Beyond commodification of knowledge in IT-mediated organizations

A literature review on knowing – in – practice

Freya Johansson
**Abstract**

Tacit knowledge transfer remains a challenge within the field of IS. This literature review therefore chooses to view knowledge in a different way: as relational and embodied, where humans as well as non-humans have equal agency over the affordances and constraints related to knowledge. Using a sociomaterial lens, the research findings on tacit knowledge in an organisational environment are explored in answering the research question "How can tacit knowledge be understood from a sociomaterial perspective?" The contributions are that knowledge in white-collar work is surprisingly often embodied and tacit, and that IT has the potential to play a key role in knowledge translation, as a boundary object between networks. This thesis thereby concludes that practice-based knowledge translation is a more fruitful approach in passing on tacit knowledge in organisations, because it takes into account the unpredictable, embodied and site-specific nature of knowing - in – practice.

**Keywords:** Sociomateriality, embodiment, tacit knowledge, knowledge translation

**1. Introduction**

Knowledge management is a highly relevant contemporary topic and remains a key success factor for organisations in the networked age: "In an economic system where innovation is critical, the organizational ability to increase its sources from all forms of knowledge becomes the foundation of the innovative firm." (Castells 1996, pp. 160).

Scholars have up to this date focused on the opposition between tacit and explicit knowledge as a starting point for theorising about knowledge transfer (Sallis and Jones, 2002). In this context tacit knowledge is generally referred to as an individual, cognitive trait that needs to be extracted in order to be transferred (Nonaka, Ryoko & Noboru, 2000). In research as well as for practitioners this extraction process continues to be a hard nut to crack.

The field of IS is no exception; there are many examples illustrating failures in knowledge transfer that has had significant ramifications, often applying an IT-driven approach (Akkermans and Van Helden, 2002; Lam 1997; Newell, Scarbrough & Swan, 2001; Swan, Newell & Robertson, 2000). This literature review contests the above mentioned views and instead explores a relational approach to organisational learning as well as knowledge transfer, perceived through a sociomaterial practice lens (Feldman and Orlikowski, 2011; Nicolini, 2011; Sandberg and Tsoukas, 2011).

The theoretical framework of sociomateriality as well as the notion of knowledge management are areas of interest in the field of informatics, as searches in the IS database ACM reveals. The matter of embodied knowledge has been given some previous scholarly attention, primarily focused on physical, manual labour such as dancing, nursing or roofing.
However, research on embodiment of high-order cognitive work, so-called knowledge work (Drucker, 1986) is still lacking (Gärtner, 2013).

Furthermore, in conducting database searches on the selected keywords for this study, I discovered that not many scholarly efforts have combined the fields of informatics and pedagogics in order to synthesise the findings about tacit knowledge in organisations perceived with a sociomaterial practice lens, which subsequently is the gap this paper aims to fill.

As a scholar of pedagogics as well as informatics, I have always had a deep fascination for organisational learning mediated by IT. After having studied several epistemologies related to adult learning I perceived the practice based approaches, drawing from concepts of Schön (1983) as well as from sociocultural learning theory (Säljö, 2014) as particularly interesting as they offered a more emergent perspective on workplace learning compared to cognitive or behaviouristic views.

An emerging ontological standpoint, with roots in Bourdieu (1980/90) and Goffman (1959), got further enriched with studies in informatics, whereby I discovered Actor Network Theory as well as Sociomateriality which subsequently made me conclude that a sociomaterial practice lens (described in the following chapter), would seem the model with most explanatory capacity in the field of research intersecting pedagogics and informatics. Why? Because notion is taken of the situated, unpredictable interplay between agents and materials framed by practice, rather than by abstract scientific theories.

The structure in this paper is as follows: it begins with related research positioning this thesis within the area of concern. The next chapter outlines the chosen research method, followed by a literature review investigating sociomateriality and tacit knowledge in a heterogenous array of organisational settings, answering the research question: How can tacit knowledge be understood from a sociomaterial perspective? This in turn is followed by a discussion addressing the implications of the findings of this review for the field of knowledge management within IS.

The paper ends by looking ahead at possible streams of future research.

2. Sociomateriality and the practice lens

In this section the related research within sociomateriality and the practice perspective is described, leading up to the research method in the following chapter.

2.1 Sociomateriality

Sociomateriality is not a theory in itself but a framework with a unifying relational ontology, which is in contrast to a substantialist ontology gives the material and the social the same possibilities for agency. Sociomateriality has gained growing importance in the field of IS since it has been recognised that a dualist model between the social and the technological is no longer sufficient to account for the complex ways that humans and IT are engaged and entangled (Cecez-Kenanoviz, Galliers, Henfridsson, Newell, & Vidgen, 2014). Sociomateriality is closely related to practice theory, which will be explained in the following section. An exhaustive account of sociomateriality will not be provided in this brief overview.
due to space constraints. Instead I will describe the roots of Wanda Orlikowskis sociomaterial perspective, which is also the theoretical backdrop for this review on knowing-in-practice. To set the stage, I begin with a quote from Orlikowski and Scott:

*Work practices are inherently sociomaterial, and so to understand work, we must understand its sociomaterial (re)configurations. The implications for organizations are particularly important; these practices don’t just mediate work, they perform organizational realities. (Orlikowski and Scott, 2008, pp. 467).*

The view on sociomateriality represented by Orlikowski has its philosophical roots in Giddens structuration theory (Giddens 1984) as well as Actor Network Theory (Latour, 2005).

