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Rules, Practices and Information Technology (IT): A Trifecta of Organizational Regulation[1]

"Don't get involved in partial problems, but always take flight to where there is a free view over the whole single great problem, even if this view is still not a clear one" (Wittgenstein 1914)

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Abstract

As information technology (IT) based regulation has become critical and pervasive for contemporary organizing, Information Systems research turns mostly a deaf ear to the topic. Current explanations of IT-based regulation fit into received frameworks such as structuration theory, actor-network theory, or neo-institutional analyses but fail to recognize the unique capacities IT and related IT based regulatory practices offer as a powerful regulatory means. Any IT-based regulation system is made up of rules, practices and IT artifacts and their relationships. We propose this trifecta as a promising lens to study IT-based regulation in that it sensitizes scholars into how IT artifacts mediate rules and constitute regulatory processes embracing rules, capacities of IT endowed by the artifact, and organizational practices. We review the concepts of rules and IT-based regulation and identify two gaps in the current research on organizational regulation: 1) the critical role of sense-making as part of IT based regulation, and 2) the challenge of temporally coupling rules and their enactment during IT based regulation. To address these gaps we introduce the concept of regulatory episode as a unit of analysis for studying IT-based regulation. We also formulate a tentative research agenda for IT-based regulation that focuses on tensions triggered by the three key elements of the IT-based regulatory processes.

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1. Introduction

Latour's (1992) eloquent discussion on the use of seatbelts illuminates vividly the genuine relationships between rules and information technology (IT[2]) artifacts: "Early this morning, I was in a bad mood and decided to break a law and start my car without buckling my seat belt. My car usually does not want to start before I buckle the belt. It first flashes a red light reading 'Fasten Your Seat Belt!' Then an alarm sounds; it is so high pitched, so relentless, so repetitive, that I cannot stand it. After ten seconds I swear and put on the belt. This time, I stood the alarm for twenty seconds and then gave in" (Latour 1992, p. 251). Latour wants to start his car, but something invisible prevents him from doing so and manifests as an annoying physical constraint. The 'affordances' of the software - the possibilities for action immediately related to Latour's perception (Gibson, 1986) - create the noise yet the intimate connection of this noise to the regulatory purpose of the 'safety-belt' rule remains a mystery to Latour. The affordances hide behind the *invisible* code that controls the generation of the high-pitched noise. In contrast, a speed bump is a *visible* indicator through its shape and location of the meaning of a speeding rule.

The IT-based regulation illuminated in the above scenario reveals two unique traits: 1) the meaning of regulation as rule based following has become invisible and is embedded into the software and hardware of the car; and that 2) the process of regulation can face discrepancies

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[2] We use the term Information Technology (IT) to denote a class of material computing technologies as well as the related software stack enabling and running the technology functions. We use IT artifact unless it is clear from the context to denote an instance of such technology with specific material capacities to participate in the regulatory process. We refer to information systems (IS) as socio-technical systems that have semiotic and social qualities in addition to technical characteristics as studied as part of management research.

– temporal distance between the initial rule formulation by the lawmaker and its meaningful enforcement in the car. Given the invisibility and the temporal distance, both the actual presence of the rule and its meaning are voided; only the annoying physical 'feature' or 'bug' remains. It is through the driver's reflexive inquiry, whereby the presence of a rule and its meaning can be disentangled. Without the inquiry, the driver cannot do what he or she wants (i.e., start the engine) and the rule appears as a physical constraint. The system – particularly, when it is coupled with mechanisms that prevent starting the car until the seatbelt is fastened – appears ruthless, and the possibility of introducing 'anti-programs' is severely limited (Latour 1996). Even conveying an audio message – 'fasten your seatbelt' – would fail in mediating the underlying rule meaning. What ultimately is needed is somebody explaining that the noise communicates a violation of a rule or a police officer issuing a ticket. The lesson: to be a truly effective form of regulation, a rule needs to become meaningful and remain meaningful throughout the period when somebody is subjected to it even when the meaning of the rule is made 'invisible' as IT delivers related "regulatory consequences".

Latour's example illustrates some unique challenges of IT-based regulation many of which have not been adequately addressed in the extant discourse. People are likely to see regulatory interventions as meaningless injunctions, if they fail to recognize the physical constraint imposed by IT as a form of rule enforcement, which reaches beyond time and space (Latour, 1994, 2005; Reynaud, 2005; Reynaud and Riechbé, 2009). To put it differently: the questions of the *meaning* and *sense-making* of rules form still a central element for the effective *process* of IT-based regulation. In fact it is heightened, because of the invisibility of the rule and the variety of possible behaviors that can be attributed to the IT artifact. During IT-based

regulation, rules as expressions of expected normative (future) behavior and materialized in objects need to be made both *visible* and *meaningful* to render the intervention effective.

As information technologies have advanced and become pervasive, organizational regulation has drastically changed its material foundations. Rules have become detached from traditional forms and shapes of rule carrying artifacts (Kallinikos, 2012) such as organizational handbooks, message boards, alert plaques, etc. They are now expressed in cryptic materialized forms in computer software and hardware. In consequence, organizational gestures related to IT use and their expressivity (Merleau-Ponty, 1960) have become increasingly difficult to read in terms of what people actually do (or should do). All work contexts look almost the same: people are seated in open spaces and operate their computers while being involved with the same apparent set of gestures. Moreover, software that embodies the rules and organizational tasks has different temporal dynamics from those unfolding in settings that set up organization's rules. As a result, IT-based regulation has become highly equivocal (Weick, 1990) and organizations need to primarily convey, maintain, produce, and transform rules in an implicit, highly cognitive manner. The rules just 'frame' users' way of thinking of the operating the IT artifact rather than the IT use being seen part of an explicit regulatory process that materializes the meaning of the underlying rules. Rule-making and rule-following are becoming increasingly private as they are extensively circumscribed by technically mediated processes. Consider financial regulation and the tasks and obligations of a trader when engaging in a transaction on behalf of a client. Can the trader use information obtained through his social networks or not[3]? What information actually needs to be known about the client to

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[3] See the report on "Bogus Terror Tweet Sparks Shares Blip," *Financial Times*, April 23, 2013, http://on.ft.com/17V6yUo (last accessed on June 8, 2017).

embark on a transaction? It is often not even internally clear whether the trader followed all the rules and protocols in market interventions that are time-critical[4]. Users cannot see others following the rule and therefore do not easily understand what it means to follow the rule. Finally, the spatial and temporal distance between rule-making and rule-following has expanded. It has shifted from institutionally enforced social forms of regulation to complex technologically mediated operations, which have rendered regulatory processes fragmented and complex and changed their spatial and temporal dynamics. Multiple and versatile IT artifacts, including enterprise systems, social media, and even email, invite users' interactions in a heterogeneous and distributed manner and subject them to varied often hidden forms and sources of regulation. In consequence, on the trading floor, the rule-following or –breaking behavior by a trader is not only difficult to observe and control socially but makes socially distant, often unknown, or unidentifiable actors accountable. This has transformed how critical business decisions are made and justified within organizations (see Lanzara et al., 2015) and raises questions about the performativity of markets and the devices they rely on (Callon and Muniesa, 2005).

Yet, in all these technology engagements the underlying rules, to be meaningful, need to be created, invoked, and mobilized socially – often from a significant distance. The presence of meaning making is unique and essential for (social) regulation: regulation assumes and is ultimately made possible by the mobilization and re-mobilization of meaningful rules and rule following. This makes regulation also socially effective and different from mere technical constraining of behaviors (Reynaud, 2005). But how is such a process possible, when IT

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[4] This has become much more complex with high frequency trading and fully algorithmic trading processes-where does the meaning enter into the regulatory process and by whom?

increasingly obscures the meaning of rules due to its inherent lack of visibility and by its power to distribute rule making and following dynamically across time and space?

To understand how this challenge has been addressed in the current IS discourse, we will examine theories of regulation and how the trifecta between rules, IT artifacts, and practices, as necessary elements of a regulatory process, have been theorized. In studying these relationships we aim to gain a solid understanding of how IT capacities and regulatory processes interact and penetrate one another. To this end we review research in organization theory and information systems and identify three streams of studies: 1) studies emphasizing the *rule materialization* i.e. how rules as objects of regulation become embedded in the material artifacts, 2) studies centering on *rule sense-making* i.e. how the meaning of rules is created, negotiated and maintained, and 3) studies focusing on *rule's temporal connections*, i.e. how the visibility of the rule as embedded in IT artifacts become temporally de-coupled from practices. We identify gaps in the three streams of studies – especially the questions of meaning and temporal coupling are underexplored. These gaps establish two challenges in IT-based regulation research: 1) how to study regulatory processes in ways that retain key tenets of the three elements of IT based regulation while being faithful to practice theory and the significance of meaningful rule following, and 2) how to recognize situations where temporal (de)coupling of rules from practices take place and handle the resulting lack of attribution of meaning to rules.

In response to these challenges we formulate the notion of the regulatory episode, an empirical strategy honoring the practice-based research to study both the micro level sense-making, as illustrated in the individual's need to enact rules in the seatbelt example, as well as the macro level shifts in the temporality of practices and materialized rules as illustrated by the trading

floor example. This methodological innovation surfaces the process-entity paradox and opens a research agenda on IT-based regulation that can help scholars interested in IT and regulation to coordinate their research effort despite their varying ontological commitments. Indeed, the notion of regulatory episodes will help bracket during the inquiry opposed, simultaneous sides of the IT-based regulation system.

