

Knowledgeability and modes of identification in (dis)embodied boundary practice in networked learning.

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Abstract

Building on a continued interest in boundaries and boundary practice in relation to ICT-based networked learning (Ryberg & Sinclair, 2016), this paper addresses the issue of knowledgeability and identification through (dis)embodiment in design for boundary practice in networked learning. According to Goodyear (2015) teaching is about designing opportunities for people to learn, and from a learning perspective, how participants respond to design through their practices and through their use of boundary objects is interesting. Inspired by Wenger-Trayner & Wenger-Trayner's (2015) concepts of knowledgeability and modes of identification, we analyse how two different case studies conducted at the Danish online Master programme on ICT and Learning (MIL) differ with regard to potential boundary practice and use of boundary objects.

In study I, the design for learning was based on a 2D virtual learning environment (Dirckinck-Holmfeld, 2006), whereas the design for learning in study II was based on a 3D virtual world (Riis, 2016). Carlile (2002; 2004) proposed a hierarchical typology for boundary objects aiming at transfer, translation and transformation, and in our analysis, we identify examples of such boundary objects in the two learning arenas. Our findings show that all identified categories of boundary objects can mediate knowledge according to the typology. Nonetheless, certain boundary objects in the 3D learning arena (study II), in particular the avatar, seem to promote a different kind of embodied transformation, which has implications for identity formation of the participants. Furthermore, the 3D virtual space affords a concrete materialised, albeit virtual, opportunity for reification, which is different to that of the 2D environment.

In the paper, we will elaborate on these differences, and based on the two case studies we propose that boundaries in networked learning should not only be regarded as socio-cultural differences, but as socio-material differences and dependencies as well. In particular, the materiality of a 3D virtual arena and avatars provides new relational and performative opportunities in networked learning.

Keywords

Networked learning, boundary practice, boundary object, culture, materiality, avatars

Introduction

All leaning involves boundaries, and in networked learning where information and communications technology (ICT) is used to promote connections, action and interaction, discussions on boundaries and boundary practices are always prevalent (Ryberg & Sinclair, 2016). In general, learning and collaborating at the boundaries is complex due to lack of shared vocabulary, habits, routines, world view etc. (Dirckinck-Holmfeld, 2006), and in ICT-mediated contexts technology itself adds to the complexity due to decontextualisation (Gourlay & Oliver, 2016) and changing space-time configurations (Timmis & Williams, 2016). In practice studies, the concept of boundary objects has been proposed as a way of talking about certain objects that mediate knowledge between practices (Carlile, 2002; 2004, Wenger, 1998, Star & Griesemer, 1989).

As seen from a social learning perspective (Wenger-Trayner et al., 2017), the challenge in networked learning is to create possibilities for learners to participate in meaningful ways while transcending boundaries by way of using boundary objects to mediate the ongoing negotiation of meaning, learning and identity.

Method and context of the study

In this paper, we use findings from two different studies (Dirckinck-Holmfeld, 2006 and Riis, 2016) conducted at the Danish online Master programme on ICT and Learning (MIL). The MIL programme is based on an overall ‘problem-oriented project pedagogy’ where the students mainly meet, collaborate and learn in a ICT-mediated environment (Dirckinck-Holmfeld, 2006; 2002, Fibiger et al., 2004). Since the programme’s establishment in 2000, the use of different technologies, both as infrastructure, tools and as analytical objects, has changed in line with the general technology development (Riis, 2016).

