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Paul M. Leonardi

Northwestern University, Evanston, Illinois, USA, Leonardi@northwestern.edu

Carlos Rodriguez-Lluesma

IESE Business School, Madrid, Spain, clluesma@iese.edu

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Sociomateriality as a Lens for Design

Imbrication and the constitution of technology and organization

Paul M. Leonardi

Department of Communication Studies

Department of Industrial Engineering and Management Sciences, Northwestern University, USA

Leonardi@northwestern.edu

Carlos Rodriguez-Lluesma

Department of Managing People in Organizations, IESE Business School, USA

CLluesma@iese.edu

Abstract. The notion of ‘entanglement’ has been central to the development of the emerging perspective on sociomateriality in organizations. But employing a metaphor of entanglement implies an ontological commitment to treat social and material agencies as empirically inseparable. This commitment to inseparability makes it very difficult to think about redesigning systems to work better because they cannot be dismantled into their component parts and re-arranged. Shifting from a metaphor of ‘engagement’ to one of ‘imbrication’ eliminates this problem because social and material agencies are seen to retain their distinctive form despite the fact that they depend on one another for the production and perpetuation of sociomaterial practices. Imbrications can be undone and remade. Thus, a designer can work with an imbricated structure in a way he or she cannot with an entangled web of practice. The result is that the metaphor of imbrication provides more possibilities for imagining design-oriented action and more opportunities for envisioning changes to technologies and organizations than does a metaphor of entanglement without sacrificing the relational ontology that makes the sociomaterial perspective so attractive to scholars.

Comment to Bratteteig & Verne

The emerging perspective on sociomateriality has a number of benefits for research on the management of technology in organizations. One of these benefits is that it by defining technologies and organizations in the same way—as constellations of social and material agencies—organizations and information systems scholars can finally dispense with debates about technological VS social determinism because they conceptualize technology and organization as different abstractions of the same underlying phenomena (Leonardi 2009). A second benefit is that discussing organizational practices as ‘sociomaterial’ reminds researchers that technology is not only important during times of implementation, but that the affordances tools provide people for conducting work tasks are part of that work and, consequently, central to all organizational processes (Orlikowski 2007). A third benefit is that the term ‘materiality’ (even if it is compounded with the pre-fix “socio”) draws attention to the substance and significance of the artifacts with which people work. A long-standing complaint of information systems scholars has been that researchers who purport to focus on how technologies are implicated in organizational action do not describe the technologies they study in any depth, which precludes detailed theorizing about their role in the production and maintenance of organizational practice (Monteiro and Hanseth 1995).

This last benefit—re-focusing attention on the materiality of the tools with which people work—is especially important if one wishes to take a design orientation to organizational analysis. By design orientation we mean conducting research that not only allows us to describe organizational processes, but to generate insights about how to improve them (cf., Hevner et al. 2004). The reason this focus on materiality supports a design orientation is because it is through an understanding of how the features and functionality of a technological artifact are activated in the context of use and enable and constraint specific ways of organizing practices and policies that researchers can begin to see how using technology differently might improve people’s lives. This focus, and the design orientation that undergirds it, is clearly advocated in Bratteteig and Verne’s (2012) study of the technologies and organizational policies that enable and constraint the estimation of tax payments in Norway. As the authors argue, unless researchers (and maybe tax collectors!) are able to break the ‘sociomaterial’ down into the ‘social’ and the ‘material,’ there may be little hope for designing better technologies and organizations that meet people’s needs.

Despite the attention to a technology’s form and function that the term ‘material’ in the word ‘sociomaterial’ encourages, at least one of the underlying ontological positions that has buoyed the emerging sociomaterial perspective threatens this focus. The concept of ‘entanglement,’ which is drawn, somewhat loosely, from the meta-theoretical stance of agential realism (Barad, 2003), belies any distinction between the social and the material—this is why Orlikowski and Scott (2008) suggested that the term should not even include a hyphen. Although upon first glance the notion of ‘sociomaterial entanglement’ would not seem to jeopardize a focus on materiality, a closer inspection reveals several problems.