2. IT-Based Regulation: A Theoretical Review

2.1. Rules, Regulation and their Material Carriers

Regulation can be broadly defined as the collective process constitutive of rule-making, rule-maintenance, rule-following, and rule-enforcement achieved by organizations' members through the configuration and mobilization of appropriate resources (Hage and Aiken, 1969; Leblebici and Salancik, 1982; Suddaby et al., 2007; Reynaud, 1988, 1997). Per Reynaud (1997: XV) the process is grounded into collective negotiation of *meaning* as "actors try to justify in front of others the principles or maxims that underlie their actions, by postulating and claiming that they have a value, if not universal, but generalizable. By trying to make rules acceptable and legitimate, actors contribute to the emergence and transformations of rules, to the regulation which is grounded into actors' interactions". In this regard regulation forms a process involving the "capacity to undertake initiatives and to elaborate rules" (Reynaud, in de Terssac, 2003, p. 103).

Since Max Weber's conceptualization of organizations as rational rule systems, regulation has remained one of the centers of organizational inquiry (Weber, 1968; Merton, 1957; Crozier, 1964; Crozier and Friedberg, 1977; Cyert and March, 1999; Beck and Kieser, 2003). The

interest is unsurprising given that regulation cuts at the heart of coordinating collective action systems within organizations. It also facilitates socialization and promotes identity formation which all are central for any organization's existence and stability. To understand why rule-making, rule-following, and rule-enforcement are so central to organizing we need to grasp the nature of rules and what their compliance entails.

Rules are not mere factual descriptions or estimates of behaviors; rather, they state *what ought* or *ought not to happen* given a set of conditions (von Wright, 1963). Rules are not mere empirical regularities (facts), although many observed regularities are determined by rules. First, factual observations cannot refute rules like they can facts (Bach and Harnish, 1979) – the fit of the rule expressions to the world is different (from-word-to-world). Second, observers can only detect the rules underlying observed social regularities by searching for accounts of *why* the people behaved, given the situation, in a certain way (von Wright, 1963). Accordingly, rules are expressed in normative statements, such as "if we face situation Y, then we *are expected (ought)* to do Z" (Twining and Miers, 1999). Third, rules refer to and intertwine with beliefs regarding conditions and norms of expected (shared) behaviors (Wittgenstein, 1958; Mills and Murgatroyd, 1991). While intrinsically anticipatory – yet dissimilar to predictions – rules cover new cases *forever* and by doing so define "stable" future conduct (Bach and Harnisch, 1979).

In order to be effective in regulating, the rules include several components that clarify their scope and use conditions and justify their use including: 1) the character (i.e., the rule expresses normatively a permission/prohibition/guidance or something else); 2) the subject (i.e., identity of those who should conform to it); 3) the condition (i.e., the circumstances under which the rule is applicable); and 4) the content (i.e., the sort of behavior to which the rule applies) (von

Wright, 1963). These four components jointly specify different parameters that can contribute toward controlling variation in organizational behaviors – i.e. produce predictability in social interactions and thereby constitute the foundation for building repeatable, low variation and scalable "concrete action systems" (Crozier and Friedberg, 1977).

Rules are inter-subjective and carry on meaning only in relation to practices. Therefore rule-following is not automatic and mechanistic but practice based. It can only take place in dialogical practices – i.e. no one can follow rule alone (Wittgenstein 1958; Taylor 1993). Rule-making and rule-following follow a (recursive) structuration and are founded on practical consciousness embodied in social and material practices (Crozier and Friedberg, 1977; Giddens, 1984; Taylor 1993). Rule-as-is and rule-as-applied are recursively organized in the same way as language and parole are related in linguistic practices (Giddens 1984; Taylor 1993). This makes rule violation and change possible and a necessity through practices. As Mills (2003) notes, not only do actors establish, enact, and enforce rules, but they also misunderstand rules (their meaning) and resist them (their authority). Overall, an organization's mode of operating as a regulatory system is more akin to an open, chaotic system with emergent features, in contrast to the idea of a deterministic, closed mechanism of a Swiss watch- the impact from rules to practices is not one-directional and causal (Taylor 1993).

In organizational studies rule-making and rule-following form an arena where tussles involving power, structure, and practices are identified and played out. One source of tensions is the fact that the authority of a rule can originate from multiple sources (Reynaud, 1988): either the rule-making is *endogenous* to the social group, or it is *exogenous*, whereby rules are created by external sources and the group follows the promulgated rule (Reynaud, 1988). For example, speed limits can be seen to be regulated through the collective activity of policemen (with a

legal limit) and that of drivers who judge the maximum over-the-speed-limit likely to be legitimate for a judge and/or other members of the community of drivers.

To be effective rules need to be memorized and distributed for continuous recognition and enforcement. Therefore, writing down rules into material systems (e.g., personnel handbooks) have been a key element in organizing since the dawn of modernity. Written forms also improve rule accuracy, completeness and add to their complexity (Weber, 1968; Merton, 1957; Crozier, 1964; Crozier and Friedberg, 1977; Cyert and March, 1963; Beck and Kieser, 2003; de Vaujany, 2010).Written rules provide more exact reference points for defining desirable and acceptable behaviors and thus minimize variation by detailing the rule's character, content and conditions. By doing so written rules make rule following easier and more likely. The downside of rule-carrying written systems is that they are inherently inert and effort-demanding with respect to needs of regulatory control and change. Organizational practices have higher alteration frequency (i.e., temporal dynamics) and more random spatial diffusion in terms of behaviors (i.e., spatial dynamics) than assumed in materialized rule systems.

Overall, materialization of rules for regulatory purposes connects the trifecta of elements – the rules, the practices (behaviors in local context), and the rule-carrying artifacts – into comprehensive regulatory systems. These systems articulate and carry on the relationships necessary to regulate effectively. The process connecting the three elements seeks to improve the rule visibility and to ensure their meaningfulness in relation to targeted practices in appropriate time-and-space continua. Over the last century the complexity and scope of such regulatory systems has expanded: new alternatives for materializing rules have emerged and many have become foundational for modern organizing including mass communication systems and media technologies such as phone or material innovations such as the file cabinet

in the second half of the 20th century (Yates 1989; Kallinikos 2012; de Vaujany and Mitev, 2017). These new material means have vastly expanded the range and variety of material resources amenable for rule specification, monitoring, enactment and maintenance (Giddens, 1984).

2.2. The Potential of IT-Based Regulation

From the perspective of regulation, IT allows for new forms of interactions- "people meet, and talk, and live in cyberspace in ways not possible in real space (Lessig, 1995: 1743)"- and hence permits new regulatory practices. IT can store, disseminate, diffuse, and enforce rules across space and time in ways and with functionality that differs significantly from earlier material means. This makes IT highly flexible and powerful in its regulatory capacities (Orlikowski, 1992; Kallinikos 2012) in that it offers a unique, distinct, and powerful medium for materializing and enforcing rules (Latour 1992; Kallinikos 2012; Lessig, 2009). Because of its unparalleled storage, processing, and transmission capacities IT artifacts can record and maintain a nearly limitless number of complex rules and expand their scope and character; IT artifacts can also encode and embed these rules in ways that enforce and hide related rule following (Latour 1996, 2005); IT artifacts can infer new facts (conditions) based on the ways in which actor's rule-following unfolds as to determine whether new rules are needed, or which rules to apply to a given situation (creation of new rules); IT artifacts can also build unlimited sets of meta-rules, that is, to infer which rules are to be applied, when, and what to do when rules change; finally, IT artifacts can identify, record, and track regulatory events at enormous scale creating unparalleled means to control organizational practices (Bubenko et al., 1994; Kardasis and Loucopoulos, 1998).

In consequence, diverse sets of IT artifacts populate most organizational contexts we live in today. They offer multifaceted capacities to regulate organizational action at unprecedented scale and scope. These artefacts have the potential to effect new types of regulatory practices that earlier forms of material mediation did not have (e.g., Leonardi, 2012; Kallinikos, 2012). To exemplify, the recently introduced Dodd-Frank Act establishes a broad range of detailed and complex IT-based regulatory processes for equity trading and related accounting practices which overnight fundamentally changed regulatory practices within financial services. Moreover, these regulatory processes would be impossible to understand and manage without relying on a wide variety of IT-based regulatory capacities. Overall, IT-based regulation has deeply and broadly penetrated organizations and now relays most organizational practices at amazing scale and depth (Mutch, 2010; Orlikowski and Iacono, 2001).

2.3. The IT-Based Regulation System

To understand how new IT capacities shape regulatory processes requires us to adopt a lens that sufficiently recognizes the presence of IT and what it changes in regulatory processes (Orlikowski and Iacono, 2001; Hosein et al 2003; Kallinikos 2011). This requires that we approach IT capacities as analytically distinguishable elements within practices while at the same time we see practices as separate, but intrinsically interlinked with and penetrated by such capacities. Intricate connections between IT and practices have been mainly investigated in two dominant strands of sociomaterial analysis: actor–network theory (ANT) and practice theory (Cecez-Kecmanovic et al., 2014). ANT helps scholars to focus on the myriad of relationships between material and social 'actants' that jointly constitute 'actor networks' which, in turn, constrain and enable organizational practices. Here, ANT, helps understand how hybrid relational networks 'perform' and temporally stabilize and regulate the broader

dynamic of 'actants'. Such arrangements are perceived as relational effects – combined interactions between social and technical/material elements – rather than direct impacts of confined material entities with predefined qualities on social order (Law, 2008). In studying IT-based regulation ANT approaches IT artifacts as salient actors in their own right that participate in regulation – they become 'actants' that constitute regulatory processes while at the same time being constituted by the broader movement of regulatory processes. The IT artifacts, in conjunction with other elements in the network, such as rules, and jointly with social actors induce relational effects perceived as regulation. For the ANT theorists, however, the role of rule meaning disappears from the analysis. For Latour, text serves as an inscription rather than an embodiment of meaning. Meaning is in a way seen a property of the process itself. Practice theory is, in contrast, concerned with exploring meaningful *practices* as the principal constituent of social order. Such practices form the basic epistemic object in the study of regulation (Nicolini, 2013) and IT-based regulation is approached here as the local enactment of rules, which become meaningful for the participants as parts of their IT use practices (Gherardi 2012, for a more general discussion see Taylor 1993). Here, the material specificity and network effects emerging from the material characteristics of IT, or rule-making as explicit regulatory process are largely ignored while the local meaning of rule in practice is revealed.

