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Principles for IT Praxiography

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ABSTRACT

As information technologies become increasingly distributed, assembled and evolving through use, new conceptualizations of IT-as-artifact are pertinent. This theoretical paper compares two different analytical approaches that explicitly attempt to move beyond our commonplace conceptions of information technologies as single, fixed, and stable objects. The paper starts by outlining a structurational practice approach, an influential line of research in the Information Systems field. Secondly, a more radical practice approach is borrowed from the field of Science and Technology Studies and discussed as a promising path for bringing the complexities of contemporary IT into view. Building on the latter practice approach, the paper concludes with a set of principles for conducting IT praxiography that can improve our understanding of how IT emerges through a range of differing sites, practices and concerns.

Keywords: Emergence, Assemblage, Design-in-use, Enactment, Praxiography, Structuration theory, Actor-network theory

1. THE VANISHING ARTIFACT

Entering into a debate on the links between sociology and information systems development, Button (1992) suggests that the research preoccupation with the social practiced side of technology has caused technology to ‘vanish from view’ [1]. He refers to this as the curious case of the vanishing technology. Monteiro and Hanseth (1995) similarly criticize a tendency in IS research to black box the specificities of technology by applying monolithic terms such as information system, information technology, or computer system [2]. They call for research on IT in organizations to be more specific about technology, the level of granularity at which it is studied, and technical details of the particular technology in question.

Orlikowski and Iacono (2001) follow up on this curious disappearance of the IT-artifact in a research commentary entitled *Desperately Seeking the “IT” in IT Research – A Call to Theorizing the IT Artifact*. In a literature survey of articles from the journal *Information Systems Research (ISR)*, Orlikowski and Iacono (2001) find that the “IT artifact tends to disappear from view, be taken for granted, or is presumed to be unproblematic once it is built and installed” (p. 121)[3]. In this literature survey they delineate different ways in which technology is understood. These are by means of a tool view, a proxy view, an ensemble view, a computational view, and a nominal view of technology, each with a number of subcategories.¹ They thus found *many* conceptualizations of technology and discuss how most of these take the technology for granted

as a universal object. Orlikowski and Iacono note that such simplifications make it easy to talk and write about technology, but render it difficult to see how technologies must be held together, fall apart, and are altered at different times and places. They consider this unclarity a serious problem for the field: “[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. We believe that to understand these implications we must theorize about the meanings, capabilities, and uses of IT artifacts, their multiple, emergent, and dynamic properties, as well as the recursive transformations occurring in the various social worlds in which they are embedded. We believe that the lack of theories about IT artifacts, the ways in which they emerge and evolve over time, and how they become interdependent with socio-economic contexts and practices, are key unresolved issues for our field...” (p. 133)[3].

Orlikowski and Iacono suggest five premises for a research agenda that could adequately re-theorize IT artifacts. These five premises are ways of working against the tendency to view and talk about IT artifacts as universals, as single, stable entities that remain the same every time and everywhere. Orlikowski and Iacono’s five research premises [3]:

- IT artifacts are not natural, neutral, universal, or given. They are never “just objects” but always already implicated in actions and effects.
- IT artifacts are always somewhere – embedded in particular times, places, discourses, and communities. “Their materiality is bound up with historical and cultural aspects of their ongoing development and use, and these conditions, both material and cultural, cannot be ignored, abstracted, or assumed away” (p. 131).
- IT artifacts are made up of multiple fragile and fragmentary components “whose interconnections are often partial, provisional and which require bridging, integration, and articulation in order for them to work together” (p. 131).
- IT artifacts are not fixed or independent, but emerge from ongoing social and economic practices. They both undergo transitions over time and may co-evolve in multiple ways.
- IT artifacts are dynamic, and their stability is always conditional. It thus becomes important to understand why and how artifacts are stabilized in certain ways at certain times.

