

# RETHINKING SOCIOMATERIALITY: INFORMATION TECHNOLOGIES AND THE POSSIBILITY FOR IMAGINATION

*Completed Research Paper*

**Elpida Prasopoulou**

Department of Government, University of Essex  
**Wivenhoe Park, Colchester, Essex CO4 3SQ, UK**  
elpidap@essex.ac.uk

## **Abstract**

*This article explores how humans come into being with a technological world, that is, a world where information technologies are present in every aspect of human activities becoming internal to what it means to be human. Its empirical focus is on technological scenarios since they uniquely assemble both humans and non-humans into a coherent narrative prescribing what can be legitimately said and done within everyday practices. Their normative character allows a critical reworking of sociomateriality which brings to the fore how both norms and technological objects enable and constrain meaning within everyday practices. The idea of constitutive entanglement, central to sociomateriality, is articulated in more detail while its political repercussions are brought to the fore and examined in detail. As such, sociomaterial accounts acquire more depth as they can challenge the inherited languages of description of technological phenomena, show their historical character and experiment with the possibility of transcending them.*

**Keywords:** sociomateriality, constitutive entanglement, imagination, scenarios

## **Introduction**

Information systems, as a scholarly field, have long explored technology's effects on human practices (Orlikowski 1992; Suchman 1987; Zuboff 1988). Information technologies are seen as imbricated into an ongoing stream of social interactions that allows people to tinker with technological artifacts and reconfigure their affordances (Leonardi and Barley 2010). This human-centered approach of technological change has specific limitations on the ways it allows us to conceptualise the constitutive entanglement of people with information technologies. It presents users unconstrained from discourses, rules and norms composing the ideological context in which technologies are put into use. In the same vein, government rationalities and subsequent public policies and other programmes of action remain outside the realm of analysis in information systems. As a consequence, the field has limited theoretical tools in order to explore the pervasiveness of information technologies in everyday life or analyze how users will engage with new, more responsive, environments (Hildebrandt 2013). Most importantly, these approaches silence the political implications of future technologies and the need for a more active role on behalf of citizens.

In this article, I explore the entanglement of people with information technologies in order to understand how humans come into being with a technological world. That is a world where information technologies are present in every aspect of human activities becoming, as Braun and Whatmore (2010: xvii) put it, 'so self-evidently internal to what it means to be human'. My objective is to explore the possibility for imagination in a world where reality is performed through the repetition of mundane acts of delimitation among humans and non-humans. I use imagination not as an internal, mental activity but as the prerequisite for active engagement on behalf of citizens. It is the possibility, for people, 'to project and inscribe new and unheard-of ways of being and acting, beyond the currently acceptable political languages and norms of our times, onto the political agenda' (Norval 2012: 810). My starting point is the observation that in today's societies 'technological change [is taken] to be the model for political invention' (Barry 2001: 2). This approach raises significant questions that beg further examination. How are people imagined to act in a technological society? How are information technologies imbricated into their everyday activities? What is the relationship between citizens and users? Can people imagine with information technologies and claim a different reality? I examine these questions through the analysis of technological scenarios in foresight reports. The scenarios are unique communicative devices condensing, in an easy-to-understand narrative, dominant discourses, people and their material surroundings. In this respect, they delineate what is possible, what can be legitimately said and done and what subject positions can be taken (Norval 1996) as well as the ways people imbricate information technologies into their everyday practices. The implications are not just discursive; they are also material since people are conditioned to interact with technologies in very structured ways while delimiting the repercussions of in situ innovation or tinkering in contemporary large-scale technological systems. It is precisely the implications of the envisaged regimented use of information technologies over tinkering that leads me to reflect on the possibility of political imagination with technological objects.

My theoretical lens for the study of the aforementioned issues is sociomateriality (Orlikowski 2007) which I critically rework in order to articulate in more detail the idea of constitutive entanglements of humans and non-humans. A strong proponent of the centrality of matter in everyday practices, sociomateriality remains rather restrictive on its understanding of the process of mutual constitution of humans and non-humans (Kautz and Jensen 2013; Leonardi 2012; Mutch 2013). Empirical accounts (e.g. Leonardi 2011; Scott and Orlikowski 2012) adopt a very narrow view of human-technology interactions focusing mainly on what people 'do' with information systems. Yet, this approach denies matter the active role in our collectives which sociomateriality purportedly explores. It narrows the focus on user-technology interactions preventing research from showing the actualization of reality through the mutual adjustment of heterogeneous elements with all its intricacies. This is quite problematic as information technologies become indispensable components of everyday life. Their use expands well beyond the confines of traditional organizations into everyday life while at the same time their functions are black-boxed and inaccessible to the end user (Kallinikos et al. 2013). As information technologies perform reality in ways that are hardly perceptible, if at all, to the end users we must be well equipped to problematize these performatives and explore the possibility of imagination as a trigger for change. For this, I critically read sociomateriality with Barad's work on performativity and the materialization of matter (Barad 1998;

Barad 2003; Barad 2007). Barad's ideas have been instrumental in the development of sociomateriality (Orlikowski 2009; Orlikowski and Scott 2008). This parallel reading allows me to be more open-minded about the ways technologies enter the human world, become sedimented through processes of objectification and classification, once entangled in practices, ultimately leading to the production and regimentation of specific subjectivities. It is my contention that we cannot examine what is constituted (i.e. what without which we cannot think at all, according to Butler (1993)) without delving into the complex work of articulation of subjects and objects through which reality is produced and sustained. Yet, this articulation of reality requires language, norms, institutions, laws and regulations to be brought back into sociomateriality without neglecting the ways matter asserts itself in the world. It is precisely this process of assembling all these heterogeneous elements together that I try to explain through sociomateriality in my reading of technological scenarios.