If we admit the necessity of recognizing the salient role of IT capacities and IT-related practices for storing, maintaining and distributing rules and combine it with the idea of rule meaning and networks introduced by ANT and practice theorists we can analytically express IT-based regulation as a triangle (Figure 1). This triangle advances a holistic, analytic frame to explore and understand IT-based regulation as a socio-technical system and process. The triangle

identifies a trifecta of essential elements and their relationships that constitute an IT-based regulatory process. It promotes a relational view by providing a dynamic framework that helps construct an account of logics that characterize IT-based regulation. The framework also highlights inherent tensions at work- for example the need to simultaneously balance entitative/processual views and material/symbolic dimensions in the analysis of regulatory processes. Accordingly, Figure 1 can be read roughly as follows: 1) rules convey normative statements to a set of participants in practices (Giddens 1984; Crozier 1964); 2) practices are temporally and spatially bounded activities: "routinized types of behavior that consist of several elements, interconnected to one another: forms of bodily activities, forms of mental activities, 'things' and their use, a background knowledge in the form of understanding, know-how, states of emotion, and motivational knowledge" (Reckwitz, 2002, p.249; see also Giddens, 1984; Bourdieu, 1990; de Certeau et al., 1998; Taylor 1993; Levina and Vaast, 2006); 3) IT artifacts enter in practices as 'things', standing material capacities – defined by software, hardware, and associated functionalities – which have the capacities to encode, store, process, display rules and possess the power to convey and enforce rules within practices (Lessig 2009; Hosein et al 2003; Kallinikos 2011, 2012). The use of such capacities during regulation manifests itself through an ongoing materialization of rules towards organizational practices whereby rules become related, conveyed and embedded in practices as parts of IT capacities.

Figure 1 distinguishes three perspectives on IT-based regulation when viewed as an amalgam of broad organizational practices: 1) IT design, which materialize rules into IT artifacts; 2) rule creation and maintenance, which formulate rules that govern practices; and 3) IT use, which focuses us on questions about individuals' use of IT artifacts as part of their practices. In the following, we discuss these three relational elements of IT based regulation in this order as

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they largely express the temporal sequence in which the IT based regulatory system emerges and how its effects are felt. Over time, these three relational elements establish and mediate an *IT-based regulation system* which embodies deeply structured and practice based relationships between rules, IT artifacts, and organizational practices.
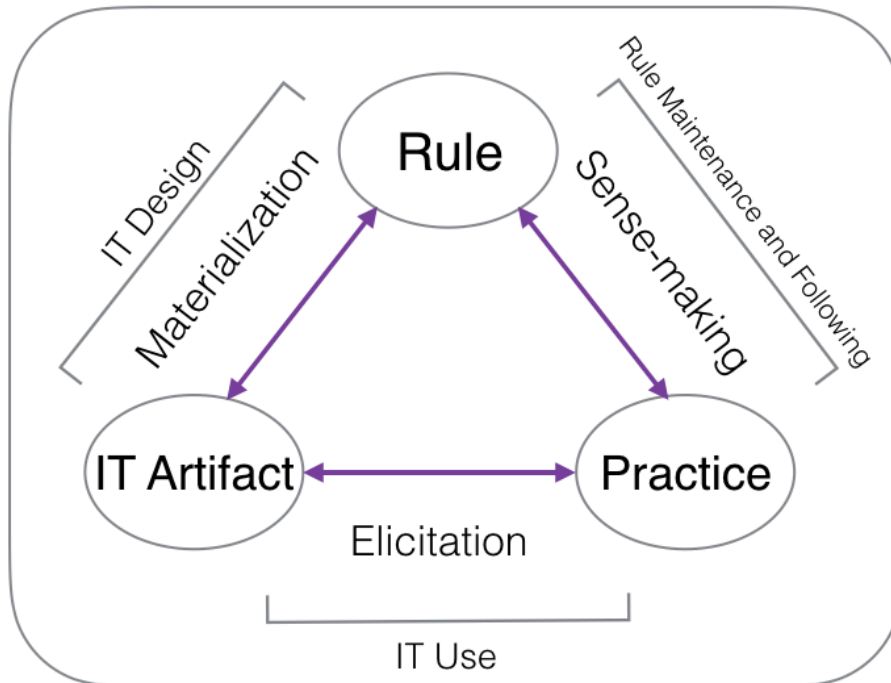
Figure 1: An IT-based regulation system

These relationships are called *materialization*, *elicitation,* and *sense-making* dimensions of IT-based regulation. The unique IT capacities influence how rules are defined in terms of content, condition, character and how they are expressed and designed as part of IT design – the *materialization* relationship. IT use invokes *elicitation* – an actor's effort and skill in drawing forth her regulatory response when using the IT artifact. During elicitation, and through their varying positioned capacities of enforcement, IT artifacts 'invite' practices to follow the rule. At the same time, awareness of the existence of the rules within the IT artifact shapes the actor's interactions with the IT including e.g. how she submits to the pitched noise or how she can force the system to work around the rule. Finally, the meaning of the rule needs to be

established through an actor's practical *sense-making* whereby the content of the rule becomes expressed, defined, negotiated, and enacted in local practices that define rules and socially enforce related rule following. Here, rules and practices connect through sense-making which reveals the rule meaning and makes regulation effective.

We emphasize that the three relationships *jointly mediate* as a system the meaning and effects of rules towards practices (see also Lanzara et al 2015). The analysis of IT-based regulation calls for *systematic* and *directed* probing of *all* recursive relationships within the triangle. In other words, in practice (pun intended), the IT-based regulation system produces and enacts ongoing *temporal, social and spatial bindings* between rules, their materialized forms in IT artifacts, and practices. During any IT-based regulatory process the states of relationships constituted by everyday activities between the three elements of a regulatory process will vary in nature, strength, and form. When any element of the triangle (rule, IT artifact and capacity, or practice) or its relationships change the regulatory system will change. In particular, the triangle sensitizes us to questions of the visibility and meaning of materialized rules to the participating actors during their (reflexive) IT use. In this regard, IT is distinct from other types of material systems embodying rules. During IT use IT based systems acquire a dual character of being an object of practice *and* also the carrier, enforcer and/or reminder of rules. To do so, both IT and rules need to be entified during the design in order to establish and connect rules with IT artifacts. This involves identifying, justifying, and activating rules, prototyping, and running trial uses of their embedding in IT artifacts. IT and rules are initially separate "out there" and outcomes of distinct practices. But the rules become part of a regulatory process *only* when they are integrated during materialization and thereby become wrapped in everyday practices. The impact of IT artifacts and related activities in shaping the entire system (Figure

1) is pivotal in the analysis of IT-based regulation: affordances around IT artifacts form parts of practices and ensure that rules will align so that the practice embodies and views IT use as being related to and an expression of meaningful rule following. When done successfully, IT allows effective and dynamic propagation of rules across time and space. Yet, temporal, logical, social, material and/or spatial drifts between the three elements during IT use can put the visibility and the meaning of rules at risk and, as a consequence, jeopardize possibility for effective regulation. Indeed, everyday activities of design, management and use can also constitute new temporal relationships and new spaces (i.e. by allowing more distributed and remote interactions, or longer projects), which can be translated by new regulation modes.

The proposed notion of the IT-based regulation system is holistic. Therefore, it helps identify and bridge ontological tensions that emerge within the triangle. One corner of the triangle is relational (practice) while two others are entitative (Rules/ IT artifacts) or rather, "entified". "Entification" here means that IT design and use activities 'perform' and make visible elements in rule and IT 'corners' while declaring rules or materializing rules into 'thingy' arrangements. Rules as texts - forms of 'freezing' rules into lines of code or into other artifacts - and IT artifacts need to be approached through 'entitative' commitments that characterize IT design and use in practice. In contrast, regulatory practices and related processes of meaning making (and their relationships to rules and IT artifacts) call for relational commitments. Parts of the system reify and shed light on the fixed material or symbolic character of rules and IT, respectively, so that regulatory principles, code, software components can endure across time and space as "entities" that enable and perform regulation. Once mobilized, rules as entities get invoked and their material properties become enduring properties of IT artifacts where they are transformed, reproduced and maintained. The element of 'practice' and its relationships to IT

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artifacts and rules reveals meaning and temporal coupling of rules within practices as relational and emergent whilst spawning constant tensions. These tensions can unravel the state of the system and its connections between the three elements. As noted, such tensions emerge when entities within practices become wrapped during materialization; tensions also emerge when the collective movement of rules initiated by IT design hit the practices (see appendix 2 for a comparison of Latour's structural and Merleau-Ponty's phenomenological position concerning regulatory events). We return to this issue below while discussing challenges for future regulation research.