Drawing from Barad (2007) and her agential realist perspective it has a heavy accent on relationality, which entails that there are no boundaries between humans and materials; everything that takes place in life is derived from the relations we have within the webs of connections around us.

Furthermore, Orlikowski is influenced by Barads (2003) *agental cut*, which relates to what and who objects and people are in a specific situation, that could be compared with a snapshot photograph of an otherwise constantly changing discursive - material practice called *agental intra-action* (Cecez-Kenanovic et al, 2014). These rather complex post-humanist concepts fits under the larger umbrella *performativity*, which I will explain further in the result section.

From Orlikowskis own account (Orlikowski and Feldman, 2011) sociomateriality in her view originally came about as a reaction against the IT-driven approaches towards technology in the workplace. As Orlikowski herself noted, the actual appropriation of the technology looked altogether different in reality compared to how it was intended to be used. She also noticed a significant discrepancy between the current theories of technology implementation and the emergent, exploratory way that her and her colleagues conducted programming and design on a daily basis. What Orlikowski found lacking in the theories was accounts for unintended uses of technology such as serendipitous discovering of work-arounds or new coding solutions. It was on the basis of this gap between practice and theory about IT-implementation that Orlikowski saw the need for a framework that embraced the human agency as well as the technological, which she had realised were inseparably intertwined in practice (Orlikowski and Feldman, 2011).

In summary, the previously mentioned relational ontology influenced by Barad (2007) and Actor Network Theory (Latour, 2005) are perhaps the most significant trait of Orlikowskis sociomaterial perspective, since it repeatedly stresses that humans and non-humans have the same grounds for agency in networks, and that the negotiations about this agency takes place within a constant process of emergent practice, that in turn is creating and recreating organisational reality.

The following section elaborates on the neighbouring practice perspective, applied on knowledge.
2.2 The practice perspective on knowledge

A practice perspective on knowledge means that knowledge is context-specific and inseparable from practice (Nicolini, 2011). I will begin by illustrating the flow knowing - in - practice by Gherardis (2006) framework that clearly shows the dynamic nature of the mutual constitution view of practice and practicing.

![Diagram of the mutual constitution of practice and practicing]

To clarify the figure somewhat I will explain three of the terms Gherardi (2006) uses to depict the texture of workplace learning in figure 1, limited to the collective levels of knowing: Memory work refers to the self as a historical product, formed by cultural as well as social practice. A texture breakdown refers to an interruption in the normality of practice, such as
a computer failure. A *situated curriculum* means the site-specific opportunities for learning for newcomers in any given community of practice.

Practice theory being relational, entails mutual constitution and therefore that the world is in constant creation (Feldman and Orlikowski, 2011). This mutual constitution is not without tension however, but instead riddled with inequalities and power struggles, where power is being perceived as a fluid two-way force from a Focauldian perspective.

Knowing - in - practice equals embodied, tacit knowledge, as we know *how* tacitly and *how to perform* according to the requirements of the context with our bodies.

The practice perspective, just like sociomateriality is a framework with different streams rather than a fully grown theory. It views the world through the perspective of practical rationality instead of a scientific rationality, which for research can entail studying organisational phenomenom using a wide range of qualitative methods such as 'life world interviews', 'qualitative research diaries' or 'instructions to a double' perceived trough a sociomaterial lens (Sandberg and Tsoukas 2011).

Practice theory can be traced to Weber, Heidegger, Wittgenstein and Bordieu (Sandberg and Tsoukas 2011) as a way to order the world. It can be explained as the things we do without thinking about them, termed absorbed coping (Dreyfus, 1995). It is only when a breakdown occurs, that we can unveil the practice, such as when technical aids fail to function properly (Sandberg and Tsoukas 2011).

Nicolini (2011) accentuates the site-specific logic of practice, meaning that knowing must be studied in real-time on the site of practice with awareness of the texture of relations that binds it together with not just one, but a nexus of practices.

Just like sociomateriality, practice theory is based on a relational ontology, as an alternative to a subject/object ontology.

Temporality is important in practice theory, since activities that are repeatedly conducted in essence shape the social world. An important part of temporality is anticipation, meaning that we are always thinking ahead at the next step when we are immersed in practice, which is also how we embody expertise (Nicolini, 2011).

A relational ontology in turn entails consequentiality, which means that our actions, interwoven in a web of materials and technologies, shape the world and therefore bear significance. Knowing and learning are emergent, and therefore hard to control. Practice theory is against dualism, such as in the subject/object view, but for theoretical purposes things are still sometimes divided to aid analysis (Feldman and Orlikowski, 2011). Such is the case in this paper as well.

This paper takes the radical view on practice-based knowledge which emphasises the embodied nature of practice and the interplay between human as well as non human actors (Sandberg and Tsoukas, 2011). This is a perspective in direct opposition to the notion of knowledge as an entity that can be possessed. Instead knowledge is viewed as emergent, site-specific, constantly changing and connected to communities such as IT-mediated networks.

The next section describes the method used in this review.
3 Method

In this section I provide a description of the structured stepwise process that was undertaken in order to narrow down the search scope and at the same time ensuring that all relevant research on the topic of this review got encircled. The chapter ends by presenting the four key-concepts that guided the analysis of the data. As basis for the stepwise process of the data collection Webster and Watsons (2002) recommendation for a literature review within the field of IS was used. This included four steps: creating an oversight, screening for keywords, reviewing the citations in the compiled articles to generate more articles and finally using a larger database to uncover articles citing the chosen ones from the previous steps.

