VISUALIZING INSTITUTIONAL LOGICS IN SOCIOMATERIAL PRACTICES

Completed Research Paper

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Abstract

This paper aims to deepen our understanding of how sociomaterial practices influence and are influenced by competing institutional logics, by combining a sociomaterial lens with the institutional logics perspective. We present findings from an interpretive, longitudinal case study of the emergency surgical ward of a Nordic University Hospital. By focusing our analysis on how affordances and agency emerge through the implementation, use and development of digital and physical visualization boards, we show how these artifacts constitute an integral part of the operational staff's sensemaking of a new institutional logic. We make two contributions. Firstly, we show how the way visualization artifacts shape individual focus of attention can facilitate integration of a new institutional logic in operational practices. Secondly, we show how the perceived affordances of a technology are created from the experience of using several different technologies and how the rejection of one technology simultaneously can constitute another.

Keywords: Sociomateriality, institutional logics, visualization artifacts, organizational change

Introduction

A recurring theme in the information systems (IS) literature concerns how to conceptualize the relationship between the social and the material in a way that encompasses not only interactions between people and material things, but also the mutually constitutive relationships between the social and the material (Leonardi 2011; Leonardi and Barley 2008; Orlikowski 2007; Orlikowski 2010; Orlikowski and Scott 2008). In this paper we combine a sociomaterial lens with the perspective of institutional logics to deepen our understanding of how sociomaterial practices influence and are influenced by the dynamic between competing institutional logics. The sociomaterial lens has proven useful in explaining how organizational and technological change are interwoven (Leonardi 2011) and how the social and the material are entangled in practice (Orlikowski 2007) but it has not sufficiently accounted for and linked institutional macro-structures with underlying interpretive processes through which practices occur. Nor has previous research fully explored how sociomaterial practices at the micro-level emerge and develop in complex institutional contexts influenced by multiple and partly conflicting norms, beliefs and guiding rules (Battilana and D'Aunno 2009; Lawrence and Suddaby 2006; Meyer et al. 2013; Mignerat and Rivard 2009). We argue that the perspective of institutional logics, defined as the basis of taken-for-granted rules guiding behavior of field-level actors (Scott 2008), provides a promising means to fill this gap. With our combined theoretical approach we respond to recent calls for bringing materiality into institutional analysis (see, for example, Orlikowski 2007; Orlikowski and Barley 2001; Pinch 2008). In doing so, we aim to cross-pollinate the current conversation within institutional theory, focusing on the role of agency in driving institutional change at the micro-level of organizing, with the sociomateriality discourse within IS, focusing on the mutual constitution of technologies and human action.

We present findings from a longitudinal case study of the emergency surgical ward of a Nordic University hospital. In the case, we observe how a new institutional logic that is part of a larger institutional trend in the service and healthcare industry, influences work practices and the introduction and use of physical and digital visualization artifacts intended to support improvement of work practices. The new logic consists of a production philosophy called Lean Management practices (Lean practices). Lean practices originate from the automotive industry and has recently become a popular method for increasing productivity and quality also in the service industry and in healthcare. A central method in Lean practices, aimed to support everyday continuous improvement, is workflow visualization. Inspired by digital and physical visualization boards commonly used in the manufacturing industry, the surgical ward has since 2011 implemented and continuously developed two visualization boards, one physical and one digital. By studying how the use and development of these boards affect the adoption of Lean practices in the operations, our aim is to answer the following research question:

How can visualization artifacts, entangled in sociomaterial practices, influence the dynamic between competing institutional logics and the integration of a new institutional logic into operational practices?

Our empirical description shows how the implementation, use and development of the digital and physical visualization boards direct the staff's attention on particular features of the operations and provide occasions for the staff to make sense of the new Lean work practices. By focusing our analysis on how affordances and agency emerge through the implementation, use and development of these visualization boards we show how visual representations construct the operational reality in a way that makes the principles of the Lean logic central to the staff's efforts to develop effective work practices.

Our study makes two contributions. Firstly, we show how the way visualization artifacts, entangled in sociomaterial practices, can shape individual focus of attention and thus facilitate the integration of a new institutional logic in operational practices. Secondly, we show how the perceived affordances of a technology are created from the experience of using several different technologies and how the rejection of one technology simultaneously can constitute another. Finally, our study suggests that there is additional potential in blending the research streams on institutional logics and sociomateriality.

Theoretical Background

The increased focus on the micro-foundations of institutional theory has contributed to an emphasis on the mutual constitution of agency and structure and brought light back to the role of actors' everyday practices in both the reproduction and transformation of institutions (Lounsbury and Crumley 2007; Thornton et al.

2012). However, critique has been voiced against the under-theorized role of technologies, or in a broader sense materiality, in institutional theory and organization studies in general. Scholars have called for research moving beyond conventional approaches to either ignore technology, take it for granted, treat it as a special case, or focus solely on technology effects or use (Orlikowski 2007; Orlikowski and Scott 2008) and suggested an alternative view, asserting materiality as integral to organizing (Introna and Hayes 2011; Orlikowski 2007). To address this challenge, our study combines a sociomaterial lens with the institutional logics perspective. We begin our literature review with an overview of the institutional logics perspective. This is followed by an outline of the material turn in IS and organizational studies in general and an argument for how an increased focus on the entanglement of the social and the material has potential to provide valuable insights, both into the micro-foundations of institutional change and into the process and implications of the continuous development of sociomaterial practices.

The Institutional Logics Perspective

One of the most intriguing aspects of recent developments in institutional theory is the increasing effort at linking up institutional and practice-based approaches, to deepen our understanding of the 'how and why' of organizational change, and the origin of new practices (Lounsbury 2008; Lounsbury and Crumley 2007). In macro-oriented institutional approaches human agency is portrayed as primarily shaped by macro-institutional forces, whereas the role of everyday practices in both the reproduction and transformation of institutions has been less central (Feldman and Orlikowski 2011). The intention behind the 'practice turn' is to go beyond this deterministic approach to collective action to understand the mutually constitutive ways in which agency is shaped by but also produces, reinforces, and changes its structural conditions (Feldman and Orlikowski 2011; Jarzabkowski and Seidl 2008; Lounsbury and Crumley 2007; Nicolini 2009; Whittington 2006).

The emergence of the concept of logics has been a key turning point in redirecting attention to the study of institutional sources of practice variation. Institutional logics represent the frames of reference that condition actors' choices for sensemaking, the vocabulary they use to motivate action, and their sense of self and identity. The principles, practices, and symbols of each institutional logic differentially shape how reasoning takes place on how rationality is perceived and expected (Thornton et al. 2012). The core premise is that the interest, identities, values, and assumptions of individuals and organizations are embedded within prevailing institutional logics (Thornton and Ocasio 2008) distinguishes an institutional logics perspective from macro-structural approaches, which emphasize the primacy of structure over action (DiMaggio and Powell 1983: p.6).