These five premises question the tendency to take IT-artifacts for granted as stable and fixed entities. These premises all abandon any notion of IT-artifacts as universals and call for attending to the practices in which they are implicated, assembled, transformed, and held stable. Turning to the social one way of realizing these premises. Yet as Button notes, in attending to social and human issues, practice-oriented studies of technology have tended to push the technological artifact out of view [1]. How can we conduct research based on these premises without technology vanishing from view? In the light of this discussion, I will present two approaches to the study of technology and practice that work this tightrope.

2. TECHNOLOGY IN PRACTICE

In the article *Using Technology and Constituting Structures: A Practice Lens for Studying Technology in Organizations* (2000), Orlikowski proposes what she calls a practice lens that can allow us to focus on the use of technology as a process of enactment [4]. Enactment is defined with reference to a dictionary definition: to constitute, actuate, perform, or to represent in or translate into action (p. 425n2). The term indicates an activity or an event through which something is done or acted out. Orlikowski uses the term to extend a structuralist understanding of technology design and use.

In structuralist models, technologies are approached as embodying social structures, which have previously been built into technology - most often by designers. This is a process of construction through which designers' intentions, or, social, political, and moral structures such as hierarchies, procedures, and knowledge become written into material artifacts. Once embedded with properties, technologies work back in shaping the social, structuring organizations, work practices, and use activities in particular ways. This way of thinking the relation of technology and social practice is quite common in both IS literature [5, 6] - and in social studies of technology [7, 8]. The image is recursive. The social shapes technology, and technology shapes the social. This is a perpetual interplay, and over time the social and technical are increasingly enmeshed and entangled in one another through this process of recursive structuring. This is a useful way of thinking about how information technology and social practice co-evolve through a dynamic interplay. Yet, this view presumes that a technology's physical properties are in place and stay in place after being constructed. This view falls into the universalizing trap of treating the properties as fixed, stable, and the same everywhere and at all times that Orlikowski and Iacono warns against [3].

Orlikowski points out problems with this perspective and with the very notion of design as construction. Firstly, the notion of technology as a fixed and stable entity does not align with empirical evidence and contemporary circumstances where technologies are modified, continually evolve in use, and do all sorts of things neither anticipated nor planned by designers. Orlikowski posits the following critique of existing structuralist models: "[T]heir presumption that technologies embody specific stable structures is nevertheless problematic because it depicts technologies as static and settled artifacts with

built-in arrays of fixed and determinate structures that are (always and readily) available to users. Such assumptions of technological stability, completeness, and predictability break down in the face of empirical research that shows people modifying technologies and their conceptions of technology long after design and development" (p. 406) [4].

Orlikowski refers to a range of studies of how use evolves in ways unanticipated by designers [4,9,10,11]. Examples include misunderstandings of designer intentions, inadequacy of user skills and competencies, or, that users deliberately resist, alter, or work around the technological design perhaps by adding, modifying, or substituting procedures or elements. Orlikowski implies that we need to be more attentive to this excess - the actions, outcomes, and detours that cannot be explained by the technology or design as source. This shifts focus away from the interior stable properties of technologies to that which is enacted and emerges. Orlikowski suggests that the dilemmas of the field derive in part from *starting with the artifact rather than starting with practice*. Orlikowski argues that technologies can only be seen to structure action when routinely mobilized in use, when linked to and made part of specific practices and settings. If a new technology does not get off the shelf, what does it structure? What emerges depends upon particular practice.

Orlikowski elaborates upon her practice lens with a critique of more traditional sociological ways of thinking about structures, rules, and resources as existing either external to and independently of human action (out there), or, as internal schemas built into people as programmed rules of thumb, skills and judgments, or cognitive abilities (in our heads). This view is criticized as *objectivist reification* - rules exist out there prior to and independently of our action - and as *subjectivist reduction* - that rules and procedures reside internally in individual subjects (p. 406). The problem with both of these views is that they assume that rules and procedures exist outside and separate from practice, be this in individuals, in communicative structures, or in material objects.

Ongoing enactments

The concept of enactment is brought in by Orlikowski as a resource for thinking about the world as dynamically in the making [4]. She stresses that it allows us to study how that which we might think about as structure is always constituted *in practice* and only gains its existence through performative events or moments. This view takes practice as its starting point, and always looks for structures, rules, and procedures as outcomes or effects of practices. Social structures are embodied in instantiations, not in the materials of the technology.