My exploration of the mutual constitution of discourse and matter is organized as follows: in the next section I critically engage with sociomateriality. I discuss its origins in the study of information systems within practices. I reveal its ambivalent stance towards matter but also its neglect of discourse. In order to correct these issues I return to performativity, the origin of many of sociomateriality's ideas. My aim is twofold (1) to develop a detailed account of the mutual constitution of humans and non-humans; and (2) to reveal the motives of Barad's take on materiality since her work has been instrumental in the development of sociomateriality. Then, I analyze technological scenarios in order to show how humans are imagined to come into being with a world where information technologies are pervasive. My aim is to show how societal norms are imbricated into technological design guiding humans to assume specific subject positions. In the next section, I explore the effects of this conditioning over both humans and non-humans in order to discuss the possibility to imagine alternative outcomes. Finally, I conclude my paper with an overview of the issues that open up for information systems research with the proposed reworking of sociomateriality.

## Rethinking sociomateriality

Sociomateriality starts from the premise that matter is of paramount importance in organizing. Orlikowski (2007) in her seminal article that introduces the concept in IS research advocates for an approach to technological phenomena that is attentive to matter. As she states in this article:

Materiality is integral to organizing [...] the social and the material are *constitutively entangled* in everyday life. A position of constitutive entanglement does not privilege either humans or technology (in one-way interactions), nor does it link them through a form of mutual reciprocation (in two-way interactions). Instead, the social and the material are considered to be inextricably related – there is no social that is not also material, and no material that is not also social. (Orlikowski 2007: 1437 emphasis on the original)

She elaborates this view in a subsequent publication (Orlikowski 2009) where the treatment of technology either as absent presence or exogenous force in social life is criticized as providing overly human-centered or deterministic accounts of IS phenomena respectively. This position is further corroborated by Leonardi and Barley (2008) who argue that an emphasis on the tangible properties of information technologies can produce new insights on their impact on organizations. As a solution to this conundrum, Orlikowski (2009) argues for the study of technological phenomena as *entanglements in practice* of people and information technologies. This approach on sociomateriality, however, already contains the seeds of ambivalences that beg closer consideration for this novel approach to fulfill its promise in the study of information systems. For sociomateriality, despite strong claims on the importance of matter, remains ambivalent when faced with the possibility of a post-humanist agenda in information systems. Moreover, it neglects discourse as the other component of the proposed entanglements reducing humans to users 'doing' something with information technologies. A genealogy of the concept is quite illustrative of these observations since further clarification of both discourse and matter are necessary for a more comprehensive research agenda.

The shift towards materiality can be traced back to the problematic developed by Orlikowski (2000) regarding ongoing changes in the use of information technologies. The introduction of a practice-lens (Orlikowski 2000), as a response to change-related questions, in the study of technological phenomena drew attention to the situated use of technologies imbricated into a web of norms, institutions and rules

but also their material conditions. After all, as Schatzki explains (2001: 12), persistence but also change in social life rest ‘on the successful inculcation of shared embodied know-how’. Nonetheless, the practice-lens remained decisively human-centric (Leonardi 2011). It privileged human activity, especially that of individuals, as the force mastering the entry of non-humans into the human world but also its impact. Information technologies are seen as mediating practices and not as actively contributing to their constitution. This led to accounts that portrayed information technologies malleable enough for humans to choose to do otherwise, given existing conditions (Orlikowski 2000). And yet, there are several instances, as Leonardi (2011) acutely observes, where humans confronted with inflexible technologies usually chose to maneuver around them by reworking their knowledge assumptions and working routines. These findings challenge dominant human-centric understandings of technological change in information systems. They raise questions on whether people actually perceive information technologies as malleable enough to tinker and experiment with when in contact with them or, nowadays, information technologies have already a naturalness that is hardly contested. As such, they pave the way for a materialist treatment of the constitution of reality that can accommodate non-human agency.

Sociomateriality aims at rectifying overly human-centered IS accounts by imbuing material concerns in IS research. However, what is actually this materialist turn remains ambiguous in all the founding works (Orlikowski 2007; Orlikowski 2009; Orlikowski and Scott 2008). Orlikowski (2007) describes the social as the field of embodied, materially interwoven practices over which humans do not have complete mastery over the entry of non-humans into the human world nor their impact over the development of shared practical understandings. In her own words, ‘humans are constituted through relations of materiality – bodies, clothes, food, devices, tools, which in turn, are produced through human practices. The distinction of humans and artifacts, according to this view, is analytical only; these entities relationally entail or enact each other in practice’ (Orlikowski 2007: 1438). Yet, whether she argues for a distinct social ontology is not clear. Her theoretical work does not articulate how a materialist perspective would enable us to think differently of information technologies. Instead, she offers varying definitions of the term (see Orlikowski (2007; Orlikowski 2009) and Orlikowski & Scott (2008)), an observation made by Kautz and Jensen (2013) in their critique of sociomateriality, which rather obscure, instead of clarifying, the core tenets of sociomateriality as a new theoretical lens in information systems. This lack of clarity is quite evident in the empirical work substantiating the initial theoretical claims. Leonardi’s (2011) work on car crash simulation technologies showcases this ambivalent treatment of matter. In the article, he shows the conditions under which human routines and technological properties change during human-technology interactions. However, the reconfiguration of the crash test system is initiated by humans in order to reflect changes in the company’s business philosophy. Intention and action are attributed to autonomous individuals who, this time, appear to be a bit more aware of the limitations set by their material environments. Matter, in this case information technology, is portrayed as less malleable. However, there is no clear explanation as to why this is the case; and how matter, if at all, comes to impose its own meanings over human practices.