Friedland and Alford (1991) suggest two distinctive views about the relationship between individuals and institutional logics, one emphasizing opportunities, the other constraints (Friedland and Alford 1991, p.76). The first view emphasizes how institutional contradictions provide individuals and organizations with opportunities for agency and institutional change by exploring these contradictions. The second view emphasizing constraints posits that institutional logics shape individual focus of attention, preferences, organizational interests, and the categories and repertoires of actions to attain those interested preferences. Unlike earlier neoinstitutionalist accounts that view cognition primarily as a source of institutional constraints (e.g., DiMaggio and Powell 1991; Zucker 1977) institutional logics provide the cognitive and symbolic building blocks for how social actors through their social interactions transform and reproduce social and cultural structures (Thornton et al. 2012).

A recent stream of research has started to focus on the multiplicity of different and often contradictory logics in contemporary organizational society (Reay and Hinings 2009; Seo and Creed 2002; Suddaby and Greenwood 2005) and the ability of actors to effectively make sense of simultaneously operating logics in multiple institutional spheres (Kraatz and Block 2008). However, much of the research in this area has focused on organizational-level responses to these contradictory environmental pressures. As Kraatz and Block (2008) noted, there is an absence of research on how local actors experience and manage this complex terrain. The literature currently lacks a clear, empirically based understanding of how social actors translate logics into action and navigate among multiple logics as they engage in everyday organizational activities and furthermore, how these micro-level activities help reproduce or transform organizational structures. It is here we see the opportunity of a cross-pollination between the current conversation within institutional theory and the IS debate on sociomateriality. With a few exceptions (Baptista 2009; Labatut et al. 2012; Lawrence and Suddaby 2006; Mangan and Kelly 2009; Raviola and Norbäck 2013) the role of information

technology and in the broader sense materiality, has been largely ignored in the discussion of the micro-foundations of institutional change but, as we will argue next, holds great potential to be explored from a sociomaterial perspective.

The Material Turn

The sociomaterial perspective, assuming a constitutive entanglement of the social and the material in practice (Orlikowski 2007) has deepened our understanding of the relationship between humans and artifacts. As structuralism and constructivism, sociomateriality rejects the idea that technology alone is the cause of organizational change because social actors decide how they let their work be influenced by technology (Leonardi 2012). However, scholars argue that the former two approaches downplay the role of technology in their areas of inquiry (Leonardi and Barley 2010; Orlikowski 2000). Therefore, the main research goals of sociomateriality scholars is to investigate how organizations and technology can be seen differently if we consider that social and material are entangled (Orlikowski and Scott 2008).

The sociomaterial lens employed in this paper is based on a relational ontology which rejects the notion that the world is composed of individuals and objects with separately attributable properties that exist in and of themselves (Orlikowski 2010). Such an ontology privileges neither humans nor technologies (Barad 2003; Knorr Cetina 1997; Latour 2005; Pickering 1995; Schatzki 2002), nor does it treat them as separate and distinct realities (Orlikowski 2010). The notion of constitutive entanglement (Orlikowski 2007) presumes that the distinction of humans and artifacts is analytical only and that these entities relationally entail or enact each other in practice. Continuously ongoing and constitutive entanglement results in sociomaterial assemblages, temporarily binding together a heterogeneous assembly of distributed agencies (Orlikowski 2007). All practices are always and everywhere sociomaterial, and that this sociomateriality is constitutive, shaping the contours and possibilities of everyday organizing.

Several researchers have advocated the concept of affordances as a promising approach to overcome the subject-object and agency-structure oppositions that have restrained much of the research at the intersection of technology and organizations (Leonardi and Barley 2008; Markus and Silver 2008; Zammuto et al. 2007). We adhere to the view that affordances are rooted in a relational ontology which means that people's goals are formulated, to an important degree, by their perceptions of what a routine or a technology can or cannot do, just as those perceptions are shaped by people's goals (Faraj and Azad 2012; Leonardi 2011).

However, even if we adhere to a relational ontology, viewing the social and the material as inseparable and mutually constituting, in this paper we make an analytical difference between human and non-human agency. As (Pickering 1993, p. 564) claims, non-human agency is 'temporally emergent in practice', as its form is never decisively known in advance, and humans continually explore it in their everyday work. Human agency, conversely, is characterized by intentions (Pickering 1993). Nevertheless, we place human agency – purposiveness, intentionality and will – in a necessary relation to non-human agency within an assemblage of entities that acts collectively (Raviola and Norbäck 2013).

We summarize our literature review by concluding that the traditional assumptions in institutional theory, about agency being a solely human property remain largely unquestioned, and the study of the technological structures interacting with human actors' work, so far remains a declaration of intent. Here, the sociomaterial perspective, viewing the social and the material as inseparable and mutually constitutive and agency as collective and distributed in sociomaterial practice, can offer new and valuable insights. By combining a sociomaterial lens with the institutional logics perspective we respond to the call for inclusion of materiality into institutional analysis (Orlikowski 2007; Orlikowski and Barley 2001; Pinch 2008).

Methodological Approach

This study employs an interpretive, single case design. The study started as an explorative study within a larger research project aimed at investigating the implementation of Lean practices in institutional complex environments. In the initial phase of our fieldwork at the University Hospital we noted how several visualization artifacts played central roles in the way the staff made sense of and developed new work practices. The research question in this paper emerged during fieldwork and together with our realization that the implementation of Lean practices at the emergency surgical ward constituted a suitable case to study how sociomaterial entanglements influence and are influenced by the dynamic between competing

institutional logics. The following section is structured as follows: we start by outlining the institutional context in which the University Hospital operates and the new logic of Lean practices recently has strengthened its influence. We then move on to describe the research site and how we proceeded with our data collection and analysis.

Empirical Context: Institutional Logics in the Healthcare Field

The healthcare industry in developed economies and nations has for the most part of the century been managed by professional dominance (Scott et al. 2000). The primary institutional logics have stressed professional authority and the quality of care as defined by the physician (Bird et al. 2010). However, the biggest trend affecting professional work in the past 30 years has been the call for greater accountability and efficiency in service delivery. This has manifested itself in North America through calls for market competition and privatization as a means to deliver better and more efficient professional services. In Western Europe, the trend has developed under the name of new public management, signified by attempts to introduce market-based decision-making practices used in private industry in centralized and local government bureaucratic activities (Leicht et al. 2009).

For more than a decade this marketization trend has been influenced by the introduction of methods used in operations management, such as Lean Production, Six Sigma, and TQM. These newer-quality models stress customer focus, continuous improvement, decentralization and teamwork, emphasizing the importance of contributions by the full range of participants in the health-care delivery system (George 2003; Proudlove et al. 2008). Lean management practices has increasingly been adopted by actors in the healthcare sector and has in many cases, improved patient flow and reduced patient queues (Lodge and Bamford 2008; Suárez-Barraza and Ramis-Pujol 2010). The fundamental principles of Lean practices emphasizes the development of process capability with a focus on maximizing flow rather than resource utilization (Liker 2004; Modig and Åhlström 2012). Lean also involves the development of a learning capability through established routines for problem identification, problem solving, and solution retention which are all necessary ingredients for continual improvement (Fujimoto 1999).