Based on the initial findings by Dirckinck-Holmfeld (2006) concerning the role of boundary objects in a collaborative 2D virtual learning environment (study I), we expand the discussion to include a focus on how the use of boundary objects differ, when the arena changes to that of a 3D virtual world (study II). The 2D learning arena was a system called Virtual-U, and according to one of the developers, it was one of the first online environments designed with a specific pedagogical vision and framework in mind (Harasim, 2017). The Virtual-U focused on “discursive spaces” designed to facilitate collaborative learning and knowledge construction, and it was based on a campus metaphor e.g. with course template, conferences (for discussions) and personal workspaces (ibid., p. 127-128). The 3D learning arena was a virtual world called Second Life, and as stated by one of the developers, it was designed as a shared simulated 3D space with no predefined purpose in mind other than socializing and promoting the users’ freedom “to create their own fictions and communities, imbuing them with meaning through interaction” (Ondrejka, 2008, p. 231). Table 1 below shows dominant features of the two arenas.

	The 2D arena in study I Virtual-U™	The 3D arena in study II Second Life™
Purpose	Developer-determined - teach, study	Self-determined - multi purpose
Environment metaphor	Campus workspace non-fictional	Mirror or fantasy world non-fictional/ fictional
User representation	2D-profile, username (icon) pseudonyms not allowed	3D-avatar, avatar name pseudonyms are default
Communication modalities	Vision, writing	Audition, vision, proprioception, writing
Dominant interaction frequency	Asynchronous	Synchronous
Content creation	User-created	User-created

Table 1. Dominant features in two settings for ICT-based networked learning. (Adapted from Riis, 2016)

Each learning arena offers many distinct features or affordances that are both functional and relational. As such, the purpose of the different arenas can be challenged. Furthermore, as pointed out by Hutchby (2001) some affordances are complex and need to be learned, and in our study, this holds true especially in terms of the perceived embodiment in the 3D arena. As an example, the sense of proprioception (e.g. experienced by seeing one’s nose or limbs when moving), which in the 3D environment depends on the user’s chosen point-of-view, became a distinct boundary between the user’s perception of ‘I’ in the real and the virtual world – thus providing an opportunity to reflect, negotiate and learn, both individually and collaboratively.

At the MIL programme, arguments for collaborative networked learning have primarily been based on a socio-cultural perspective on learning, with the ideas of Lave & Wenger (1991), Wenger (2010; 1998) and Wenger-Trayner & Wenger-Trayner (2015) on situated, social learning as main inspiration. At the ontological level, socio-cultural theories suggest that learning is constructed, social, situated, mediated, distributed, and a matter of coming to be (Riis, 2016). At the pedagogical design level, the teaching and learning processes are realized through the inherent need for collaboration in problem-oriented and project-based learning (Dirckinck-Holmfeld, 2016).

Knowledgeability has been put forward as a way of describing the body of knowledge and complex relations that people build and maintain between intersecting practices, and the formation of identity is modulated in and

across the boundaries of such practices through different modes of identification¹ (Wenger-Trayner & Wenger-Trayner, 2015, Wenger, 2010).

Boundaries and boundary objects in learning

The concept of boundary practice has been studied in various research domains where it has been used to describe a wide variety of phenomena, incl. professional identity, symbolic capital, politics and knowledge sharing in and between intersecting practices (Lindberg, Walter & Raviola, 2017, Lee, 2007, Wenger, 1998).

Based on an extensive review of boundary research within the educational field, Akkerman & Bakker (2011) defined a boundary as any *socio-cultural* difference leading to discontinuity in action or interaction. In educational research boundaries are typically identified in and between domains, practices and contexts. However, as stated by Akkerman (2011, p. 22) ‘a boundary is not a static and predefined distinction’, rather boundaries are experienced subjectively and contextually. Experienced boundaries can easily remain implicit during interactions, and the learning potential or opportunity is only realized when people identify boundaries through dialogical and collaborative engagement and negotiation. Further, Akkerman & Bakker (2011) found that the research interest in boundaries over the past decades has been linked to an attempt to reconceptualise the notion of (knowledge) transfer based on an appreciation of differences and diversity as potentials for learning. In fact, as Wenger-Trayner et al. (2017) argue, boundaries should be regarded as learning assets, and when designing for learning “the principle is to systematically make boundaries a learning focus” (p.18).