Additionally I was guided by Brymans (2011) more general advise on the genre of literature reviews within the social sciences. In using and applying the four chosen key-concepts I am drawing from Newells (2015) approach, wherein she uses a framework of three concepts (enabling contexts, processes and content or purposes) to guide her review over recent IS literature on knowledge.

3.1 Creating an oversight

Working with the analogy of a funnel, I began by conducting a broader search in major cross disciplinary databases on the keywords sociomateriality and tacit knowledge. The chosen databases were relevant for the research domain, with the exception of Google scholar. This search provided a large number of hits in Google scholar and ACM and a smaller number of hits in the rest of the databases, which indicated that there might be a gap in the research within this topic, as mentioned in the introduction.

<table>
<thead>
<tr>
<th>Library</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Google Scholar</td>
<td>2020</td>
</tr>
<tr>
<td>Ebsco Host</td>
<td>11</td>
</tr>
<tr>
<td>Science Direct</td>
<td>17</td>
</tr>
<tr>
<td>ACM Digital Library</td>
<td>412701</td>
</tr>
<tr>
<td>Scopus</td>
<td>2</td>
</tr>
</tbody>
</table>

*Table 1 Results from a general database search on keywords sociomateriality and tacit knowledge*

3.2 Focused screening for keywords

In line with Webster and Watsons (2002) recommendation for a literature review within the field of IS, the following step was a more focused screening of abstracts, introductions and conclusions of the articles found in the chosen databases. Google scholar and ACM were hereby exempt since the first provided too many non scholarly hits and the latter provided hits with less relevance to the cross disciplinary approach of this review. The Umeå university library search engine was included as a safety measure to ensure that no relevant
articles from neighbouring research fields or databases got overseen in the intended search scope. Only scholarly and peer reviewed material were included to ensure high quality data.

This focused screening on the sets of keywords sociomateriality and tacit knowledge, and sociomateriality and embodied knowledge provided 11 hits as a starting point of this review: nine articles, one literature review, one dissertation and one editorial. The editorial in turn was only used to gather three more articles, which is why it is not included in the datamaterial.

<table>
<thead>
<tr>
<th>Library</th>
<th>Initial results</th>
<th>Results after initial review</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ebsco Host</td>
<td>15</td>
<td>3</td>
</tr>
<tr>
<td>Science Direct</td>
<td>17</td>
<td>5</td>
</tr>
<tr>
<td>UB library search</td>
<td>69</td>
<td>2</td>
</tr>
<tr>
<td>Scopus</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>103</td>
<td>11</td>
</tr>
</tbody>
</table>

*Table 2 Results after focused screening of titles and abstracts on keywords sociomateriality and tacit knowledge as well as sociomateriality and embodied knowledge in chosen databases.*

As Webster and Watson (2002) advises, it is important to not only look at the IS field in the database search, since the field itself is interdisciplinary. This point being especially relevant for this review as it is cross disciplinary in nature. Therefore efforts were made to include the largest educational database ERIC through using the search engine EBSCO Host.

**3.3 Going backwards**

Next step, following Watson and Webster (2002) is to go backwards by reviewing the citations for the articles provided in step 1 to provide prior articles worth considering. By reviewing citations I started to discover patterns of authors that were cited repeatedly, which led me to collect an additional 6 articles and one book. In this process I also ensured that I had found the key authors in the field by checking how many times their contributions had been cited by other scholars. The citation count was a minimum of 181 times and a maximum of 3590 (in the case of Orlikowski). In this step I found the most prominent researchers within sociomateriality and practice theory that laid the groundwork for the research background on sociomateriality, the practice perspective and my four key concepts.

**3.4 Looking forward**

This in turn, led me to step 3 which according to Watson and Webster (2002) entails looking forward and using a larger database, in this case Google Scholar, to uncover articles citing the chosen ones from the previous steps. I chose to track citations only from the first round of
keyword searches since the most cited articles within the broader field of sociomateriality and practice theory from the second round provided too general results. This third round yielded one additional article and thereby ended my data collection, which after a few iterations ultimately resulted in 13 articles, 1 literature review, and 1 book, in total 15 hits.

The datamaterial spans from many different organisational settings, such as healthcare, product design, construction, science, car-manufacturing and railway incident support. The principle for inclusion was thus not the type of organisation but to what extent tacit and embodied knowledge and knowledge transfer could be identified. I also did not find it pertinent that all the organisations in question relied heavily on IT to perform their work, because of the fact that I have instead chosen to apply the results of the review on an IT-setting in the discussion section of this review.

The concept matrix found in the end of this chapter is used to illustrate the presence of the key concepts that emerged from the literature review.

3.5 Key concepts
The findings in this review were thus ordered using four key concepts. These concepts emerged from several readings and note-taking from the articles and the book. Using an inductive, qualitative approach the concepts were changed a number of times as my knowledge on knowing-in-practice deepened. Initially the concepts were sociomateriality, the practice perspective on knowledge, tacit knowledge and embodiment but in the process of analysis I instead decided to use sociomateriality as well as the practice perspective on knowledge in the related research section (2), since it provided a more logical structure of the thesis. In reviewing the data repeatedly, I noted that the most common themes under the sociomaterial umbrella were embodiment, tacit knowledge, knowledge transfer and performativity, which were therefore used as themes instead. The last iteration included changing knowledge transfer to knowledge translation, as it better describes the knowledge sharing that is taking place within the sociomaterial practice lens and moreover relates to the conclusion and discussion more accurately.

3.6 Reflections on method
Having read some other literature reviews within knowing in the field of IS (Marabelli and Newell, 2012; Cecez-Kemanovitz et al, 2014; Robey, Bodreau & Rose, 2000; Newell, 2015) it is noticeable that there are as many ways to design a study of this kind as there are reviews, which in turn opens up for many choices and decisions that the author is confronted with.

