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Roles, design, and the nature of CSCL

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ABSTRACT

In this article, I argue that roles are a key construct for CSCL that demonstrate the interdisciplinary strengths of CSCL as a field. CSCL is a problem-driven field with a history of incorporating different paradigms, and has the advantage of using a design stance to understand phenomena like collaboration and learning that are difficult to study. Roles are understood differently by different disciplines, but the concept of roles serves as a boundary object between the different disciplines within CSCL and highlights potential areas for research.

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1. Introduction

This special issue brings together a variety of articles on the nature of roles in computer-supported collaborative learning (CSCL), with a wide variety of perspectives ranging from the impact of scripted roles on student learning to emergent roles in naturalistic (not even explicitly 'learning') communities. The temptation is to arrange these articles on a continuum from those that assign roles (via scripts, or other means) and those that allow roles to be determined by participants and study what emerges. However, casting this special issue as 'should we script roles or not' would do a great disservice to both the studies in the issue, and to the field as a whole.

Roles are a key phenomenon not only in CSCL, and not only collaborative learning, but in learning and in collaboration more generally. Perhaps more importantly, roles help highlight what is unique and valuable about CSCL research and what it has to offer to other fields ranging from psychology and sociology, to education, to computer–human interface design. In the remainder of this commentary, the unique aspects of CSCL will be laid out, how roles and scripting fit into CSCL, and what this implies for other fields.

2. Characteristics of CSCL

2.1. CSCL as disciplinary crossroads

The field of CSCL has existed for approximately 20 years. Like many other new fields of study, the emergence of CSCL can be identified with both an intellectual and a cultural history. The intellectual history of CSCL, like so many other nascent fields,

stemmed from developments that suggested novel combinations of ideas that permitted new solutions to old problems, in this case using technology to structure collaboration and learning. The problems of teaching and learning, and of collaboration, were old. What was new was the possibility that computers, and especially networked computers, could influence these processes. Like many problem-focused disciplines, CSCL did not neatly decompose into existing traditional disciplinary epistemologies. The problem itself could neither be called simply an engineering problem, nor a psychology problem, nor an education problem, nor an information design problem. Rather, CSCL attracted a variety of people from all of these disciplines who had interest in the application area. Evidence that this field was problem-driven rather than epistemology-driven can be seen in the debates over what the letters in CSCL stood for. While these days it is common to expand CSCL to computer-supported collaborative learning, one early book that helped define the field deliberately chose not to take a stand on the particular terminology (Koschmann, 1996a, p. xi).

The cultural history of CSCL is equally important in helping to define what CSCL is. Koschmann's (1996b) initial statement of the field included an explicit contrast between the computer-aided instruction and intelligent tutoring approaches that took a 'realist and absolutist' approach to studying learning with the more situated approaches that drew on communication theory, cultural theory, and more relativistic models of not only learning, but also of research itself. The juxtaposition of these perspectives is not unique and many fields from mass communications to curriculum design have encountered these two styles of research. Yet, CSCL served as a crossroads in many ways, because although these approaches were all included, there were also serious attempts to enmesh them. For instance, Roschelle's (1992) article on convergent conceptual change examined not only socio-cultural but also individual psychological understandings of what happens when someone's mind is changed by a conversation. Similarly, larger,

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multiyear research efforts such as CSILE (later Knowledge Forum) (Hewitt & Scardamalia, 1998; Scardamalia & Bereiter, 1991; Scardamalia, Bereiter, McLean, Swallow, & Woodruff, 1989), the Knowledge Integration Environment (Linn, Davis, & Bell, 2004), or CAMILE and associated efforts (Guzdial et al., 1997) incorporated multidisciplinary teams of researchers that not only studied, but also designed, built, and enacted CSCL environments. Their work also bridged the epistemologies of different disciplines.

2.2. Individual versus group versus cultural level phenomena

Another characteristic feature of CSCL is that the primary phenomena of interest, collaboration and learning, span many grain-sizes. Lemke (2001) has pointed out that when phenomena cross multiple timescales, typically the study of those phenomena hinges on trying to create theories within a timescale, and then linking those theories across timescales. In studying human activity, it is often hard (if not impossible) to connect different timescales through reductionism. In CSCL, the learning that takes place during collaboration is related to individual, and group, and cultural phenomena. Thus, CSCL is studied at many timescales, ranging from micro-genetic or gestural analysis of phenomena taking place moment by moment to the long-term evolution of an online community over many years. Importantly, these diverse methods are not de facto subspecialties, but rather are orchestrated in tandem to examine particular CSCL environments or theories. DiSessa (1991) has labeled endeavors such as this *local sciences*, in which overall reductionist coherence is set aside to allow for evolution of pockets of coherence around particular applications or problems.

