The Trouble with 'Knowledge Transfer': On Conduit Metaphors and Semantic Pathologies in Our Understanding of Didactic Practice

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Abstract. It is a feature central to cooperative work that practitioners develop and maintain their collective competences and skills, and one will in many settings find elaborate didactic practices that reflect this state of affairs. The concept of 'knowledge transfer' that plays a key role in the knowledge management research area offers an obvious framework to the study of mutual learning. However, the notion of 'knowledge transfer' is a semantic pathology despite its widespread use in academia and everyday language, or more precisely, it is a conduit metaphor that mystify the very concept of didactic practice. The argument is that we need to abandon the conduit metaphor all together and present a viable alternative. In this paper we suggest that talking about 'didactic practice' is one such alternative and substantiate this assertion by presenting an ethnographic study of didactic practice in the building process.

Introduction

It is a feature central to cooperative work that practitioners develop and maintain their collective competences and skills, and one will in many settings find elaborate didactic practices that reflect this state of affairs. These aspects of cooperative work are pertinent to CSCW and the concept of 'knowledge transfer' that plays a key role in the knowledge management research area offers an obvious framework. However, the notion of 'knowledge transfer' is a semantic pathology, or more precisely, a conduit metaphor that mystify the very concept of didactic practice. The notion of 'knowledge transfer' may be deemed a conduit metaphor as it alludes to the (false) idea that knowledge is somehow a thing that may be transferred by the conduit of words and information technology from actor A to actor B. Contrary to what is often assumed, then, the notion of 'knowledge transfer' tends to impair and obscure the for CSCW essential focus on actual didactic practices.

The ironic thing is that although a large number of studies within CSCW and related research fields (e.g. [2-5]) are very critical of the notion of 'knowledge transfer' i.e. that knowledge is a thing that can be stored, retrieved, and distributed in a thing-like manner through the conduit of information technology, the term or metaphor remains in heavy use.[1] Szulanski [10, p.12], for example, state in a well cited article that "even though transfers of knowledge are often laborious, time consuming, and difficult, current conceptions treat them as essentially costless and instantaneous." It appears that the notion of 'knowledge transfer' is hardly mentioned without being criticized in the same breath (at least in academia) for in one way or the other making allusions to unproblematic conduit of knowledge from one person to the next and yet its use as an analytical category seem to flourish unhindered. Perhaps, and this is the assertion here, this is because of a lack of a better alternative.

In this paper it is pointed out that talking about 'didactic practices' is a viable alternative to using the misleading metaphor 'knowledge transfer' in the study of mutual learning in cooperative work. This assertion is substantiated by presenting an ethnographic study of didactic practice in the building process. In this manner this article attempt to contribute to the critical agenda and share the critical spirit of the work of for example Huysman and de Wit's [4], Fitzpatrick [3], Bansler & Havn [2], and Huysman and Wulf [5]. The critical literature on 'knowledge management' relocates the problem of knowledge and mutual learning in a number of ways, stressing issues such as the social distribution of expertise, and the importance of 'who knows', as well as the contextual nature of much knowledge articulation, use, and mutual learning. Not least, it reminds us that not all solutions are technical solutions. Broadly speaking, this study shares this outlook. More specifically, the contributed of this paper is to point out that talking about 'didactic practices', rather than 'knowledge transfer' will make our lives as CSCW researches

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[1] A search on 'knowledge transfer' in the ACM Digital Library (http://dl.acm.org/) returns no fewer than 18 307 results (on December 8, 2011).

and practitioners much simpler as it presents us with a way out of the conceptual muddle than is the notion of 'knowledge transfer'.

We will proceed in the following manner. First we will discuss 'knowledge transfer' as a conduit metaphor. Secondly, we will consider the methods of our ethnographic study. Third, we will present and investigate a case of didactic practice in the building process. Fourth, we will discuss our findings. Finally, a conclusion and some perspectives will be provided.

Knowledge transfer as a conduit metaphor

As mentioned above, although opposition to the notion of unproblematic 'knowledge transfer' is present in CSCW and related research fields (see e.g. [2-5]), the very expression or metaphor 'knowledge transfer' is far from being stamped out in everyday language and academic discourse.[2] What is it about the term 'knowledge transfer' that makes it so pervasive still? The short answer is that 'knowledge transfer' is a conduit metaphor, a semantic pathology, pervasive to the English language in general and this is why it is so resilient even in the face of relentless critique from CSCW and elsewhere. Let us elaborate.