As Leonardi (2012b) suggests, sociomaterial researchers typically invoke the entanglement as a starting point. That is, researchers begin by assuming that practices are sociomaterial and move forward from there to show how an inextricable relationship between social norms and a technology’s materiality shapes, produces, or changes, organizational action. A metaphor of entanglement suggests that there is no untangling to be done, not because untangling is hard (think of the image of a tightly bound knot of two pieces of rope), but because conceptually there is nothing to untangle – the sociomaterial is one thing, not two (there is only one piece of

rope). Bratteteig and Verne's (2012) suggest, that such a view of entanglement is demotivating when viewed from, and perhaps antithetical when applied to, a design orientation. As they suggest in reference to citizen frustration about the estimation of taxes using the eGovernment tool: "Seeing sociomaterial assemblages as inseparable, unsolvable entanglements can lead the citizen to give up, and not make any move towards disentangling" (p. 68). If things cannot be broken apart, they cannot be reassembled in different and perhaps better ways. Consequently, any focus on the 'material' that a sociomaterial perspective might appear to give becomes useless if the goal is to design better systems, like the eGovernment technology used in the Norwegian Tax Agency described by Bratteteig and Verne.

To reclaim the power of design, Bratteteig and Verne suggest moving away from a conceptualization of sociomaterial practices as inextricable 'entanglement' to a view of sociomaterial practice as a space in which human and material agencies are 'imbricated' (Leonardi 2011). Their argument is that the metaphor of 'imbrication' is better suited to a design orientation than the metaphor of 'entanglement' because imbricated structures, although appearing seamless from a healthy distance, are nothing more than interlocked patterns of distinct elements when seen close up. In other words, a practice that looks 'sociomaterial' from overhead seems much more 'social' and 'material' on the ground. Bratteteig and Verne suggest that if organizational practices are seen as imbricated as opposed to entangled, they can then be taken apart (because there are two pieces of rope, not just one) and their constituent components (human and material agencies) each can be modified and then reassembled in different ways to improve people's experiences. To explain the importance of this point, we turn to a brief discussion of the differences between entanglement and imbrication and the consequent ideological commitments entailed in choosing one metaphor over the other.

1 Entanglement vs. imbrication

Drawing on work in the philosophy of science and technology studies, Orlikowski (2010, p. 13) observes that most approaches to technology in organizations follow an "ontology of separateness," which posits two independent entities—the social and the material—that then are related to each other. By contrast, Orlikowski claims that in the beginning is the mangle, and that it makes no sense to ask for a demarcation between the material and the social: "It would not be incorrect to say that our existence has now become so entangled with the things surrounding us (if it even makes sense to use the notion of 'surround') that it is no longer possible to say, in any definitive way, where we end and they begin, and vice versa" (Introna 2009, p. 26; quoted in Orlikowski 2010, p. 13). This approach, and the relational ontology it implies, is based on Niels Bohr's 'philosophy-physics,' (Barad 1998), which suggests that we need to discard the basic assumptions of measurement transparency that underlie Newtonian Physics; in other words, "that observation-independent objects have well-defined intrinsic properties that are representable as abstract universal concepts." (Barad 1998, p. 94). Bohr claimed that what was known could in no way be separated from the "agencies of observation," and that both factors formed a "non-dualistic whole," which constituted the cul-de-sac beyond which knowledge could not proceed. Hence, as Barad (1996, p. 170) who has translated and championed Borh's work for the social

sciences suggests, “there is no unambiguous way to differentiate between the ‘object’ and the ‘agencies of observation’—no inherent/naturally occurring/fixed/universal/Cartesian cut exists. Hence, observations do not refer to objects of an independent reality.” What is being described is our participation within nature, not nature itself. Barad entangles epistemological and ontological considerations, such that what something becomes inseparable from the process through which we come to know it. As a consequence, the entanglement in practice view privileges “neither humans nor technologies..., nor does it treat them as separate and distinct realities.” (Orlikowski 2010, p. 12).

We sympathize with Barad’s and Orlikowski’s push to discard a representational approach to epistemology (and its associated ontological commitments). There is no ready-made world out there because there is no one-to-one mapping of objects to ideas (Putnam 1981). Thinking of the world as composed of logical atoms and of language as a representation thereof, is simply untenable. As Wittgenstein argued against his own ‘Picture Theory of Meaning,’ language cannot mirror reality because our uses of a particular words share only a ‘family resemblance’ to each other, and the grammatical form in which those words are embedded may change without any alteration in the expression of thought (Wittgenstein 1953). The meaning of a word does not consist in its relation to some atomic fact; rather, the meaning of a word lies in its use within the language game of a community. For this reason, no account of an object or event can be proven to be its ‘one true’ description. What we find instead are different descriptions of reality that can be proven to be better or worse (Putnam 1997).

