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A Relational, Indirect, Meso-Level Approach to CSCL Design in the Next Decade

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Abstract This paper reviews some foundational issues that we believe will affect the progress of CSCL over the next ten years. In particular, we examine the terms *technology*, *affordance*, and *infrastructure* and we propose a relational approach to their use in CSCL. Following a consideration of networks, space, and trust as conditions of productive learning, we propose an indirect approach to design in CSCL. The work supporting this theoretical paper is based on the outcomes of two European research networks: E-QUEL, a network investigating e-quality in e-learning; and Kaleidoscope, a European Union Framework 6 Network of Excellence. In arguing for a relational understanding of affordance, infrastructure, and technology we also argue for a focus on what we describe as meso-level activity. Overall this paper does not aim to be comprehensive or summative in its review of the state of the art in CSCL, but rather to provide a view of the issues currently facing CSCL from a European perspective.

Keywords CSCL · Networked learning · Affordances · Infrastructure · Meso-level · Ethics · Indirect design

Introduction

Because Computer-Supported Collaborative Learning (CSCL) is an emerging field of research and interest, it still struggles to find a provisional stability and even

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continues to argue over its very name (Koschmann, 1996, 2001; Strijbos, Kirschner, & Martens, 2004). However, if we think of CSCL from a sociology of knowledge perspective we can see that CSCL has already emerged as a scientific field and a community complete with its own conferences, books, educational programs, and now a journal. The commonsense starting point in CSCL is that learning is social in nature, contextualized and situated in particular settings. The theoretical framework adopted in this paper can be described as socio-cultural, in a broad sense, in that it draws on the works of Vygotsky (1978), Leontjew (1977), Engeström (1987), Lave and Wenger (1991), Wenger (1998), Giddens (1984), Castells (1996/2000), Dewey (1916) and Negt (1975), among others. It should be noted that with regard to epistemology and methodology these traditions are in some ways contradictory, in the relation between subject and object, the level of analysis, and the understanding of technology, for example. As a consequence, there needs to be serious reflection on the ways in which it might be possible to solve these contradictions and on the consideration of whether it's productive to try to solve them at all. Also arising from the very nature of the object of its research, the field of CSCL is interdisciplinary and naturally draws upon a variety of feeder disciplines such as education, anthropology, psychology, sociology, computer science, cognitive science, communication, media, artificial intelligence, and informatics. Studies in CSCL are diverse in their contributions dealing with analysis, theory, modelling, construction, and design. The methods applied in CSCL research stretch from controlled laboratory experiments on group collaboration to action-oriented, situated, social experiments designing for various forms of collaborative learning in a global digital networked setting. What knits the field together and what makes it special is the *integration* of the four fundamental concepts: computer, supported, collaborative, and learning.

However, in some of the recent work reflecting on CSCL, including Koschmann (2001) –one of the founding fathers of CSCL-there is a questioning of the necessity of integrating technology into CSCL:

> "CSCL research has the advantage of studying learning in settings in which learning is observably and accountably embedded in collaborative activity. Our concern, therefore, is with the unfolding process of meaning-making within these settings, not so-called "learning outcomes," It is in this way that CSCL research represents a distinctive paradigm within IT. By this standard, a study that attempted to explicate how learners jointly accomplished some form of new learning would be a case of CSCL research, even if they were working in a setting that did not involve technological augmentation. On the other hand, a study that measured the effects of introducing some sort of CSCL application on learning (defined in traditional ways) would not." (ibid. pp. 19)

Strijbos et al. (2004, pp. 1 and pp. 246) make a somewhat different point, but one that also implies a non-technological emphasis. For these authors the emphasis in CSCL is on learning and the weakness in CSCL is in learning and educational design. Unlike Koschmann, we think it is both necessary and challenging to keep technology within our focus. Unlike Strijbos et al. we see the technological aspect as deeply integrated in a socio-cultural approach to the understanding of collaborative learning. The technology has to be taken seriously as a property, either symbolic or material—a set of tools which can afford meaning making—because this is precisely what makes

this research area special. In our opinion this is where CSCL has something profound to contribute to the field of learning.

Much of the research that has taken place within CSCL has focused on the micro level of collaborative learning-on the collaborative learning taking place in single, small groups. Supplementing these approaches, we would like to argue for more focus on what we would call the meso level of collaborative learning:

- On how to design for collaborative learning at the institutional level, in organizations, school settings, and in networked learning environments,
- On what the basic conditions are that allow for collaborative learning in these settings,
- On how the technology and infrastructure affords, and mediates the learning taking place.

The meso could be thought of as a level that was intermediate between small scale, local interaction and large-scale policy and institutional processes. We would argue that differentiating into levels assists us in identifying the detail of what otherwise might appear as a simple or monolithic social system. We would also suggest that it is possible to use levels and the distinctions between macro, meso and micro levels in a more analytic way. In this form, meso is an element of a relational perspective in which the levels are not abstract universal properties but descriptive of the relationships between separable elements of a social setting. The term micro identifies small group interaction with a highly local (not necessarily spatially local) setting. Meso would identify interactions in and with the settings beyond the small group, but still with a local focus that was open to routine control and intervention. Macro would identify the level of interaction beyond meso that was general in character (even if represented locally) and not open to routine control such that it could on most occasions, be treated as a given. In this sense meso points to the place of social practice as the locus in which broader social processes are located in small, local group activity (Schatzki, 1996; Schatzki, Cetina, & von Savigny, 2001). This suggested link with social practice also links the idea of a meso level of analysis with previous work in cognate research areas such as CSCW. In CSCW organizational concerns have been more generally addressed than in CSCL (e.g., Harper, Randall, & Rouncefield, 2000). The link to social practice also provides a bridge to broader concerns with organizations (e.g., Orlikowski, 2000; Wenger, McDermott, & Snyder, 2002). Such factors as we identify at the meso level have been investigated previously in CSCL research, most notably in cultural historical activity systems terms. Activity systems are not restricted to a micro level and could, in theory, apply to all of the levels we identify above (Engeström, 1987, 1999, 2001).