Design plays a key role in uniting these grain-sizes. Rittel and Webber (1973) labeled the problem of planning design to be a *wicked problem*, meaning that traditional inductive and deductive science often fails to provide sufficient prediction to allow planning to be deterministically conducted. On the one hand, CSCL maintains a degree of breadth due to its applied nature – all related disciplines and approaches are welcome to the degree they are useful. But on the other hand, as pointed out by DiSessa, design means that we may need to favor local sciences as opposed to a more unified, but less catholic, global science of CSCL. The alternative is what Herb Simon has called the *sciences of the artificial*, or *design science* (Simon, 1969). Designers use processes to solve problems where there is no closed solution. They explore problems as part of solving them, they iterate, and they apply metaknowledge and craft to create solutions that work, even though the science is insufficient to predict the outcomes of the designer's choices.

2.3. Why CS makes CSCL fertile ground for research

The existence of the 'CS' in 'CSCL' provided new opportunities for both design and research. The possibility of anonymity, of recording every instant message or every message opened by a user, of delivering impossibly complex scaffolds through tutoring systems – all allow designers ways to influence and researchers ways to study the complex ballet of interactions we call collaboration and learning. Computing provides a vital lever with which to move collaboration and learning, and therefore provides unprecedented opportunities for both design and for study through design in what is now called design-based research (Design-Based Research Collective, 2003; Wang & Hannafin, 2005).

Technology does not, however, provide complete control over the collaborations and learning, nor does it end the problem of design. As Stahl (2001, p. 169) writes:

"The naïve, technology-driven view was that tools (...) would make a significant difference on their own. The subsequent experience has been that the classroom culture bends such

tools to its own interests and that this culture must be transformed before new media can mediate learning the way we had hoped they would. So CSCL research has necessarily and properly shifted from the affordances and effects of the technology to concerns with the instructional context."

As pointed out by Salomon (1996), technology itself does not constitute a learning environment; rather, he proposes that researchers should focus on differences in patterns of relationships between learners, tools, and their context. We have levers to pull in the design and implementation of technology, and we may have additional, more familiar levers to pull in the form of teaching, classroom orchestration, and the like. However, each of these involves a design/enactment distinction – there is the designer or orchestrator's intent, and then there is the less predictable enactment in a real context. As put by Hall (2001, p. 185), "How are collaboration and learning a contingent response to designed environments"?

Although this lack of control may foil would-be experimentalists, others have used new methods to study socially contextualised designs in context (Hoadley, 2004). Design-based research methods use iterative change-in-context, as well as the growing intuition of designers-in-context, to explore highly context-dependent interventions. Here, computers can have a 'triggering effect' (Salomon, 1996) on the people, contexts, and processes of learning and collaboration that we wish to study. The Design-Based Research Collective (2003) stated: "Because the intervention as enacted is a product of the context in which it is implemented, the intervention is the outcome (or at least an outcome) in an important sense." (p. 5). There is room for design, important not only as a flagpole to rally different disciplines around, but as a vehicle for both practical applications and a particular sort of cross-grain-size research.

To sum up, CSCL, which considers how learning and collaboration can be fostered through computers or other means, has a unique intellectual and cultural history that brings disciplines together. Because of the object of study, unidisciplinary approaches have been insufficient, and researchers from different paradigms have had to construct 'local sciences' that may span grain-sizes, disciplines, or timescales. In part due to the affordances of technology, researchers have had both the boon and the challenge of dealing with design. On the one hand, design allows practical application, and is an effective way to deal with systems where the consequences of actions are not fully predictable. On the other hand, design may require us to deal with the dichotomy between what is intended and what actually happens, making controlled experimentation more problematic. Nowhere are these features more evident than in how CSCL studies roles in collaboration.