Orlikowski argues that by studying enactment we are better equipped to acknowledge and account for the processes through which technologies are used - both in line with the designer's expectations, but also in new and different ways that may be different from or perhaps contradict or exceed the intended use foreseen by the designers [1]. This view allows us to explore, as Orlikowski moves on to do in the article, the differences in use - different versions of the artifact that evolve through use. Technologies-in-use are

thus continually enacted and through long spirals of repetitive enactments they *come to look like* sameness and stability. Yet, stability is always provisional.

In this discussion of technology and practice, Orlikowski distinguishes between a technology-as-artifact and a technology-as-practice. Technology-as-artifact is described as the “bundle of material and symbol properties” and technology-in-practice is “what people actually do with the technological artifact in their recurrent, situated practices” (p. 408). This paper suggests that Orlikowski does not press her own critique far enough. What starts out as a critique of the construction view (artifacts as designed by designers and thereafter the same and stable every time and every where) ends up as another version of this view by maintaining the IT-as-artifact as an object existing ‘outside’ of practice and discourse. The IT-as-artifact stays in tact. Before returning to this point of disagreement I will first present a second approach to the study of technology practice.

3. TECHNOLOGY AS PRACTICE

To introduce a way of studying technology *as* practice I will turn to STS researchers de Laet and Mol and their way of thinking through the concept of enactment [12,13]. Unlike Orlikowski, de Laet and Mol are less interested in developing a robust theory, but they use the term enactment to bring a number of empirical questions and problems into focus. Their work represents a very different way of doing research and producing new knowledge. And I will therefore present their work as providing a conceptual framework for investigating material objects empirically. The conceptual framework suggests a number of analytical tricks that can guide empirical investigations and knowledge production more than providing a grand explanatory theory such as structural theory.

De Laet and Mol’s work forms part of a wider field of STS research concerned with shifting social science away from dealing only with social structures, communicative layers, symbols, and meaning, and with moving sociological theorizing into the physical realm of material objects, nature, bodies. These aims entail new ways of thinking about relations of the social and the material as ‘mutually constituted’ and not belonging to different ontological domains [14,15]. The work of de Laet and Mol can thus be grouped together with other STS work that is particularly preoccupied with materiality (for example, how materialities appear and vanish) and socio-material hybrid phenomena. Both these preoccupations resonate with concerns of IS research and have provided a theoretical resource for the field as seen, for example, in the work of Aunestad and Hanseth (2000), Monteiro (2000), Büscher et al. (2001) [16, 17, 18].

This orientation furthermore foregrounds the very practices, events, and situations in which objects are handled, made, and re-made. Similar to Orlikowski’s suggestion to start with practice and not the object, de Laet and Mol’s study implies *never* viewing objects as given beforehand, but as always brought into being through practice. They illustrate how technological objects can be investigated through the practices in which they are made, used, adjusted, become localized, framed, visible, or

invisible[12]. Again similar to Orlikowski, de Laet and Mol aim to move away from the notion of construction that posits that objects, once constructed, are stable and fixed entities: Maintaining identity and stability of any object requires continuing efforts. Things fall apart, need to be used, maintained, and valued. In short, they *are* through all sorts of practices. This turns the focus of study around and renders technology not what one begins with, but what gets constituted [13,14,15].

I will give an example to illustrate the conceptual framework proposed. The example is from a study by de Laet and Mol of a water pump in Africa [12]. They analyze this bush pump, a technological object, as adaptable, flexible, and ‘fluid technology’. I will outline their arguments and then contrast these with the proposals of Orlikowski [4].

Studying appearances and boundaries empirically

De Laet and Mol explore different ways of describing what the bush pump is and explore the different practices in which it is located [12]. On the one hand, the pump has a history. An inventor and an engineering company have developed it in different versions. Secondly, it has a certain look and feel. They describe what it looks like as well as a number of invisible parts that are under the ground, e.g. the mechanisms that pump water out of a well. Next, it can be compared and described as different from other pumps, for example by way of its effective hydraulic system, its durability, and specific functionalities. There is thus a range of possible descriptions, each of which enacts particular properties of the pump (p. 237)[12].

