2000).

If the controversy intensifies or transforms, and shifts in interests occur due to the action of others (Latour 1998, 1999, p. 87) or exogenous forces (Hughes 1994), we must research the accounts of these shifts, transformations, and

forces. What are the spoken reasons for these shifts, if they are spoken? How has the speech of the actors changed to indicate a change of interests? This is when the momentum behind the technological system breaks (Hughes 1994), and when strategies or translations fail (Akrich 1994, p. 207). Actors tend to speak at these times of flux, as new alliances are considered, new actors and new interests, even new articulations.

From the point of view of the technological actor particularly, but it may be generalized to all actors (Sørensen et al. 2001), indications of recalcitrance are also moments of interest. This is when existing policies fail, the laboratory blows up (Latour 2000), computers break down, weaknesses in implementations are exposed, and the actors resist consensual interpretation. This may lead us to question and investigate the actors who dominate other actors, who attempt to control the outcome of the process, the key passage points. These actors with the power may speak authoritatively, simplify articulations, speak of capacities (Grint and Woolgar 1997, p. 33) and facts (Latour 2000).

The moments of interest are in line with Orlikowski and Iacono's recommendations on theorizing the technological. Table 1 reiterates these recommendations, and draws the links with the society and technology literature, and identifies some of these moments of interest.

The contribution of *moments of interest* allows researchers, if they so wish, to identify the technological within the discourse, locate the interactions with the social, and watch as the actors progressively take form, or alternatively, as alignments fall apart.

5.1 Possible Applications and Implications

Most of these *moments* are relatively uncontroversial to IS researchers. That is, many studies involve the collection of data around times of controversy, strategy shifts, and even stakeholder analyses. These studies, however, often treated technology in the background. The first challenge is to convince researchers that the technology may be considered as something important to study. The second challenge is to find a way to conceptualize the technology, to understand it, and to incorporate it within the study.

Among the main means to understanding the technological that are not typical within IS research are the study of articulations and objections. Articulations may emerge from discussion with actors, or naturally occur within discourse when actors speak of the technology, or interact with the technology. These articulations may change or be reduced; alternatively, we can watch for nomological claims ("the nucleus has the following properties") and reconstruct the original elaborate articulations ("Joliot proposed the idea of a nucleus that could have the following properties").

Table 1. Capturing the Technological

Orlikowski and Iacono (2001) Recommendation	***Relationship with Society and Technology Literature***	***Possible Moments of Interest for Capture***
1. Technology is not natural, neutral, universal, or given.	Anti-essentialist view that technology is contingent, shaped and interpreted by humans.	Search for times of controversy, and look for varying interpretations of capacities. Interrogate notions of capacities, but there will be times when actors agree. When they disagree, each interpretation may say something about the actors.
2. Technology is embedded in time, place, discourse, and community.	Social constructivist view that there is always a discourse around a technology and its construction; open the black box.	Follow the actors and the discourse; notice the change in the actors, who gets included, who does not. Note when actors speak in detail regarding the technology, i.e., collect articulations.
3. Artefacts are made up of multiple components that require "bridging, integration, and articulation in order to work together" rather than being a whole, uniform, and united.	Open the black box, and be specific on the technology to see how humans and nonhumans make society durable, or how they fail. Politics of social affect the technological, e.g., M-16.	Be specific. Monitor discourse for articulations on capacities and how these become accepted, or refused. Analyze the content of the articulations, compare and contrast to identify sources of strain in the social. Watch how each technological actor works with others, and which social actors are involved.
4. Artefacts are not fixed or independent, but rather emerge from ongoing social and economic practices.	The study of the process of alignment of heterogeneous actors. Successful and unsuccessful alignments, objections, and articulation comparisons.	Monitor modifications over time of how goals change and unplanned uses and adapting to new environments. How do others speak of or use the technology, and how does the technology react? Document analysis of technological design, and monitoring of use and changes or adaptations. Collect statements of intentionalities and shifts in goals, including those of the epistemic community and their practices.