This review has been guided by Webster and Watsons (2002) paper on writing a literature review within the field of IS, however, it is from 2002 which means that there might have been developments in style and expression since then. On the other hand I have also had Brymans more general advise on literature reviews within qualitative research (2011) as a secondary source.

Additionally, in selecting the articles for this review I have strove to use as fresh research as possible, with the majority of the datamaterial dating between 2011 and 2016. The two sources of literature of an older date (Gheradi 2006 and Orlikowski and Scott 2008) are very frequently cited works within the sociomaterial practice lens research and the
A review would therefore seem incomplete without them, which is why they also are included.

<table>
<thead>
<tr>
<th>Articles/books and Source</th>
<th>Research Setting</th>
<th>Theoretical Grounding</th>
<th>Key concepts</th>
<th>Research Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rowell, 2015 Doctoral Dissertation in Education</td>
<td>Trauma Surgery</td>
<td>Sociomateriality Orlikowski and Scott 2006; Leonard, 2010</td>
<td>P, E, T, K</td>
<td>Qualitative Exploratory Study</td>
</tr>
<tr>
<td>Pritchard and Symon, 2014, Management Learning</td>
<td>Rail Engineering</td>
<td>Sociomateriality Orlikowski and Scott 2006; Leonard, 2010</td>
<td>K, T</td>
<td>Qualitative Exploratory Study</td>
</tr>
<tr>
<td>Artcles/books and Source</td>
<td>Research Setting</td>
<td>Theoretical Grounding</td>
<td>Key concepts</td>
<td>Research Method</td>
</tr>
<tr>
<td>--------------------------</td>
<td>------------------</td>
<td>----------------------</td>
<td>--------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Newell, 2015, Journal of Information Technology</td>
<td>n/a</td>
<td>Practice Perspective on Knowledge Latour, 2005; Orlikowski and Scott, 2008; Nicolini, 2013</td>
<td>K, T</td>
<td>Literature Review</td>
</tr>
<tr>
<td>Sandberg and Tsoukas, 2011, Academy of Management Review</td>
<td>Management/Organizational Studies</td>
<td>Practice Theory Nicolini, 2009; Schatzki, 2002; Orlikowski and Scott, 2008</td>
<td>K</td>
<td>n/a</td>
</tr>
<tr>
<td>Gherardi, 2006, Book</td>
<td>Construction industry</td>
<td>Practice Theory Weick, 1985; Polyan, 1962; Schatzki, 2002</td>
<td>P</td>
<td>Case Study</td>
</tr>
<tr>
<td>Orlikowski and Scott, 2008, The Academy of Management Annals</td>
<td>n/a</td>
<td>Sociomateriality Suchman, 2007; Schatzki, 2002; Barad, 2003</td>
<td>P</td>
<td>Literature Review</td>
</tr>
<tr>
<td>Cecez-Kemanovitz et al, 2014, MISQ</td>
<td>n/a</td>
<td>Sociomateriality and Organizing Orlikowski, 2008; Leonardi et al, 2012</td>
<td>P</td>
<td>Literature Review</td>
</tr>
</tbody>
</table>

Table 3: concept matrix illustrating occurrence of key-concepts in the collected data, adapted from Webster and Watson, 2002 and Cecez-Kemanovic et al. 2014

4 Knowledge - in - practice and 4 key concepts

The research question in this review is answered with the aid of four domain-specific concepts. A common denominator is that all of them fit within the larger sociomaterial umbrella labeled the practice lens, presented in chapter 2. The main part of this chapter consists of a closer look at the body of research which constitutes this review wherein each of these concepts are simultaneously placed.

4.1 Performativity

The sociomaterial concept of performativity has its main sociomaterial propagate in Barad (2003) but can also be seen in the light of Goffman's (1959) performed self. The art of performing an occupational identity is not about learning the explicit tasks of the job-
description but to tacitly embody the *becoming* of a project-leader, researcher or a nurse. Performativity also entails performing of rules and codes, spoken as well as unspoken, within the organisation.

In the practice context where material and actors are ontologically equal, non-human actors have the same potential in performing practice as humans. Therefore the organisational reality is in constant co-creation through the relations between the actors in the network (Gherardi, 2006).

In two of the articles performativity is expressed in the sense of performing a professional identity within the workplace.

Learning to perform like a trauma surgeon entails learning to perform a authoritarian body, 'acting like a general' and strive towards a big measure of control. In Rowells (2015) study several participants referred to the surgeons as 'control maniacs'. This part of being a surgeon is not learned in the substantial number of years in medical school, but is gradually socialised, embodied and performed in practice coordinating surgeries.

In a similar way car body worker perform their identification with their job: "Little by little, workers embody their tasks, their gestures and their tools. Being a car body worker becomes more than a job; it defines their identity". (Bazin, 2013, pp. 386)

Performing knowledge is exemplified in one article, and illustrated in this example:

*Knowledge, in scientific practice, lies not in textbooks, but in successful replication of experiments. In this sense scientists perform science through the knowledge acquired by the body.* (Vitteri, 2013, pp 369)

Two of the articles are referring to performativity in the sense of performing organisational routines. In one case (Nicolini, 2011) a typical day of a telemonitoring nurse is described, which demonstrates how routines can be performed:

*Every nurse at G. knows that you report to work at 8 A.M. precisely, go to the cardiology ward, and put on your uniform. You wear a white coat and clogs. In your coat pocket you put a ruler to measure the with of the electrocardiogram (ECG) curves, a pen, a pencil, a highlighter, and a small notebook or agenda (or check that they are there).* (Nicolini, 2011, pp.607).