Following from this approach, we would like to throw light on the field of CSCL making use of the theoretical lenses of educational research, human centered informatics, and the social sciences more generally. In doing so:

> First of all, the right vocabulary is necessary for thinking about the phenomena that occur on levels of analysis that we are not familiar with discussing. In addition, we need appropriate conceptual resources and analytic perspectives. This is what is meant here by *theory*. Philosophy used to provide such intellectual tools, but recently this has become a task for interdisciplinary sciences. (Stahl, 2006, pp. 306)

In the following, we are not providing a theory, but in line with Stahl we would like to contribute to the collaborative process of establishing a meaningful conceptual framework for the understanding of conditions for productive learning in networked learning environments. In order to understand the new emerging practices in this area and to be able to contribute to the productive development of them, we must develop conceptual tools. This is even more necessary because of the interdisciplinary nature of the field. Integrating concepts from different disciplines involves a cost in terms of the intellectual work necessary to ensure that the historically embedded meaning travels with the concepts, and that the concepts are rethought and integrated in the perspective of the new practices and the insights from neighboring disciplines. We will focus on two sets of issues: technology affordances and infrastructure; and networks, space and ethics. The first set of issues is highly general and relates to the theoretical lenses that we might adopt in relation to CSCL. It is our contention that these issues can all be understood using a relational point of view and would benefit from an explicit consideration of meso-level activity. The second set of issues moves towards the objects of research for CSCL. These have emerged in our work as being crucial to an understanding of the conditions for productive learning in networked learning environments.

Background

This paper emerges out of two European research networks and some of the projects related to them. The first of these networks, E-QUEL, an acronym which stands for "e-quality in e-learning," aimed to develop a virtual center of excellence for innovation and research in networked learning for higher and post-compulsory education (http://www.equel.net/). The E-QUEL network brought together researchers and practitioners from 14 institutions across Europe in six different countries and finished its funded work in 2004. The project was organized so that each of the partners worked in plenary sessions and assigned themselves to seven different significant interest groups (SIGs), each of which reported through a position paper at the conclusion of the project and a final dissemination event held at the Networked Learning conference held at Lancaster University, April 5–7, 2004 (http://www.shef.ac.uk/nlc2004).

The second network is called Kaleidoscope; a European Union funded Network of Excellence that aims to integrate 76 research units from across Europe (http://www.noe-kaleidoscope.org). The network was established in January, 2004 and it has a funded duration extending to December, 2007. This large network consisting of 23 partner countries is engaged in a wide range of activities. This article largely reflects work conducted as part of one of the network's projects: "Conditions of productive learning in networked learning environments." It is also informed by the broader work of the network, such as participation in the CSCL SIG and in the activities of the Virtual Doctoral School.

The work conducted in these two networks has informed our ideas in two separable ways. At a general level, the issues we identify arose out of the discussions that took place within the networks. At a more particular level, we illustrate some aspects of our argument with studies that were introduced as case studies by network partners. All the issues addressed here have emerged in our work as crucial to understanding the conditions for productive learning in networked learning environments.

Technology, Affordances, Institutions and Infrastructure

We argue that the concept of technology and the relationship between the design of technology and the use of technology is a crucial issue within the CSCL community. Vygotsky's socio-cultural approach, suggesting that tools fundamentally mediate higher mental functioning and human action, is a deeply accepted stance and at times it is even taken for granted in the CSCL community (Vygotsky, 1978; Cole, 1996; Kaptelinin, Danielsson, & Hedestig, 2004). Human action employs means of mediation and these means shape actions in crucial ways. In education it is common to focus on how information and communication technology (ICT) functions as a tool for the appropriation and understanding of conceptual knowledge (Säljö, 1999). It is not necessarily useful to categorize mediating means into external or technical tools on the one hand, and internal or intellectual tools on the other. These functions and uses are in constant flux and transform as the activity unfolds (Engeström, 1999). Tools such as maps, written documents, technical drawings, etc. are not simply a mental function; they also have a clear material form. As such, they persist, continuing to exist as physical objects even when they are not incorporated into the flow of action (Wertsch, 1998). Both the material and symbolic properties of tools are seen as having important implications for understanding how internal processes come into existence and operate. Fjuk and Berge, in a case study presented as part of our Kaleidoscope activity, argue that in order to understand these processes, analysis and design must consider the individual learner in her/his concrete situation and the mediational means that are employed (2004). Fjuk and Berge argue that it is important for systems developers to understand the incorporated role of artifacts in networked learning environments. This means going beyond the operational functionality of a particular technology and considering the constellation of artifacts in relation to the specific conditions in a setting and the objectives of the activity.

The focus on social practice links this work to a similar position elaborated by Orlikowski (2000). Orlikowski suggests making an analytical distinction between the use of technology, what people actually do with technology, and its artifactual character: the bundle of material and symbolic properties packaged in some socially recognizable form, e.g., hardware, software, techniques, etc. (Orlikowski, 2000, pp. 408). Through a theoretical and empirical analysis, she demonstrates that the same artifact used in different institutional contexts and by different social actors can evoke very different actions. Theoretically, these different processes are explained by Orlikowski using structuration theory (Giddens, 1984), and she makes a distinction between two discrete approaches (Orlikowski, 2000, pp. 405):

a) An approach which posits technology as embodying structures (built in by designers during technological development), which are then *appropriated* by users during their use of the technology.
b) A practice-oriented understanding where structures are emergent. Structures grow out of recursive interactions between people, technologies, and social action in which it is not the properties of the technology, per se, which structure the practice. Rather, it is through a recurrent and situated practice over time, a process of *enactment*, that people constitute and reconstitute a structure of technology use (Orlikowski, 2000, pp. 410).