While often leading to improved quality and flow efficiency, the application of Lean practices and similar managerial approaches have consistently been troubled and hindered by several of the unique features of health care (Nembhard et al. 2009). Such features include the uncertain and risky nature of the work, which inhibits experimentation required to implement innovations and the highly hierarchical and segmented professional structure of the workforce, which creates strong professional and weak organizational identities and can hinder the collaborative learning required for mastering increasingly interdisciplinary innovations in care (Nembhard et al. 2009). These problems are aggravated by the divided authority structure in healthcare organizations and persisting views of medical care as a craft profession, aspects of the organization that traditionally have created perceived goal conflicts between organizational management and the professional workforce (Nembhard et al. 2009). Perceived conflicts include the definition of quality, the purposes of improvement initiatives and by underdeveloped performance measurement and control systems.

We base the identification and depiction of institutional logics (the professional and the Lean logic) in this study on interviews with and observations of operational staff, members of the improvement team and representatives from the SSDU, corroborated with theoretical descriptions of the logics (Currie and Guah 2007; Leicht et al. 2009; Nembhard et al. 2009; Scott et al. 2000). In Table 1, we outline the characteristics associated with each logic in order to demonstrate the major differences and similarities between them. We do not claim that these two are the only logics of practice at the ward; they were, however the two most salient logics at the time of our study.

The Research Site

The research site, hereafter referred to as "The Hospital," is a publicly owned and funded tertiary academic medical center which, after a merger in 2004, operates at two main sites in a Nordic capital. It has a budget of approx. 1 billion Euros and its staff of 15,000 serves a population of 2 million inhabitants. As outlined in the previous section, the healthcare field has historically been subject to a complex and changing institutional environment and its current exposure to multiple institutional logics makes actors such as The Hospital a suitable research setting to explore our research question.

Table 1. Characterizations of Institutional Logics	
Logic of medical professionalism	**Logic of Lean Practices**
Professional autonomy	Team-based problem-solving
Quality defined by physician	Standardization
Development of professional expertise	Flow efficiency
Validated work processes and methods	Continuous improvement

In 2007, the hospital management initiated a strategic long-term improvement program building on Lean management principles and practices, with the aim of improving quality and efficiency throughout the care processes. The implementation started at the emergency department, which generates approximately 60% of all hospital admissions. The strategy was guided by goals to reduce average patient waiting time, increase the throughput of patients and improve quality and safety through standardization and continuous improvement of work routines. In the daily operational work, the lean-inspired program translates into six principles:

- *Teamwork:* All steps in the care process should be linked and performed in teams to eliminate duplication of work tasks.
- *Visualization:* Create overview of the work and patient flow.
- *Standardization:* Patients following the same flow through the emergency department should, to the extent possible, be handled according to a standardized routine.
- *"Right from the start":* Build a culture of interrupting workflow to fix problems immediately as they occur, to get "quality right the first time".
- *Create a steady flow:* The goal is to keep a cycle time, across wards and throughout the care chain.
- *Try:* A routine may need to be adjusted several times before it works smoothly.

The implementation process is designed and facilitated by the hospital's Strategic Services Development Unit (SSDU). The SSDU consists of eight so-called "flow coaches", responsible for training and coaching line Managers and the operational "improvement teams" in the development of Lean practices. Two system developers work as the bridge between the operations and the IT organization with the primary purpose to develop the operational IT systems to better support the adoption of Lean practices. An important part of their responsibility is the support and development of the digital visualization boards, introduced to support visualization and coordination of patient flow within and across wards.

For the purpose of this paper, we choose to focus our study on the surgical ward, which is one of three emergency surgery wards. We choose to focus on the surgical ward because it is the ward that most recently started to implement Lean practices. While the new work routines were implemented at the Emergency desk in 2007 and at the Orthopedic and the Oral and Maxillofacial wards in 2009, the surgical ward began their implementation process in October 2011.

Study Design and Data Collection

Recently, it has been argued that research in the field of institutional theory has largely failed to employ methodologies consistent with the need to attend to meanings systems, symbols, myths and the processes by which organizations interpret their institutional environments (Suddaby 2010; Suddaby et al. 2010). This study responds to this call by accepting the notion that organizations engage in structured patterns of collective interpretation which involves the attachment of meaning to events and the infusion of value into organizational processes and outcomes (Daft and Weick 1984; Suddaby 2010). This means that we attend less to the organizational products of institutional pressures and more to the processes by which institutional pressures are understood. Focusing on the perception, use and development of digital and material artifacts our interpretive approach is in line with the interpretive tradition of artifacts and information technology studies (Klein and Myers 1999; Walsham 1993; Yanow 2006).

Data collection was initiated in November 2012. Retrospective data were collected for the period October 2011-November 2012 and real time developments were studied from November 2012 to June 2013. The

advantage of retrospective data is being able to trace events over time, but there are unavoidable concerns about reliability of recall and subjective bias amongst informants (Golden 1997). We therefore triangulated data by tapping into different sources of data and by complementing primary data with supplementary data (Eisenhardt 1989). Also, we focused in the interviews on concrete events, rather than framing our questions around general development of more abstract concepts (Miller et al. 1997).

We adopted a combination of data collection methods: observations of daily work, interviews, participation in meetings and seminars, studies of archival materials, and continuous informal discussions with medical professionals. To create an overview of the operations and of how the implementation of Lean practices was perceived and affected the daily work routines at the emergency clinic, we initially interviewed people from all wards at the emergency clinic as well as Flow coaches and system developers at SSDU. When we decided to focus our study on the developments at the surgical ward, we initially interviewed people who had worked at the ward since before the implementation, who were members of the improvement team and could provide rich information on initiatives and challenges since the start of the implementation. To reduce the risk of capturing only a narrow set of interpretations, we also interviewed more recently employed staff and people who were not members of the improvement team. These interviews involved representatives of all the relevant professional categories: Surgeons, Anesthesiologist, Nurse Anesthetists Surgical Nurses and Assistant Nurses (25 interviews). Interviews averaged one and a half hours, were open- ended, and followed a protocol that evolved with the research project (Strauss & Corbin, 1998). To begin with, the interviewee was asked to narrate his/her personal experience with respect to the implementation and continuous development of Lean practices and the development and use of the visualization boards. The interviewees were especially encouraged to elaborate on practices or functionalities of the visualization boards which they found problematic and on how they had worked or might still work to try to solve these problems. Through the iterative process of data collection and analyses, more focused questions emerged concerning different aspects of Lean practices, certain functionalities of the visualization boards and internal problem-solving and decision-making structures. The interviews were recorded and we produced detailed interview notes from the tapes.

The interviews were complemented with consultation of relevant documents. The materials reviewed included protocols from meetings of the improvement team since the start of the implementation (225 PowerPoint slides), specified standards and role descriptions for the new work routines, action plan for implementation (in total 50 written pages) and prototypes and user manuals of the digital visualization board (15 written pages). In addition, we spent several days (approx. 50 hours) at the ward between December and May 2013, observing daily work routines and participating in the operational morning meetings as well as the meetings with the improvement team held for two hours every second week. We shared our preliminary findings with IT representatives and Flow coaches at SSDU and received helpful comments that confirmed and elaborated identified issues and themes.