A key tenet of the entanglement approach is its consideration of the identity/difference with its all-or-nothing view of our access to reality. Barad (2003, p. 802) puts it bluntly:

“[D]uring the nineteenth century, Nietzsche warned against the mistaken tendency to take grammar too seriously: allowing linguistic structure to shape or determine our understanding of the world, believing that the subject and predicate structure of language reflects a prior ontological reality of substance and attribute. The belief that grammatical categories reflect the underlying structure of the world is a continuing seductive habit of mind worth questioning.”

We contend, however, that more alternatives to representationalism exist than the holism espoused by Barad, Itrona and Orlikowski, among others. The fact that grammar may not map perfectly to reality does not mean that it should be discarded. We agree with Suchman (2007), that technology acquires its meaning when embedded in social practice and, therefore, in relation to both the agent(s) involved and other material elements. A relational view of technology need not dissolve the difference between these two poles. The distinction that Kenny (1992) provides between the power of a physical key to open a door and the vehicle of that power affords a first glimpse into our approach. Imagine a key that has the power to open one door and only that door. Although that power is certainly real, we would be wrong to look for the actual power in the key itself, as this power is clearly relational, at least in two senses. First, It is relational in the sense that, absent the door, the key loses its power; and, second, it is relational because the key acquires its meaning only in the context of a community in which keys and doors exist and people are trained at opening doors with keys. Indeed one could point to certain physical characteristics of the key and say that the power lies in, for example, its shape and component material—that is, in its ‘materiality,’ in Leonardi’s (2012) terms. But that move would

only constitute one instance of what Lukes (2005) calls the ‘vehicle fallacy’, which consists of confounding vehicle and power. In Lukes’ own words,

This idea has led sociologists and military analysts, for example, to equate power with power resources, such as wealth and status, or military forces and weapons. But having the means of power is not the same as being powerful. As the United States discovered in Vietnam and postwar Iraq, having military superiority is not the same as having power... [C]ounting power resources can be a clue to [power’s] distribution, but power is a capacity, and not the... vehicle of that capacity (Lukes 2005, p. 70).

Similarly, although the key’s retains its materiality does not imply that it retains its power, as they are two distinct entities, material and relational, respectively. In other words, the power that the key has to open the door is afforded by the materiality of both the key and the door, but is not equivalent to either or both of them. Rather, it is an emergent power that inheres in the relationship between the two *relata*. This example illustrates how a relational ontology need not negate any real separation between entities.

If the quest is for a relational ontology that respects and interrelationship, but not a conflating of social and material agencies, then the metaphor of imbrication becomes a useful alternative to the metaphor of entanglement (Leonardi 2011). The verb “to imber” derives from a kind of Greek and Roman tile, known as *imbrex* (from *imber*, “rain”), used in combination with other kind of tile called “tegula”. Imbrices were laid out so that one slightly overlapped the next one, in the same way as the scales of a fish, thereby channeling the rain over the *tegulae*, and off the roof. In the same way as *imbrices* and *tegulae* differ in their constituent make-up, so too do social and material agencies. “Though both [are] capabilities for action, [they] differ phenomenologically with respect to intention. Thus, like the tegula and the imbrex, they have distinct contours and through their imbrication they come to form an integrated organizational structure” (Leonardi 2011, p. 37). Social and material agencies do not always differ only analytically, like the concavity and convexity of the line. This assumption flies in the face of structural arrangements that, although well known by agents, may be nonetheless constraining, like the internal structure of an ERP system, or the feebleness of a given mechanical tool. It seems obvious that, absent any other consideration, the structure of the ERP system is not a state of affairs that depends in its moment-by-moment existence on any entanglement with the agent, but to some extent imposes itself on agents as an external reality that both constrains and affords agents’ purposes.

More general examples may include the particular demographic structure of a country, which will differentially enable and constrain rates of population replacement, taxation schemes or education policies. The material entanglement approach, however, proscribes the option to analyze how it is exactly that agents and technology interact and form the patterned imbrications that we know as *practices*. We agree that the entanglement approach may serve well on some occasions. In Heidegger’s (1962) terminology, this metaphor may be useful for a ready-to-hand mode of engagement, which arises when a tool is transparent to an agent and there is no perceived distance between technology and agent because the practice proceeds smoothly. In those cases one experiences action as unmediated. When this transparency of action is broken, though, the experience turns into what Heidegger (1962) terms unready-to-hand or present-at-hand modes of engagement. The differences between them need not detain us here. In these latter circumstances, the entanglement metaphor loses its explanatory power because technol-

ogy appears more as a topic of investigation in the way that Mouzelis' critiques Giddens' (1984) structuration theory for treating technologies "as topics, not so much as means of acting but as strategic goals, as objects that the subject approaches with theoretical, critical or monitoring intent" (2000, p. 748).