When boundaries become a focal point of a design for learning, boundary objects come into play. Star (1989; Star & Griesemer, 1989) introduced the concept of boundary object to describe an object that serves to mediate several intersecting social worlds, while simultaneously satisfying the informational requirements of each of them. Originally, Star & Griesemer (1989, p. 410-411) proposed four categories of boundary objects (repositories, ideal types, coincident boundaries and standardized forms), and Carlile (2002; 2004) further extended the notion of ‘effective’ boundary objects into a hierarchical classification based on three levels of knowledge boundaries:

- A syntactic boundary, which potentially leads to *transfer of knowledge* through the use of representation objects (e.g. repositories)
- A semantic boundary, which potentially leads to *translation of knowledge* through the use of learning objects (e.g. standardized forms and methods)
- A pragmatic boundary, which potentially leads to *transforming knowledge* through the use of transformation objects (e.g. models and maps)

In the following, we are using different aspects of Carlile’s classification to identify and analyse boundaries and boundary objects in two different learning arenas in ICT-based networked learning organised as problem-oriented and project-based learning.

Boundary objects in a 2D learning arena (study I)

In the first study, Dirckinck-Holmfeld (2006) explored how boundary objects serve as resources to support students’ collaboration and learning in a networked learning arena organised as problem-oriented and project-based learning, the MIL programme. Based on a case study of a course group’s work, the study identified four different types of boundary objects:

- Group products
- Ideal types of frameworks, concepts, models
- Standards and guidelines
- Communication infrastructure (ibid. p. 2).

Among these objects, the *group products*, such as the problem formulation, the outline and the project seemed most important as boundary objects, however the other kinds of boundary objects also played important roles for the students to collaborate and learn. *Ideal types* such as theories, models and concepts supported the establishment of a shared repertoire among the students and provided insights into different world views and

interests. *Standards and guidelines*, such as the group agreement, the calendar, the communication rules support the students in doing the work, and finally the *communication infrastructure* in Virtual-U, such as the discussion conferences, the course template and the Messenger unit (Virtual-U chat), was instrumental for the collaboration to take place.

Based on her study of MIL students' collaborative learning in the 2D arena, Dirckinck-Holmfeld found that all categories of boundary objects can mediate knowledge on different levels, and "what determines the 'efficiency' of a boundary object is *relational* to the situation, and to the objectives" (ibid, p. 7), thus adding to Carlile's (2004) relational understanding of knowledge and power.

When a boundary object supports the collaborative process on the routine level it functions at the syntactic level and the participants share the syntax, however when there is a breakdown, the participants will have to go to the level of semantics or pragmatics in order to 'repair' the knowledge boundary. As the focus in problem and project-based learning is on transformative learning (and paradigmatic changes in world views) it is vital, that the students use the boundary objects that are in focus in the collaborative learning process, such as the group products and the ideal types to go beyond syntax and semantics and challenge each other at the pragmatic level investing themselves.

Other boundary objects such as group regulated standards, guidelines and communication infrastructures are also crucial for the learning to take place, however as subsidiaries for the collaboration and transformative learning process to take place, these should primary serve at the syntactical level to be efficient.

Boundary objects in a 3D learning arena (study II)

The second study, which also was conducted at the MIL programme, was based on a multiple case study involving 53 students over a vast period of time in four consecutive action research cycles and did not initially focus on boundaries and boundary objects (Riis, 2016). However, after reviewing and analyzing the data anew, we have identified the same types of boundary objects as in study I. One type of boundary object, namely the *ideal types of frameworks, concepts and models* as exemplified in compulsory literature, seemed to function in similar ways. In both studies, the literature represented a domain-practice alignment, meaning that in study I, the literature reflected discursive, online collaboration, whereas the literature in study II focused on embodied, online collaboration. As an example, in study II, the students stressed the possibility of experiencing and performing concepts such as immersion, embodiment and presence in a very grounded manner via their avatars, leading to a deeper understanding and a more critical stance towards the concepts. Our analysis also shows how the three other types of boundary objects; *group products, standards and guidelines and communication structure*, were present, but differed due to their more manifest materiality.