Similarly, gestures, or organisational routines are performed. Bazin:

*They develop their own style, their personal signature when performing the pattern (see theme 1) within a collective motion. In this way, the workers understand that the gestures itself carries a cadence, a rhythm of its own.* (Bazin, 2013, pp. 387).

One book and one article describes performing safety in different ways. In Fenwicks case the difficulty of performing of safety in a mental health emergency is illustrated, as a police officer with marginal training on this sort of situations is approaching a mentally ill person who is under the illusion that he is in the midst of the gulf war:
How to approach such a person? How is safe performed? James observes that even the back of his police vehicle can offer a safe place to calm a person in distress. (Fenwick, 2014, pp. 273).

Gherardi (2006) study exemplify how safety is performed from various perspectives on practice within the construction industry:

In other words, a ‘safe’ workplace - a ‘safe’ organisation - results from the constant engineering of diverse elements (for example, skills, materials, relations, communications) which are integral to to work practices of the members of an organisation. Safety, then, is knowledge objectified and codified in expertise and circulated within a web of practices. In order to exist it must be performed in, by and through safety practices, i.e. through discursive and material social accomplishments. (Gherardi, 2006, pp. 48)

One article describes performing the organisation by fashioning the body according to tacit contextual codes, that are so sublime that the actors perceive that their choice of clothing is based on their own personal sense of style (King and Vickery, 2013).

Lastly two articles provide a historical background on performativity and recommendations for future research within sociomateriality (Orlikowski and Scott, 2008; Cecez-Kamenovitz et al, 2014).

4.2 Knowledge translation

As previously stated, the most common view on knowledge within academia is the structural cognitive view, which means knowledge is perceived as entity in a persons head. The analogy of a hard drive could thus be used to explain how actors obtain and transfer knowledge.

Within knowledge management it is common to treat knowledge as a transactional business asset the same way as you would with money, this view is however bound to lead to failures in knowledge transfer, as addressed in the introduction of this paper. Knowledge transfer within the practice lens is labeled knowledge translation, which places emphasis on the fact that site-specific knowledge needs to be translated instead of transferred to another context in order to be successfully moved (Nicolini, 2011).

The word translation in this context originally derives from actor network theory (Latour, 2005) and means both transference and transformation. It includes both linguistic and material objects and is based on the premise that ways of knowing results from the movements of entities in time and space and the relations that are created between them in this process. Just like translating a language a little modification in the process is inevitable (Gherardi, 2006). An important factor in this context is the stabilisation of the above mentioned connections and the keys to this are interests and power (Nicolini 2011; Gherardi, 2006).

The stabilisation of a relationship in turn rests on the ability to translate other actors interests to the personal ones which is done by a process of negotiation. Gherardi: “Any translation is the result of the active work of an array of heterogenous entities that, as the process proceeds, either find a place or are locked into place.” (Gherardi, 2006, pp. 62).

The negotiation process itself rests on discursive practices and intermediaries, also called boundary objects. Examples of these are texts, images, contracts and money. The boundary
objects weave diverse interests together and align them. Knowledge translation via boundary objects therefore entails establishing new relations as well as keeping current connections in place (Nicolini, 2011).

Two of the articles represent failed attempts of knowledge transfer. In the case of the mental health emergency, the police officers and paramedics work together and translate each others knowledge. For example they use tacit skills in calming the person in question, or work together to make the most of each others presence, such as deciding whether it would calm or escalate the situation to bring in a police officer or a paramedic on the scene first. However, when the para-professionals such as police officers arrive to the hospital, the knowledge translation stops. The respondents express frustration about that their knowledge about what previously has taken place in the case is not asked for nor valued: "Jackson, the A&E psychiatric consultant, agreed that valuable knowledge brought by ‘pre-hospital practitioners’ about the incident history, home context, etc. was often simply not listened to in the emergency department.” (Fenwick, 2014, pp. 274). This article suggests that the hierarchical power structures, effectively dividing para - professionals and professionals are the main reasons for that.

The other example, also from the health care sector, suggests that the expert knowledge of trauma surgeons does not translate well to other departments within the same hospital, such as administration. Using the habitus concept, Rowell (2015) illustrates how the surgeons bring their habitus into the domain of administration and attempts to assert their usual behaviours such as authoritative leadership and quick solutions to multifaceted problems, which in turn causes frictions and prevents knowledge translation.

However, there are also examples of more successful knowledge translation, in four of the articles. We will now look at a few examples of this.

The telemonitoring call between a nurse and her patient (Nicolini, 2011), is a case that is also referred to by Marabelli and Newell (2012), which shows how the nurse mediates knowledge translation between the patient and the doctors, by using a therapy sheet as a boundary object. The therapy sheet is effectively stabilising the different connections and at the same time making new ones. This view on knowledge translation emphasises awareness of the site as crucial for the translation process and differentiates between translation by contact and translation at a distance (Nicolini, 2011).

The difference between these two types of translation is that translation by contact takes place in the same space, such as a meeting between different stakeholders in the same room. Proximity, or "brushing" is what sets translation by contact apart from translation at distance. Translation by distance is on the other hand exemplified by the therapy sheet, that mediates knowledge from different geographical locations (the patient and the nurse) as well as different knowledge networks in a process which could be described as "knotting" or "weaving"(Nicolini, 2011).