Bratteteig and Verne's analysis demonstrates the need to go beyond the discussion of whether there is or there is not a space between material and social agencies, and inquire into the mechanisms through which material and social agencies become imbricated within that space. To provide one such lever, we suggest employing the concept of 'conversation.' To illustrate what we mean by a conversation between social and material agencies we will build on Galison's (1997) idea of the trading zone as the socially invented (as opposed to 'constructed') space in which imbrications takes place. In the following section we will further refine Leonardi's (2011) use of the metaphor of imbrication by discussing how material and social agents come to form a dispersed, routinized web through person-to-person, person-to-material and material-to-material conversations.

2 Imbrication as conversation

Peter Galison's (1997) monumental chronicle of the evolution of microphysics in the twentieth century, illustrated as an interaction of communities of physicists with theoretical, experimental and practical constraints, is instructive because his concept of 'trading zone' shows precisely the working of the space between material and social agencies that we argued is necessary to understand their interaction. Galison tells the convergent story of two different research traditions in microphysics, both concerned with the discovery of subatomic particles, but based, respectively, on running numerous experiments and their statistical analysis and on getting an image of them (or of their trace). The progressive convergence of the two streams of research took place through the emergence of a 'trading zone,' where patches of theories were borrowed, and recombinations of existing instruments and experiments were made. This view contrasts with the 'translation' metaphor, which holds that there is a process through which meaning in the language of tradition A is replicated in the language of tradition B. Rather, the 'trading zone' image is that of a new, hybrid language created in a newly opened space that both parties come to share. In Galison's (1997, p. 783) own words,

Two groups can agree on rules of exchange even if they ascribe utterly different significance to the objects being exchanged; they may even disagree on the meaning of the exchange process itself. Nonetheless, the trading partners can hammer out a local coordination despite vast global differences. In an even more sophisticated way, cultures in interaction frequently establish contact languages, systems of discourse that can vary from the most function-specific jargons, through semispecific pidgins, to full-fledged creoles rich enough to support activities as complex as poetry and metalinguistic reflection.

Central to the concept of trading zone, then, is the creation of more-or-less fine-grained languages that allow (and differentially) constrain interactions. If trading zones are spaces of conversation, then we can understand the sociomaterial imbrications that produce and sustain

microphysics as a conversation among the physicists active in each of the two traditions, and of the theories, experiments and tools embedded in those traditions. We need to understand ‘conversation’ in this context in a broad sense, as existing, among others vehicles, in natural language, in theories (a specialized subset of language), in experimental procedures and performances, and in the use of tools. In Aristotelian terms—uncannily parallel to Galison’s analytical axes— we could claim that the kinds of signification that populate the trading zone can belong to the habits of theory (*theoria*), action (*praxis*) and technique (*techné*). Conversations take place when, for example, patches of theories are borrowed, experiments are adapted to one’s tradition, or hybrid tools are built. Further, if we wish to understand the evolution of the ‘microphysics imbrication’ we need to realize that it is just the highest level of a nested set of conversations: between traditions, in the first place, but also between people, between people and technologies and among technologies themselves.

The trading zone, the more or less ample area between both physics traditions, is where the highest-order imbrications takes place, while more fundamental sociomaterial imbrications occur in the work practice that occur within specialty departments, and so on. Central to a conception of the interaction of social and material agencies is Galison’s concept of ‘intercalated periodization,’ which depicts theorizing, experimenting and instrument usage as interacting with ‘partial autonomy’ (Galison 1987). To illustrate, constraints on experimental inquiry may be long-, medium- and short-term. Whereas, for example, the idea of unification of fundamental forces of nature may make up a long-term constraint for experimental activities, gauge theories and different models and phenomenological laws used in particle physics constitute respectively medium and short-term constraints for the same field (Galison 1987, p. 254). Different kinds of constraints lead to different inputs into the dynamics of imbrication. These constraints are not ‘things’ and are surely activated by the goals the researchers have imposed on themselves; but it is also true that the material dynamics of tools are a different kind of beast than, for example, the theoretical commitments of the agents involved. The fact that constraints and affordances only appear as emergent phenomena when the relevant *relata* come about does not mean that they are prior temporally, logically, or ontologically than the *relata*.