Data Analysis

Our overall analytic approach was iterative and abductive, with the goal of building and refining theory from rich case study research (Eisenhardt 1989). We transferred all the interview transcripts to Excel which enabled us to code passages within transcripts and to sort the segments by codes. Except serving as a repository for regular memos as we analyzed the data, we could also log a timeline of key events and organizational changes in the excel sheets. We used a simple form of thematic coding to highlight the differences in actors' perspectives and identify typical statements, recurring issues, and common terms (Fereday and Muir-Cochrane 2006). We analyzed the data as it was gathered, and returned to it repeatedly as the fieldwork progressed. This process was informed by the relevant IS and OS literature. In this way, the data analysis was an emergent process involving interplay between data interpretation and theory (Putnam and Pacanowsky 1983; Walsham 2006). We followed Langley (1999) by iteratively developing a textual description and a time line of key events, which enabled development and verification of theoretical ideas in subsequent analytical steps (Langley 1999). The textual description provided a chronological description of events and activities, as well as an explanation of how and why the identified sequence of events and activities resulted in the outcomes observed.

We cross-checked accounts using three different means (Miles and Huberman 1994). First, we contrasted and compared interviews, highlighting discrepancies, which were investigated through follow-up questions or, where relevant, addressed in successive interviews. Second, we conducted a detailed examination of the

visualization artifacts. As much research in this area shows (Bechky 2003; Star and Griesemer 1989), the 'voices' of the objects and the stories told by their structure and characteristics are important counterpoints to interviewees' stated motivations and aims. Third, the extensive documentation of discussions, decisions and activities of the improvement team since the start of the implementation enabled us to map the process of events and triangulate with the interview material.

Presentation of Empirical Data

The Implementation Plan and the Role of the Improvement Team

The surgical ward has a complex and dynamic operational structure with a workforce divided into several medical professional categories. A greater part of the workforce, 70 Anesthesiologists and as many Anesthetic and the Surgical nurses rotate between different departments of the hospital every seventh week and hence, only work at the surgical ward temporarily. Under these conditions, the implementation of new work routines offers many challenges in terms of involving and motivating staff to commit and contribute to the continuous development of the work standards. In October 2011 the operational improvement team was formed, consisting of 20 representatives from all staff categories of the ward as well as from the customer wards: Post-surgery, Anesthesia, Medical surgery, Transplantation surgery and Gynecology. The team is led by a Flow coach from SSDU and a so-called "Flow leader" who is also Head of surgeons. The improvement team, which has remained largely intact since its creation, gathers every second week to discuss current issues in the operations, share ideas for potential improvements and plan activities in pipeline. The system developer from SSDU often participates in the meetings to discuss potential improvements to the IT-systems.
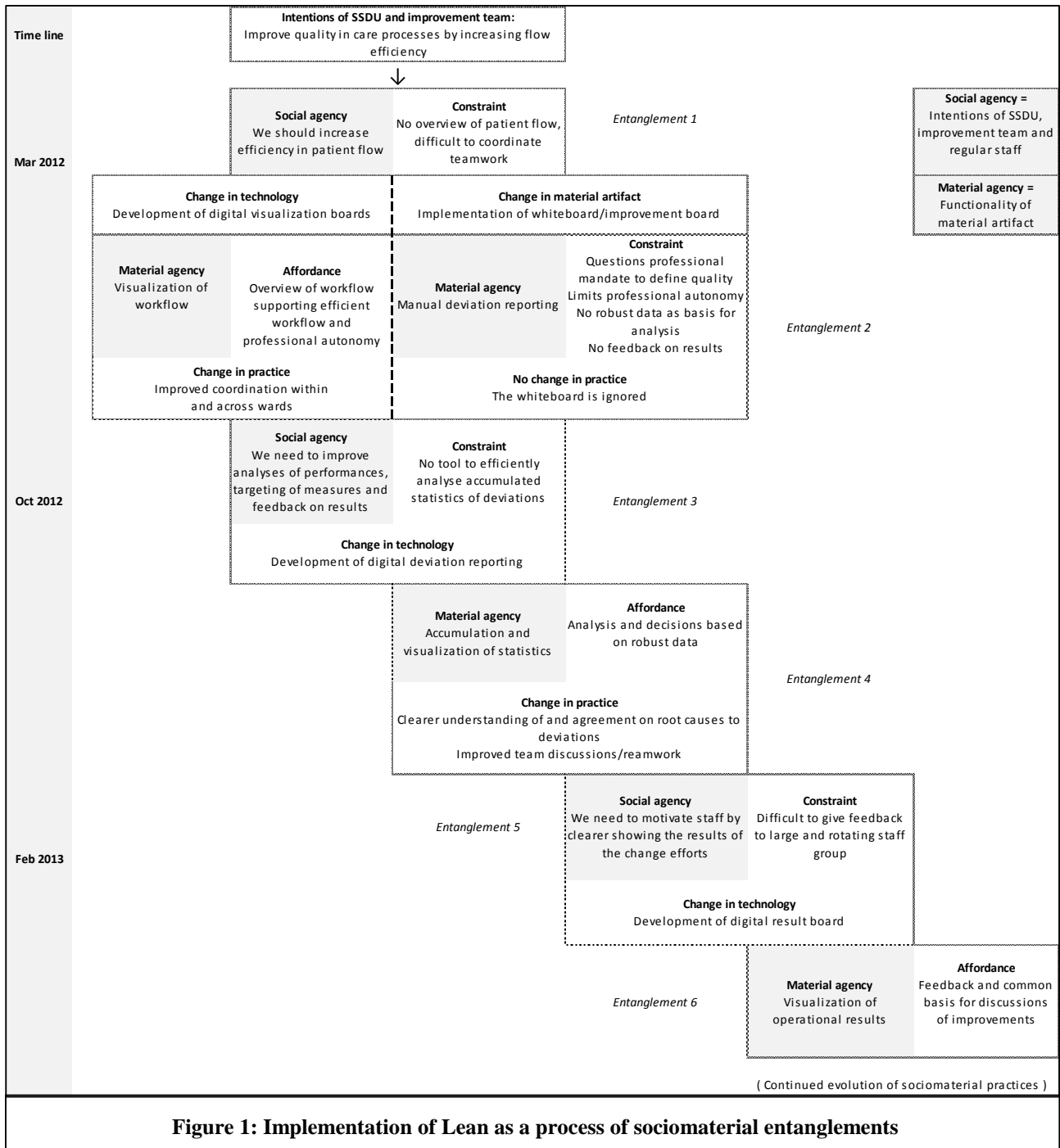
During the first meetings of the improvement team in October and November 2011, the team worked to develop a common view and analysis of the current operational processes. This resulted in a detailed map of their current operational processes including all steps, tasks and people in the workflow of the wards. This process map was used to identify bottlenecks and wasteful activities and to create a map of a future optimal process based on the principles of Lean practices. The most common wasteful activities identified were: inefficient use of surgery rooms, waiting time due to delays in patient arrival from other departments, and misunderstandings or unclear communication between staff at the ward or with staff at other departments. The improvement team also invited the rest of the staff to share their thoughts and ideas on the implementation in workshops organized during the fall of 2011. During the time period from October 2011 to March 2012 the improvement team worked to formulate a plan for the implementation and in March 2012 the new work routines were implemented:

- *Parallel patient flows:* Two surgery rooms are used in parallel, one for patients who need surgery within 24 hours and one room for the most acute patients who need surgery within 2-6 hours.
- *Efficient prioritizing of patients*: A surgeon always works in the operational management team and is responsible for the communication with the doctor notifying the patient for surgery.
- *Visualization of patient flow:* The operational management team use data from the patient database to prioritize and display patient flow on a digital visualization board.
- *Routines for feedback and follow-up:* Daily morning and afternoon meetings ensure that all staff members are familiar with the new work routines. In the afternoon a whiteboard, called "improvement board" is used to facilitate team discussions about deviations from standardized routines and opportunities for improvement.