In study II, the *group products*, were also very strong boundary objects. Contrary to the written report in study I, these students had to do an analysis of the 3D virtual world as learning arena, build a reflected example of such learning arena in their designated sandboxes, and finally present their theoretical arguments and demonstrate (with required peer-interaction) their arena in synchronous sessions. The manner in which the students were able to reify their collaborative work through material products and embodied processes inworld, was underlined as one of the major benefits of this type of learning arena.

As for the *standards and guidelines* boundary objects, in study II, the students initially struggled with the extra task of getting to know, understand and practice the distinct 3D virtual world culture, which by all accounts constituted an ontological challenge. In study II, the students spent considerable amounts of time on avatar-acclimatization and general enculturation. As well as the students in study I, these students needed to focus on the MIL culture, which seemed to change considerably from what they were used to from previous courses and modules in the MIL programme. The students emphasized the more informal and playful tone with regards to interaction with both their peers and the teacher. On the other hand, the students also pointed to the difference in meeting other people/avatars in the learning arena, especially in terms of meeting strangers. More often than not, in such cases, the students were left quite perplexed until they learned to "crack the cultural code" (ibid., p. 253). Meeting strangers, typically educators from around the world, was also a deliberate design decision throughout the research cycles, and in hindsight these meetings illustrated exemplary boundary practices.

In study II, one of the most remarkable boundary objects was the *communication infrastructure*. The students were all accustomed to the asynchronous conference discussions, when they first entered the 3D virtual world. In many accounts, the students highlighted the possibility of communicating synchronously and via material

objects inworld (the avatar itself included). As found in study I, online students appreciate synchronous communication as a means of quick clarification and consolidation in negotiation processes, and in study II, the synchronous way of teaching and learning was often described as being “emancipating” in comparison to what the students were used to (ibid., p. 219). Besides differences in communication frequency, the students also pointed to another aspect of the communication infrastructure, which has to do with the materiality of the learning arena. The rich possibilities in terms of multimodality, and especially the possibility of visualising, creating and performing their processes and products of learning, were generally highly appreciated.

Finally, in study II, we identified a new type of boundary object, the 3D avatar, which turned out to be the most powerful boundary object given that it was through the avatar that the students experienced and participated in the inworld teaching and learning activities. The majority of the students became deeply involved in customizing the avatar in terms of its appearance and adjusting to its behavioural traits and possibilities. Through this boundary practice, the students were often challenged by boundaries between their own personal preferences and the technological affordances, and as such the avatar represented the materialisation of continuous identity struggles, oscillating between playful and carefree learners and goal-oriented and reflected students. In general, the avatar was a highly ‘effective’ boundary object with regard to both collaboration and knowledge sharing, however, for a few students in this study, the avatar became an impenetrable boundary, an object of obstruction rather than progression, as expressed by this student:

Whether people want to play with paper dolls or if they have a need to make virtual social relations must be their choice. (Student quote from Riis, 2016, p. 264)

In summary, our analysis of study II, has shown how the different materiality of the boundary objects and as a consequence the boundary practices as well, as compared to study I, provided the students with new possibilities for knowledge sharing and learning in a more embodied and performative manner.

Discussion

In both studies, we have identified and analyzed ‘effective’ boundary practice and boundary objects that can mediate knowledge creation and sharing on all proposed levels and thus promote both transfer, translation and transformation of knowledge in alignment with the findings of Carlile (2002; 2004). Table 2 below provides an overview of the boundary objects in the two studies.

	Boundary objects in Study I	Boundary objects in Study II
Group products	Written project report	Oral project presentation
Ideal types of frameworks, concept and models	Exemplary literature in terms of domain-practice alignment	
Standards and guidelines	Reflecting the MIL culture and that of the group	Reflecting the Second Life culture, the MIL culture and that of the groups
Communication infrastructure	Asynchronous conferences, incl. the group’s own conferences (synchronous chat)	Synchronous space, incl. the groups’ own sandboxes (asynchronous conferences)
Student representation	Logo and name (2D)	Avatar and pseudonym (3D)

Table 2. Overview of boundary objects in the two studies.