It is therefore obvious that sociomateriality, despite initial aspirations, does not examine technicity as originary, that is, as something more fundamental than simply imbricating technological artifacts into everyday life or even adjusting them to the human body (Braun and Whatmore 2010). Existing research primarily develops factual narratives of encounters between humans and information technologies without explaining how observed reconfigurations lead to new practices. Moreover, it fails to explain how thought, language, and action change once matter becomes equally constitutive of practices. As a result, sociomateriality cannot explain what Butler calls ‘the regulatory practices that produce the bodies that govern’ (Butler 1993: xi). Research accounts using sociomateriality resemble practice-sensitive contextual explanations of technological change (e.g. Avgerou 2002) rather than explorations into the entanglement of humans with non-humans within practices. This is despite sociomateriality drawing direct inspiration from Barad’s (1998; 2003; 2007) reworking of performativity to elucidate what she calls the ‘mattering of matter’, that is a more intricate understanding of material agency. Barad goes at great lengths to explain how ‘the natural world only acquires definitive boundaries, and concepts only acquire definite content, together’ (Rouse 2004: 146). Sociomateriality is not equally clear about the role of discourse and matter in the constitution of reality.

This has not to do only with an ambivalent stance towards matter. The treatment of discourse is equally problematic and it can be traced all the way back to the way the study of practices has been introduced in Information Systems (Orlikowski’s (2000) work has been instrumental to the practice turn in IS).

Practices are not seen as ways for ‘rules, norms and concepts to acquire their meaning, and their normative authority and force, through their embodiment in publicly accessible performances’ (Rouse 2007: 631). They have been defined in an instrumental way denoting only what people ‘do’ with information systems in organizational contexts. This understanding of practices, imbricated also into sociomateriality, channels research to a rather slim layer of observable interactions between humans and information technologies. People are seen to tinker with information technologies responding to organizational needs, pre-existing work routines and inner feelings towards technological artifacts. Sociomateriality is left an unfinished project. It can neither account for the normative aspects of technological development and their effects on the constitution of meaning within practices nor the contribution of matter in the actualization of this meaning through a world of algorithms and computers. Yet, sociomaterial accounts, if they are to follow through the idea of constitutive entanglement of humans and non-humans proposed by Orlikowski, are not just about acknowledging the vitality of matter in the constitution of the conditions of possibility for human agency (e.g. Bennett 2004; Bennett 2010; Krause 2011). They must also explain how discursive practices produce – demarcate, circulate, and differentiate – technological phenomena in a way that matter becomes indissociable from the regulatory norms that govern its constitution (Butler 1993).

In order to overcome existing limitations in sociomateriality, I propose a more systematic engagement with discourse in IS research in tandem with a more decisive step towards a materialist agenda. For this, I turn to Barad’s work on performativity in order to clearly articulate the idea of constitutive entanglement of humans with non-humans. This is done in the following section.

## **Bringing performativity back in: A reappraisal of discourse and matter**

Performativity sensitizes research to the existence of processes that “work to bring into being certain kinds of realities” (Butler 2010: 147). Based on Austin’s observation that words do things and are not just assertions (Austin 1962), Butler (1993) developed the idea of performativity in order to explore how human bodies are gendered through a web of discursive and material practices. Focus was placed on the way discursive practices, in the Foucauldian sense, impose boundaries on bodies that are not just discursive but also material. They dictate what is intelligible but also what is abject and unthinkable. They show what is legitimate to do but also what is its constitutive outside (Butler 2010). A core tenet in Butler’s work is that these boundaries are not settled once and for all. On the contrary, performative power is exercised through mundane and repeated acts of delimitation that seek to maintain existing boundaries (Butler 2010). These acts are not just the outcome of human agency since performativity considers agency as a distributed phenomenon originating in the interactions among humans and non-humans. This way, matter, viewed as a process instead of site or surface (Butler 1993), is reintroduced to constructivist accounts focusing exclusively on language.

Barad elaborates on the idea of agency as a distributed phenomenon among humans and non-humans. Her objective is to overcome the nature/culture divide by affirming the importance of matter in scientific practices but also differentiating between physical and artificial matter (i.e. nature and instruments of observation) (Barad 1998; Barad 2007). This way, reality is constituted through the manifestation of various materialities that come into being through agencies of observation that include humans and their instruments. Humans do not simply record pre-existing properties of physical matter. Their participation in scientific and social practices endows them with specific types of knowledge allowing them to actively shape the meaning of what they observe. However, their agentic powers are not totally unconstrained. They are bound by the physical properties of their instruments. It is physical devices that perform a cut between ‘objects’ and ‘agencies of observation’ attributing specific properties to ‘objects’ that do not pre-exist but are immersed and indissociable from phenomena. Meaning is mutually constituted by humans and non-humans since the entanglement of their agencies enables them to equally contribute to the constitution of reality (Rouse 2004). Since Barad’s work is the main inspiration for the sociomaterial turn in information systems some clarifications about her work are necessary. Barad’s critique on the precedence of language in explanations for scientific phenomena, an idea strongly present in Orlikowski’s work, does not signal the abandonment of discourse over matter. Barad situates the constitutive entanglement of humans and non-humans in a web of discursive and material practices through the idea of the apparatus. Apparatus, a concept central to Foucault’s work, denotes ‘a thoroughly heterogeneous

set consisting of discourses, institutions, architectural forms, regulatory decisions, laws, administrative measures, scientific statements, philosophical, moral and philanthropic propositions – in short the said as much as the unsaid. The apparatus itself is the network that can be established between these elements' (Agamben 2009: 2). It is through this use of apparatus, which *inter alia* has a striking affinity to the much more recent term of socio-technical assemblages but also practices, that Barad can discuss how reality is constituted.