The practice-oriented structuration approach to technology presented by Orlikowski in (b) suggests that although the technology embodies particular symbolic and material properties, the technology in itself is not a structure that determines the use and the users. Rather, the opposite is true: the structure-understood as resources and rules-is instantiated and emerges through the user's responses and enactment in relation to the technological artifact. We would go on to argue, however, that Orlikowski may present too strong a contrast between the two approaches summarized in a) and b) above. Seen from the practice of design, technologies do indeed embody features and properties and they also carry meaning. Having been designed with certain purposes in mind, certain understandings of communication, interaction and collaboration were embedded in the design process. There are many examples of this within education. The design of virtual learning environments reflect certain models and understandings of communication, interaction, collaboration, teaching, and learning and they provide particular functionalities (Tolsby, Nyvang, & Dirckinck-Holmfeld, 2002). Although these might vary in flexibility and in adaptability, the information architecture embodies particular symbolic and material properties. These properties are not determinant of the use made of them—here we agree with Orlikowski—but they make available certain features that can become affordances in use, and make some kind of practice more available than others. How the technology is enacted is therefore closely related to the properties, social as well as technical, which are reified in the design. (For more on this discussion, see also Stahl, 2006, esp. Chpts. 13 & 16). For CSCL it becomes an interesting research question to ask both how technologies are taken into use in ways related to what may be thought of as their technological affordances (see below), and also how they are reconfigured by users in varying situations and institutional contexts, including how users find creative ways to deal with inappropriate design.

This problem raises a question about the level of analysis being used and it would be reasonable to ask the question: "Do meso-level processes show up in micro-level analyses?" Our answer is that, in principle, macro- and meso-level processes will be available within micro-level interaction. However, we argue that on its own, the availability for analysis of interaction related to other levels is not enough. We argue that you need a theoretical approach that explicitly takes the meso level into account, not just in terms of explanations but also to direct attention to those features of a setting that may remain invisible while attention is focused on macro- or micro-level analysis. Therefore, analysis focused at the meso level also has to take account of both macro- and micro-level processes. Indeed, we argue that analysis at the meso level can help to link processes at the other two levels together.

Another way to deal with this question is to examine how we conceptualize technology. In her paper, Orlikowski (2000) counterposes technology thought of as:

a) "an identifiable, relatively durable entity, a physically, economically, politically, and socially organized phenomenon in space-time"–a technological artifact.
b) "a repeatedly experienced, personally ordered and edited version of the technological artifact"–technology in use (Orlikowski, pp. 408).

She makes it clear that this distinction is analytic rather than ontological in character but our work leads us to question the usefulness of this distinction in relation to certain kinds of technology. In particular we wonder whether the Web or Internet can usefully be thought of as technological artifacts in relation to CSCL. We would support the general position that Orlikowski seeks to maintain, but we are

concerned that conceptions that apply the metaphor of artifact to large, complex and composite forms such as the Web and Internet are in danger of reifying a deeply reflexive phenomenon. In important ways the Web and Internet do not fully conform to Orlikowski's criteria. Though relatively durable, they are constantly in flux; though organized, they show an uncommon self-organizational capacity; they are a network form, rather than stable economic, political and social forms. This dynamic form suggests that we cannot treat the Web or Internet as a technological artifact, but we can presume that these forms exist significantly at the macro-level of analysis. That is, although deeply reflexive they are beyond routine control or influence. At the meso level, the deployment of Web and Internet technologies in the form of intranets, virtual or managed learning environments, etc. brings these complex forms to a level in which routine control and influence may indeed be possible and the technology is always a repeatedly experienced and edited version. At the micro level we would point to the ways in which Web and Internet technologies become part of the local and particular interactions. At the micro level of interaction technology is always technology in use. We suggest that the concept of technology, and in particular the concept of technological artifacts, is an area ripe for further CSCL research, especially in relation to large-scale and composite technological forms such as the Web and Internet and the way in which they impact at different levels of analysis.

Affordance

The concept of affordance has been central to thinking about technology within the CSCL tradition and beyond. The idea of affordance has been applied to technology in the sense that:

> "technologies possess different affordances, and these affordances *constrain the ways that they can possibly be* '*written*' *or* '*read*'." (Hutchby, 2001, pp. 447)

The concept of affordance, used in this way, allows for the possibility that technologies can have effects on users and that particular technologies can constrain users in definite ways. The idea has its origins in the work of Gibson (1977) who was interested in the psychology of perception. Gibson argued for a non-dualist understanding of perception. His main interest was studying perception as an integrated or ecological activity. Affordances in Gibson's view might vary *in relation* to the nature of the user but they were not freely variable; the affordances of a rock differed from those of a stream, even though different animals might see the affordances of each differently. Gibson's view is strongly relational and differs in significant ways from the later application of the idea of affordance by Norman (1990, 1999). Donald Norman takes an essentialist and dualist approach in which technologies possess affordances and users perceive them. Arguably, Gaver (1996) developed a position that is more aligned with Gibson's original idea, and in his 1996 paper Gaver clearly argues for an ecological and relational perspective close to the one presented here. Nonetheless, it remains the case that Gaver argues that on the one hand, objects have affordances, and on the other that they are made available through perception. This is a clearly dualist outlook and subsequent appreciation of his work has largely identified this aspect rather than his ecological and relational remarks. All three authors have recently been reviewed by Kirschner, Strijbos, and Martens (2004), who emphasize the distinction added by Norman

between an affordance as a property possessed by an entity and an affordance as it is perceived. Kirschner et al. (2004) suggests that educational researchers and designers are not dealing with the affordances of technologies themselves; rather they are dealing with the perceptible (Gaver, 1996) or the perceived (Norman, 1990, 1999). In both Norman's and Gaver's view, the link between an affordance and action is one that relies upon the perception-action coupling.