The eminent linguist Michael J. Reddy [9] coined the term *the conduit metaphor* in an effort to describe what he regarded as a semantic pathology pervasive to the English language. According to Reddy, the English language alone hosts more than a hundred expressions based on what he calls 'the conduit metaphor' [9]. Reddy calls it 'the conduit metaphor', because it implies that thoughts or ideas are transferred from actor A to actor B through some conduit or other. Reddy argues that it is almost impossible for an English speaker to discuss communication without committing to some form or other of that metaphor. A Conduit metaphor

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[2] A search on "knowledge transfer" in Google Scholar (http://scholar.google.com/) returns no fewer than 102 000 results (on December 8, 2011).

is a linguistic term, then, referring to a dominant class of figurative expressions used when discussing communication itself.

In his seminal article Reddy [9] discussed the conduit metaphor's distorting potential in culture and society. For example, he points out that the expression 'You'll *find* better *ideas* than that *in the library*' is a conduit metaphor asserting that ideas are in words, which are on pages, which are in books, which are in libraries—with the result that "ideas are in libraries." One implication is that libraries full of books, tapes, photographs, videos and electronic media contain 'culture'.

Importantly, according to Reddy there are no ideas in the words; therefore, none in libraries. Instead, there are patterns of marks, bumps or magnetized particles capable of creating patterns of noise and light. Using these patterns people can (re)construct content such as for example a cultural heritage.

Because culture does not exist in books or libraries, people must continually reconstruct it. Libraries preserve the opportunity to perform this reconstruction, but if language skills and the competences of reconstruction are not preserved, there will be no culture. Thus, Reddy asserts that the only way to preserve culture is to train people to 'regrow' it in others.

He stresses that the difference of viewpoint between the conduit metaphor and his view is profound. Humanists—those traditionally charged with reconstructing culture and teaching others to reconstruct it—are increasingly rare. Reddy proposes that, despite a sophisticated system for mass communication, there is actually less communication; and moreover, that people are following a flawed manual. The conduit-metaphor influenced view is that the more marks and signals moved and preserved, the more ideas "transferred" and "stored." Society is thus often neglecting the human ability to reconstruct meaning such as cultural heritage based on e.g. marks on the pages of books. This ability atrophies when what is deemed 'extraction' is seen as a trivial process not requiring instruction past a rudimentary level [9].

Reddy concludes that the conduit metaphor may continue to have negative technological and social consequences: mass communications systems that largely ignore the achievement of (re)construction of meaning and the skills that go into

it. Because the logical framework of the conduit metaphor indicates that people "capture ideas in words"—despite there being no ideas "within" the ever-increasing stream of words—a burgeoning public may be less culturally informed than expected [9]. In this manner Reddy convincingly describes the distorting potential that conduit metaphors may have on culture and society at large.

Moving form society at large to concerns more specific to CSCW we may, following Reddy [9], ask this: What are the distorting potential of the metaphor 'knowledge transfer' on knowledge management and the design of knowledge management systems?

Turning to a widely cited review article in MIS Quarterly by Alavi and Leidner [1] may give us part of the answer. Without referring to the work of Reddy or the linguistic term 'conduit metaphor', Alavi and Leidner [1] describe how the 'knowledge management' literature has been plagued by the entire repertoire of conceptual pathologies associated with the conduit metaphor: 'Knowledge' as an 'object', something that can be 'encoded, stored, and transmitted'[1].

Furthermore, the experience with 'knowledge management systems' has often been one of disappointment. Considerable effort and resources have been invested in the development and deployment of such systems but with very few results in terms of productivity and profitability to show for it (see e.g.[2, 7, 8]). To take but one example from the literature:

> 'A good example of how information technology alone cannot increase the leverage of professional knowledge comes from a large consumer products company. As part of reorganization, the company decided to improve professional work. Professional staff was instructed to document their key work processes in an electronic database. It was a hated task. Most staff felt their work was too varied to capture in a set of procedures. But after much berating by senior managers about being "disciplined," they completed the task. Within a year the database was populated, but little used. Most people found it too general and generic to be useful. The help they needed to improve their work processes and *share learning* was not contained in it. The result was an expensive and useless information junkyard. Creating an information system without understanding what knowledge professionals needed, or the form and level of detail they needed, did little to leverage knowledge.' [6, p.104.].