Parolin and Matozzi (2013) describes knowledge translation as a process whereby embodied knowledge is performed in activity and thereby translated to the object through articulation as in this quotation regarding the crafting of a soft chair illustrates: "Carlo’s body become sensitive to softness together with the seat becoming soft..."(Parolin and Matozzi 2013, pp. 364).
The smartphone can also be used as an efficient boundary object in knowledge translation, as shown by Pritchard and Symon (2014). In this case the mobile phone photography works as an efficient boundary object between the mobile operating managers, or MOM’s, and their managers. This type of work necessitates efficient knowledge sharing since it is distributed between the field and the office, with the common goal to find out the cause of a incident related to the railway. The smartphone photograph is the point where knowledge sharing begins, as the MOM’s e-mail the picture of the incident to their superiors. The smartphone photograph at the same time acts as the basis for decision making: "Smartphone photography is positioned as the starting point to knowledge sharing and as enabling people to work together while apart." (Pritchard and Symon, 2014, pp 568). However, this translation is not without tension, as described in the beginning of this paragraph. The MOM’s express discontent with the increasing amount of time spent taking pictures, interfering with their regular work. They also state that their expertise knowledge is becoming devaluated in comparison with instant photo evidence. Resistance strategies emerge from these tensions such as some MOM's deliberately taking pictures in a bad light (Pritchard and Symon, 2014).

The last subcategory identified under the concept knowledge translation is theoretical background and advise about how to achieve knowledge translation. Three articles and one book fall under this theme.

4.3 Embodiment

Embodiment can be perceived from a variety of perspectives, in this review the term is used to describe tacit knowledge expressed through the body. It is closely linked to performativity in the sense that actors enact membership in their organisational communities by the way they express themselves physically, with gestures, clothing and manners. Taking a radical perspective on the practice lens material mediators such as IT can also embody knowledge which is how knowledge is expressed and translated in sociomaterial practices (Marabelli and Newell, 2012).

I have chosen to include embodiment in this review because it stresses the physical level of tacit knowledge that easily becomes forgotten in knowledge work, but still remains a crucial and very real success factor for actors participating in organisational learning and work socialisation.

Embodiment is a multifaceted expression, as the research shows. Five of the articles in this review depict embodiment according to the radical perspective, as knowledge is being expressed through tools and artefacts. Examples of this are when instruments such as the microscope, are becoming an extension of expert vision of the researcher and turned into an embodied mastery that cognition alone can not account for. This is demonstrated in that the researchers notice no difference between themselves and the equipment as they are immersed in practice:

*Thus Eva’s body re-orient itself, and her gestures, postures and movements are spatially reorganized to achieve a new order where the relationships between the artifacts and the body become linked.* (Vitteri, 2013, pp. 371).
Knowledge is embodied in machines in the surgical theatre through the equipment that produce vital sounds such as heart rate monitors and oxygen saturation that tells the surgeon the conditions of the patient. The surgeons do this by using their hearing, and they know tacitly when something does not sound right. This scenario also exemplifies how the expertise of the surgeon is dispersed amidst information technology and other materials, continuously co-creating knowledge, in a mutual constitution (Rowell, 2015). As Rowell points out, this sociomaterial assemblage simultaneously illustrates how fragile expert knowledge can be. A breakdown such as the failure of an important monitoring device would reveal the entanglement of practice and directly influence the behaviour of the surgeon, who would have to resort to manual routines and re-arrange the whole practice which depending on the severity of the breakdown could also endanger the patient. A similar case is in the telemonitoring of hearth patients, where the expertise skill lies in the combination of discursive and embodied activites:

One can also notice how the knowing shines through the bodily doings involved in telemonitoring. For example, the column on the right side of Table 1 shows that conducting a call constitutes a choreography in which the discursive and the non-discursive aspects blend seamlessly, constituting different moments of the same knowing (the nurse is even capable of hearing whether the recorder has been positioned correctly or whether because it is incorrectly positioned the the incoming trace will be full of “artefacts”, disturbances that make the ECG trace more difficult to interpret). (Nicolini, 2011, pp. 610).

Another example of embodiment is enacted through so-called gestures, which can be translated to organisational routines (Bazin, 2013). This study has its focus on the automotive industry and shows how a monotonous, strictly controlled work in the assembly lines also can contain creativity and self expression. The performance of gestures are regularities that several actors share and recognise, which provides sense and purpose to actions. Gestures express belonging to a community and to be able to perform them with ease and elegance is the tacit, embodied part of knowing - in - practice in this context:

At one point, the mastering merges the technique and aesthetics aspects of gestures and embodied artifacts so deep in the practitioner’s flesh that they become body parts. (Bazin, 2013, pp. 392)

Three of the articles addresses embodiment in the Focauldian sense, in the sense of disciplining the body into practice, whereas one article asks the question whether or not an organisation itself can be embodied. Embodying practice are covered in two of the articles and one article applies the embodied perspective on things as well as humans. The sort of embodiment of knowledge described in the latter case is not entirely straightforward to grasp, as the authors uses the term bodies for all types of human and non-human actors:

As we have shown such a process does not involve only Carlo and the seat or Giovanni and the metal structure, but also other bodies, present within the situation or just recalled from other situations (words, drawings, other artifacts, etc.) (Parolin and Matozzi 2013, pp. 364)
Lastly, one article provides an overview covering six types of embodiment (Gärtner, 2013). The first one is brute embodiment, where the body is perceived as hardware for the cognitive functions of the mind, derived from Taylorism as well as Cognitivism. The second one being physiological embodiment whereby notion is taken of the neuro-biological body in terms of reacting to stimuli from the brain or the outside environment. The third perspective, enacted lived embodiment, entails that the body is not something an actor has, but rather that is lived and has capacity for perception and sense. The fourth type, intelligible embodiment in turn describes childhood bodily interactions with the world as a scaffolding for more complex abstract constructions such as mathematics or computing.