Orlikowski and Iacono (2001) Recommendation	***Relationship with Society and Technology Literature***	***Possible Moments of Interest for Capture***
5. The stability of technology is conditional as new materials are invented, new features developed, functions fail, standards are set, and unintentional uses	Stability is only contingent and temporary. Unintended consequences and uses, new conditions of use. Technologies can object to other technologies (bullets and gunpowder), but exogenous forces may also play a role, whether social or technological.	Monitor for changes introduced by other technological actors (that may be mediated by humans). Monitor for conditions where the technological objects to new uses, changes, or replacement. Identify the endogenous or exogenous factors that lead to recalcitrance or to alternative strategies.

To understand objections, we may use two devices. First, we can watch how the technology interacts with other actors when it is adapted to their interests and/or appropriated, and verify interpretations and/or claims of effectiveness. Second, we can substantiate these claims through the soliciting of speech from other actors; i.e., we can study the schematics and design of the technological, and compare those results with the consensual *ideal* that may exist outside of the discourse through an appeal to an epistemic community (developers, specialists, and experts). These results are most notable when a failure occurs, and disparate opinions arise as to the causes and the consequences.

Societal applications of these moments of interest have been considered previously with respect to cryptography and e-commerce policy (Hosein and Whitley 2002). We found that within the technology-policy discourse, various actors expressed themselves through articulations. That is, in speaking about the policy, they spoke about the technology in detail without any intervention by the researchers. Within two countries' parliaments and within high-level policy papers, articulations regarding the technology emerged naturally.

We also found that the technological was a key component to the interests of the actors: it was not possible to separate the technological from those interests. The *public's interests* involved secure transactions technology for hacker protection; the *government's interests* involved the technologies of access to communications for public protection; while the epistemic community of developers and cryptographers articulated *risks* and objections to alternative design requirements for infrastructure protection; and industry spoke of costs and risks to secure technological infrastructure for economic protection. Yet they were all discussing the same technology.

Similarly, these moments of interest may arise, or be solicited, in organizational discourse. To imagine an example, an adaptive new system is implemented into an organization, similar to the Lotus Notes in Orlikowski (1992a). First we could look to the statements of the various actors within the organization, the consultants and outside providers, as the system is considered and implemented, and the functionality is shaped and adapted to meet the needs of the organization. Each set of actors may speak of the technology in different ways, some may say things quite specific about the network configuration, access controls and usability, functionality and adaptability; as we compare and contrast these differing statements, we may better understand the interests of the actors, while also gaining an understanding of the technological actor, i.e., the system.

Some changes and adaptations may fail as the technology blows up; others may cause organizational resistance or an interaction. Articulations of the causes and the effects of the objection can be analyzed; even appeals to the epistemic community, the developers of the original technology, successful and expert implementers, other consultants, designers, etc., may give additional understanding as to the functionality of the system.

5.2 Concluding Remarks

This research note understands that the technological may not be required for all IS research. Sometimes the politics of the human actors is enough to follow and document. Other times the technology is truly a proxy, or merely a computational device.

There may also be occasions where the technological does not actually arise at all in a discourse. In some situations, this may be a political act, however. These situations arose in the policy-discourses on interception of communications (Whitley and Hosein 2001) and lawful access to traffic data (Hosein 2001; Hosein and Escudero-Pascual 2002). In these discourses it was found that it was to the advantage of the framers of the discourse, i.e., government, to give nominal regard to the technology. Limiting the discussion of technology and thus reducing the competing articulations within the official discourse ensured that the outcome of the policy process was in their interests. Therefore, some discourses may not obviously include the technological, but this may be symptomatic of the strategies used by some actors and may require an intentional research intervention to include other actors, including the epistemic community and the technological.