The Emergence of a Sociomaterial Assemblage

We have structured our empirical presentation as a chronological process of "sociomaterial entanglements". Figure 1 shows an overview of how new work routines and technologies are implemented and developed in sociomaterial practice. In the figure we make an analytical distinction between social and material agency. However, as we will further explain in our analysis, in practice human and material agency are always in relation within an assemblage of entities that acts collectively. "Affordances" and "Constraints" represent the operational staff's perceptions of the emergent sociomaterial agency.

Time line				
	Intentions of SSDU and improvement team: Improve quality in care processes by increasing flow efficiency			
	↓			
	Social agency We should increase efficiency in patient flow	**Constraint** No overview of patient flow, difficult to coordinate teamwork	*Entanglement 1*	**Social agency =** Intentions of SSDU, improvement team and regular staff
Mar 2012				**Material agency =** Functionality of material artifact
	Change in technology Development of digital visualization boards	**Change in material artifact** Implementation of whiteboard/improvement board		
	Material agency Visualization of workflow	**Affordance** Overview of workflow supporting efficient workflow and professional autonomy	**Material agency** Manual deviation reporting	**Constraint** Questions professional mandate to define quality Limits professional autonomy No robust data as basis for analysis No feedback on results	*Entanglement 2*
	Change in practice Improved coordination within and across wards	**No change in practice** The whiteboard is ignored		
	Social agency We need to improve analyses of performances, targeting of measures and feedback on results	**Constraint** No tool to efficiently analyse accumulated statistics of deviations	*Entanglement 3*	
Oct 2012				
	Change in technology Development of digital deviation reporting			
	Material agency Accumulation and visualization of statistics	**Affordance** Analysis and decisions based on robust data	*Entanglement 4*	
	Change in practice Clearer understanding of and agreement on root causes to deviations Improved team discussions/reamwork			
	Entanglement 5	**Social agency** We need to motivate staff by clearer showing the results of the change efforts	**Constraint** Difficult to give feedback to large and rotating staff group	
Feb 2013				
		Change in technology Development of digital result board		
	Entanglement 6	**Material agency** Visualization of operational results	**Affordance** Feedback and common basis for discussions of improvements	
	(Continued evolution of sociomaterial practices)			

Figure 1: Implementation of Lean as a process of sociomaterial entanglements

Entanglement 1 and 2:

Implementation of the Digital Visualization Board

The idea to develop a digital visualization board was inspired by the Lean principle of workflow visualization and adopted from the manufacturing industry where digital boards are commonly used to support the overview of workflow. The first version of the board was installed at the orthopedic ward when they started to implement Lean practices in 2009. Boards are also installed at the pre- and post-surgical ward, x-ray and laboratory units as well as at most customer wards. Each board is custom made, showing only the

information necessary for the staff at each ward.

The digital visualization board was installed at the surgical ward in March 2012. Data for all acute notified patients in the surgical operations are obtained from the patient database and presented in a prioritized order on the visualization board. The board shows the number of prioritized patients within each priority class, how long each patient has been waiting, the planned method for anesthetics and when the patient is ready for anesthesia or surgery. The Surgeon notifies the system 30 minutes before finishing the surgery. This serves as the signal to the customer wards to prepare the next patient.

The boards are displayed on monitors inside and outside the surgery rooms, as well as on the intranet, enabling the staff to keep an overview of the patient flow and the work teams' activities from any location at the hospital. This has enabled them to better plan their work and utilize their time more efficiently:

"The board gives us a clear overview of the current status and what we need to do. I do not need to adapt to common meeting times and can plan my own work and use my time efficiently." /Anesthetic nurse

The digital board also created transparency and enabled a more efficient workflow between wards. The ability to see patients' and colleagues' availability on the monitors enabled more efficient communication and coordination of work. Much of the staffs' time used to be spent on keeping abreast of the situation at the ward and there were many phone calls to coordinate the patient flow to and from the ward. After implementation, a quick look at the digital board gave all necessary information about when and where the next patient needs attention. This was particularly helpful for the Anesthetic nurses who are running between many different patients at different wards every day. They explain that the board enables them to focus fully on the patient without having to wonder if anyone is waiting for them elsewhere.

Furthermore, the board is perceived to improve teamwork by making communication and coordination of the work easier and more efficient. The overview of teams, team members and their scheduled activities has made it easier for the staff to keep track of each other. It has also enabled a more constructive working dialogue. Having the board as a common reference point, doctors and nurses do not have to call each other to plan or double-check things but can instead focus on discussing patient-related issues or strategies for upcoming surgeries. These new communication routines are perceived to create a deeper understanding of the others' work tasks and priorities.

"We understand each other's work better and have more patience if problems or delays occur. We are also less anonymous to each other. A nurse is not just a nurse but a colleague." /Anesthesiologist

The Introduction of the Improvement Board

The improvement board was developed by SSDU and the improvement team and introduced in March 2012, at the same time as the digital visualization board. Its primary purpose was to support the routine of deviation reporting and facilitate continuous improvement of work routines. The board was developed out of a standardized template created by SSDU and modified by the improvement team. SSDU's intention was to provide a support tool for the staff to explore and continuously develop. The boards include checklists and short manuals of key work processes, post-its with noted deviations and proposed measures. According to the new standard the staff should note down all deviations occurring during the day, bring to the afternoon meeting and put them on post-its on the whiteboard where they would serve as a basis for discussions and improvements.

The daily afternoon meetings were held for a couple of weeks and then replaced by a weekly meeting. This was agreed on mainly for practical reasons. Most of the staff did not have time to jointly gather around the board every afternoon and they argue that one weekly meeting enabled them to better see and analyze trends in the reported deviations. The improvement board was used during the weekly meetings for three month but was then discarded. There were several reasons for this. Firstly, the staff did not experience the discussions about reported deviations as constructive or leading to quality improvement and professional learning. They felt uncomfortable if they had to report a mistake involving a colleague and accused if they were reported as responsible for causing a deviation. Furthermore, the whiteboard's limited functionality in storing, structuring and analyzing operational deviations and improvements over longer periods of time was not perceived to give a robust basis for problem solving. Finally, the whiteboard did not afford tracking of cases, nor did it provide feedback on results of proposed measures. This deficiency was perceived to be a demotivating factor in the pursuance and development of standardized work routines.