The fifth type of embodiment is situated embodiment which accepts that knowledge is affected by a socio-material environment, but places less agency in the human body. Lastly, the sixth perspective is social embodiment that has its focus on how social structures affect the body, and draws on Focault in that it acknowledges that disciplining of the body produces control. Gärtner (2013) ends this overview by suggesting the practice lens as a unifying perspective on embodiment since it offers:

...such an integral conceptualisation of cognition, knowing and learning in the flesh because they allow considering pre-reflective knowledge that is (literally) embodied in former and current, situated experiences, but also artefacts and social relations embedded in broader historical practices. (Gärtner, 2013, pp. 349).

The following section describes tacit knowledge, which is also closely related to the concept of embodiment.

4.4 Tacit knowledge

The practice perspective goes as far as suggesting that the division between cognitive and explicit knowledge is pointless, since it is much more accurately described as intertwined with practice. Orlikowski and Scott however (2008), still divides the social and material for the sake of analysis and i will in the same way make a dualistic distinction between more explicit and tacit forms of knowledge in this paper. The reason for this is that i believe that it is important to study the physical way of knowing - in - practice in order to find the answer to the research question how tacit knowledge with a sociomaterial interplay can be understood.

Tacit knowledge is a unique form of knowledge because it creates a memory imprint in our bodies, that is hard to describe or pass on. It is socially negotiated and expressed through the senses: hearing, smell, touch, sight and taste. Tacit knowledge is taken for granted agreements, for example the unspoken rule that it is dangerous to touch fire. Gherardi draws parallels between tacit knowledge and the aesthetic turn in organisational studies, that entails absorbing the ‘pathos’ of an organisation with your senses. The aesthetic dimension is personal organisational knowledge acquired through the senses that is collectively negotiated and impossible to describe verbally (Gherardi, 2006).
Tacit knowledge can also be exemplified in one's ability to drive: being a good driver does not require thinking, and it can not be passed on verbally. Instead it requires being in the present and continuously reacting to the obstacles and affordances of the road.

Tacit knowledge is in some of the datamaterial represented as one's ability to perceive the gestalt of an organisation, referring to the aesthetic dimension described above. One book and five articles belong to this category. An example of this theme is from King and Vickery (2013) who explore how tacit aesthetic knowledge can be understood as the ability to choose the appropriate clothes for a given organisational context.

In Vitteri's article (2013) the body of scientists represents a repository of tacit knowledge in the way that they learn to dissect mice and study stemcells under the microscope:

Knowing how to see how the cells are can not be learnt by oneself, but only by observing with others, both with the naked eye and the help of the microscope, aided by the glance and the help of others. (Vitteri, 2013, pp. 370)

The tacit knowledge of the scientist is further explained in the following quotation:

The construction of scientific knowledge occurs in the connection established in the laboratory between the scientists' observations and the linguistic categories created and used to name the physical world. Science is therefore seen as the tacit result of their training and the gestalt they develop through this process. (Vitteri, 2013, pp. 369)

On the other hand tacit knowledge can be perceived as unspoken commonly agreed upon statements as shown by Rowell:

Both of these comments demonstrate the tacit belief that if a surgeon's behaviour did not reinforce the psychological structure of the surgeon being in control of the situation and not in doubt, it could engender doubt from the patient and/or among the care team and thus potentially endanger the performance of the team. (Rowell, 2015, pp. 81-82).

Tacit knowledge can in the third case be perceived as expert knowledge that can not be articulated in words as in three of the articles. One example of tacit embodied knowledge is again from Vitteri (2013) and the way that researcher Elisa has learnt to feel on the mouse's belly whether it is pregnant or not, which avoids wasting the animals unnecessarily in the dissecting process.

By telemonitoring nurses in Italy a part of their job it is the ability to judge whether to call in a doctor to prescribe different medicines in a specific situation, and know how to relate to the different hierarchies within the hospital, not to offend anyone (Nicolini, 2011).

In mental health emergencies expert tacit knowledge is talked about in the following way:

These first response practitioners were often frustrated at not knowing what to do, but they must 'deal with it' as best they can. They talked of learning how to read what Gareth called a 'copper's nose' (Fenwick, 2014, pp.270).

The next section discusses the findings of this review, followed by a conclusion and suggestions for further research.
5 Implications of the practice turn for knowledge management within the field of IS

As this review has shown, dealing with organisational knowledge is not a straightforward process that can be reduced to extracting knowledge from inside somebody's head in order to transfer it. This view is old fashioned and does not apply to modern IT-mediated organisations anymore. An IT-driven approach, commonly applied in the field of IS, (Marabelli and Newell 2012), on the other hand lacks consideration for the human perspective of knowledge sharing and perceives IT as a miracle cure in succeeding with organisational knowledge sharing. This leads to failures since the social factors are not taken into account, as exemplified by Newell et al (2001) when a new intranet was deemed as solution for increased cross-organisational knowledge sharing but because of the way it was implemented instead got the opposite effect.