This idea of a network linking discursive and material elements in a specific historical period, which underpins Barad's work, is missing in sociomateriality. The absence is quite evident once sociomaterial accounts try to interpret empirical phenomena. Scott's and Orlikowski's (2012) work on user-produced information in social media is quite telling in this respect. Drawing directly from Barad's work, they study TripAdvisor's ranking mechanism as a case where the establishment of common metrics in leisure industry altered people's perceptions of value. Scott and Orlikowski (2012) explain that TripAdvisor's ranking mechanism has profound implications on how hoteliers tailor their customer offerings in order to achieve good reviews but also on how prospective travelers understand and subsequently use these reviews in order to plan their trips. The authors treat TripAdvisor's rating mechanisms as an apparatus and discuss how it is constitutive of reality. However, the use of apparatus, in this case, is a very narrow one. Issues such as the origin of this ranking mechanism in the norms governing leisure in today's societies, the new meanings it triggered within the practices of both the leisure industry and the holiday goers, the imbrications of political, ecological and normative concerns regarding leisure in contemporary societies, its conditioning of the human body (which is also material) are not problematized in the article. Instead, the authors produce a detailed account on various categories of users interacting with the site and how they use its ranking mechanism. The ways on how material constrains (i.e. the ranking mechanism) are formative of new subjectivities (i.e. constitutive of human identity) are not explained. The idea of constitutive entanglement of humans with information technologies remains ambiguous as critical elements of this entanglement are left outside the analysis.

Situating the interaction of users with information technologies among a heterogeneous set of discourses, institutions, laws, norms but also things, both natural and artificial, allows for another layer of explanations that confers in existing sociomaterial explanations a much needed depth. The contingent nature of reality is revealed in tandem with the struggles necessary for its constitution. For any ordering of natural and social relations is based on exclusion. There were other possibilities that have been left out and can always be reactivated (Mouffe 2005). The existence of other possibilities allows imagination to develop. Butler, in her work, explains how the constitution of normality leaves some bodies out. She goes even further to explore how this abjection is constitutive of reality but also finds its way back through the imagination of alternatives that are claimed by problematizing existing discursive and material practices through contestation. Barad's agential realism leaves out this possibility of imagination. Her initial work refers to the discursive-material production of abject bodies in her description of ultrasonography (Barad 1998) paving the way for the imagination of alternatives. However, the existence of other possibilities fades away in her later work (Barad 2003; Barad 2007) once matter takes center stage in explications on how reality is actualized through intra-actions between objects and agencies of observation. The reason for this lies in the way matter is treated by Barad. In her work, she argues for the inseparability of discourse and matter where non-humans are both physical phenomena (i.e. nature) and the instruments for their observation. However, the production of these instruments, so crucial for the constitution of both human subjectivities and objects, is not problematized. The scientific knowledge, social norms, industry standards and regulations imbricated into their design are assumed by not explicated in Barad's notion of phenomena as bundles of actions both discursive and material.

It should be clear at this point that Barad's intention to erase the nature/culture dichotomy by reworking the intertwinement of discursive and material practices (emphasizing the role of objects in the human understanding of reality) leaves unproblematized the constitution of some categories of matter, mainly technological artifacts. This omission is not taken into account in sociomateriality although it is of critical importance for information systems. This has been observed by Mutch (2013) who states that sociomateriality cannot account for the specific material properties of the various information systems it purports to examine. However, the solution is not only on an ontological level but also on how information systems incorporate various discourses (therefore are constituted by them) and how in their turn constitute both humans/subjects and their bodies (matter). This approach has specific repercussions for the study of information systems. Discourse is moved center-stage in order to account for the existence

of meaningful practices. Following the post-structuralist tradition, I take discourse to mean ‘concrete systems of social relations and practices that are intrinsically political, as their formation is an act of radical institution, which involves the construction of antagonism and the drawing of political frontiers between ‘insiders’ and ‘outsiders’” (Howarth et al. 2000: 4). Hence, discourse also involves the exercise of power as it excludes some possibilities in favor of others. The role of things in sociomateriality is also revamped since a critical approach problematizes matter. It brings information technologies in the forefront by re-igniting the tension between what Daston (2004: 24) calls ‘their chimerical composition and their unified gestalt’. Things reclaim their talk, in the sense of both enabling and constraining meaning. At the same time, humans are allowed to rethink their practices and social relations through their use of things. They are allowed to imagine their circumstances differently. Such an approach gives sociomateriality a critical edge since it reveals the fissures of any performative. Returning to technological scenarios, the proposed take on sociomateriality, reveals the ways humans and information technologies are put into practice (Tully 2008: 22). It also offers the possibility to challenge existing arrangements in such ways that their contingent circumstances will be revealed to citizens to enable them to govern themselves differently (Tully 1988).

I explore these issues in the following section where I examine scenarios on future information technologies. These scenarios allow me to examine how normative elements are imbricated into information technologies inviting specific types of interactions with humans (i.e. subjects). My main aim is to describe whether people can imagine with matter; or, the intense work of articulating discursive and material entanglements within practices significantly delimits human capacity for imagination.