Kirschner et al. (2004) proposed a six-stage model for a design framework based on affordances. This sophisticated and detailed model categorizes affordances as educational, social, and technological. Educational affordances are defined as "those characteristics of an artifact that determine if and how a particular learning behavior could be enacted within a given context." (Kirschner et al., 2004, pp. 14). Social affordances are defined as "properties of a CSCL environment that act as social-contextual facilitators relevant for the learner's social interaction." (2004, pp.15). For technological affordances, the definition relies on Norman and technological affordances are "perceived and actual properties of a thing, primarily those fundamental properties that determine how the thing could possibly be used." (2004, pp.16). It can be seen that all three definitions rely upon an essential reading of affordance, on the *properties* and *characteristics* of CSCL environments, artifacts, and things. In all types of affordance considered by Kirschner et al., the property of having an affordance lies within the thing, environment or artifact, even if the affordance relies on these features being perceived (2004).

The view of affordance that we have begun to consider and would propose to the CSCL community is one that returns to a Gibsonian view and extends the ecological stance found in Gaver (1996): a view that treats affordance as a *relational* property. In this view, affordance is not simply a property of an artifact alone, but it is a 'real' property of the world in interaction. In this way of thinking about affordances, properties exist *in* relationships between artifacts and active agents, which would include animate actors and, following Actor Network Theory, inanimate actants, even though there are distinctions between these different active agents in terms of intentionality. This view is non-essentialist, non-dualist and does not rely on a strong notion of perception. Affordances in this view could be discerned in a relationship between different elements in a setting whether or not the potential user of an affordance perceives the affordance.

In educational settings we are likely to be concerned with reflexive social relationships. For example, in a CSCL setting a task set for formative or summative assessment can provide the affordance of focusing group activity around which collaboration can occur. A relational view of affordance would suggest that we could analytically discern features of the setting apart from the perceptions of particular groups of users. Any actual group of users would have varied understandings and draw out different meanings from the setting, but designers can only have direct influence over those abstract elements that may become affordances in the relationship between the task and the participants. An example of such relational thinking can be found in Kreijens and Kirschner (2004). They point to the affordance of proximity in encouraging face-to-face interaction such as that associated with coffee machines/water coolers. They point to the need for teleproximity in computer networks, a simulacrum of actual proximity using designed features in digital environments. The affordances of both proximity and teleproximity rely on the relationship between participants rather than being a feature of any particular participant or a feature of the digital or physical environment.

We would argue that such a reading of affordance, alongside a view of analytic levels, allows the dynamic appropriation of artifacts in settings to be a central focus of research without losing sight of the design requirement to develop relatively fixed forms for a design, knowing that the interpretation and enactment of the design will be contingent and subject to interpretation in the interactions in any given setting.

Institutions

Implementation of CSCL in higher education is a complex task involving management, administration, and ICT support as well as teachers and learners. The environment students inhabit is now a dense interconnection between many technologies in what have been described as students' 'learning nests' (Crook, 2002). The student experience is developed through activity using mobile phones, SMS and voice, instant messaging, institutional Virtual Learning Environments (VLE), and a variety of access points for digital resources including journal articles and e-books. The practices of teaching staff are influenced in lecture theatres and classroom settings by the availability of technical resources, such as digital projectors and network links. Research in CSCL recognizes that influences on practice arise from organizational as well as pedagogical perspectives (Collis & Moonen, 2001; Dirckinck-Holmfeld & Fibiger, 2002). Despite these contributions, however, the implications beyond the practice of the individual teacher or small groups of teachers are still relatively vague. Change nevertheless involves processes well beyond the individual or small group.

In a recent case study of a Masters-level program developed as part of our work, Jones (2004b) argues that obtaining a single login to enable all students in a distance-education program to access library-like digital resources is a multi-level problem. Jones (2004b) argues that the technology does not present itself as a simple technological artifact; rather the technology is immediately a socially-mediated form. At a macro level the required digital resources are enmeshed in a legal framework of ownership concerned with property rights. Access to the materials and resources available for teaching and learning is not a simple matter as some of the materials that appear freely on the web are ephemeral with links moving or disappearing on a regular basis. Secure resources have to be embedded in an institutional and organizational infrastructure that takes on some of the roles, such as preservation, that libraries have hitherto fulfilled. This institutional support may be external to the university and even the educational sector, as with materials supplied by government, NGOs, and corporations. When resources become organizationally supported they often disappear from the Web's open access behind password protection. The creation of a single log-on authentication for staff and students and a public 'commons' for educational materials is a political, legal, and social process well beyond the control of single educational programs. The significance of meso-level activity, focusing on organization and technical provision in departments, faculties, and entire universities in this multi-level process is very high and conditions the range of choices available at a micro level.

Infrastructure

In common usage, infrastructure refers to the generally subordinate and relatively permanent parts of an undertaking. In a city we might think of roads, the sewage

system, the water supply, the electricity or gas utilities, and the communications systems such as telephone lines. Infrastructures for CSCL, and learning more generally, might include the provision of ICT as it is closely related to the organizational and institutional factors mentioned above. In a sense, the infrastructures are the working out of institutional processes in relation to available technologies. Earlier we noted that it was difficult to consider technological forms such as the Internet and Web as artifacts. We would suggest that one way of considering such amalgams, such composites of technologies, is as infrastructures. Recently the notion of a "learning oriented" infrastructure has been introduced, relating more general ideas of technological infrastructures to the specific practices of learning (Lipponen & Lallimo, 2004).

Nyvang and Bygholm (2004), in a case study of a campus-based networked learning environment developed for presentation in the Kaleidoscope network, draw on the works of Star and Ruhleder (1994, 1996). They suggest that we interpret ICT in use as infrastructures that both shape and are shaped by practice. They go on to propose that we understand infrastructure as a relational concept. "Thus we ask, when-not what-is an infrastructure." (Star & Ruhleder, 1996, pp. 113). This understanding of infrastructure has strong resonance with the earlier accounts of technology and affordance, and we would suggest that the infrastructure for CSCL is a location in which these general issues find focus for research. Infrastructures are concerned with the design of complex environments rather than singular tools or artifacts, environments that are informed by pedagogical and organizational understandings of practice. We return to the issue of design when we discuss the issue of design in relation to space and place. Our argument here, following work by Guribye (Guribye, Andreassen, & Wasson, 2003; Guribye, 2005), is that infrastructure can best be understood in a similar way to that suggested for affordance: as relational and ecological.