The greatest benefit of this approach is that we can incorporate all accounts into such a framework; if people speak in deterministic ways or in constructivist

terminology, we can incorporate all accounts that try to give form to the social and the technological. If people ignore the technological, we may find it. If the technological accounts ignore the social, we may identify it. After all, these *moments of interest* are the points of greatest contingency, controversy, disinterest, and conflict for not only the technological, but the social as well.

6 REFERENCES

ACLU. *Fahrenheit 451.2: Is Cyberspace Burning? How Rating and Blocking Proposals May Torch Free Speech on the Internet*, New York: American Civil Liberties Union, 1997.

Akrich, M. "The de-scription of Technical Objects," in W. E. Bijker and J. Law (eds.), *Shaping Technology/Building Society: Studies in Sociotechnical Change*, Cambridge, MA: The MIT Press, 1994, pp. 205-224.

Australian Broadcasting Authority. *Broadcasting, Co-regulation and the Public Good*, NR 101/1999, 1999.

Benbasat, I., Goldstein, D. K., and Mead, M. "The Case Research Strategy in Studies of Information Systems," *MIS Quarterly* (11:3) September 1987, pp. 369-385.

Bijker, W. E. *Of Bicycles, Bakelites, and Bulbs: Toward a Theory of Sociotechnical Change.* Cambridge, MA: MIT Press, 1995.

Bijker, W. E., and Pinch, T. "The Social Construction of Facts and Artifacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other," in W. E. Bijker, T. Hughes, and T. Pinch (eds.), *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*. Cambridge, MA: The MIT Press, 1987.

Bimber, B. "Three Faces of Technological Determinism," in M. R. Smith and L. Marx, *Does Technology Drive History? The Dilemma of Technological Determinism*. Cambridge, MA: MIT Press, 1994.

Bowker, G. C., Timmermans, S., and Star, S. L. "Infrastructure and Organizational Transformation: Classifying Nurses' Work," in W. Orlikowski, G. Walsham, M. R. Jones, and J. I. DeGross, *Information Technology and Changes in Organizational Work*. London: Chapman & Hall, 1996, 344-370.

Fallows, J. "The American Army and the M-16 Rifle," in D. A. MacKenzie and J. Wajcman, *The Social Shaping of Technology*. Buckingham, England: Open University Press, 1999, pp. 382-394.

Grint, K., and Woolgar, S. *The Machine at Work: Technology, Work, and Organization*. Cambridge, MA: Polity Press, 1997.

Haas, P. M. "Introduction: Epistemic Communities and International Policy Coordination," *International Organization* (46:1), 1992, pp. 1-35.

Hosein, I. "The Collision of Regulatory Convergence and Divergence: Updating Policies of Surveillance and Information Technology," *The Southern African Journal of Information and Communication*, 2001.

Hosein, I., and Escudero-Pascual, A. "Understanding Traffic Data and Deconstruction Technology-Neutral Regulations," United Nations Economic Commission for Europe, 2002 (forthcoming).

Hosein, I., and Whitley, E. "Developing National Strategies for Electronic Commerce: Learning from the UK's RIP Act," *Journal of Strategic Information Systems* (11:1), 2002.

Hughes, T. P. "Technological Momentum," in M. R. Smith and L. Marx (eds.), *Does Technology Drive History? The Dilemma of Technological Determinism.* Cambridge, MA: MIT Press, 1994.

Jones, M. "Structuration Theory," in W. Currie and R. Galliers (eds.), *Rethinking Management Information Systems: An Interdisciplinary Perspective.* Oxford: Oxford University Press, 1999.

Latour, B. *Pandora's Hope: Essays on the Reality of Science Studies*. Cambridge, MA: Harvard University Press, 1999.

Latour, B. *Progress or Entanglement? Two Models for the Long Term Evolution of Human Civilization*. Taiwan: Institute for National Policy Research Conference, 1998. (Electronic version, no longer on-line.)