The sociocultural perspective (Säljö, 2014) does take both actors and materials in consideration but is also not not sufficient in accounting for the impact IT has on knowledge management because it perceives materials as tools and places humans at the forefront of agency. As this review has shown however, non-human objects such as smartphones, laboratory equipment and surgery supplies account for the knowledge - in - practice in as high extent as the knowledgeability of the actors, which makes the toolbased approach to knowledge management within the field of IS limiting. Furthermore, from a sociomaterial perspective, the material elements in the articles of this review are more accurately described as embodiments of knowledge, such as the microscope of the researcher. The tool based view does not account for these seamless extensions of knowledge in networks where the knowledge and practice are inseparable.

As previously exemplified, the sociomaterial networks are characterised by power struggles, which makes this perspective especially suitable in IS research and practice because it explains the influence IT implementations can have on social life and vice versa, without placing any of the actors at the forefront. A good example of this constant negotiation takes place between the MOMS and their smartphones (Pritchard and Symon, 2014). In this case the smartphone is no longer a mere tool, it is an actor containing more desirable knowledge than the mobile operating managers can offer since it provides instant picture evidence from incident sites rather than verbal accounts that may be open for misinterpretation.

As the developments within IT are becoming increasingly ubiquitous, such as the recent progress within the area of sensor technology (Newell, 2015) there is a need for a different epistemology on knowledge. In this case technology has surpassed the image of a tool, as sensors are most often unseen at the site of practice, and from a sociomaterial perspective hosts strong agency as is exemplified in various techniques of tracking and the societal implications these technologies bear with them (Newell, 2015).

The sociomaterial practice perspective views organisational knowledge holistically, and does not make a distinction between tacit and implicit knowledge. However, using
Orlikowskis (Orlikowski and Scott, 2008) division of constructs for analytical purposes, this review indicates that a significant part of knowledge in practice is tacit, embodied and hard to put in words, as in the case of the laboratory technicians studying stem-cells (Vitteri, 2013) or the craftsmen working on the invention of a chair (Parolin and Matozzi, 2013). This needs to be taken in account when theorising about knowledge transfer.

Knowledge transfer is a concept tightly coupled to knowledge management within the field of IS, and there have been many technological innovations aimed towards facilitating knowledge transfer, with various results (Newell, 2015). In order obtain a higher success rate within knowledge transfer it is time to perceive inter-organisational knowledge transfer with a practice lens (Marabelli and Newell, 2012).

This review has shown that transferring tacit expert knowledge over domain boundaries is very complex, as in the example of the mental health emergencies (Fenwick, 2014) where many different department with little insight in each others practice were involved.

Adapting a sociomaterial practice perspective means adhering to the idea that knowledge needs to be translated instead of transferred. Marbelli and Newell (2012) suggests that translation by distance could be implemented by the help of mediators, such as in Nicolinis (2011) study on telemonitoring where a therapy sheet allows a patients medical history to be moved from one site to another. Translating tacit knowledge on a distance in distributed work is really where IT could be playing a key-role, as has been shown in Pritchard and Symons example (2014) where the smartphone photography acts as a mediator for knowledge translation. The many possibilities for purposely using IT as a boundary object that translate knowledge between networks in distributed organisations is therefore a topic for further research.

In sum, to successfully manage knowledge in IT mediated organisations, the cognitive and IT-driven perspectives on knowledge must be left behind. Even the word knowledge management paints a false picture of the reality, as this review contributes to the growing evidence of organisational knowledge as fluid, unpredictable, even unmanageable in the traditional sense of the word. A practice perspective (Newell, 2015) suggests managing knowledge work as a more accurate description, and thereby one more step towards embracing the practice perspective on knowledge within IS research and practice.

6 Conclusions and future research

This paper set out to investigate how tacit knowledge can be understood from a sociomaterial perspective through the means of a literature review.

By compiling research from a variety of organisational settings, it is obvious that tacit, expertise knowledge is dependent of material and social relations and furthermore often embodied in practice and therefore difficult to transfer. This review show examples of non-successful knowledge transfer (Rowell, 2015, Fenwick, 2014), as well as how well managed knowledge translation can look like, in the case of telemonitoring (Nicolini, 2011) or the two craftsmen and the chair (Parolin and Matozzi, 2013). Gherardi:

*The metaphor of translation evokes power and distributed knowledge, the dissemination of meanings and of learning processes. It highlights that power is*
the effect of processes that associate humans and non-humans: the power of a manager is the effect of association obtained by means of long telephone calls, record keeping, clothes, machines, secretaries, other managers and so on. That which we call 'organisation' is a relatively stable pattern in which these and many other elements are held together; it is the material manifestation of networks of knowledge and power. (Gherardi, 2006, pp. 62).

There is an emerging perspective within the practice lens that suggests that the concept of knowledge translation should replace the contemporary term knowledge transfer, and the research in this review (3.3) shows contributions towards describing knowledge translations in action.

This shift would mean to the field of IS that a sociomaterial practice-based view on knowledge needs to be embraced, which in turn perceives knowledge as site-specific, unpredictable and embodied in practice instead of as a commodity residing in individuals and groups. Newell (2015) suggest that future research should focus on the role of the IT-artefact in knowledge work. Building on this perspective future research should more specifically study the role of IT as a boundary object in the same sense as the medical journal (Nicolini, 2011) that mediates the process of knowledge translation.

I thereby agree with Marabelli and Newell (2012) that more research is needed on how to achieve successful knowledge translation in practice.

Thus a new approach to knowledge within the field of IS is needed, especially with the emergence of AI, sensors and crowdsourcing entering the scene of knowing - in - action. A sociomaterial practice approach has the potential to shed light on the taken for granted tacit and embodied facets of knowing described in this review, as well as on knowledge translation and the agency of technology within organisational settings mediated by IT.

References