We have argued that technology, affordance, institution and infrastructure are terms that the CSCL community may need to revisit. We have suggested that all four may be better understood using a relational perspective. We have also set out a number of ways in which we think this approach may lead to new research directions. The idea of technology and, in particular, the idea of technological artifacts is an area ripe for further CSCL research. We argue that technology and the affordances that may emerge in its use are factors that require investigation at a more meso level than has been usual in CSCL.

Conditions for Productive Learning: Networks, Places and Ethics

This section examines three issues as examples of areas that need further research in CSCL from different levels of analysis. The first examines the capacity that networks have at a general level to influence learning. We suggest that networks are implicated in the patterning of forms related to digital technologies—the Web and Internet, for example—with embedded features linking individuals, groups, and institutions across time and space in ways that influence the broad conditions for learning. The second issue examines questions related to design in such environments. Design in this sense concerns both task and spatial design and, using the example of space and place in networked settings, argues for the appropriateness of an indirect notion of design for networked learning. Finally we examine the question of ethics. This discussion focuses on the social dimension of activity in networks and relates to the discussion of the meaning of collaboration and communities of practice.

Networks and Networked Learning

Castells (1996, 2000) writes about inclusion/exclusion in networks and the architecture of relationships between networks, enacted by information technologies, which configure the dominant processes and functions in our societies. Castells, following Wellman (Wellman, Quan-Haase, Boase, Chen, Hampton, Isla de Diaz, & Miyata, 2003), has described the form of sociality in network society as one of 'networked individualism' (Castells, 2001, pp. 129 ff). On the one hand, the new economy is organized around global networks of capital, management, and information, whose access to technological know-how is at the root of productivity and competitiveness:

> "Business firms and, increasingly, organizations and institutions are organized in networks of variable geometry whose intertwining supersedes the traditional distinction between corporations and small business, cutting across sectors, and spreading along different geographical clusters of economic units" (Castells, 1996, pp. 502)

On the other hand he claims that the work process is increasingly individualized:

> "Labour is disaggregated in its performance, and reintegrated in its outcome through a multiplicity of interconnected tasks in different sites, ushering in a new division of labour based on the attributes/capacities of each worker rather than the organization of the task" (1996, pp. 502)

This overall trend in societal development raises fundamental questions about the relationships between the networked society and the organization of learning environments within formal education. The term networked individualism suggests that it is possible to take a critical approach to theories of community based on consensus, without ruling out the possibility of communication and dialogue. In particular, 'networked individualism' suggests that it is possible for subjects to communicate from their own unique, socially situated positions. It also suggests that a community is reconfigured in networks so that different aspects of the community are supplemented whilst others are decreased. It is an interesting research question whether the Internet will help foster more densely knit communities or whether it will encourage sparser, loose-knit formations. We believe it is a significant question for CSCL whether the designs of networked learning environments have to, or perhaps should, reflect the trend towards 'networked individualism' or, on the other hand, whether CSCL could serve as a counter practice offering opportunities for developing collaborative dependencies in networked learning environments.

The idea of networked learning has developed some force within European research, expressed in a number of publications and a series of international conferences. One definition of network learning from this tradition is that:

> Networked learning is learning in which information and communication technology (ICT) is used to promote connections: between one learner and other learners, between learners and tutors; between a learning community and its learning resources (Jones, 2004b, pp. 1).

The central term in this definition is *connections*. This definition takes a relational stance in which learning takes place in relation to others and also in relation to

learning resources. Networked learning differs in this way from CSCL and Communities of Practice in that it does not privilege strong relationships, such as cooperation and collaboration, or the close relations of community and unity of purpose. Unlike CSCL and Communities of Practice this definition of networked learning draws particular attention to the place of learning resources and peer learners in relational terms (for further elaboration of this view see Jones, 2004a, 2004c; and Jones & Esnault, 2004).

European research and practice has been heavily influenced by Communities of Practice thinking, and other learning environments for professionals have built more explicitly on ideas of Communities of Practice and the pedagogical principles of collaborative learning. This trend is evident, for instance, in the form of problem—and project-based learning: encouraging and expecting students to work together and to rely on interdependencies among students (see, for example, Dirckinck-Holmfeld, 2002; and Fjuk & Dirckinck-Holmfeld, 1997). The concept of Communities of Practice has developed from the apprenticeship model proposed by Brown, Collins, and Duguid (1989), and is most commonly associated with the work of Etienne Wenger (1998).

For Wenger, networks are not necessarily in opposition to the ideas of Communities of Practice. Wenger suggests that a network with strong ties resembles a community.

> "Communities of practice could in fact be viewed as nodes of 'strong ties' in interpersonal networks" (1998, pp. 283)

However, he also stresses the difference in purpose:

> "...but again the emphasis is different. What is of interest for me is not so much the nature of interpersonal relationships through which information flows as the nature of what is shared and learned and becomes a source of cohesion-that is, the structure and content of practice" (1998, pp. 283)

In other words, Wenger is not only concerned with the flow of information between nodes; he also emphasizes the differences in what flows across the network. Communities of Practice are characterized by three related structural properties—a shared enterprise, mutual engagement, and a shared repertoire (Wenger, 1998, pp. 72)—while networks are characterized as interconnected nodes (Castells, 1996/2000), or the *connections* between learners, learners and tutors, and between a learning community and its resources (Jones, 2004b, pp. 1). As such, networked learning is concerned with establishing connections and relationships whereas a learning environment based on Communities of Practice is concerned with the establishment of a shared practice. An area of common ground between network analysis and Communities of Practice may be found in the idea of networks of practice, proposed by Brown and Duguid (2001) to deal with relationships that are too broad and diffuse to be considered Communities of Practice.