## **Technological scenarios: People in a world of (technological) objects**

Technological scenarios are unique communicative devices in governmental practices. Their aim is clearly performative as they show what is intelligible to say and do with information technologies. The intention to perform concrete versions of reality has been noted by authors such as Kinsely (2010) as part of broader government programmes of action to preempt the future. In many ways, technological scenarios resemble various other communicative devices in contexts of uncertainty, such as business models or analyst reports, already discussed in extant literature (e.g. Beunza and Garud 2007; Doganova and Eyquem-Renault 2009). They bring together ‘elements of commensurability and comparability that frame the field of references’ (Doganova and Eyquem-Renault 2009: 1561) for its audience (mainly experts) in order to facilitate decision making. Technological scenarios are also unique since they contain strong normative elements. They entangle current and future information technologies with everyday instances and show what sort of subject positions can be legitimately taken by people (i.e. what identities can people assume but also how they can interact with their material conditions). It is their normative character that I explore in this article. Since their intention is to show how available resources should be deployed but also what will be the trends in the future, they are quite revelatory of the dominant discourses on technology and society. This way, they show, in an arguably condensed manner, how humans come into being with this world. They depict everyday practices where people interact with various information technologies.

In my analysis, I focus on two seminal foresight reports: *Envisioning digital Europe 2030* (Institute for Prospective Technological Studies 2010) which explores the future in governance and public policy and *Biometrics at the frontiers* (Institute for Prospective Technological Studies 2005) which advocates a future where biometric technologies will be fully integrated into everyday practices. The reports have been commissioned by the Institute for Prospective Technological Studies (IPTS) which is one of the seven scientific institutes of the European Commission’s Joint Research Centre. Its focus is to develop science-based responses to policy challenges. As such the scenarios are developed with a strong policy focus in order to stir EU resources towards the most challenging policy objectives. The scenarios are developed through a rigorous methodology and attempt to be comprehensive in terms of the technologies represented in the narrative. They are also quite revelatory of the government rationalities guiding policy. As such, they provide fertile ground to explore the various entanglements of people with information technologies allowing rich insights into both discourse and the various manifestations of matter.

## **Setting the context: Imagining a technological society**

Information technologies are pervasive in a technological society. All scenarios describe situations (e.g. travelling, picking up children from school, cooking, going to the supermarket, going to work) very close to our present experience. There is, however, a fundamental difference, that is, the intermediation of information technologies in every human activity. Nothing can be done unless people insert or receive information from a technological device which is in turn connected into larger information infrastructures. Even a cursory reading of the scenarios attests to this observation:

I helped him spoof the cafeteria entry system [at school]. I just printed a high-resolution picture of my iris and Ed presented that to the system (pg 21)

The biometric access system which clock hours worked was introduced to replace the outdated systems of punch-cards (pg 23)

We use our fingerprint as a password when accessing medical records (pg 24)

At first glance, their role seems quite simple. They provide access to secure spaces ensuring that only the people who have the right to be in them are admitted. However, a closer reading of the scenarios reveals that social relations are gradually mediated exclusively through information technologies. People do not rely on their own capacities to make judgments. Even simple acts like buying food in a school cafeteria or picking up children from kindergarten are authorised by technological devices. It is not just an issue of convenience. Technologies become in-betweens in the social order. This is done in more radical ways than previous technologies like paper-based documents or numerical passwords. In these instances, the human body was supplemented by objects such as identity cards which had to be 'read' by other humans in their exchanges. Now, it is the technology itself that reads information from the human body. This resembles Barad's description of how instruments contribute to the constitution of phenomena. However, this material agency is silenced in the scenarios. Information technologies are envisaged as tools at the service of humans. The subtle changes occurring because of the specific material properties of information technologies are dismissed under the general assumption that they just perfect human practices.

And yet, as humans immerse themselves into a world of information technologies their experiences become conditioned by matter. Artificial matter now mediates our interactions with our surrounding environment whether this is also artificial (e.g. cities) or nature itself. Admittedly, this observation can be made for older technologies as well. However, information technologies are not passive matter but they also exhibit something more than vitality. They respond to human actions. Most importantly, they exhibit intentionality. In this vein, human practices start to become conditioned by the response of matter to human actions. The discourses underpinning these scenarios are rather deceptive in that sense. Information technologies do not just improve human activities making identification better or preventing ecological disasters. As they become naturalized, they make people to read truth into the machine and adjust their actions accordingly. For example, the Mayor of Seville in *Digital Europe 2030* performs her official duties by checking the levels of the city's energy consumption through a wearable wireless device that taps into the information available to a web-based network. In the same report, people check their mobile phones immediately after a high magnitude earthquake, awaiting information from their government. It is this over-reliance to technological devices, already observed in the attachment of people to their mobiles, which reformulates the entanglement of humans and non-humans. Information technologies become utility objects totally immersed, hence hardly perceptible, into material surroundings. Interestingly enough, they become also evocative as they provoke strong feelings in humans. This excerpt from the *Digital Europe 2030* report shows the affective properties of new technologies:

Although RAEWS (Risk Assessment Early Warning System) is just an ICT system with a human presence interface with the voice and look of a human being, he has a personal relationship with it. He consults 'her' frequently in his professional life and almost as often in his private life if incidents happen, because RAEWS helps him to minimise risk from flaws in human decision making. As a result, 'she' has become the most important 'person' in his life. John knows that he can always count on 'her'. (*Digital Europe 2030*, pg 49)

Matter changes, it acquires human properties. It becomes a companion and an advisor to humans. It can talk; not just through humans thinking or talking about it but on its own. Humans seem to institute relations with them in a primary sense. Their identities are defined by their interactions with matter. This



raises a pressing question: How are humans envisaged in this world of responsive matter? I explore this issue in the following section.