In this manner McDermott [6] describe a common experience of failed 'knowledge management systems' and give us a window into the consequences of the use of conduit metaphors when performing knowledge management and designing knowledge management systems. McDermott [6] does not himself attribute these troubles with pervasive use of conduit metaphors in the English language - this is the argument that we are trying to make.

It turns out, then, that just as there were consequences for the use of conduit metaphors in relation to culture and society at large (recall the Reddy's case above), there are grave consequences using conduit metaphors when performing and studying knowledge management and designing knowledge management systems. As indicated above, it may for example lead to the (uncritical) assumption that knowledge is a thing that can be managed in the sense of being stored, retrieved, and distributed in a thing-like manner through the conduit of information technology.

How do we move forward? An analytical concepts or category such as 'knowledge transfer' does not loose its misleading allusions merely by being criticised again and again in the literature. It is too deeply entranced in our discourse and everyday language to be altered or tempered by criticism alone - no matter how sophisticated and well argued this critique may be. That is, critique of the notion of 'knowledge transfer' is not enough we need to abandon this conduit metaphor all together.

Abandoning the use of a well-entranced conduit metaphor such as 'knowledge transfer' involves presenting an alternative; it involves supplanting it, not with another conduit metaphor, but with something different. What are the alternatives then? There are perhaps many. We will in all modestly present one, namely, to speak of 'didactic practice' instead of 'knowledge transfer'. The notion of 'didactic practice' takes as its starting point those activities of the actors that are centred on developing and maintaining the collective competences and skills of the cooperative ensemble, rather than alluding to the effortless and instantaneous. The rendering of the case below will serve as a substantiation of this argument. Before moving on to our case we will consider the methods of the study.

Methods

The case presented below springs from (part of) an ethnographic fieldwork carried out in the course of fourteen months on a building sites and architectural offices. In this period, work within the domains of architecture, engineering and construction was studied. The building project, the development of the new domicile for a publishing house, is a multi-storey building in glass, steel and concrete constructed at the city of Copenhagen's waterfront. It is a relatively large building of 18 000 m2 distributed across eight floors. A combination of observation and interviews was used. The fieldwork also included collecting (scanning, taking screenshots or photographs of) artifacts used and produced by the actors engaged in the building project.

A case of didactic practice in construction engineering

We will now turn to an investigation of didactic practice in the building process where an apprentice and an accomplished actor engage in didactic activities as part of their cooperative work practice. We will do so in an attempt to show that talking about didactic practice represents a viable alternative to engaging in studies of 'knowledge transfer'. Let us commence and start by providing some context.

An accomplished practitioner and an apprentice are engaged in coordinating building construction work on a large project advanced to the latter stages of construction work, more precisely, the construction of the roof. The physical location for the case studied is the site manager's trailer on a construction site. Complex roof construction work requires the coordination of a diverse ensemble of actors (i.e. various contractors such as carpenters, plumbers, electricians, roofers etc.) each performing a range of specialised construction task.

The particular representation, shown in figure 1, is of a *section view*, a view from the side virtually cut through the building. It shows the roof construction around a drainage. To demarcate what the team believes to be different areas of