3. Status of IT-based Regulation Research – a Critical Review

3.1. A Review of IT-based Regulation

We conducted a review of organization and IS research as to identify to what extent and how the systematic relationship between rules, practices, and IT has been explored in the past. A description of the review steps and the list of articles included in the analysis are reported in Appendix 1. The review sought to identify and characterize how dimensions of the IT-based regulatory process outlined in Figure 1 have been conceptualized and analyzed. The results are summarized in Table 1. Because some articles were coded into more than one group (relationship dimension), the final set of 29 articles resulted in 39 analysis entries (see Appendix 1). The most striking outcome of the literature review is the overall small number of final included papers (29). This counts a very small percentage (less than 1% among thousands of papers published during this period in the selected journals). Excluded papers addressed the topic only nominally – either using the term "rule" in a non-social sense (e.g., computer science-oriented) or being marginally concerned with the properties of 'rules' or 'technology'.

For example, the rule<–>IT relationship is primarily investigated as a general dependency between social and material worlds without noticing the special status of rules as means of regulation (Giddens 1984). Rules are just treated as one element among many constructs including 'roles,' or 'structures,' without a clear differentiation. Surprisingly, most studies focusing on materialization and sense-making are about 20 years old and were found during snowballing that is. tracing the references quoted in the papers we first extracted. Ironically, this suggests that the research community has expressed a decreasing interest in the topic despite the enormous growth of the scope, forms and impacts of IT-based regulation.

Table 1. Review of IT-based Regulation Research

Theoretical relationship	Theoretical categories used	Number of papers in category	References
Materialization: The nature of the IT–rule relationship; how the rule becomes materialized into the IT medium.	Control through technology, Involvement of management, Capturing IT features IT impact, Structure, Formalization, codification, embedding, enforcement, and transformation of rules Technology rigidity, memorization, affordance, and rule activation Effects of social norms, adherence to norms Negotiation of rules (during materialization) Proceduralization Material coupling	16	Robey, 1981; Orlikowski and Robey, 1991; Orlikowski 1991, 1992; DeSanctis and Poole, 1994; Tillquist et al., 2002; Christiansee and Venkatraman, 2002; Kappos and Rivard, 2008; Poole, 2009; Jones and Karsten, 2009; Aron et al., 2011; Chai et al., 2011; Leonardi, 2011; Yang et al., 2012; Gherardi, 2012; Berente and Yoo, 2012.
Sense-Making: The significance of the practice–rule relationship; how understanding the meaning of the rule mediates the practice.	Cognitive skills Obscured control Learning and complexification Instrumental and faithful/unfaithful uses of technology (is the meaning of rule followed) Inconsistency and stretching Dialectic of change, opposition Enactment, structuration Technology use mediation and adjustment Access control, governance Memory traces (related to meaning) Routine dynamics, genre, communication Normative enactment Rule ambiguity Procedural and interpretative loose coupling Contradictions, congruence, system change	15	Zuboff, 1985; Orlikowski, 1991; Zhou, 1993; DeSanctis and Poole, 1994; Schultz, 1998; Schultze and Orlikowski, 2004; Robey and Boudreau, 1999; Chiasson and Davidson, 2005; Li et al., 2007; Jones and Karsten, 2008; Poole, 2009; Feldman and Orlikowski, 2011; Gherardi, 2012; Berente and Yoo, 2012; Allen et al., 2013.
Elicitation: IT–practice relationship within temporal perspective: How use of IT systems *hic et nunc* is temporally aligned with the materialized rule.	Duality of technology Routinization of behaviors Materialization processes of rules Planes of temporality Structuration process Affordances of action Imbrication Updating of practices Temporality of contradictions in agency–norms relationship	8	Orlikowski, 1992; Pentland and Rueter, 1994; Robey and Boundreau, 1999; Jones and Karsten, 2008; Poole, 2009; Leonardi, 2011; Gherardi, 2012; Allen et al., 2013.

Overall, we distinguish three streams of IS and organizational research that focus on elements and relationships identified by the trifecta system of IT-based regulation depicted in Figure 1. The first stream focuses on mechanisms of incorporating rules into IT artifacts and the properties of such processes; the second one (influenced mainly by Giddens's (1984) structuration theory and late Wittgenstein's observations of rule following see e.g. Taylor 1993) focuses on practical *sense-making of rules, what following a rule locally means* and the

related meaning relationship; while the third stream heeds attention on the dynamics of alignment (or "synchronization") of technologies and practices in drawing forth the expected regulatory response – *the elicitation relationship*. The themes of the first group (labeled as 'materialization relationship') covered about 55% of all studies. The group stresses the design of forms of 'control' and 'influence' afforded by IT with regard to governing organizations (Robey, 1981; Orlikowski and Robey, 1991). It approaches the materialization process as 'parameter-setting,' where rules get entered 'into' technology as to 'script' user behaviors (Tillquist et al., 2002; Kappos and Rivard, 2008). Latent rules stored in the IT system can be 'activated' (Jones and Karsten, 2009) and/or 'delivered' through practices (Poole, 2009). Several theoretical perspectives have been applied to account for the materialization process. They mostly highlight facets of promoting rule based behaviors such as observing relationships between rule design and use (Orlikowski 1992), design and feature appropriation (DeSanctis and Poole 19994), rule implementation during project and post-project phases (Christiansee and Venkatraman 2002), or differences in adoption and post-adoption related rule enactment (see, e.g., Orlikowski, 1992). The rigidity of IT-based rules – the strength of the coupling between IT and rules during materialization – is seen to depend on multiple factors including the capability of agents to embed the rule-specific knowledge into IT (Christiaanse and Venkatraman, 2002), or the capability of agents to decode the rules and change them in the system (Gherardi, 2012; Chai et al., 2011; Berente and Yoo, 2012). Berente and Yoo (2012) note also alternative forms of materialization; in particular, they shed light on contradictions that arise when a singular rule materializes through IT across diverse practices. In such situations they discuss the necessity of maintaining loose coupling between materialized rules and local practices as a kind of 'joint regulation' (Reynaud 1983).

The second group labeled as 'sense-making relationship' covers in about 51% of studies. These works draw on the rich sociological and philosophical literature informed by later Wittgenstein and Heidegger on rule based sense-making and following including Giddens (1984), Bourdieu (1990; see also Taylor 1993), and in organizational studies (Weick 1995). These studies focus through the prism of 'sense-making' solely on the practice<->rule relationship. They deploy several perspectives in understanding this relationship to reveal the intersubjective and negotiated nature of rule following as rules become embedded in technologies. These studies focus on how the rules become interpretively 'read' in local practices. Early on, Zuboff's (1985) seminal study recognized workers' need to develop cognitive skills to engage effectively with IT controlled work. The study was followed by a stream of studies in which varying cognitive facets of the practice–rule relationship were explored such as agent's capability to understand rules (Orlikowski, 1991; DeSanctis and Poole, 1994; Feldman and Orlikowski, 2011; Gherardi, 2012), or the compatibility between rules and practices (Robey and Boudreau, 1999; Schulz, 1998; Chiasson and Davidson, 2005; Allen et al., 2013)

The third group focuses on the elicitation behaviors associated with IT use. About 25% of the studies covered themes centered on temporal dynamics of rule enforcement during IT use. To this end they analyzed element interactions and their joint temporal dynamic within IT–practice relationship. The group has used a variety of theoretical lenses to examine how embedding of rules and their enactment in practices grows pluralistic and conflicting over time. Early works in this stream recognized the temporal disjuncture between 'design' and 'use' (Orlikowski, 1992; Robey and Boudreau, 1999), whereas later studies have examined the different planes of temporality (Jones and Karsten, 2008), the temporal interweaving of rules and practices as

'imbrication' (Leonardi, 2011), reasons for 'temporal discrepancies' in IT–practice relationships (Gherardi, 2012), or how temporal discrepancies affect practices (Allen et al., 2013). Yet, none of the reviewed articles have examined such temporal aspects as elements of IT-based regulation, which can temporally decouple the original rule content from the practice to the extent that the rule appears no longer meaningful for a given situation.

In summary, the extant literature has diligently explored multiple facets of regulation separately along each regulatory relationship. Overall, the literature lacks an integrated perspective on IT-based regulation as a dynamic system that involves mutual, constitutive relationships between rules, IT artifacts, and practices. Specifically, we miss dynamic analyses of how changes in any of the three regulatory elements generate cascading alterations in other elements and/or relationships over time while delivering the same or different regulatory outcomes. This lack of integration is problematic, if we recognize that two essential requirements need to be fulfilled while creating effective IT-based regulation: 1) IT artifacts must be capable of delivering visibility and meaning of rules to practice on a time- and space-continuum, and 2) agents must be capable of making sense of rules materialized in IT artifacts within their practices. To approach IT-based regulation holistically, we need to advance analytical tools that are capable of explicating how/why the *IT-practice* relationship *does or does not elicit the expected responses from either of the two elements* depending on the outcomes or effects associated with the two other relationships: rule-IT (materialization) and rule-practice (sense-making). This topic has grown in criticality for the study of regulation in general, because in contemporary, IT rich environments increasingly determine the relationships between all three elements which are now instrumental for most organizational regulation. Therefore, we next address the challenge of meaning and temporal coupling

associated with IT-based regulation emanating from a more holistic analysis of IT based regulation.