### ***Humans, citizens, users***

The humans inhabiting the scenarios are of a very specific type; they are constantly connected to large information infrastructures. They are expected to be able to read the information immediately and act upon it in an efficient manner. The description of responses to large-scale catastrophes (i.e. an earthquake) is quite telling:

At the time of the earthquake, Michael is cleaning his bike in his house near the west coast beach. He senses the ground moving but does not pay any particular attention as low magnitude earthquakes often happen in this region. Within a couple of seconds, though, he receives an urgent notification on his mobile phone: 'A tsunami, the result of an earthquake of magnitude 7 with submarine, shallow seismic focus that hit the country at 16:03, is anticipated to hit the west coast within 6 hours. Please take appropriate action'. Michael already knows he must evacuate his house within the next 2 hours at the latest and head towards the mainland. (Digital Europe 2030, pg 44)

This behavior is not seen as passive. On the contrary, people are imagined as actively involved in the construction of their living and working environment. They are active citizens. They participate in the constitution of the reality they inhabit by feeding various information systems with data and interpreting responsibly what is given back to them. They are in direct communication with their governments which allows them to be more pro-active in their everyday lives. Furthermore, people are envisaged to take initiatives and adopt various forms of self-organization, as in the case of peer-to-peer banking networks. They seem to be free and able to create their own social orders through self-regulation. However, the very idea of active citizenship relies on the existence of information infrastructures that are either heavily regulated by governments, as in the case of early warning systems, or manipulated in ways that affect human behavior, as in the example of raking mechanisms.

And yet, people are eager to have new systems installed in their homes or working spaces or use new devices. In the *Biometrics at the frontiers* report, the father of the household has installed an advanced data storage system that allows access to family members through iris recognition. The house is equipped with biometric white appliances to safeguard the family's young children from domestic accidents. The toddler is given a biometric teddy bear in order to get accustomed to the idea of objects responding to him. People do not contest the need for information technologies. When they do not fully comply to prescribed uses, it is not for purposes of contestation. Tinkering is a rather playful activity that challenges technological systems and reveals their weaknesses. It is not a way to challenge existing uses and allow for different types of entanglement with information technologies. There are several examples of this approach, in the *Biometrics in the Frontiers* report; the story of the school children bypassing an antiquated iris scanner to gain access to the school cafeteria and the technological savvy son of the family who explains how he is accessing his father computer.

As a result, people are disciplined by the objects they desire. This disciplining is performed indirectly through the high specificity of interactions invited by the technologies. Human bodies are conditioned to respond to their environments in highly regulated ways. People become users embodying norms through their interactions with technologies. More importantly, they seem to forget that these systems are designed by humans. Hence, they incorporate sedimented social relations into their design. This way, their role as citizens questioning existing social orders and raising new claims seems to fade away. The way people qua citizens are invited to participate in such a society is discussed in the following section.

### ***Making it real: Technologies are not perfect***

In *Biometrics at the Frontiers* technologies have flaws. All scenarios refer to instances when systems failed to operate efficiently causing problems to their users. The employee with sweaty palms that keeps getting rejected by the biometric time-clock, the problems with biometric passports that prevent the family from travelling, or the supermarket biometric loyalty scheme that compromises a witness protection program costing the life of a woman; all are examples of very plausible system flaws that can cause significant

disruptions in the everyday lives of their users. They are, nonetheless, mentioned in the scenarios because they serve a specific purpose; they make the reports more realistic. Infallible technologies will make scenarios look more science fiction than plausible versions of a near future. Most importantly, admitting that future technologies have flaws shows that governments are aware of potential problems and work towards their solution. Practices like privacy-by-design corroborate this view attesting to the governments' and IT industry commitment to provide heavily regulated technologies that will serve users.

The pre-emptive regulation of information technologies is, however, constitutive of their material properties. People are invited to think of information technologies in specific ways with limited abilities to challenge dominant understandings. Information technologies are instituted as passive and easy to regulate. This is the foundation of the user – technology relationship. Artificial matter is malleable, maybe not at the user level but someone is shaping it during design, and users can enjoy them without major problems. It follows that the possibility of in situ improvisation on behalf of people in such heavily regulated infrastructures remains questionable. Although innovation is invited, as the scenarios indicate, it has mainly to do with the use of available information and not the possibility for imagining alternative ways of being within the technological society or possibly outside it. People are not allowed to find for themselves the fissures of such strong performatives. They are invited to participate into the improvement of technologies without challenging their function and positioning in their everyday practices. However, matter is not passive. It may act upon practices sometimes imperceptibly but also fundamentally.

The possibility for citizens to imagine alternative ways of being and voice their concerns over proposed technological designs (or even start to formulate concerns) in this entanglement of government rationalities, regulations and norms with information technologies requires further consideration. I examine this possibility in the following section.

## **Information technologies and the possibility of imagination**

Technological scenarios contain one prevailing narrative; people will be constantly immersed into a world where digital representations mediate all types of social relationships, personal as well as public. This type of symbiotic relationship between humans and non-humans allows us to delve further into the idea of constitutive entanglement which is central to sociomateriality. As people perform various activities with information technologies it gradually becomes evident that they are assuming specific subject positions based on meanings invested in them through their technological devices. To understand how people come into being as users with the world (i.e. information technologies), it is important to situate their practices within broader norms, rules and meanings. It is my contention throughout this article that unless normative elements are incorporated into sociomaterial accounts, it is difficult to understand what is constituted, that is, why people assume specific subject positions and objects acquire their roles in every day practices. In this section, I further my proposition by situating the entanglements of humans and non-humans, as observed in the scenarios, into the broader rationality of risk in contemporary technological societies. Then, I move on to discuss the theoretical repercussion of this approach for the study of sociomateriality.