Latour, B. "Technology Is Society Made Durable," in J. Law (ed.), *Sociology of Monsters: Essays on Power, Technology, and Domination*. London: Routledge, 1991, pp. 103-131.

Latour, B. "When Things Strike Back: A Possible Contribution of Science Studies to the Social Sciences." *British Journal of Sociology* (51:1), 2000, pp. 107-124. (On-line version was used, available at <http://www.ensmp.fr/~latour/Articles/78-sciencestudies.htm>.)

MacKenzie, D. A., and Wajcman, J. "Introductory Essay and General Issues," in *The Social Shaping of Technology*. Buckingham, England: Open University Press, 1999, pp. 3-27.

Markus, M. L. "The Qualitative Difference in Information Systems Research and Practice," in A. S. Lee, J. Liebenau, and J. I. DeGross, *Information Systems and Qualitative Research*. London: Chapman & Hall, 1997, pp. 11-27.

Monteiro, E., and Hanseth, O. "Social Shaping of Information Infrastructure: On Being Specific about the Technology," in W. J. Orlikowski, G. Walsham, M. R. Jones, and J. I. DeGross (eds.), *Information Technology and Changes in Organizational Work.* London: Chapman & Hall, 1996, pp. 325-343.

Orlikowski, W. "The Duality of Technology: Rethinking the Concept of Technology in Organizations," *Organization Science* (3:3), 1992a, pp. 398-427.

Orlikowski, W. "Learning from Notes: Organizational Issues in Groupware Implementation," *Proceedings of the Conference on Computer Supported Cooperative Work'92,* 1992b, pp. 362-369.

Orlikowski, W., and Iacono, C. S. "Research Commentary: Desperately Seeking the 'IT' in IT Research—A Call to Theorizing the IT Artifact," *Information Systems Research* (12:2), 2001, pp. 121–134.

Pitt, J. C. "The Autonomy of Technology, in Technology and Responsibility," in P. T. Durbin (ed.), *Technology and Responsibility*. Dirdrecht: D. Reidel Pub. Co., 1987.

Pouloudi, N., and Whitley, E. A. "Representing Human and Non–human Stakeholders: On Speaking with Authority," in R. Baskerville, J. Stage, and J. I. DeGross, (eds.), *Organizational and Social Perspectives on Information Technology*. Boston: Kluwer Academic Publishers, 2000, pp. 340-354.

Rapporteurs sans Frontieres. *Report: The Twenty Enemies of the Internet*, 1999.

Sørensen, C., Whitley, E. A., Madon, S., Klyachko, D., Hosein, I., and Johnstone, J. "Cultivating Recalcitrance in Information Systems Research," in N. Russo, B. Fitzgerald, and J. I. DeGross (eds.), *Realigning Research and Practice in Information Systems Development: The Social and Organizational Perspective*. Boston: Kluwer Academic Publishers, 2001, pp. 297-316.

Walsham, G. "Organizational Metaphors and Information Systems Research," *European Journal of Information Systems* (1:2), 1991, pp. 83-94.

Walsham, G. "Actor-Network Theory and IS Research: Current Status and Future Prospects," in A paper delivered at the IFIP TC8 WG 8.2: Information Systems and Qualitative Research, A. S. Lee, J. Liebenau, and J. I. DeGross, *Information Systems and Qualitative Research*. London: Chapman & Hall, 1997, pp. 467-480.

Whitley, E. A., and Hosein, I. "Doing Politics Around Electronic Commerce: Opposing the Regulation of Investigatory Powers Bill," in N. Russo, B. Fitzgerald, and J. I. DeGross (eds.), *Realigning Research and Practice in Information Systems Development: The Social and Organizational Perspective*. Boston: Kluwer Academic Publishers, 2001, pp. 415-438.

Winner, L. *Autonomous Technology: Technics-Out-of-Control as a Theme in Political Thought*. Cambridge, MA: MIT Press, 1977 (reprinted, 1992).

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