3.2. *The challenge of Meaning and Temporal coupling in IT-based regulation*

The trifecta suggests that any rule materialization needs to be *simultaneously* tied to the meaning that a rule conveys to the targeted practice. Yet, the presence of such a 'double' relationship is rarely recognized (for an exception see e.g., Berente and Yoo, 2012). From Latour's (2005) perspective, the social (i.e., roles, norms, actor's identities, etc.) and the material (i.e., objects, hardware, and software) form both an integral part of the same 'assemblage'- an irreversible network of actors following behavioral programs and anti-programs. The question of the meaning of rules is hence inherent for all involved processes. For example, a speed bump when it is hit by a car at high speed can destroy the car as a mere physical event within the network, but it also expresses an embodied rule meaning to curtail humans driving at high speed (Latour, 1996; 2005). When an IT artifact mediates the rule, the meaning of the rule becomes easily invisible; it is embedded in IT-related design practices and behavioral scripts they produce. They can often only be deduced indirectly by an actor reflecting here and now his or her IT use. Moreover, the meaning can change (materialization fails), deteriorate (the rule is no more relevant), or become lost when the IT artifact gets connected to a growing heterogeneous network of actors where it gets increasingly disconnected from the (institutional) practices that created the rule in the first place.

The disconnection between a rule's form and function and its weak visibility during IT-based regulation (Kallinikos, 2012) brings forward genuine implications for how rules can temporally

be bound to practices. This results in some desirable features for elicitation in IT-rich environments such as how the script is ultimately connected to the rule and its meaning. Yet, such implications have been rarely surfaced in the past research and practice. Consider, for example, recent uses of social media on trading floors to communicate real-time financial information.[5] Traders traditionally had to comply with reporting rules that follow the quarterly rhythm and are determined by the announced reporting dates for financial data of traded firms. However, the newly changed dynamic of providing financial information through social media demands now that analysts follow continuously social media, while the established formal reporting rules miss the original intention of these rules to capture the information that influenced trader's decisions. Although the initial connection between traders' reporting by using the IT artifact and their compliance with the rule is still in place, the reporting as elicitation is now perceived a nuisance, because misunderstandings about sources of information on which traders ultimately based their actions will inevitably arise. Reporting compliance errors will consequently lead to new coordination problems between traders and other financial groups- especially when intensified regulation adds now additional checks of traders' search behaviors and their primary information sources (including the use of social media).

Temporality, in general, implied by the trifecta has become a salient topic in organization studies (Orlikowski and Yates, 2002; Schatzki, 2010; Langley et al., 2013; Hernes, 2014) and, the idea of temporal decoupling, in particular, is not new (Simmel 1917). Yet, in the context of IT-based regulation, we noted a significant void of theorizing and empirics (Orlikowski and

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[5] *The New York Times*, April 3, 2013. http://nyti.ms/YOq2U2 (last accessed on June 26, 2015).

Yates, 2002). We posit that one reason for this void is the lack of richer conceptualizations of regulation dynamics. In this regard, Alter (2000; 2003) introduces the useful concept of "dyschrony" (from the Greek δυς, "difficulty" or "lack" of synchrony) to probe such dynamics. In most collective activities, rules "do not submit easily to the will of transformation of actors. Rules only imperfectly settle managerial problems raised by dynamic contingencies—they can have a life of their own. One reason for this is that they fail to obey the same action rhythm" (Alter, 2000, p.201). In other words, the increasing temporal decoupling of rules and practices when IT artifacts mediate their relationship is likely to interfere with the constitutive relationship between rules and practices and will influence to what extent IT artifacts truly regulate (Alter, 2000, 2003) in contrast to just enforcing behaviors. In a state of dyschrony, an IT artifact starts constrain behaviors by itself as the meaning of rules is "forgotten". At the same time other artifacts or contexts impose alternative rules creating a conflict about how an actor should proceed. In such situations the regulating IT artifact becomes a material, natural constraint for the actor (Alter, 2003). This suggests that the material properties of the IT artifact and the potential of its temporal (de)coupling from the underlying rule needs to become a critical element in theorizing about IT-based regulation. Here, Alter's concept of "dyschrony" can open up fresh analyses of IT-based regulation in that it offers a richer vocabulary to analyze the process of temporal 'decoupling'. Two, separate viewpoints of temporality need to be here recognized- micro-level (phenomenological) and macro-level (actor network theory). Appendix 2 summarizes Latour's and Merleau-Ponty's complementary viewpoints on temporality of regulation from an actor-network and phenomenological perspective, respectively.

4. Research Challenges in IT Based Regulation

So far we have formulated the concept of rule and IT-based regulation and reviewed research that has sought to understand specific conditions and properties of IT-based regulation. We observed two gaps – the question of how IT *mediates* between rules and practices which are founded on sense-making, and the potential effect of a loosening temporal coupling between practices and rules when IT mediates their relationships. In this section we propose how these two challenges can be addressed in future research. Our discussion focuses on: 1) the unit of analysis when inquiring into the state of the IT-based regulation system, and 2) the pertinent research questions that these two forms of 'misalignment' within IT based regulation raise.

4.1. Regulatory Episodes as Epistemic Windows

Unique methodological and epistemological challenges emerge from the presence of alternative and conflicting ontological perspectives within the IT based regulation system. Materialization and sense-making raise polarized questions of both being and becoming, structure and flow, and design and use. The methodological approach should also be sensitive to specific characteristics of IT-based regulation including rule meaning and temporal coupling. Consequently, empirical inquiries into IT based regulation demand flexibility in how we draw upon theories that inform our inquiries into each and all of the three regulatory relationships. The trifecta also calls to observe IT-based regulation as a process in contrast to seeing it as a state.

Rules are implicated in practices and often questioned collectively as part of sense-making for their validity and appropriateness. This invites research to focus on 'moments' within practices

where the relationships between the three elements of the regulatory system are put on stage and probed for plausibility and fidelity – i.e. when calls of regulatory scrutiny, criticism, and change come to the fore. We denote such moments **'*regulatory episodes*'** and define them as temporal and spatial contexts (similar to locales in Giddensian (1984) terminology) where involved actors reflect upon and discuss what they should do in terms of rules and the status of their compliance – i.e. what is the rule's meaning in relation to current practice given the status and process of its materialization. These are meaningful 'events' (Merleau-Ponty, 1945: 472-481, 2003; Hernes, 2014) in the sense that they have a power to transform the settings and their interrelated rules (see Gosden, 1994 and Hernes, 2014 for similar ideas in terms of their concepts of "systems of references" or "fields of events"). In such settings the flow of everyday activity is in some way broken and problematic for actors. Their doubts, underlying assumptions, rules, temporal structures, tools, are rendered visible in actor's conversations and become targets of reflexive learning (Merleau-Ponty, 1945). These events and their relationships offer therefore empirical and analytical opportunities for researchers to study the state and unfolding of these relationships (see Appendix 2 for additional analysis how such inquiries can be done from macro and micro perspectives).

In this regard, regulatory episodes emerge as 'selective' epistemic windows into regulatory practices that help capture the simultaneous change in all three regulatory relationships and make them transparent. Therefore, a regulatory episode can form an appropriate unit of analysis to explore the state and dynamics of regulatory processes in that it offers a holistic lens towards the necessary, recursively organized, and constitutive elements of IT-based regulation. The benefit of this approach is that it passes the test of the necessity of introducing contradictory and contested epistemologies: materialization involving things such as rules or code that

dominate materialization while their effects and use being at the same time viewed as relational practices.

An additional benefit of this approach is that a regulatory episode "brackets" the following and/or breaking of rules in practices (Nicolini 2009). This permits the use of complementary theoretical lenses and multiple levels of analysis to be brought to bear in understanding IT based regulatory processes. These lenses can zoom into micro, fine-grained and local practices and meaning as well as zoom out to macro-level phenomena characterized by regulatory demands, rule systems, technical capacities and so on. These dual perspectives produce incommensurate, yet complementary results where IT-based regulation is investigated as a sequence of regulatory episodes where the system's states shift over time and different relationships and their generative effects become intelligible.

The challenge in studying such a system is here twofold: multiple levels and theoretical constructs need to be introduced to address the meaning of temporality and the temporality of meaning. The first is addressed on the micro level by zooming in on the local meaning of rules (Nicolini, 2009). The second is accomplished on the macro level by zooming out towards the temporal coupling of rules and practices. When we approach the system by setting our first sight on practices the obvious (first) micro lens will focus on an individual user's rule following and/or breaking. This calls for the study of phenomenology of meaning making during the now 'opened' regulatory episode. The subsequent (second) macro lens next traces the connections of this practice to rules (sense-making) and IT artifacts (elicitation) and then focuses on collective, processual couplings between rules and IT artifacts (materialization) and the temporal connections between rules and practices (temporal coupling during elicitation). In either case, the analysis of a regulatory episode captures a phase within the regulatory system,

which changes as a function of modifications in its relationships as new forms of regulation emerge.

When we zoom into the micro level we seek to reveal the agent's creation of meaning around rules when IT use behaviors are elicited. The individual's perceptions of constraints or her insights and memory of the nature of a binding rule is always situated and embodied. The individual's rule meaning draws upon her memory and is constituted in her interactions where she attributes meaning to the situation which covers its unique contextual elements, timing, technology features, and other participating individuals. The regulatory episode can also be viewed here from the angle of the external environment (rules). Here the embodied experience shifts towards appreciation of the institutional memory of rules and related routines. Consider the seatbelt example as an example of a regulatory episode when observed through the micro lens. Here the account would include Latour's perceptions of him as a driver being annoyed by the sound whilst becoming aware of what the sound might mean, caving at some point, and complying with the familiar rule despite his frustration.