The case studies we drew upon in our work provided contrasting examples. In some learning environments this issue is dealt with by a combination of the networked perspective alongside a community of practice, in the sense that the individual learner is supported in relating learning to his/her work practices, which are seen as the primary community of practice (Jones, 2004b). In other learning environments, however, different means are used, such as team based project work in order to not

only design for and facilitate connections between students and between facilitators and their learning resources, but also to establish true interdependencies and mutual engagement between all participants, such as peer students, teachers, and facilitators (Dirckinck-Holmfeld, Sorensen, Ryberg, & Buus, 2004).

The notion of networked learning and the practical application of the design of networked learning environments raise several questions:

- Should researchers, in CSCL and education more generally, serve as critical opponents to the overall trends in the networked society as expressed by Castells (1996, 2000) and stand up against "networked individualism," or should the design of CSCL and education reflect these trends?
- Which models-networked or community of practice models—are more productive with respect to the learning of the individual participant, and under what conditions? Is it, for example, more productive for busy professionals to be organized through a pedagogical model based on relatively weak ties among the participants, or is it more productive to be organized in accordance with a pedagogical model facilitating the development of the strong ties in a community of practice?

The theoretical approach based on the metaphor of networks is one that has a strong resonance with the relational approach suggested earlier.

Space and Place in Networked Environments

Several authors have in recent years pointed to the need to distinguish between space and place in computer networked environments (see, for example, Goodyear, Jones, Asensio, Hodgson, & Steeples, 2001; Jamieson, Taylor, Fisher, Trevitt, & Gilding, 2000; Ryberg & Ponti, 2004). Goodyear et al. (2001, Part 8) claim that we should not try to design the elements that are most closely involved in learning itself. In Fig. 1 below, Goodyear et al. suggest that designers can design for organizations, tasks, and spaces but it is participants who make them into communities, activities, and places. Perhaps even more importantly the figure suggests no known link to learning itself, either for the designer or the participant. The authors suggest that the learners them-

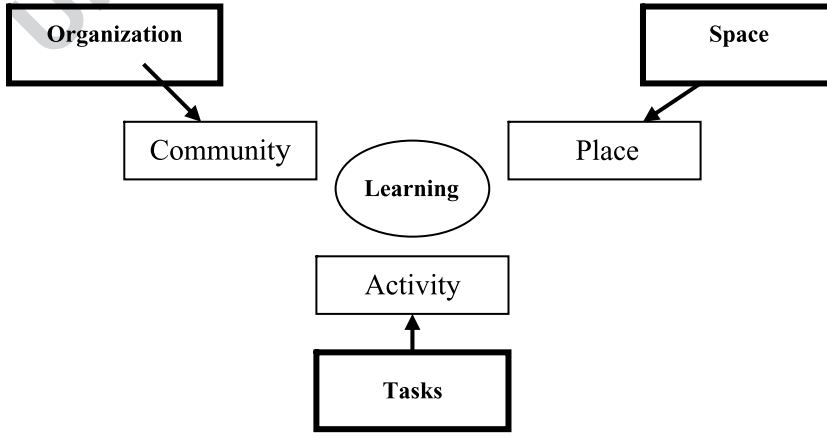

Fig. 1 Design an indirect approach Goodyear et al. 2001

selves should have some capacity to adapt and reconfigure what teachers and designers create for them. They argue that it is appropriate to try to design learning spaces (the physical learning environment, including all the artifacts which embody "content") but they point out that we should expect students to customize these designed learning spaces and make their own "local habitations" or "nests" (Nardi & O'Day, 1999; Crook, 2002). More generally, they argue for a distinction to be made between space, understood as a relatively stable and potentially designed environment, and place, understood as contingent and locally inhabited.

The distinction between space and place is connected in significant ways to the earlier discussions of technology, affordance, and networks. Participants in a computer network are simultaneously situated at a real point in time and space and displaced from that point in a space configured through the network. Ryberg and Ponti (2004), writing from within the Kaleidoscope project, are interested in the development of social context in networked environments. They comment on Lash (2001) who argues that networks are non-places.

> "Technological forms of life are disembedded, they are somehow 'lifted out.' As lifted out, they take on increasingly less and less the characteristic of any particular place, and can be anyplace or indeed no place. This lifted-out space of placelessness is a generic space... It is not any particular space, but a generic space. Its context is no context at all. Its difference is indifference... The Internet is a generic space. It is no particular space. Indeed, networks are themselves by definition lifted-out spaces." (Lash, 2001, pp.113)

Ryberg and Ponti ask the question:

> "If networks are non-places, with no context at all, how can we create a social context to support interaction and sociability?" Ryberg and Ponti (2004, pp. 2)

Drawing a distinction between space and place, Ryberg and Ponti quote Harrison and Dourish (1996) "space is the opportunity, place is the understood reality."

The distinction between space and place is fundamentally rooted in the shift toward networked environments and is one example of the set of problems in which designers only have an indirect control over the intended outcomes of their design. Indeed, we argue that this fundamental design problem could be useful in specifying a more general case for the ways in which design can be thought of in CSCL. It is also related to the notion of space as produced through interactions between individuals and institutions, rather than thinking of space as simply given. This point would be true of *all* spaces, and would not simply apply to virtual spaces (see, for example, Lefebre, 1991 ; and Urry, 2000). Overall, we argue that the notion of space and place is a problem area that could have significance for CSCL in its own right as well as practical implications in terms of design in that it illustrates a wider point with major significance concerning the indirect nature of design in networked learning environments and the dependencies of design on social context, types of organization, and enacted practice.