The idea of risk, so widely discussed in academia, is behind many of the information systems presented in the scenarios. People are invited to take the possibilities of various risks seriously and act upon them. This is accomplished by the development of a new embodied knowledge on how to prevent risk but also on how to react in critical situations. People are expected to be more cautious and use technological devices to verify their interactions with other people or information systems. It is for this reason that people need to scan parts of their body (e.g. eyes, fingerprints, face) in their everyday activities no matter how mundane they might seem. Human bodies grow gradually accustomed of these interactions with technological devices. This is quite evident during highly disruptive events. People are seen to log instantly into their devices in order to get directions. This is presented, and it has already become, a natural element of human behavior. However, this is not just the natural reaction. It is also the responsible thing to do. Information technologies are building blocks of societal infrastructures regulated by government and private organizations, tampering with them is considered deviant, despite being presented in a playful, childish manner in the scenarios (i.e. the story of children bypassing the school's paying system). In this vein, the symbiotic relationship of people and information technologies defines a new economy of rights and duties in technological societies. It is through the constitution of citizens as primarily users of large-

scale information systems that new moral obligations are brought to the fore. Prudence and social solidarity are now mediated by information technologies. Citizens have a dual responsibility towards its government; to provide all the necessary information for technological infrastructures to operate efficiently and most importantly use the available infrastructure in their everyday activities or during disruptive events.

The immersion of humans into the regimented ways of information technologies should not be solely attributed to the latter's normative elements. Equally important are the affective qualities of information technologies. Objects evoke strong emotions in humans. As already noted in the literature (Turkle 2007), people think with various objects related to their personal biographies. They develop strong feelings for them since they inextricably tie them with specific memories. Most importantly, in the case of information technologies, their use creates an embodied anticipation, as Kinsley (2010) notes, for new spaces of interaction which obscures their normative aspects. This transformation of technologies for governance into objects of desire accounts for the absence of contestation. People do not perceive information technologies as subordinating them. On the contrary, they are seen as the medium that bounds humans together into collectives. In this vein, their affective power originates in their ability to bestow in people a strong sense of participation in larger communities with shared goals and values. This is already evident in eco-friendly technological devices which allow people to monitor, and therefore regulate, their impact on the environment (Marres 2011; Marres and Lezaun 2011). As people embed these objects into their everyday practices, they have a strong sense of accomplishment. They feel actively contributing to a greater good and being more responsible citizens. In the same vein, in systems like TripAdvisor, people feel they can have a saying, and therefore, shape industry practices. This growing sense of participation through information technologies attests to Agamben's (2009) observation that the proliferation of apparatuses minutely regulating human behavior is done in the name of human happiness. This explains why people do not seem to contest their transformation into docile bodies whose bodily movements are increasingly regulated by information technologies. They are constituted as users the same time they are constituted as citizens. Matter contributes to the actualization of this double constitution through its reverberation into every technological object.

The process of actualization is not an overt one. As seen in the technological scenarios, information technologies serve as the background of human action providing the necessary information for the exercise of human agency. However, this is not a neutral object position as it contains intentionality. Information technologies, as Kallinikos (2005; 2006) acutely observes, are closed systems that invite specific types of interaction. This can already be seen in our daily interactions with a variety of information systems. Patient record systems and multiplayer online games already transform humans into 'docile bodies' inserted, by design, to the system in specific ways (Ekbja and Nardi 2012). Or, to return to one of the works already discussed in this paper, TripAdvisor's ranking mechanism is another example of highly formalized interactions with information infrastructures. It is precisely this closed nature of information technologies that makes people to assume the subject position of user while exercising their citizen rights and duties. Human agency is conditioned by matter in ways that are rendered imperceptible in the midst of various almost instinctive interactions with information technologies. If this fundamental shift in the way people interact with information technologies cannot be clearly seen in the case of TripAdvisor and the leisure industry; it should become more obvious in the case of the peer-to-peer banking system described in one of the scenarios. Although it is presented as a grassroots initiative that overcomes the inertia and fallacies of the traditional banking institutions, it is essentially based on information infrastructures allowing only specific types of input and producing pre-determined outputs. As a result, people may look like the active authors of information into these systems but in reality their actions are highly formalized by the logics of artificial matter.

These insights on the mutual constitution of humans and information technologies raise questions on the possibility of imagination in technological societies. Imagination requires critical questioning of one's subject position to be able to challenge it. However, this questioning is not a purely mental activity. The possibility of tinkering with one's material conditions is of paramount importance. People must experiment with their devices in order to challenge dominant functions and designs. It is their way out of rigidified practices and into the imagination of alternative social orders. This is quite different from the malleability of human-centered accounts. It is an acknowledgement of the political character of tinkering as a means for humans to imagine and develop new ways of being with the world. Unfortunately, technological scenarios foreclose the possibility for tinkering and imagination. The constitution of user

subjectivities negates tinkering. As analyzed in previous sections, tinkering is presented as deviant activity. People are not allowed to bypass information systems. It should be noted that not all types of tinkering raise issues of concern which, in their turn, trigger the formulation of publics around them. It is up to the attentive students of sociomateriality to carefully follow humans and non-humans in their entanglements in order to understand how change is triggered as people make sense of their possibilities and challenge them.