In study I, Dirckinck-Holmfeld (2006), pointed out new relational dependencies of boundary objects, and based on our current analysis of study II, we observe how the 3D learning arena, with avatars and other virtual objects, functions as proxy for the material in ways not possible in the 2D learning arena, supporting that not only differences in, but dependencies of the *materiality of the technology*, play an important role in ICT-based networked learning. Moreover, based on our analysis of the findings from both case studies, we propose to extend the relational view on boundaries and boundary object to the ontological level of learning and knowledge sharing, suggesting that a socio-material perspective might be beneficial to understanding the phenomenon.

According to several authors (Gourlay & Oliver, 2016, Johiri, 2014; 2011, Fenwick, Edwards & Sawchuk, 2011, Edwards, 2011) socio-materiality points to the inseparability of the social and the material, and a study of technology-in-practice therefore needs to address this. From a socio-material perspective knowledge and knowing arises from 1) emerging patterns of interaction between material phenomena, 2) the material arrangements for knowing about the phenomena, and 3) knowledge practices (Østerlie, Almklov, Hepsø, 2012). Our analysis has shown how, in particular, the differences in the design of material arrangements (understood as the learning arenas) and the design of practices (understood as teaching and learning processes) play an important role with regard to student experiences and learning opportunities. Furthermore, a socio-material approach may provide new insights on knowledgeability, given that

[The] question of producing knowledge and learning shifts from a representational idiom, mapping and understanding a world that is out there, to a view that the world is doing things, full of agency. Not only humans act, because non-humans act on and with humans. (Fenwick, Edwards & Sawchuk, 2011, p. 3)

As such, in a socio-material perspective, the body of knowledge and complex relations would be more attentive towards the entanglement of material artifacts and the bodily performances of the learners, which still would be entwined with discourse. Importantly, and especially in regard to the 3D learning arena, a socio-material perspective would highlight the importance of ‘taking account of ‘human’, ‘nonhuman’ and ‘cyborgian’ forms of agency (indeed all such material-discursive forms)’ (Barad, 2003, p. 826). A stronger focus on socio-materiality could facilitate boundary work emphasizing the dependencies between agency and identity, and according to Barad this would be recommendable because

[agency] is a matter of changes in the apparatuses of bodily production, and such change take place through various intra-actions, some which remake the boundaries that delineate the differential constitution of the ‘human’. (ibid.)

While the 3D learning arena has directed our attention to materiality, it is important to point out that a stronger focus on the materiality of the 2D learning arena could be just as relevant in terms of finding and designing for new ICT-based networked learning opportunities. As stated by Riis (2016) embodiment depends, among other aspects, on sense of presence and sense of co-presence. While the avatar in the 3D arena contributed to a sense of presence, which seemed quite embodied, the continuous dialogues in the 2D arena contributed to sense of co-presence, albeit disembodied. In both cases, students expressed feelings of ‘being there’, and of ‘being there together’ (cf. Schroeder, 2011).

As such, we find that a socio-material perspective, would provide new insights into different modes of identification in terms of either disembodied or embodied engagement, imagination and alignment (cf. Wenger-Tayner & Wenger-Trayner, 2015, Wenger, 1998). Relationships with other and self, are always a matter of negotiation at and with the boundaries of practice, and a socio-material approach could uncover unexpected potentials for learning in both arenas.

Finally, in both studies the strongest dependency between learners and boundary objects, occurred in relation to the dialogical and collaborative fabric of the learning designs, calling for a continued focus on the social aspects of design for learning in problem-oriented and problem-based networked learning.

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ⁱ The modes were called 'modes of belonging' in Wenger (1998).