responsibility, the architectural plan is marked with highlighter pens in different colours. For example, blue marks the area that one particular subcontractor is responsible for, and yellow is the colour for another. This is a task that involves two people. One assesses the areas of responsibility, he reports the area out loud, e.g. "the roofing felt is going to cover the sandwich panels – KBK should do this." A second engineer marks the area in question. After finding the right area on the architectural plan he highlights it with the chosen colour. What we find here is a practice that encompasses talk, architectural plans and writing tools as the two actors collaborate on inscribing areas of responsibility onto the architectural plans (subsequently these plans are scanned and sent as PDF files to the various subcontractors involved in order to inform them of their responsibilities as seen by the manager). It is in this context that the didactic activities that we are going to investigate plays out.
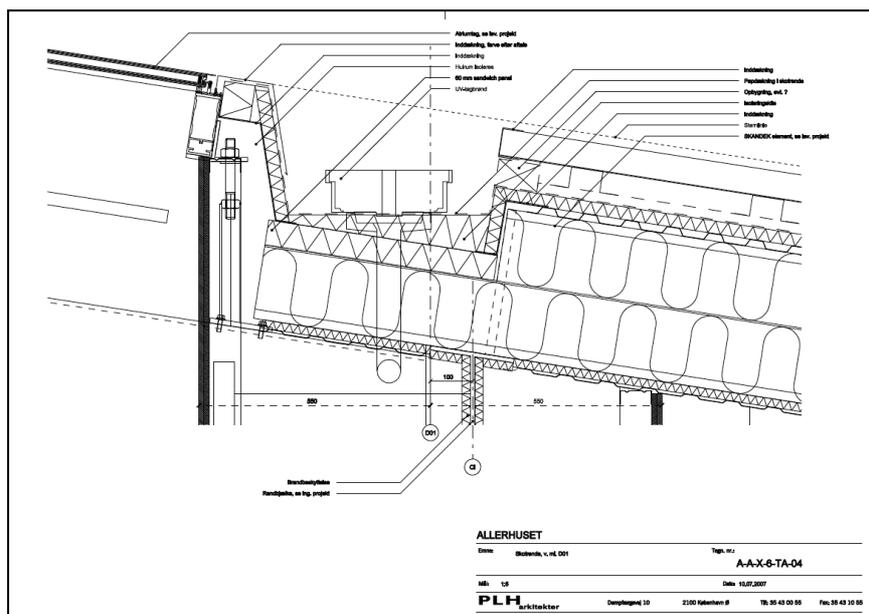

Figure 1: Detail architectural plan of roof construction *before* it is coloured with highlighters for coordinative purposes.

The action that we will now consider begins with a request from Peter, the caller, to Steen, the colourer (lines 1-2).

1 Peter: The roofing felt is going to cover the sandwich panel
2   KBK[3] should do this.
3   (Pause)
4   No, No. Not there.

However, before Steen, who is an apprentice, has coloured anything, indeed before he has said a word, Peter, who is his manager, challenges him, telling him what he is doing is wrong. How does he know that there is something wrong with what Steen hasn't even done yet? Here no talk has yet been produced by Steen, but talk is not the point. Providing an answer in this practice encompasses something other than talk. Steen must locate and colour the relevant part of the architectural plan in order to respond according to Peter's expectations. His movement of the highlighter to what Peter regards as the wrong place on the architectural plan is the visible event that prompts Peter's intervention (line 4). However, Steen's response to the correction calls this presupposition into question. Steen does not immediately colour the architectural plan but instead hesitates (line 5), before replying with an "hmm".

5 Steen: (Pause) Hmm.
6 Peter: Wherever the roofing felt goes.
7 Steen: Ahh.

In line 6 Peter moves from request to coaching by talking to Steen and telling him what to look for in the architectural plan, i.e., "Wherever the roofing felt goes".[4] In the present case, in order to use what Peter has just said in their col-

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[3] KBK is the acronym for a subcontractor that was responsible for some elements of the roof construction.

[4] Roofing felt' is also sometimes referred to as 'asphalt roofing'.

laborative effort, Steen must be able to find the course of the roofing felt in the plan - knowing what 'roofing felt' means in the abstract is not enough. Wittgenstein notes: "If language is to be a means of communication there must be agreement not only in definitions but also (queer as it may sound) in judgments" [12 p. 75, § 242]. As the manager setting the task, Peter is in a position to evaluate Steen's practical judgment.

8	(Pause)
9 Peter:	See, like right here, and down here.
10	(Tracks it with a pen across the architectural plan)
11 Steen:	All right, yeah ok.