"Once in a while a couple of post-it notes came up on the whiteboard, but no one never knew what happened to them. It was difficult to see what people had written and deviations were saved in thick binders that nobody knew what to do with." /Anesthesiologist

"People lost motivation to follow the new standards and to report deviations because they saw that their effort is not worth anything." /Assistant nurse

Besides the insufficient functionality of the whiteboard, it was perceived as old-fashioned and conservative. Many of our interviewees do not understand why SSDU argued and still argue for a non-digital solution when most other routines are digitalized, such as the management of journals

"Honestly, you felt quite stupid and old-fashioned when you stood by the whiteboard and tried to lead the meeting." /Anesthesiologist

The improvement board is still present at the ward but serves as the general noticeboard placed on the wall in the local office, behind the computers on which the operational management team prioritizes patients and displays the patient flow on the digital visualization board.

Entanglement 3 and 4: The Introduction of Digital Deviation Reporting

According to the principles of Lean practices and the new work routines developed by the improvement teams, deviations from standardized procedures should be reported and serve as the basis for discussions, learning and improvement in the operational teams. Minor deviations from work practices should be discussed and solved within the work teams, while more serious problems affecting patients or work environment should be escalated to senior managers. For the ladder type of deviations all departments at the hospital use an IT system to report and escalate deviations. The former kind of deviations has not previously been reported at the surgical ward. Among all new work routines so far introduced to the ward, this routine turned out to be the most challenging to pursue.

The first challenge was related to the structural conditions of the work at the ward. Large staff groups, rotating workforces, high employee turnover and the use of temporary workers did not create the necessary continuity to establish and develop standards.

"To be able to evaluate yesterday's work, the employees who worked yesterday need to be here today." /First Line Nurse Manager

The second challenge was the medical staff's perception of standards as undermining their professional role and intellectual challenge of their work. Some interviewees explain that following standards creates the feeling that the ultimate goal of the work is quantity. They perceive standards as a mean to measure time and that quality was secondary.

"Standards create the feeling of working in a factory, it is all about how many patients we operate and how much behind schedule we operate. I know it's not the intention of the principle but it's still the feeling it creates." /Anesthesiologist

In addition to the challenge of making the staff follow standards came the challenge of making them report deviations from the standardized processes. Firstly, because the afternoon meetings were replaced by one weekly meeting it was difficult to remember the deviations that had occurred during the week. Secondly, it was difficult to properly discuss and find root causes to the reported deviations since the staff who were present when the deviation occurred were often not attending the meeting. As a consequence, the deviations were perceived as subjective descriptions and sometimes lead to irritation because people felt accused.

"It worked like a shame and blame system aimed at identifying scapegoats. It didn't feel good. You don't want to be the person picking on others for their mistakes, nor being the one accused for committing one." /Anesthesiologist

It also made the medical staff feel that their authority to define qualitative healthcare and decide how it should be achieved was undermined.

"The reporting of deviation adds to the feeling that you, as an individual are not trusted, that someone always has to watch you and tell you what to do." /Anesthetic nurse

The idea to develop a digital system for reporting of deviations came out of discussions within the improvement team. They agreed that the whiteboard did not provide sufficient support for standardization and deviation reporting. At the same time they saw potential in using the digital display board as a reporting tool since it would allow for the accumulation of deviations over time and hence a more accurate analysis

and formulation of measures. A system developer at SSDU started to develop the new feature in September 2012 and it was implemented in October 2012. According to the new standardized procedure, the team should end every surgery with a "sign-out", a quick meeting in which the team reports possible deviations on a digital checklist on a computer inside the surgery room. If no deviation occurred during the surgery, this is also reported. During the weekly meeting statistics of the most commonly reported deviations of the week is displayed and possible measures for improvements are discussed.

The digital reporting routine increased the staff's motivation to report deviations, as they perceived it as a more effective and efficient way to identify and analyze problems. If for example the team ended the surgery one hour after schedule they had to agree on the actual underlying reason for this. This provided a better basis for constructive discussions about possible measures for improvement.

"I don't see the system as a deviation reporting system but as an implementation tool. A way to keep track of ourselves and make sure we follow the standardized work routines we have agreed upon. It is a way to find the problem without having to find a scapegoat. It is just a way to discuss how the operations works." /Anesthetic nurse

The accumulated deviations statistics also helped the staff realize that the same deviations tend to happen repeatedly and, hence, are often not caused by individual mistakes, but by underlying structural reasons. Discussions became more focused on *why* deviations occurred. Yet another positive aspect brought forward by our interviewees, is the system's ability to delegate responsibility of the following of standards. It is perceived to be a good step to increase the awareness of and involvement in the new work routines.

"There were many people like me who had not worked with this routine before but who easily picked it up and got more committed to follow the standards." /Anesthetic nurse

Entanglement 5 and 6: Introduction of Digital Result Board

The most commonly reported deviation that the new reporting system brought the staff's attention to is patients arriving for surgery not sufficiently prepared by another ward. Specific examples include patients who are not showered, arriving too cold or who are not equipped with a urinary catheter. This results in delays, sometimes up to several hours. Several interviewees explain the importance in finding sufficient systems and routines to report deviations across wards on a daily basis:

"It makes a big difference if the catheter is already in place when the patient arrives. Every minute of delay means a lot because everyone's work is interlinked." /Surgical nurse

"It's really important that the responsible unit is informed. Currently, we report deviations and are happy that we have established that as a practice but we have no routines to ensure that it actually reaches the person responsible and that it results in improved work standards." /Anesthetic nurse

The latter quote from an highlights the challenge of finding efficient communication paths throughout the organizational hierarchy and to ensure that the problem, not only reaches the person with the resources and mandate to fix it, but also that the staff concerned with the problem receives feedback on its status. To keep the large and rotating staff group engaged and motivated to pursue the change efforts, in particular the routine of deviation reporting is acknowledged as one of the most important challenges. Once again the improvement team sees opportunities in developing the digital visualization board to give feedback on performances and thus enhance the motivation to report deviations among the staff.

In December 2012, the improvement team together with the SSDU systems developer, began developing a digital result board in an attempt to increase the staff commitment and motivation. The board is a TV-like touch screen showing a menu with links to key figures, the previous week's results and deviations, and an overview of the standardized process. One menu link lists suggestions raised by the staff to be discussed by higher management and ongoing improvement projects led by the operational improvement team.

The screen, installed in February 2013, was placed in the coffee room where the staff gathers for the daily morning meetings. The Flow leader explains that its intended purpose is to give the staff an overview of the ward's performance and since they are showing good results compared to their targets, he believes it will have a positive effect on the staff's motivation to keep working according to the new standards.