When we zoom out onto a collective, organizational level the macro lens reveals overlaying and conflicting practices of organizational rule making and maintenance. These are subjected to incoherent processes and are increasingly mediated by diverse and heterogeneous IT capacities and related materialization processes. Here the starting point for the analysis can be Alter's insight that IT-based regulation will inevitably generate dyschronies as materialization and rule-making follow distinct, disparate and own temporalities. This will result in unavoidable omissions in sense-making. Multiple, regulatory interventions can run in parallel, updates and compliance changes follow multiple exogenous events and reflect specific concerns for materialization such as its level of rule visibility. Regulatory processes are again

emergent and call for own sense-making activities. Consider here the example of trading compliance rules which did not recognize the introduction of social media. Such situations apply, in particular, to increasingly complicated rule sets that are now possible to materialize in IT artifacts and often form the center of organizational sense-making.

In sum, the trifecta of the IT-based regulation system not only highlights the need for researching the meaning and visibility of rules during IT-based regulation, but also exposes problematic tensions between opposing ontological commitments to either entities or relations as constitutive elements of regulatory processes. The macro lens speaks to the temporality of sense-making as a source of dyschrony between (collective) practices and materialized rules. It sees materialized rules as entifications connecting to IT artifacts (another entity) which underlie organizational practices. The micro lens focuses on the individual rule following and sense-making and speaks for the creation, preservation, evocation, and memory of meaning perceived within and mediated by the environment.

Overall, the concept of regulatory episodes conveys a methodological innovation to study IT-based regulation in that it recognizes opportunities and the need to integrate micro and macro perspectives as a fruitful dialectic. Neither lens sees what the other sees: the individual's perception of rules and how the meaning of rules plays out in a situation generates a relational 'cut' within a regulatory episode, whereas the analysis of collective rule-making and materialization accepts artifacts, their capacities and rules as given and sees them in the process of being 'entified.' The micro level mobilizes a phenomenological analysis whereas the macro views regulation as a network dynamic that lends itself to actor-network theory informed analysis. Appendix 2 (see table 3) compares these two complementary perspectives and

presents their contrasting ontological commitments as expressed in the phenomenology of Merlau-Ponty (1945; 1964) and Actor Network Theory of Latour (2005).

4.2. A Research Agenda for IT-based Regulation

In this section we advance an agenda for research into 'misalignments' in the IT-based regulation system. Table 2 organizes salient questions that emerge from the analysis of misalignments at the level of materialization (e.g. the issue of the visibility of rules), sense-making (in particular in contexts where multiple practices are likely to be enacted in a given situation), and elicitation (e..g. when conflicts emerge between events due to disparate temporal structures). Regulatory episodes suggest another useful idea in formulating the agenda: the differentiation between and dynamic interweaving of the micro and the macro level. Our agenda consequently puts forward questions that speak to either view and, together, build what forms a more encompassing agenda for the study of IT-based regulation.

For relationships involving materialization and sense-making, table 2 suggests that studies into IT-based regulation need to involve also a policy dimension that is simultaneously external and internal to the regulatory practice. The dimension leads us to ask: How do external and internal rules interact and influence temporal coupling? What sorts of rule-making and materialization processes support IT-based regulation? Questions of policies of rule setting raise also questions of temporality: what is the influence of the broader ecosystem and related mechanisms that implement and mandate the compliance with rules or result in dyschrony? Debates of compliance and modes of compliance become also visible during regulatory episodes. These can deal with rule workarounds, rule adaptations or the creation of dual systems that seek to mitigate weakened temporal couplings (Berente and Yoo 2012). Here we need to ask: what are

the paths towards successful rule making and the temporal coupling of rules? What are conditions of and mechanisms that generate dyschrony? What rules prevail and gain acceptance in which material forms? The notion of regulatory episode can serve here as a pivotal sensitizing device to understand the ongoing assimilation of new regulatory practices as rules are increasingly embedded in technologies (Barley, 1986).

Most designs of IT artifacts serving organizational function involve a regulatory dimension though this process is rarely recognized and made visible in related studies. One reason for this can be that materializing rules into IT is never an innocent undertaking. System requirements (Hevner et al., 2004; Iivari, 2007) and their validation and verification, for example, by nature will involve negotiations and legitimations for rule sets to be included in the specification. Yet, this aspect is mostly treated as a technical question of 'rule verification' and 'consistency checking' (Bubenko et al., 1994; Kardasis and Loucopoulos, 1998). Yet, the ways in which related regulatory concerns become included or excluded during such design has a power and interest related dimension. IT artifacts are now also introduced at a global scale with extremely complex and transformative rule systems with little regard to their local regulatory implications. Take Uber service as an example of an emerging global IT platform that disrupts and conflicts with local regulatory practices related to labor markets or transportation. Hence, many aspects of IT artifact design overlap strongly with national or organizational regulatory practices (rule-making/following) but, at the same time, to a great extent represent invisible aspects of such practices. The study of regulatory episodes within IS design can also reveal the significant role designers and other technical stakeholders play in anticipating and implementing regulation and influencing to what extent it is exogenous or endogenous. Here we should ask: what is an appropriate front end of designing for IT-based regulatory processes

and organizing materialization practices? What roles do new technology capacities play in this task and in the continued expansion and maintenance of exponentially complex rule sets? Who is in charge of rule related requirements and how does this agency overlap with the organization's regulatory and compliance demands?

Given the holistic nature of the trifecta we need to ask: what is the recipe of effective IT-based regulatory compliance in IT rich environments? The materialization of rules into IT has traditionally been conceptualized in IS research as a structuration process focused on rules (DeSanctis and Poole, 1994; Jones and Karsten, 2008). This structuration influences, consequently, how users engage and proceed with their regulated practices in terms of cognitive and normative orientations. The compliance becomes a question of how organizational regulation can rely on meaningful rules as an effective way to regulate local behaviors. The bulk of the articles we identified in our literature review conceptualize rules at best as potential structuring elements. This suggests that only the rule enactment turns the rules into regulatory instances. But this interpretation begs the question: how can organizational processes and change be regulated and managed at all from a practice point of view, if there is no prior continuous structuring of the rules where delicate questions about the power of material carriers and their capacities are raised? Our suggestion for inquiring holistically the state of the IT-based regulation system in terms of regulatory episodes addresses this question in that it opens a broader window onto the organizational processes of how rules become locally enacted while at the same time being embedded from a distance into IT artifacts in the form of new capacities. It is through analyzing the actor's struggle when she faces discontinuities in IT-based mediation where problems of rule-following or rule-breaking emerge. We can ask: who holds agency in such an episode – is it only the rule following actor or also the regulatory

material setup that imposes the rules into IT and then elicits actors' behaviors? How do shifts or shocks in such agencies engulf the organization and result in regulatory change?

In IT-practice relationships the issue of elicitation is foregrounded (Table 2). Here, future research needs to approach IT-based regulation as adding novel and unexpected elements into local practices where the scholar needs to ask how does a regulatory process work when it becomes increasingly mediated by IT? More detailed questions along this dimension include understanding the process of creating local rule meaning and the potential sources of dyschrony during elicitation. These studies can reveal patterns and sources of dyschronies during regulatory episodes that emerge when new IT based mediation is at stake. Tentative culprits are conflicting temporal orientations embodied in rule creation and maintenance, inadequate design of IT artifacts, or their inconsistent local maintenance and use. We can ask: how can regulation converge in synchronic ways in increasingly complex IT mediated processes and how can rule following be 'managed' as a joint regulation between the rule setters and rule followers (Reynaud, 1988)? How do stakeholders see themselves as being involved in regulation as they go about in IT design, or during IT use?

Addressing these questions offers a promising ground for longitudinal ethnographic research focused on how regulatory practices are longitudinally 'performed' and made visible along different dimensions. Here, different rule sets from varying sources or with different character or content can have different, more or less compatible temporal couplings with practices. Such research can help understand extended regulatory dynamics thereby revitalizing the 'old' debate concerning the power of artifacts in ordering social behavior (Cummings, 1978; Trist, 1981; Gibson, 1986; Latour, 1992; 1994). We also call for creating better typologies of IT-based regulatory processes and their conditions. These studies can apply either longitudinal

case study approaches or quantitative approaches that use computer based text analysis, or comparative methods such as variance-based quantitative methods. Such studies can generate insights into the conditions under which different forms of IT-based regulation can succeed or fail.

Finally, we have identified two ontological views that can inform the analysis of the regulatory dynamic: the phenomenological, embodied perspective of Merleau-Ponty and the immanent relational perspective of Latour (see the comparative table in appendix 2). These perspectives can serve two purposes during scholarly inquiry. First, they provide a methodological foundation to explore IT-based regulation within the tenets of practice theory while at the same time bringing into the fore the theoretical conundrum that troubles many organization scholars: the process-entity paradox. Our focus on regulatory episodes honors the process tradition of accounting for breakdowns; yet, the analysis of regulatory episodes helps also peek into a world where regulation is delegated to material things and where crises emerge when new material properties of IT-based regulation come to the fore. We hope that this essay invites to take seriously challenges that the fascinating world of IT-based regulation poses before all of us.