The bush pump also appears differently from one village to the next. It is set up in slightly different ways. Parts and pieces have been removed, renewed, added, or tinkered with from one village to the next. De Laet and Mol describe how, in the villages, the pump has to enter into a collaborative relationship with other technologies, such as a drilling device for boring well holes for the pump. And the local villagers need to be engaged and to collaborate for the pump to start working and keep working. So the pump is also closely tied together with the local communities and family relationships. Another appearance thus includes these people that make it work, their collaborative efforts and organization, their use of instructions, and their collective tinkering about.

Lastly, de Laet and Mol look at the practices of the Zimbabwean state and how the pump is part of a national strategy for building an infrastructure for clean water. Distant actors can also be seen as forming a part of the pumps, for example governmental agencies, NGO’s, and the engineering companies that continually are supplying new parts. The pump is also a national health promoter and a way of encouraging units of collective action in the villages, thereby building a stronger nation. In applying this strategy of analysis, de Laet and Mol question what it means that the pump “works”. They look at the different and continual practices of villagers repairing parts, adding new parts developed by the engineering company, or experimenting with their own solutions for solving problems that come up with the pump. New bits and pieces are continually added over time for the pump to work. It is taken apart and put back together in new ways.

The analysis of Laet and Mol is useful because it opens for a way of thinking about grades and shades of working. Workability is, on the one hand, defined by the measurements of cleanliness and official, standardized health indicators. Whether the pump works is dependent upon whether it produces clean water. What defines clean water is dependent upon international criteria for measuring the count of E.coli bacteria in one liter of water, for which one needs specific measurement instruments. Some pumps meet these criteria. Some do not. Some pumps are not tested at all. And when tested, the measurements can also be tinkered with and handled in ways that sometimes make the count fit and the pump work a bit better. Success or failure is thus variable and dependent upon a range of other elements such as water, bacteria, instruments, and calculation procedures. Working is a matter of tinkering and assistance and is also related to other elements such as the size of the well, the organization or conflicts of the village people, national health committees, and engineering companies.

De Laet and Mol suggest thinking about the pump's existence as *co-extensive* with this whole line of other things, people, and activities. In this way, they unravel a set of different descriptions and practices that *frame* the Pump in different ways. "[I]ts boundaries are not solid and sharp. The pump is a mechanical object, it is a hydraulic system, but it is also a device installed by a community, a health promoter, and a nation-building apparatus. It has each of these identities – and each comes with its own boundaries. To write about the Bush Pump in this fashion means that we do not mobilize the arid trope of describing a small technological artifact as if surrounded by large social environments – to which it inevitably remains alien. In each of its identities the Bush Pump contains a *variant* of its environment." (p. 254). Their article unpacks these different identities and explores the different enactments of the technology [12]. It is, however, not completely random and cannot be just anything at all: "...the Bush Pump's various boundaries define a limited set of configurations. They each, one might say, *enact* a different Bush Pump" (p. 237)[12].

Multiple enactments co-exist and assemble

Different enactments assemble together and produce consequences, such as the pump being successful or providing better health in Zimbabwe [12]. De Laet and Mol suggest that the pump holds together precisely because of the many differing local enactments, distributed action, and surprises (p. 253). They therefore suggest thinking and talking about the pump as a fluid technology, a flowing object that does not have a fixed pattern or boundary, but may alter shape as it flows or meets with other elements. Also, the very configurations of which the pump is a part are not stable either. Villagers and families may fail to cooperate around drilling holes and maintaining the pump, and spare parts may be unavailable at different times and places. The configurations and relations the pump is part of gradually shift and change. The central point here is that these subtle changes in the relations that sustain the pump, and a series of different enactments and gradual adaptations, allow for the pump to hold together as an overall successful, working, and continuous technology. The analysis moves across different levels of abstraction

and combines these in the analysis. For example, national strategies, water bacteria, screws and bolts, and village communities are analyzed in similar terms as elements that form part of the configuration that shapes the pump as a working technology. They illustrate that boundaries between technology and context may be drawn in different ways. The authors thereby suggest that the very distinction of what is defined as technology or context – properties of the pump or the community – is also an enactment, a boundary continually drawn through particular practices [12].