An Anesthesiologist, also a member of the improvement team explains that the screen works as a reminder and an encouragement to "keep up the good work" and as a way to introduce new initiatives to the staff. For example, they have not yet started to work according to a Lean work method called PDSA (Plan-Do-Study-Act), a method that builds on the principle of continuous improvement and is intended to guide the work

teams through cycles of problem-solving. However, the Anesthesiologist argues that by including it in the menu on the screen, we make it an explicit ambition and plant it like that in the minds of the staff.

"We can only work with what is visible. It's like, if it's not on the screen, it doesn't exist at all." /Anesthesiologist

A surgical nurse explains that it is encouraging to see how suggestions for improvement from the operational staff are escalated from discussions on the operational floor to managers with the resources and mandate to take measures.

"It works as an assurance that our efforts matter and that continuous improvement is not just a nice word." /Surgical nurse

Analysis

In this section, we first discuss how visualization artifacts can facilitate integration of a new institutional logic in operational practices. We also address an important discovery emerging from our iterative analysis process, namely how rejection of one technology may influence the constitution and entanglement of another technology.

The Sociomaterial Integration of Institutional Logics

From the institutional logics perspective, individual focus of attention is shaped not only by top-down influences of logics present at the field level, but by bottom-up environmental stimuli (Ocasio 2011). Applying a sociomaterial lens, we view this environmental stimuli as an ongoing enactment of sociomaterial practices where agency, resulting from the entanglement of humans and technologies, reproduces and transforms organizational and institutional structures. Furthermore, the institutional logics perspective emphasizes situational changes in organizational contexts as opportunities for cognitive change, which in turn may lead to organizational and institutional transformation (Thornton et al. 2012). Translated into our model of sociomaterial entanglement, situational changes occur when a new routine or a new technological feature is adopted and perceived as either an affordance or a constraint and intentions to either develop new routines or a new technologies arise.

Our empirical presentation described the emergence of five situational changes (entanglements), each directing the staff's attention on particular features of the operations and providing occasions for the staff to make sense of the new Lean work practices. By focusing on how affordances and agency emerge in these entanglements we show how the way visualization artifacts shape individual focus of attention can facilitate integration of a new institutional logic in operational practices.

The first agency emerging as a result of the implementation of the digital visualization board is the *visualization of work flow*. Except mirroring the operational reality by visualizing an overview of the workflow, the digital board also constructs the operational reality by visualizing information that was previously hidden or hard to comprehend because of its unstructured and fragmented nature. Although the operational staff has been introduced to the Lean principle of flow efficiency in presentations and standard handbooks, they have not yet been able to grasp the meaning and consequences of it in their own everyday practice. The digital board's visualization of work flow allows all written standards, principles and checklists to acquire a visual form that shapes and informs the meaning of the words they contain and presents the principle of flow efficiency as something concrete, understandable and possible to achieve. The visualization of work flow constructs the operational staff's reality in a way that broadens the staff members' attention from resource efficiency - utilizing their own time in an efficient way, to flow efficiency - utilizing their time to achieve an efficient flow of the patient.

The second agency giving rise to perceived affordances is the *accumulation and visualization of statistics* which emerges with the development of the deviation reporting functionality of the digital visualization board. While the previous routine of manually reporting deviations on the whiteboard was perceived to not give enough robust data for analyzing and deciding on measures, the digital deviation reporting functionality enables storage and retrieval of accumulated information about deviations. In the same way as the visualization of work flow constructs the operational staff's reality in which the flow of the patient replaces the individual work task as the focus of the staff members' attention, the visualization of accumulated deviations changes the staff's perception of deviations, from a view of them as individual mistakes to an understanding of deviations as caused by structural problems. The enhanced storage,

retrieval and visualization of deviations afforded by the new reporting system allows for a better understanding of the Lean principle of team-based problem-solving and facilitates the establishment of it as a core principles for organizing activities in the operations.

The third and final agency emerging as a result of the introduction of a new digital result board is the *visualization of operational results*. The efforts of the improvement team representatives to encourage and motivate the staff to keep following the standardized work routines and report deviations did not have great effect, much due to the staff's perception that their efforts did not lead to tangible results. However, the digital result board's visualization of key operational figures compared to its targets and over time drew the staff's attention to the positive result development and furthermore, strengthened the awareness of common operational targets based on Lean principles. The feature in the menu listing suggestions raised by the staff to be discussed at higher management levels and ongoing improvement projects led by the operational improvement team, serves as an assurance that the staff's efforts matter and that the Lean principle of continuous improvement is a possible strategic guide. The visual aspect of the digital result board allows firstly for a certain immediacy, the central message is immediately processed, and comes across instantaneously and memorably, and secondly for hidden and fragmented information to be presented to the observer as an arranged totality of meaningful parts. The digital result board affords a retrieval and presentation of data, which strengthens the Lean logic of continuous improvement.

In summary, our analysis of the agencies and affordances emerging throughout the process of sociomaterial entanglements show how visual representations not only express or represent reality, but also assist in constructing it (Meyer et al. 2013). In the sociomaterial reality construction emerging from the use of the digital visualization board, the deviation reporting feature and the digital result board, the Lean principles of flow efficiency, team-based problem-solving and continuous improvement are core principles in the operational practice. While the Lean logic has not previously challenged the professional logic as a reference point to understand and act in the operations, the visualization artifacts construct the operational reality in a way which reconstitutes the Lean principles, from alternative ways of organizing, to the most effective ways to organize operational activities to achieve the staff's professional goals. In other words our study shows how a technology which affords multiple logics and which is adopted based one logic, can shape focus of attentions and sensemaking towards a second logic and thereby drives institutional change.

Orlikowski (2007) argues that sociomateriality represents the enactment of a particular set of activities that meld materiality with institutions, norms, discourses, and all other phenomena we typically define as "social". We find the metaphor of melding useful to understand how the entanglement process of the ward emerges and develops, but, as hobby gastronomes we would like to take Orlikowski's metaphor one step further by invoking the analogy of how to make a successful mayonnaise. Like many other culinary preparations, mayonnaise is an "emulsion", a special combination of water and fats. Usually, when we add a few drops of oil to water, it forms little circles. However much we mix them together, they won't bind together. Nonetheless there are substances, known as emulsifiers, which can perform this miracle. The ingredients of mayonnaise do indeed include oil, and an aqueous component, which can be either vinegar or lemon. To bind the two, egg yolk is used as an emulsifier, as it is rich in surfactants: molecules with two ends that attach to the water and oil molecules like glue. By adding them to the mixture and whipping vigorously, a mayonnaise is created, which to the naked eye looks perfectly homogeneous.