Table 2: Research Agenda towards IT-based Regulation

Dimensions of IT-based regulation	Theoretical tensions	Methodological approach		Research Questions	Examples
		Zoom in to individual's sense-making	Zoom out to networks and related macro controversies		
Materialization of rules in IT	Rules being either visible or invisible during IT use Material nature of rules vs. their intended meaning and use	Rules, IT artifacts, and practices are parts of the same experience of the world. The actor's experience is tied closely to the artifact with specific learned rules and practices. The intended meaning of the artifact in use gets folded into the practice and can become mysterious.	IT use involves configuration of material networks where the visibility of rules is potentially low. Irreversible nature of rule materialization implies that its local meaning can disappear.	Who and what is involved in IT-based regulation and in setting up rules? What enters the focus of discussions during a regulatory episode? What is the network of materials, actors and rules involved in the regulatory episode and what are their effects? How do IT systems enable and constrain organizational regulation and compliance given their material capacities? How is the given material form of IT-based regulation taken into account when setting up the regulatory system? How does the use of IT systems inform and feed back to regulation and policy change?	The design of IT systems introduce strong regulatory practices that materialize complex sets of rules into IT artifacts. The strict and varied material forms of encoded rules anticipate and implement new targets and forms of organizational regulation. The use of IT implies compliance or breaking with rules even without knowing the presence of rules. Global platforms and IT artifacts may conflict or remain unintelligible locally.

Dimensions of IT-based regulation	Theoretical tensions	Methodological approach		Research Questions	Examples
		Zoom in to individual's sense-making	Zoom out to networks and related controversies		
Sense-making of of rules	Practice at odds with established rules	Joint sense-making and perception of rules and their experience	Attributing meaning and breaking of rules while establishing the rule system in practice	How is the meaning revealed during regulatory episodes? How are meaning making practices aligned with materially embodied activities such as design, use, and maintenance of IT artefacts?	Speed bump or password interface or database prompt helps to remind users of the presence and meaning of a rule and regulatory intent.
	Meaning gets lost as organization and networks grow larger	Drift in interpreting rule meaning as rules originate from multiple practices	Collective action and regulatory change as network building Follow the evolution of a network which describes and formulates the regulatory process	How does the rule meaning remain intact given increasingly diversified material practices? How is rule meaning revealed and communicated through IT use? Can multiple practices involving many rule systems be regulated at all given a limited set of IT artifacts?	Rogue traders may exploit complex organizational reporting lines by picking some and ignoring other constraints based on understanding the rule meaning.
Temporal coupling of rules	A disconnect between material form and intended regulatory function	Embodied individual memory of rules in local settings Conflicts between regulatory events for an individual	Dyschrony in regulatory processes. Emerging conflicts within networks and practices	What are the patterns and sources of dyschrony during IT-based regulation? What are the effects of dyschrony for regulatory outcomes?	The information value may differ between rules dictating financial reporting requirements and what is available in social media.
	Weak rule visibility	Improvisation with novel, conflicting interpretations of rule meaning	Separation of design time from use time Mechanisms of rule maintenance	How do rules connect with practices given incompatible temporal couplings and the lack of visibility? How do specific material forms of rule maintenance influence dyschrony?	The rule for using seatbelts is expressed as audible constraint if and only if the engine is turned on. The materialized form of the seatbelt rule is hidden in the vehicle's control software.

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Appendix 1: The Literature Review

We sampled research articles published during a ten-year period (2004-2013) in six top-tier IS and management journals. The six journals were *Information Systems Research*, *Management Information Systems Quarterly*, *Journal of Management Information Systems*, *Organization Science*, *Academy of Management Journal*, and *Academy of Management Review*. We surmised that these journals are most likely to address theoretically topics associated with IT-based regulation as their mission is to publish theory informed research on IT phenomena related to organizations. In our search we used keywords such as 'rules,' 'norms,' 'regulation,' 'control', and 'information technology.' We added to the sample obtained using this method additional articles by using snowballing (Webster and Watson, 2002, p.xvi). We also asked experts in organizational regulation research for additional references.

Overall, the search identified an initial sample of 138 papers. Next, we reviewed the abstract, theory, and analysis sections of each article as to ensure that the article analyzed at least one of the relationships identified in Figure 1. The review led to remove 106 articles from the sample as they treated either IT artifacts or rules nominally (Orlikowski and Iacono, 2001) generating a final sample of 29 articles. Next all 29 articles were read systematically as to identify the extent to which they address one or more of the three relationships (Vaast and Levina, 2006). This reading involved also identifying what constructs had been used to theorize along each relationship dimension. Each construct was ascertained by reading carefully the abstract, theory, and findings sections as to ensure that the research questions focused on rules, practices, and IT resources and their relationships. During this step we dropped five articles, because the detailed review revealed that the article did not focus on rule materialization, rule meaning, or elicitation processes. The final set of 29 articles (about 20% of the articles mentioning rules, regulation, control, or related terms in their abstract!) investigated theoretically and/or empirically at least one of the relationships presented in Figure 1. We next summarized each article for (a) the key constructs applied to analyze regulation and (b) key claims concerning regulation (see Table 2).

List of Sampled Articles:

1. Allen, D. K., Brown A., Karanasios S., and Norman. A. How Should Technology-Mediated Organizational Change Be Explained? A Comparison of the Contributions of Critical Realism and Activity Theory. MIS Quarterly, 37(3), 2013, pp. 835–54.
2. Aron, R., Dutta S., Janakiraman R., and Pathak. P. The Impact of Automation of Systems on Medical Errors: Evidence from Field Research. Information Systems Research, 22(3), April 2011, pp. 429–46.
3. Berente, N., and Yoo. Y. Institutional Contradictions and Loose Coupling: Postimplementation of NASA's Enterprise Information System. Information Systems Research 23(2), 2012, pp. 376–96.
4. Chai S., Das S., Rao H. R. Factors Affecting Bloggers' Knowledge Sharing: An Investigation across Gender. Journal of Management Information Systems, 28(3), 2011, pp. 309-42.
5. Chiasson, M.W., and Davidson. E. Taking Industry Seriously in Information Systems Research, MIS Quarterly, 29(4), 2005, pp. 591–605.
6. Christiaanse, E. and Venkataraman N. Beyond Sabre: An Empirical Test of Expertise Exploitation in Electronic Channels. MIS Quarterly 26(1), 2002, pp. 15–38.
7. DeSanctis G., and Poole M. S. Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory. Organization Science, 5(2), 1994, pp. 121-47. *Feldman, M. S., Orlikowski W. J. Theorizing Practice and Practicing Theory. Organization Science 22(5), 2011, pp. 1240–53.
8. Feldman, M. S., Orlikowski W. J. Theorizing Practice and Practicing Theory. Organization Science 22(5), 2011, pp. 1240–53.
9. Gherardi, S. How to Conduct a Practice-Based Study: Problems and Methods. Northampton, MA: Edward Elgar Publishing, 2012.
10. Jones, M. R., & Karsten, H. Giddens's Structuration Theory and Information Systems Research. MIS Quarterly, 32(1), 2008, pp. 127–57.
11. Jones, M.R., Karsten, H. Divided by a Common Language? A Response to Marshall Scott Poole, MIS Quarterly, 33(3), 2009, pp. 11-20.
12. Kappos, A. & Rivard, S. A Three-Perspective Model of Culture, Information Systems, and Their Development and Use. MIS Quarterly, 32(3), 2008, pp. 601–34.
13. Leonardi, P. M. When Flexible Routines Meet Flexible Technologies: Affordance, Constraint, and the Imbrication of Human and Material Agencies. MIS Quarterly, 35(1), 2011, pp. 147-167.
14. Li, E., Timon Y., Du C., and Wong J. W. Access Control in Collaborative Commerce. Decision Support Systems, special issue on Emerging Issues in Collaborative Commerce, 43(2), 2007, pp. 675–85.
15. Orlikowski, W. J. Integrated Information Environment or Matrix of Control? The Contradictory Implications of Information Technology. Accounting, Management and Information Technologies 1(1), 1991, pp. 9-42.
16. Orlikowski, W. J. The Duality of Technology: Rethinking the Concept of Technology in Organizations. Organization Science 3(3), 1992, pp. 398–427
17. Orlikowski, W. J., and Robey D.. Information Technology and the Structuring of Organizations. Information Systems Research, 2(2), June 1991, pp. 143–69.
18. Pentland, B. T., and Rueter, Henry H. Organizational Routines as Grammars of Action. Administrative Science Quarterly, 39(3), 1994, pp. 484–510.
19. Poole, M.S. Response to Jones and Karsten, Giddens's Structuration Theory and Information Systems Research, MIS Quarterly, 33(3), 2009, pp. 10-18.
20. Robey, Daniel. Computer Information Systems and Organization Structure. Commun. ACM, 24(10), 1981, pp. 679–87.
21. Robey, D., and M.-C. Boudreau. Accounting for the Contradictory Organizational Consequences of Information Technology: Theoretical Directions and Methodological Implications. Information Systems Research, 10(2), 1999, pp. 167–85.
22. Schulz, M. Limits to Bureaucratic Growth: The Density Dependence of Organizational Rule Births. Administrative Science Quarterly, 43(4), 1998, pp. 845–76.
23. Schultze, U. & Orlikowski. W.J. A Practice Perspective on Technology-Mediated Network Relations: The Use of Internet-Based Self-Serve Technologies. Information Systems Research, 15(1), 2004, pp. 87–106.
24. Tillquist, J., King J. L., and Woo. C. A Representational Scheme for Analyzing Information Technology and Organizational Dependency. MIS Quarterly, 26(2), 2002, pp. 91–118.