This approach moves away from treating technology or practices as surrounded by context and concentric circles, but instead uses imagery of extended networks and network configurations. De Laet and Mol extend this way of thinking by arguing that nothing in particular holds the pump in place and that the pump gradually incorporates (and transforms) its surroundings. Here I would like to emphasize the analytical move de Laet and Mol make in that they let go of talking about the artifact *outside any description or practice*. Instead they make parallel many different descriptions and practices and study how the line between artifact and context blurs and shifts.

4. LOCATING 'IT-AS-ARTIFACT'

I will now compare this analytical trick to Orlikowski's practice lens [4]. Orlikowski launches the practice lens to say something new about how technology's structuring capabilities emerge through use. And it is her way of working towards the five premises for how we should re-theorize technology [3]. I have suggested, however, that Orlikowski falls short of her target in that she retains the notion of IT-as-artifact as something that lies outside of practice, outside of any discussion and debate. Orlikowski separates the material properties embodied from instantiations through her distinction between technology-as-artifact (stays stable) and technology-in-use (as instantiations). She describes the "symbolic and material properties" that are embedded, prior to use – that users then misunderstand, ignore, react to, or respond to [4]. The vocabulary she applies is one of humans choosing, adapting, and inventing ways of engaging with technology to accomplish various ends (in a humanistic resistance sense). With Orlikowski, use and instantiations unfold above or outside the artifact.

A more radical practice commitment, exemplified by a study of de Laet and Mol, is to always ask *where* the IT-as-artifact can be found [12]. In a footnote from Orlikowski's enactment article (which quotes Grint and Woolgar, 1995, p. 298) Orlikowski seems to be in line with the radical practice way of thinking about the object [4,19]: "As Grint and Woolgar 1995, p. 298 remind us '[Technology] exists only in and through our descriptions and practices, and hence it is never available in raw, untainted state'. Thus, even the description and observation of 'technologies' and their 'properties' including their designation as artifacts, is a kind of *use* of that technology." (p. 425). However, Orlikowski (2000) continues to maintain the distinction between technologies as artifacts and the use of such artifacts as an analytical distinction "useful in both empirical research and everyday usage" (p. 425).

In contrast, I suggest that questioning the IT-as-artifact *as a particular* enactment can open for new lines of inquiry. A more radical commitment to practice presses us to rethink and accept technology as a phenomenon of which there can be no self-evident or transparent account. In recognition of this theoretical dilemma de Laet and Mol avoid talking about the pump's properties a priori, but work towards understanding properties in relation to specific descriptions and practices. Properties are thought of as something to be examined as co-extensive and dependent upon a range of elements and practices.

To emphasize the parallel drawn in this paper from the bush pump example to IT phenomenon, the work of Bloomfield and Vurdubakis is relevant [20]. IS researchers Bloomfield and Vurdubakis similarly point out how we tend to ignore the question of how technology becomes recognized as such: "Technological objects do not speak for themselves, we posit such objects in our accounts of the technical and then speak on their behalf. For example, in seeking to describe the material or physical properties of technology one does not leave the social behind and cross, as it were, a boundary into the realm of the technical: for such description is inherently social. It implies that certain objects and practices can be demarcated and distinguished from others on the basis of an agreed set of properties." (p. 9) Upon empirical scrutiny, IT can implode into an array of distributed elements and practices. Bloomfield and Vurdubakis point out that locating technological artifacts as single and coherent entities thus requires work [20].