In the same way as the oil naturally does not mix with the vinegar, the operational practices at the emergency surgical ward, permeated by the dominant logic of medical professionalism does not easily mix with Lean practices, founded upon a partly contradictive logic. The staff does not completely understand the purpose and do not want to conform to the new standardized work routines. As a result, the Lean principles do not initially get integrated into everyday operational practices, or to use our mayonnaise metaphor - the sauce is initially curdled. However, with the implementation of the visualization boards, the Lean logic gets introduced to the practice in a way that makes a mix of the two logics possible. The visualization boards work as the emulsifier that attaches to the Lean and the professional logics like glue and makes the sauce homogeneous. In the same way we cannot separate the yolk once it has been added to the mayonnaise, we cannot separate the material from the social in the operational practices of the ward. The staff's perception of Lean is bound to their use of the visualization artifacts, which in turn keeps reconstructing the operational reality. Rather than attributing agency either to individual actors or particular technologies, capacities for action are in this case best understood as relational, distributed, and enacted through ongoing sociomaterial practices. Opportunities for agency and change provided to individuals by institutional contradictions emerge in sociomaterial practices in which social and material agency are inseparable and mutually

constitutive. The agency manifested in the staff's action is not separable from the technology capable of shaping how they understand and act in the operations. Hence, the technology is acting with the staff and meanings and materialities are enacted together in everyday practices (Feldman and Orlikowski 2011; Introna and Hayes 2011)

How the Rejection of one Technology Constitutes Another

While the medical staff who are not members of the improvement team primarily draw upon the professional logic to interpret the new technologies and work routines, the members of the improvement team have gained a deeper knowledge about the principles of Lean and how they can be applied in the operations, and thus, have developed incentives and motivation for elaboration and development of the principles underlying the professional logic. The Lean logic has started to guide their focus of attention by shaping what problems and issues they attend to and what solutions they are likely to consider in decision-making (Thornton and Ocasio 2008). However, this focus of attention does not represent a shift away from the logic of medical professionalism; rather, it constitutes a diversification of available logics for the staff to make sense of and act in the operations. For example, when searching for a new way to support the routine of deviation reporting, members of the improvement team draw on their experiences of using both the improvement board and the digital visualization board. While the improvement board introduces deviation reporting as an idea and a method to improve operational work practices, the digital board, because of the staff's perception of it as affording goals inscribed in the professional logic, becomes the focus of the staff's intentions to develop a new routine. The negative experience of using the improvement board works as a common reference point for discussions about the actual purpose of deviation reporting and how the routine, and possible technological artifacts supporting the routine, can be customized and used to support the goals of the ward's operations. These needs and goals are formulated and discussed in the improvement team under the guidance of both the lean and the professional logic and the outcome is a digital reporting routine affording goals inscribed in both logics.

In this regard, the rejection of the improvement board is not to be seen only as a failed implementation. Since the operational staff is drawing on their experiences of using the improvement board when developing the idea of the new deviation reporting system, the constraints experienced with the improvement board contributes to the successful development and implementation of the digital reporting feature. In other words, the rejected technology shapes the attention and intentions of the staff in ways which affect the parallel, successful implementation of the digital reporting system. The implementation of the visualization boards cannot be seen as separate processes, instead they are interlinked in such a way that affordances and constraints perceived in one process influences the affordances, constraints and intentions formed in another. Hence, an artifact which does not become embedded in practice and thus part of the, in Leonardi's terms, "organizational infrastructure" long-term, may still influence actions and lead to development of other technologies. Thus, our second contribution in this paper is to show how the perceived affordances of a technology are created from the experience of using several different technologies and how the rejection of one technology simultaneously can constitute another.

Moreover, this finding highlights how opportunities for agency and change, provided to individuals by institutional contradictions, emerge in sociomaterial practices in which social and material agency are mutually constitutive. Although the improvement board is currently standing in a corner of the ward, not used by anyone it is still is part of the sociomaterial practice, shaping human cognitions and actions through the staffs' stored experiences of using it. The rejection of the whiteboard shows that the board is not only sociomaterial while enacted in practice, but also after it has been rejected by the staff it is part of the sociomaterial practice, shaping the staff's understanding of the Lean logic and what it means and should mean in practice. In line with previous research (Introna and Hayes 2011), this suggests that through our entanglement with technologies we are their constitutive context as much as they are our constitutive context. While the staff constitutes the whiteboard through their interpretation of it as useless and inadequate, the whiteboard also constitutes the staff by forming their intentions and understanding of what Lean practices means. Only if we view materiality as integral to human experience – i.e. making sense with technology and not of technology, we can understand exactly how and why the implementation and adoption of new routines and technologies emerge at the ward.

Discussion and Conclusions

The sociomaterial lens has proven useful in explaining how organizational and technological change are interwoven (Leonardi 2011) and how the social and the material are entangled in practice (Orlikowski 2007) but it has not sufficiently accounted for and linked institutional macro-structures with underlying interpretive processes by which these processes and practices occur. Nor has previous research fully explored how sociomaterial practices at the micro-level emerge and develop in complex institutional contexts influenced by multiple and partly conflicting norms, beliefs and guiding rules (Battilana et al. 2009; Meyer et al. 2013; Orlikowski and Barley 2001). We argue that the perspective of institutional logics, provides a promising means to fill this gap. Accounting for both the automatic taken for granted behavior of individuals and for the active involvement of social and material actors in changing institutions, our intention in this paper is to deepen our understanding of how sociomaterial practices emerge and develop over time.

Our study contributes to the literature on both institutional/organizational change and sociomateriality. Firstly, by showing how one technology that affords multiple logics and is adopted based on one logic, can shape human actors' focus of attention and sensemaking towards a second logic and thereby drive institutional change. Contrasting a human-centric view, in which the social agent (i.e. the human) makes sense of the material (i.e. the technology) (Barley 1986; Orlikowski and Gash 1994) our study emphasizes how sensemaking and technology use essentially constitute a sociomaterial performance in which material and social come together as one (Orlikowski 2007). We argue that in the same way that we cannot understand institutional change without understanding the role of agency, we cannot understand agency without understanding its inherent material dimension.

Secondly, our analysis of how material artifacts, despite implementation failures or other forms of non-use, can form essential components of the sociomaterial assemblage, provides deeper insight into the intricate ways in which the social and the material are inextricably intertwined. While most IS implementation studies have focused on the affordances and constraints perceived by users of one specific technology (Leonardi 2007; Leonardi 2011; Volkoff et al. 2007), this study highlights the importance of studying development, implementation and use of assemblages of technologies to understand how perceptions, intentions and actions are shaped in practice.

On a more general level, our contributions also demonstrate the importance of viewing agency and intentions emerging in sociomaterial entanglements as irreducible to any one actor (Introna and Hayes 2011; Orlikowski 2007). While the unpredictability of organizational consequences arising from introduction of new technology has been previously highlighted (Orlikowski 1996; Robey and Boudreau 1999), our study shows how agency emerges in complex and non-deterministic sociomaterial entanglements in which social actors draw on previous or parallel attempts to introduce new practices and technologies. The values, goals and priorities of actors cannot be reduced to their attributes, roles or functions but are emergent in the ongoing co-constitutive relation between all human and non-human actors (Introna and Hayes 2011).

In summary, our study offers two contributions. Firstly, we show how the way visualization artifacts, entangled in sociomaterial practices, can shape individual focus of attention and thus facilitate the integration of a new institutional logic in operational practices. Secondly, we show how the perceived affordances of a technology are created from the experience of using several different technologies and how the rejection of one technology simultaneously can constitute another. Finally, our study suggests that additional potential is to be found in mutually informing and blending the research streams on institutional logics and sociomateriality.

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