25. of Information Systems, 22(1), 2013, pp. 9-25.
26. Volkoff, O., Strong, D. M., & Elmes, M. B. Understanding enterprise systems-enabled integration. European Journal of Information Systems, 14(2), 2005, pp. 110-120.
27. Yang, Y., Singhal S., Xu Y. Alternate Strategies for a Win-Win Seeking Agent in Agent-Human Negotiations, Journal of Management Information Systems, 29(3), 2012, pp. 223–56.
28. Zhou, X. The Dynamics of Organizational Rules. American Journal of Sociology, 98(5), 1993, pp. 1134–66.
29. Zuboff, S. Automate/informate: The Two Faces of Intelligent Technology. Organizational Dynamics 14(2), 1985, pp. 5–18.

APPENDIX 2: Alternative Philosophical Positions to analyze Regulation

Latour (2005) and Merleau-Ponty (1945, 1964) offer two complementary approaches to identify and make sense of ontological tensions during the study of IT based regulation. They highlight how dyschronies and controversies can be detected through different routes while examining regulatory episodes. For Merleau-Ponty, a regulatory process is the embodied perception of what people feel they should do and about their conflicting feelings which need to be explored reflexively. Therefore, Merleau-Ponty's view uncovers the meaning an individual derives from rules and how she sees them as social constraints. For Latour (2005) or Barad (2003) regulation forms substantially a translation process for the former, and an intra-action for the latter. Neither ontology explicitly discusses the particular status of rules in their respective analyses of sociomateriality though they note that such processes have normative, moral and ethical effects. For Latour the process relates or enrolls heterogeneous actors and material entities and is instrumental in scripting behaviors of actors. As a participant in such networks, IT artifacts become a mediating force generating regulatory outcomes. Latour's translation analysis focuses especially on the stabilizing, collective results of regulatory (material) systems when they play out through materialization and elicitation relationships, in terms of our trifecta.

Challenges in integrating these two views in the analysis of IT based regulation originate from their different ontological assumptions, which are largely complementary. Table A below contrasts the underpinnings of the two ontologies and points to the two levels of analysis that, when separated, may give rise to an entity-process paradox. In phenomenological analysis, regulation becomes an individual's transcendental, emotional process disturbed by perceptions where the IT artifacts ultimately encode user's behaviors. These sensations become regulation only if they are perceived as something mediating a social and meaningful constraint. In the seatbelt case the perception of an alarm noise is a personal sensation and our reading of it as a socially meaningful constraint related to driving can generate a regulatory outcome. Accordingly, phenomenological analysis starts from the individual's flow of sensations and our embodied construction of time, context and meanings attributed to it. In contrast, for Latour, regulation is an immanent property in the flow of associations – a sequence of programs and anti-programs which go beyond the present IT artifact. Within a program participating entities become wrapped into movements initiated by the anti-program. In the seatbelt case, the driver starts the engine, which is one program, and an anti-program intervenes in the form of the voice reminder, the signal on the dashboard, and the driver responds with compliant behavior. For both views regulation can evolve into a multiplicity of behaviors which conflict with one another either due to presence of multiple feelings or the presence of multiple processes (programs) sustaining distinct temporalities.

In the ongoing discourse around sociomateriality, Barad (2003, 2007) and Latour (2005) have been viewed as the key architects of "relational ontology" (Kekez-Cezmanovic et al, 2014). These positions have been also questioned by alternative views such as the critical realist view (Mutch 2013), or integrative critical realist view (Mingers and Willcocks 2015) informed by Bhaskar's (1995) work. Yet, neither the immanent, relational theorists, nor critical realists recognize embodiment and how it relates to the temporality, spatiality and materiality of everyday activities and in particular those mediated by material instruments such as IT. Our body is the condition of possibility of our everyday experiences and their continuity. The body is also at the center of all processes that allow visibility and invisibility and, thus, create the necessary cognitive and emotional focus of our activities (such as the perception of rules or the use of performative artifacts). A theoretical way forward is the transcendental relational view of Merleau-Ponty (1945), whose work has, among others, informed Giddens' and Bourdieu's analyses of social systems and later Taylor's analysis of rule following (Taylor 1993). Giddens' major opus of structuration theory (Giddens 1984; pp. 59 and 65-66) elaborates concepts of time, space, embodiment, and practical consciousness drawing on Merleau-Ponty. Bourdieu created his concept of habitus and fields drawing upon Panofsky (1939) and Merleau-Ponty (1945) (see also Levina and Vaast, 2006 on these issues)[6]. Consequently, both Giddens and Bourdieu view bodies and associated temporal embodiments to constitute the measure and mediation of the social and technical environment. Basically, each regulatory episode embodies a context in which people *feel* what they have to do, or they need to question what they have to do at varying levels of "being". This brings into focus a reflexive subject or a set of subjects with emotions involved in prescribing something. According to Merleau-Ponty people do not perceive signals produced by artifacts they encounter

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[6] Bourdieu hesitated to do his PhD under the supervision of Merleau-Ponty – his teacher at the Ecole Normale Supérieure in Paris – and thus to become a philosopher instead of a sociologist.

externally. In contrast, they actively constitute their immediate environment through assimilated patterns of behaviors, which can be quickly (unconsciously) activated and are deeply embodied. The body and the feeling of what it *is*, and how it continuously mediates a person's relationship with the world (corporeal schema) constitutes a sensorial 'hub' that informs people's responses to signals. The world and its signals are both inside and outside, or before and after perception (Merleau-Ponty 1942, 1945). Giddens (1984: 65) notes this eloquently: "The body, Merleau-Ponty points out, does not 'occupy' time-space in exactly the same sense as material objects do. As he puts it, 'the outline of my body is a boundary which ordinary spatial relations do not cross." The body, and the experience of bodily movement is hence the center of the user's action and awareness and define its unity.

Merleau-Ponty's phenomenology offers hence an alternative lens to the social and the material dimensions of regulation. On the individual level phenomenological experience embodies a rich temporal, bodily experience. The regulatory episode offers a window into individuals' encounters with (invisible and materialized) rules that are experienced and embodied. The perception is memorized; individuals engage with their environment in a way that can be described as transcendental. The environment has been 'pre-recorded' to handle the wealth of stimuli framed as a set of expectations. The orientation is transcendental in the sense that the body forms the possibility conditions for experience. The creation of meaning becomes an individual's project and involves temporal dimensions. This process runs smoothly in line with the individual's expectations unless breakdowns create discontinuities. The latter condition throws the individual back upon herself and requires renewed attention towards the environment. In line with this, the concept of regulatory episode identifies individuals' perceived discontinuities and invisibilities. A researcher can, in such situations, follow the individual's responses when a temporal (dis)continuity is constituted in the experience.

The immanent processual Latourian view excludes regulation as a field of experiences. The tension is not about emotions or discomfort. It is a structural tension within the process. Meaning resides at the level of a (flat) collective process. It is the inherent property of the process and its controversies. The regulatory episodes are hence studied at the collective, processual level by mapping the dynamics of actors and their relationships involved in the regulatory episode. Controversy, for Latour, is about clashing programs and anti-programs (Latour, 2005) and constitutes the essence of translation. Translation is more than a linguistic process of figuring out what is being said: it is indistinctively both material and social. It elaborates mediations likely to connect heterogeneous interests and related actors to a (for now) stabilized network. The resulting 'flat' chains of translation are likely, at some point, to stabilize, if regulation is to proceed. At this point, people, artifacts, and how they should 'move' and relate is no longer questioned. Regulation and rules (words which Latour does not use because of their exogenous nature and the concept of emotions they imply) are just elements of the process characterized by "programs" and "anti-programs" and associated objective agencies (Latour, 2005 pp. 63) which help stabilize the controversy.

Table A: Two ontologies in the study of regulatory episodes

	Phenomenology (Merleau-Ponty 1945, 1964)	Actor Network Theory (Latour 2005)
Philosophical orientation	Transcendental phenomenology (Husserl, 1913; Heidegger, 1927)	Immanent, process ontology (Barad, 2007; Dewey, 1938; Whitehead, 1929)
Key ontological assumptions	The world is experienced as embodied Our experience is constitutive and constituted by visibility-invisibility, continuity-discontinuity loops, emergent conditions of possibilities of the process itself.	The world consists of processes and chains of translations Physical entities can exist but are not within the scope of theorization unless they are part of inquiry. Scientific inquiry entifies phenomena. Our activities and technologies are 'performative.'
Status of the IT artifact	Element of the embodied experience involving visibilities and invisibilities. Through meaning, IT artifacts constitute new perceptions, temporalizations and a sense of space.	Identified through the network wrapped into movements (Ingold, 2007) or inscriptions (Hanseth and Monteiro, 1997). IT artifacts are entangled into relational practices. Intra-actions create human and non-human entities and separate subject from object (Barad, 2007): "apparatuses are dynamic (re)configurings of the world (Barad, 2003: 816)."
Status of rules	Part of phenomenological experience. Temporal discrepancies between sensations constitute an objective world and experience. Rules open a way to understand regulation that so far appears as a constraint.	Inscriptions, sequence of program and anti-program, process of translation. Rules have no separate status.
Status of regulatory episodes	Recognizes visibilities and invisibilities, discontinuities and continuities (Merleau-Ponty, 1964). Discontinuities open a way to explore continuities and their constitution. Discontinuities can make visible what is being folded into practices. Discontinuities involve emotions and have their own subjective and inter-subjective dynamic. Discontinuities, folded into practices, can become reflexively disentangled from practices.	"Controversies" emerge where actors discuss what they should do with the IT artifact. Controversies involve an immanent and post-human dynamic. Controversies as critical phase during translation (Latour, 2005) whereby the regulatory network is stabilized. Controversies reach beyond discourse and involve heterogeneous entities (human and non-human). The translations include and exclude through collective action.