With this line of thinking, we can understand 'IT-as-artifact' as a *particular* enactment - that is enacted recursively in so many places and times that it appears self-evident and becomes taken-for-granted. Bloomfield and Vurdubakis suggest constantly being aware of *how* technology is recognized as such and to think about how "... any account that takes the "properties" of a particular technology as its starting point, is from the beginning caught up in those practices that generate and sustain the objectively given quality of those properties" (p. 10) [20].

Following these authors, this paper suggests that it is not so much a matter of eliminating accounts of IT-as-artifact as a question of *locating* these accounts and continuously working back to investigate the practice in which something is distinguished as either social or material. Technology-as-artifact is *also* achieved in practice, and as Bloomfield and Vurdubakis suggest, we may benefit from being more attentive to the particularity of these enactments. If we are not, technological artifacts slip into being "everywhere and the same again" as Orlikowski and Iacono warns us against [3].

Juxtaposing different appearances and descriptions as de Laet and Mol do in their study of the bush pump, is one way of problematizing the fixity and boundaries of technological artifacts. Orlikowski and Iacono also make this very move in their call for re-theorizing the IT artifact, presented at the start of this paper [3]. In their survey of IS literature and conceptualizations of technology they find a whole list of different versions of technology: as tool, proxy, ensemble, and nominal.¹ Upon scrutiny, the IT-artifact differentiates and multiplies. For Orlikowski the lack of a clear theory or account is a theoretical problem. But what if these differences are turned into an opening

rather than a dead end? De Laet and Mol's approach can be a useful analytical trick for circumventing the problem of the vanishing technology by working empirically and studying the practices in which a technology appears and is framed as such. This provides empirical answers to a theoretical problem and provides guidance for analyzing IT *as* practice, thus viewing the way in which IT comes into being as an emergent effect of a set of more or less related practices. Such an 'IT praxiography' starts with these practices, situations, and particular moments of enactment rather than starting with the technology.

5. CONCLUSION

In conclusion, IT praxiography is suggested as a set of principles that may relieve some of the desperation in the search for IT in IS research [3]. The principles are proposed as an analytical resource for sensitizing research to the situated practices and events of which IT is a part. The principles thereby follows the premises as suggested by Orlikowski and Iacono, but expands these with four additional premises listed below[12].

IT praxiography refrains from starting with a fixed definition of IT (or the expectation that we might find it once and for all if we keep working on it), but instead starts with practices, situations, and events in which information technologies appear, asking openly what occurs and what emerges. This implies:

- Never isolating information technology from the specific settings, situations, and relations in which it is made, made to work, and re-made
- Tracing in detail the different network arrangements and configurations through which information technology is framed, assembled, localized, manipulated, brought into being locally
- Scrutinizing how enactments of IT-as-artifact, its properties and boundaries, alter and fluctuate with different practices
- Not looking for explanations or determinants for what information technology *is*, but describing the process – how it came to be that way through distributed, ongoing, and collective achievement
- Including in analysis related academic networks: how researchers' activities, analysis and recommendations meet with and transform other enactments and framings [23]

These principles can qualify how people involved in the fields we study (including ourselves as researchers) continuously are engaged in processes of defining technology, aligning it with here and now practices and orientations. Such practices seem to be always ongoing, often unfinished, and more than merely matters of interpretation. IT praxiography is a relevant resource that can further analytical work on how IT emerges through multiple and differing practices that crisscross traditional divides of design-use or research-practice.

6. FOOTNOTES

1. In a tool view, technology is an engineered artifact expected to do what it is designed to do. Here technology is black boxed and assumed to be an individual and stable entity that can be transferred from site to site and used as is [3]. In this view technology is the independent variable left stable and unexamined while studies focus on dependent variables – that which is affected, transformed, and altered by the tool (p. 123). A proxy view “focuses on one or a few key elements in common that are understood to represent or stand for the essential aspect, property, or value of information technology” such as ease of use, intentions of use, measures of diffusion or cost-benefit. An ensemble view, in contrast, looks at technology as one element in a wider ensemble and at the dynamic interplay of social and technical entities [21,22]. Lastly, articles where technology is omitted and absent from the article are categorized as a nominal view [3].

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