This is a more elaborate understanding of the constitutive entanglement of humans and non-humans as it broadens the focus of existing sociomaterial accounts by incorporating norms but also elaborating on various materialities. Humans and non-humans are not encountered simply at their level of interaction. To return to my original argument on the need to re-introduce elements from performativity in the study of information systems as sociomaterial, the minute examination of normative elements brings out a more detailed account of the situation within which these encounters take place. This way, it makes them more intelligible as it is now possible to situate them into the broader rationalities that condition them. Moreover, the approach facilitates various materialities to come to the fore. The way human bodies, information technologies and living environments interact is not clear if analysis focuses solely on how people use their devices. However, the centrality of historically contingent norms to the simultaneous constitution of humans as users and information technologies as agents into the actualization of technological societies should not be seen as an over-deterministic account of the power of norms over human agency. It is rather an effort to observe the dominant languages of description of technological phenomena and bring to the fore how they produce the symbiotic relationship between humans and information technologies in today's technological societies. The objective of such critical survey of language and practices is, as Tully (2008: 17) eloquently explains, 'to explicate which forms of thought, conduct and subjectivity are taken for granted or given as necessary, and so function as constitutive conditions of the contested practices and their repertoire of problems and solutions'. This way, technicity is reinstated as originary of the way humans come into being with the world.

Underlying this critical take on sociomateriality is the possibility for introducing political concerns into information systems research. This is achieved in two ways; first, by a detailed re-description of the way information technologies are imbricated into the fabric of everyday practices. This is a substantially broader effort than simply trying to account for the intentions of various designers during system development (Kallinikos 2011). It is rather an attempt to view these intentions through the lens of their historical circumstances in order to understand the social issues they were trying to address through their technological designs. The very process of re-description contains within it the seeds for challenging dominant entanglements as it situates them within specific historical circumstances and shows the fissures of their performatives. The second way necessitates following closely humans in the field in order to see how they make sense of the world as they use information technologies. This is a more experimental take on ontology. As such, it departs from current efforts (e.g. Leonardi 2013; Mutch 2013) to theoretically define the ontological foundations of sociomateriality and then go and trace them in the field. In this article, I have followed the first approach as I examine the underlying norms guiding the interactions of humans and non-humans. However, both approaches acknowledge the necessity for a more politically-driven study of information systems through the lens of sociomateriality. I further discuss these issues in the conclusion.

## **Conclusion**

In this article, I have critically engaged with sociomateriality as a theoretical lens for the study of technological phenomena. I have argued for a more layered understanding of the entanglements among humans and non-humans that will reveal both practices of government and contestation. As information technologies become the matter sustaining collectives, it is crucial to understand how various normative elements find their way into their design instituting both subjectivities and objectivities. This should not be seen as abandoning matter over discourse but as an effort to minutely reconstruct the context in which information technologies are put into use (Asdal 2012). The proposed approach has the potential to bring to the fore the detours, negotiations and adjustments imposed in the development of information technologies revealing the spectrum of possibilities existing in nascent form in all technological objects (Kallinikos 2011). At the same time, it does not abandon the ethos of practice in the study of information systems since it also takes into account the affective power of technological objects in use. However, it

situates this affect within broader governmental and industry rationalities instead of treating it as the expression of user's inner feelings. In this vein, it is closer to an understanding of practice as publicly accessible performances of rules and norms as discussed in previous sections.

This approach contributes to existing debates on the future directions of sociomateriality. Currently, discussions on the outcomes of sociomaterial explanations of technological phenomena focus primarily around the ontological status of what is observed (e.g. Leonardi 2013; Mutch 2013). However, I argue that it is equally important, for sociomateriality, to expand its purview beyond its current focus on use in order to incorporate normative elements in the development of information technologies. This way, the rationalities underpinning the entanglement of people and information technologies will be revealed. At the same time, human efforts to tinker with technologies will regain their political character as forms of contestation to dominant rules and norms. The effort to understand how people are governed by information technologies has strong political connotations. It creates the conditions of possibility for alternative designs since it engages citizens into the process of seeking alternative ways of being and deciding democratically what kinds of values we want to inscribe in our technologies (Thorpe 2008). Such political objectives underpinning broader research projects are not uncommon in the study of technology. Barad (2007), as part of the feminist tradition in science and technology studies, develops agential realism as a critique to liberal notions of universality and neutrality. Her assertion that apparatuses are things-in-phenomena should not be solely seen as an attempt to explain how matter comes to matter, in both senses of the word. It is also an attempt to problematize the role of scientists and explain how scientific knowledge constitutes physical phenomena through the mechanisms developed for their observation. This nuanced argument is not just epistemological as suggested by Leonardi (2013). It is also political since it challenges claims of universality and objectivity showing the need to overcome epistemological myths that depoliticize technological innovation (Thorpe 2008).

In concluding, this reworking of sociomateriality brings its problematic closer to the critical tradition in social sciences. It allows sociomaterial accounts to challenge the inherited languages of description of technological phenomena, show their historical character and experiment with the possibility of transcending them (Tully 2008). In essence, the study of the mutual constitution of humans and information technologies should be about revealing the historically singular set of practices, the subjectivities it produces as well as the range of problems and solutions it provides. This asks for a more engaged scholarship in Information Systems. Researchers are demanded to work on 'the practices and problematisations they find themselves' (Tully 2008: 16) in order to reveal their contingent conditions and propose alternative solutions. They are also required to have an ethos attentive to both people and technological objects in order to be attentive to their entanglement without imposing pre-determined views over their interactions but in contrast allow them to 'talk' and explain their interactions.

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