In line 10, instead of relying on talk alone to reveal the course of the material in question that Peter wants Steen to colour, Peter moves his pen onto the architectural plan and tracks the course of the roofing material. He shows it to him in the plan. What Steen is taught is not simply 'definitions' (he already knows what 'roofing felt' means in the abstract), but rather a practice, i.e. how to code the relevant perceptual field in terms of categories that are relevant for his work. The activity in progress, including the sequence of talk, provides a language game in which these judgments are taught, a language game about precisely which features of the complex perceptual field in question to attend to. Peter is instructing Steen how to 'see' the architectural plan.

As master and novice carry on planning the constructing of the roof, further tasks are delimited, pointed out and assigned to particular contractors.

12 Peter:	Right (Pause)
13	Scandek is supposed to mount their elements.
14 Steen:	The roof slab?
15	(Points to the architectural plan)
16 Peter:	Yes.

In this manner the task continues until the result shown in figure 2 is reached. In line 12 – 16 yet another part of the roof construction is assigned to a particular

contractor. That is, the responsibility for mounting the central reinforced concrete roof slab is assigned to a subcontractor named 'Scandek'.
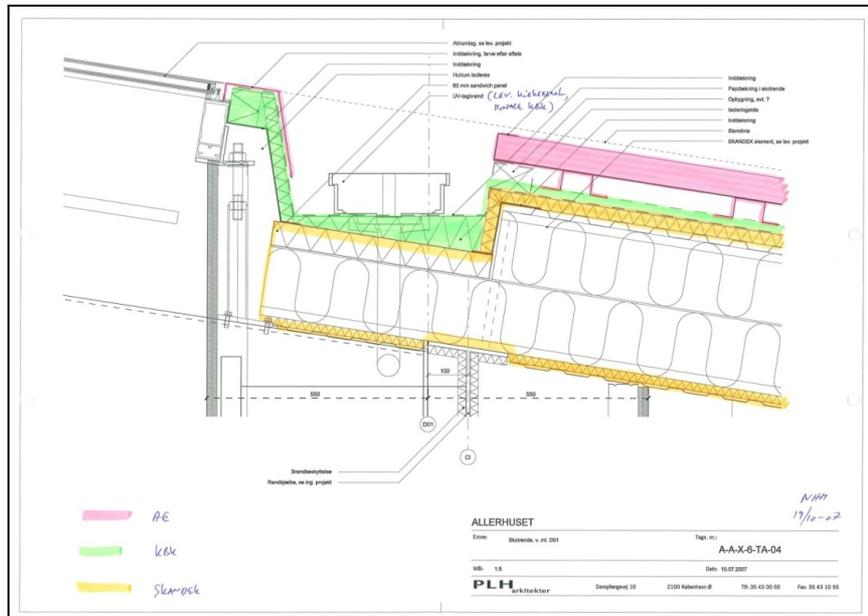

Figure 2: Detail architectural plan of roof construction after it has been coloured with highlighters for coordinative purposes.

As indicated above, we could suggest that what happens within this sequence of didactic activities internal to the cooperative work practice of the actors is a not least a progressive expansion of Steen's ability to comprehend what he must do in order to carry out the task assigned to him as Peter explicates it. We could suggest that 'patches of ignorance' on the part of Steen are revealed and transformed into practical ability sufficient to get the job done. Steen is gradually able to grasp what it is Peter wants him to do and how to see the architectural plan in order to do it (note how casting these activities in terms of 'knowledge transfer' could easily gloss over the work involved here).

Furthermore, according to Wittgenstein [12, e.g. §143-55, §179-81], the situation for the novice or apprentice is in stark contrast to that of the accomplished actor. Wittgenstein differentiates the role of the two participants in didactic practice [11, p.204], and it is this that we may highlight with reference to our case. The ac-

complished actor momentarily acting in the capacity of teacher is the one whose judgment is unchallenged precisely because he has mastered the practice himself, and now he sets the standards for what is correct as far as the apprentice is concerned. The apprentice does not have and is not required to have all the skills or techniques that are necessary for the successful participation in practice. As indicated above, this differentiation enables the accomplished actor to extend a courtesy or show consideration for the shortcomings of the apprentice's performance. The stage setting, the background necessary for judgment, is within the domain of the accomplished practitioner. That is, the behaviour of the apprentice is shaped and made intelligible by the competences of the accomplished actor. In this manner, the background for judgment of the apprentice's actions is the competence of the accomplished actor who masters the practice, and in this process of 'judgement' or guidance the practice is explicated (albeit to a limited degree).