The different nature of the imbricating elements appears most clearly in the periodization of the ‘microphysics imbrication.’ For Galison a *period* is a fragment of microphysics that can be identified as distinct from what precedes it and from what follows it. Different schools of thought have attributed change to different factors. Both positivists and antipositivists believed that science moved according to one and only one factor. Positivists, for example, “committed themselves to an unbroken, cumulative language of observation” (Galison 1997, p. 784). If positivists accorded empirical data the sole influence on the change in microphysics, antipositivists “argued that theoretical and linguistic changes of science shifted with the abruptness and totality of a gestalt switch (...). Theory shifts *forced* changes all the way through experience, leaving no bit of language, theory or perception unaffected” (Galison 1997, p. 790). Against both positivists and antipositivists, Galison holds that periodizations are intercalated because of the partial relative autonomy of theory, practice and instrumentation:

First, it is at least tripartite, granting the possibility of partial autonomy to instrumentation, experimentation and theory (...). Second (...) there is no continuous basis for observation. (...) Third, the local continuities are intercalated—we do not expect to see

the abrupt changes of theory, experimentation, and instrumentation occur simultaneously; in any case it is a matter of historical investigation to determine if they do line up (...). Fourth, we expect a rough parity among the strata –no level is privileged, no subculture is the arbiter of progress in the field or serves as the reduction basis (the intercalated strands should really be mapped in three dimensions to demonstrate that no one subculture is always ‘on top’ and that each borders on the other two). Just as brick layers would not stack-set the bricks for fear the whole building would collapse, researchers try to set breaks in one practice cluster against continuities in others. As a result of such local actions (not global planning), the community as a whole does not stack-periodize its practices. (Galison 1997, p. 799-800)

Taken together, the concepts of *trading zone* and *intercalated periodization* point us to the exploration of the expanse in which imbrications emerge out of the conversations among social and material agencies.

3 Imbrication, conversation, and design

As Bratteteig and Verne (2012) suggest:

If you see a problem as an entanglement, your only options are to accept or not accept: There is no space in between for negotiation and improvement. The notion of entanglement is useful for understanding the “user experience” for the taxpayers calling in to TICC. However, we also need the concepts of disentangling and imbrications in order for us to talk about space for action and of the possible actions in that space.

Galison’s notion of a trading zone implies that there is a space in which imbrications can and do occur. This space is invented when different communities (like taxpayers and tax collectors) come in contact around issues of mutual concern. What occurs in this space is conversation. Not simply conversations between the people from different communities, though this surely happens too, but conversations between the people and the technologies they use to carry out their work, as well as conversations between the technologies themselves. This space is where the relationship between people’s goals and technology’s features is negotiated. But if one were to adopt a metaphor of entanglement as the starting point for sociomaterial explorations, he or she would overlook these important conversations altogether because he or she would not ask how and why certain sociomaterial practices came to be as they are; they would simply be taken as given, both ontologically and empirically.

Employing the metaphor of imbrication, however, provides a lens for not only recognizing that someone is responsible for putting the social and the material together, but that they were ever separate in the first place. Acknowledging the empirical separateness and potential imbrication of these agencies is a necessary move for designing technologies and organizations that work better. Indeed, as Bratteteig and Verne (2012) suggest, from the point of view of human actor, “[f]acing an entanglement seems impossible, facing an imbrication can enable action. Imbrications that are presented as entanglements not opening up for action seem to counteract the idea of a democratic information society.”

What Bratteteig and Verne allude to throughout their paper is that some imbrications are more tightly interlocked than others – some so tightly interlocked that they may appear to be completely entangled. As Leonardi (2012a, p. 42-47) has discussed at some length, imbrications are path-dependent and it is through the repetitive interlocking of social and material agencies, over time, that some imbrications become more difficult to change than others. The longer the history of imbrications that have occurred, the more challenging it will be to remove one tile because that tile depends on the structure provided by so many other imbrications of tiles that came before, and so many imbrications that have followed depend on it. But it is not impossible. What matters though is one's ability (indeed, Bratteteig and Verne show that some tax collectors have this ability) to see which imbrications can be dismantled easily and which will require more work. The skilled operator, be she a tax collector, an engineer, or a theorist will understand which imbrications present the best and most feasible opportunities for reformulation and re-figuration. He or she will be able to tell which conversations can be redone in the space of practice so as to arrive at new conclusions. Thus, the possibility for design hinges, theoretically, on the recognition of sociomaterial practices as imbricated as opposed to entangled, and practically on one's ability to sort out which imbrications can be dismantled and reconstituted without causing the entire sociomaterial structure of an organization to collapse.

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