Ethical Issues in CSCL

Collaboration is not simply a technical, pedagogic, or pragmatic concern. Collaboration includes an ethical dimension, both in terms of the rationale for its

use and in terms of the conditions for its success. The question, "why collaborate?" cannot simply be answered by measures of success such as learning outcomes or considerations of alignment with effective learning goals. Collaboration has an ethical dimension that speaks to the ways in which we choose to structure our social lives. Too often collaboration is reduced to narrow concerns that ignore this ethical choice. This can lead to those involved in a CSCL environment to not appreciate the rationale behind activity and compare it unfavorably with individualized and transmissive methods that flow from different ethical positions.

In terms of the considerations for the successful use of CSCL, the question of trust is central. Trust has been identified as an ethical question at the heart of communication:

> "Regardless of how varied the communication between persons may be, it always involves the risk of one person daring to lay him or herself open to the other in the hope of a response. This is the essence of communication and it is the fundamental phenomenon of ethical life." (Løgstrup, 1997, pp. 17)

In work related to the Kaleidoscope network, Rasmussen (2004) has argued from this position that this:

> "...is not a question of a concept of trust which stands or falls on whether or not it is honoured. It is a matter of the simple form of trust expressed by the fact that we cannot avoid surrendering to each other." (Rasmussen, 2004, pp. 4)

CSCL and collaborative activity more generally is a public and an accountable activity in which those active are potentially subject to surveillance (see below) and as such the issue of trust becomes central.

Furthermore, Rasmussen argues that this ethical demand can only be honored spontaneously. As soon as we begin to think about whether we are really acting as we ought, the focus moves towards ourselves and away from acting exclusively in relation to the other person. This ethical requirement for spontaneity can come into conflict with the modern demand for self-reflection. In educational terms, we often require our students to be critically reflective in relation to their own work and the work of others. The question then arises as to how this might affect trust in CSCL environments. In so far as we require actions which are engaged in as a duty, these actions may lose in spontaneity and in trustworthiness, elements that are central to trust and, as a consequence, to collaboration. Also, if free communication relies upon spontaneous action and the ability to lay oneself open to others, how much does the planned nature of many CSCL environments and the pedagogic requirement for reflection affect collaboration and communication, and how might we design CSCL environments to reflect this ethical concern?

A second area of ethical issues, arising out of the social and collaborative issue of trust and affecting the conditions for productive learning concerns surveillance and control. Writers from the tradition of Foucault point to CSCL environments as environments in which participants are aware that their actions are under surveillance (see, for example, Land & Bayne, 2005; and Rasmussen, 2004). Surveillance comes from other participants in an equal power situation and often from others who are in a position of actual or potential control (e.g., teachers or managers of the teaching program). Land and Bayne point out that for the tutor, as constituted in the discourse and practices of computer mediated environments, they

are both 'seers' of their students and 'seen' by their managers in an increasing process of accountability in education (2005). This would suggest that participants would generally conduct themselves in accordance with the perceived norms of the environment and attempt to conceal actions that step outside of the accepted norms.

An example of how issues of trust impact on learning in networked environments can be found in the work done by the moderator in networked learning environments. Salmon argues that successful learning is the result of networking, but it is crucial that networking occur within a safe space:

> "[s]uccess in using CMC seems to come where most networking occurs and where there is openness and freedom to explore with little risk attached." (Salmon, 2000)

Part of the moderator's role, according to Salmon, is the creation of this safe space, and to address any concerns or fears that the learners may have. Trust is a central element in the provision of both a safe environment for learners and the conditions for communication and collaboration. An interesting research question for CSCL might be how the condition of trust affects different types of relationships. It is by no means obvious that the weak links identified in network analysis are any less dependant upon trust. Indeed, the maintenance of weak links may require a high degree of trust just as much as the strong links of community and collaboration. The ethical question of trust may however, be in tension with Castell's notion of networked individualism. The ethical confrontation (and ethical practice) as embedded in computer-supported collaborative learning is an overlooked feature, which we argue should receive greater attention.

A Relational Approach and Indirect Design

Throughout this article we have argued for what we refer to as a relational approach. This argument has been developed in relation to the uses of the terms technology and affordance in particular. At this point we wish to clarify what a relational approach might involve and how it might result in a research agenda for CSCL. At a general level, the key to the position we argue is that it is a non-dualist understanding of technologies and their affordances. This approach is not in itself novel and builds, as we noted in the introduction, upon the broad socio-cultural tradition. We do not believe that we can think of technologies as being artifacts in any normal sense of the word. An artifact distinguishes those features of the world that are the products of human activity from those that are naturally occurring. We are interested in a different distinction: that between things, conceived of as facts external to human interpretation, and the nature of those features of the world that are always subject to interpretation. A dualist approach suggests that technologies exist separately from interpretations of them and that such technologies possess affordances. The other aspect of this dualism is that the technology or affordance has to be brought into the human mind through perception. An alternative to this view could be a radical social constructivism and relativism that claimed that all features of the world have to be constructed by an active human engagement with them and that there are no definite and discernable features fixed in the world beyond human thought. The position we argue for is one that adopts a relational view, a view that neither accepts external

features in the world as fixed, nor adopts relativism. A relational view suggests that technology and its affordances exist in the relationships between people and the material world. Technologies do not have affordance within them, affordances occur *in* relationships with active agents or actants.