In addition, it would be quite wrong to delimit the unit within which this is lodged as comprised of solely the two actors Steen and Peter. Instead the unit (with very soft boundaries) is the building process understood as a community of practice or set of related communities of practice within which the skills of building engineering and the task in question are lodged. The skill to handle the task, including the complex perceptual field of the architectural plans, and to see for instance 'where the roofing felt goes', is central to what it means to see the world through the eyes of a building engineer. Being able to highlight certain aspects of a representation of a building according to a specific task is part of what it means to be an accomplished building engineer, and it is these standards that Steen is being held accountable to – standards that also include mastery of techniques such as scale and projection discussed above. The relevant unit of analysis, then, is not these two individuals as an isolated entity, rather it is the wider building process where a community of competent practitioners are engaged, most of whom have never meet each other, but who nonetheless expect each other to categorise and act in this domain in ways that are relevant and predictable and pertain to the work, tools and artifacts that constitute the community of practice, including the didactic activities within it.

Discussion

In contrast to the conduit metaphor, the view of didactic practice, as we have attempting to cast it in the case above, does not rely on the notion of knowledge as a thing that may be propelled back and forth between actors like a tennis ball in a game of tennis. In didactic practice there is no fixed form of meaning that may be transferred from actor A to Actor B through the conduit of words, artifacts and computer systems. Hence, the fallacy of expressions such as 'knowledge transfer'. In contrast, actors in cooperative work continually have to reconstruct and maintain their collective competences and skills in elaborate didactic practices that may be part of their cooperative efforts as in the case above. This is based on the fact that there are no ideas or fixed forms of meaning in the words, drawing or artifacts. Instead, there are patterns of marks, bumps or magnetized particles capable of creating patterns of signs. Using these patterns actors can (re)construct content appropriate to the norms and rules internal to their community of practice given that they have the competences and skills. Whether constructing meaning based on e.g. the artifacts of a given practice is easy, hard or even possible dependents on the skills and experience of the individual actor. Maintaining and developing such skills is crucial to cooperative work practice. In the case presented above we saw how the apprentice, mentored by the experienced engineer, had a steady expansion of his practical ability to construct meaning and get the job done based on the marks and sings on the architectural plans before him. Talking about 'knowledge transfer' in this context will only mystify and obscure what is actually going on. The conduit metaphor mystifies, and even as it is being critiqued heavily, its semantic pathology persists buried deep in our everyday language as exposed by Reddy [9]. It must be abandoned. As stated in the introduction, we must shift our focus to the actual didactic practices that are part of cooperative work and see how they are integrated with cooperative work practice. We must do so in order to move forward. This is in line with the impressive efforts conducted elsewhere in the CSCW community (see e.g. [2-5]).

Conclusion and perspectives

In this article is has been argued that investigations of mutual learning in cooperative work may take as their starting point the analytical category of didactic practice, rather than frame the such activities in terms of 'knowledge transfer'. This position spring from the observation that the term or metaphor 'knowledge transfer', despite its continued widespread use in academia and everyday language, is a conduit metaphor that obscures the actual didactic practices pertinent to CSCW. Relying on a conduit metaphor such as 'knowledge transfer' may for example lead to the (uncritical) assumption that knowledge is a thing that can be managed, i.e. stored, retrieved, and distributed, in a thing-like manner through the conduit of information technology.

The situation is acerbated by the fact that the notion of 'knowledge transfer' and associated allusions does not loose their misleading qualities merely by being criticized again and again in the CSCW community and elsewhere. The conduit metaphor in general is too deeply entranced in our discourse and everyday language to be altered or tempered by criticism alone - no matter how sophisticated and well argued this critique may be. We need to abandon the conduit metaphor, in all its variations, all together and present a viable alternative. In this paper we have suggested that talking about 'didactic practice' is one such alternative and have substantiated this assertion by presenting an analysis of didactic practice in the building process. This is in line with important CSCW research on the subject.

The challenge for CSCW emerging from this is to focus on the actual didactic practices that are part of cooperative work and see how they are an integrated part of cooperative activities. We must look and see in order to move forward.

Acknowledgements

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