The implications of this dualism for research in the CSCL tradition are to extend and deepen aspects that are already present rather than to present a unique approach. The two key areas we point to are the idea of a meso-level approach to research and an indirect approach to design. We argue that while in principle all levels that can be distinguished analytically will be present in observed social interaction, being present is not sufficient to make them available for research. We noted earlier that macro- and meso-level processes will be available within micro-level interaction. The point we make is that while they are available, they have to be made visible within a research framework. Making the meso level visible, we suggest, is particularly important at this point in the development of the CSCL tradition because of the increasing importance of the technological and social infrastructure in which CSCL activity is embedded. This point came out clearly from the case studies presented in the Kaleidoscope project. For example:

> "ICT in itself is thus not sufficient for an infrastructure-it has to be integrated in and support practice. The findings we have discussed in this paper show challenges to the emergence of an educational infrastructure. As for the solution and further work with the concrete problems elucidated in this study we would like to stress the importance of organizational structures that support not only the use of the infrastructure, but also the discussion about the proper use of the system in the context and the discussion about the goals and values." (Nyvang & Bygholm, 2004)

Other case studies identified different aspects of infrastructure concerned, for example, the delivery of online digital resources (Jones, 2004b) and the provision of video conferencing (Kaptelinin & Hedestig, 2004). In both of these cases infrastructure was not simply the technology, it concerned organizational support and changes in local practice. The case study by Kaptelinin and Hedestig explicitly raises the issue of the invisibility of some aspects of the setting (2004). The level of analysis of infrastructure was beyond the micro in situ activity of learners and CSCL groups and it was more localized and open to influence than macro-level features.

The approach to technology outlined above points to the need for what we label *indirect* design, so that we can design *for* learning. This stands in distinction from those who argue that we can design learning and learning environments directly. The relational view we have of technology and its affordances suggests that designers have limited direct control over how their designs are enacted. How learners respond to, understand, and enact in relation to any design is a complex structuration process that has to be studied in practice. Examples of such studies have been given throughout this article and they draw on a wider range of cases developed as part of our work that includes Fjuk and Berge (2004); Pilkington and Guldberg (2004); Johnsson, Vigmo, Peterson, and Bergviken-Rensfeldt (2004); and Bernsteiner and Lehner-Wieternik (2004). In our review of the case studies and theoretical work we had undertaken it became clear that there was an underlying common theme in relation to design. In order to plan and design for learning in CSCL environments some degree of predictability of response to the design is

required. Our research showed how contingent factors necessarily reduced design capacity in this critical regard. We focused on exactly what we understood to be available in terms of design as predictable aspects for planning. We suggest that designers within CSCL need to concentrate less on the material aspects of the designed artifact and more on the relationships that surround the enactment of the design and the mobilization of technologies and artifacts in that enactment along with a basic understanding of the role that the technology or infrastructure play in the teaching and learning process. This approach might also suggest a flexible approach to design in which designed artifacts are thought of as shells, plastic forms that incline users to some uses in particular but are available to be taken up in a variety of ways and for which the enactment of preferred forms depends upon the relationships developed in relation to learning. This may also point towards user-centered design methodologies, where designers and users collaborate closely in the design process (Kaptelinin & Hedestig, 2004).

Future Perspectives for CSCL

Throughout this paper we have tried to indicate where we believe our reflections point us in terms of future topics and issues for CSCL research. Overall we have argued for a relational approach to our understanding of technology, affordances, and infrastructure and we wonder if a network metaphor and an ethical dimension to our approach may be necessary. We indicated that the question of how technologies simultaneously embed constraining features and express relatively fixed properties—including design intentions—and are also brought into use contingently in ways related to and reconfigured by users with differing intentions in a variety of settings, draws us towards what we describe as a relational approach to technology and its affordances and an indirect notion of design. Technology within the CSCL tradition has had a relatively narrow focus that places in the background issues concerning the politics, policies, institutions, and infrastructures in which the processes of CSCL take place. We would argue for a greater focus on what we call the meso level of collaborative learning. We would include in this the way in which many of the aspects of the settings in which CSCL is enacted are beyond the direct control of the individuals and groups involved. Such areas might include the way institutions select and implement infrastructures within which CSCL will take place, including the use of open source software (Nyvang & Bygholm, 2004; Svendsen, Ryberg, Nyvang, Semey, Buus, & Dirckinck-Holmfeld, 2005). We suggest that the concept of technology itself, in particular the use of the term "technological artifact," is an area that requires further attention in CSCL research. We point in particular to the Web and Internet as large-scale and composite technological forms through and in relation to which CSCL now takes place. The past ten years have seen CSCL move from an environment in which the Internet was a minority concern and the Web only an emerging form, to a time when the Internet is becoming ubiquitous and the Web a basic platform.

Our research points us to a number of ethical questions related to our approach to technology. We point to how the condition of trust affects different types of relationships, including the weak links identified in network analysis and the strong links of community and collaboration. We argue that it is a significant question for CSCL whether the designs of networked learning environments have to reflect the

trend towards 'networked individualism' or whether CSCL researchers might choose to act as a counter practice by offering opportunities for the development of collaborative practices. We ask whether CSCL, and education more generally perhaps, can or should act as a critical opponent to some of the trends identified in the networked society and stand up against "networked individualism." We ask whether CSCL should privilege certain models of learning—for example, networked learning or Communities of Practice—and whether such models are more productive with respect to learning and under what conditions that might occur. We use the example of the continuing professional development of busy professionals and wonder if organization through a pedagogical model based on relatively weak ties or one based on the strong ties in a community of practice is more appropriate. We argue that these are choices that need to be made on the basis of CSCL research, which can provide good criteria for selection.

In this article we have proposed a deepening of approaches already found in CSCL, which emphasize a non-dualist and relational approach to understanding technologies and their affordances. We have linked this to what we have called a meso-level approach that explicitly addresses issues that arise beyond small group interaction but sufficiently close to that setting for the features to be open to influence and control. We go on to suggest that this approach leads on to an indirect approach to design. In our introduction we took issue with recent work in CSCL that downplayed the role of technology. In this article we have begun to articulate an approach to technology that places technology in a central position but interprets it in a particular way. Throughout this article we have not aimed to offer a fully developed theory as our thinking is still at a formative stage. Rather, our intention has been to identify issues and to begin a process that we believe might lead to answers and more fully developed theoretical approaches. We think this approach is in keeping with the exploratory and innovative field of CSCL.

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