3. Roles and scripting in CSCL

Roles are a microcosm of the complexity of CSCL, and may in fact constitute a central defining construct for the field. Each of the studies deals with roles in a different way, and yet the construct proves to have relevance in widely varying disciplinary perspectives, and across varying grain-sizes and timescales. Although it may initially jar the reader to see the concept used so differently by each of the articles in this special issue, it is productive to juxtapose these different uses, as this highlights some of the key tensions within the field, and some of the key useful distinctions that may not be obvious at first glance.

3.1. Scripting versus emergent roles: a false dichotomy?

Perhaps the most obvious distinction in how different CSCL researchers approach roles is to see them as 'scripted versus emergent'. Here, the apparent distinction is that a designer of collabora-

tion needs to make a design choice as to whether roles are assigned or directly supported through scripting, or whether learners uncover roles without the aid of this type of scaffolding. However, this may be a false dichotomy, both because of different definitions of 'role', and because designers have less control than they might believe initially.

3.2. Roles as constructs across grain-size and discipline

With respect to different definitions, we see role defined differently across the studies in this special issue: [Strijbos and De Laat \(this issue\)](#) describe how those who script roles tend to view them as a 'responsibility' and as a 'single job, task or duty'. [De Wever, Van Keer, Schellens, and Valcke \(this issue\)](#) take this notion even farther, stating that "Roles can be considered a specific type of scripting". On the other hand, those who see roles as emergent might focus on a role as 'contribution and interaction patterns', or ways of interacting as opposed to responsibilities. [Jahnke \(this issue\)](#) expands on the idea of patterns of interaction to highlight not only ways in which people interact habitually, but also "the range of expected behaviour within a group", a predominantly sociological notion of role. [Weinberger, Stegmann, and Fischer \(this issue\)](#) focus on "content-based roles" which essentially boil down to either a division of labour, a division of knowledge, or both, helping to determine what type of group learning resources exist for the individual learner. And [Sarmiento and Shumar \(this issue\)](#) specifically highlight the construct of role as a process rather than a static product through Positioning Theory, seeing role as "the ways that participants in interaction orient toward the development and change of their own actions with their relevant rights and duties to participation", thus treating role as an ever-shifting component in a sociolinguistic process. These definitions are not simply a long list of competing terminologies. Each is tied to key issues in the disciplines from which the definition springs, whether it is a psychologist examining roles as a constraining factor in external knowledge resources for a learning; a sociologist thinking about group membership, normative and deviant behaviour; or linguists focusing on the dialogic evolution of meaning through a constructive process.

[Strijbos \(this issue\)](#) also point out that roles can be defined across different grain-sizes and timescales as well. They identify micro-/meso-/macro-levels of roles, claiming micro-level roles can be thought of as tasks, meso-level roles can be thought of as patterns, and macro-level roles can be thought of as 'stances', further linking stances to 'participative style', or an 'attitude'. Again, these three grain-sizes bring in different key assumptions (for instance, that people might have consistent styles which influence their participation in a variety of types of collaborations, over a significant duration of time) that may or may not be universally held. This can be compared to key differences in assumptions held by various disciplines or considering different timescales in the early days of cognitive science – a neurologist might think about language comprehension using a model based on deficits or pathologies, for instance seeing what normal language production is like through the lens of brain injuries; a syntactic linguist might think about language comprehension by examining the syntax of many languages, seeking what might be common across their grammars. The productive interplay of such different disciplinary perspectives in cognitive science yielded great clashes of assumptions, which ultimately were tested both within and across disciplines. Surfacing such clashes within CSCL is a key opportunity, and one that the nature of 'roles' readily reveals. Thus, rather than choosing one or another definition prejudicially or randomly, the examination of these contrasting definitions may be the key to defining the most productive and interdisciplinary research trajectory. Hence, the 'roles should be scripted versus left to emerge' may

be a false dichotomy, since the question is meaningless when we do not really know what a role is or which disciplinary assumptions hold true in the realm of CSCL.

3.3. Roles as both intervention and outcome

The second criticism of this 'scripted versus emergent' dichotomy relates to an issue touched upon previously, namely that CSCL is a wicked problem, and there is an enormous difference between designed intent and enacted activities in context. [De Wever, Schellens, Van Keer, and Valcke \(2008\)](#) studied this problem directly, and found that in their context these are connected, and when given a task or division of labour for a collaboration, learners did indeed do as they were told, and yet, this leaves us with many questions. Are roles assignable at the macro-level the way they are at the micro-level? What do we call the role of someone who deviates from the norms or what the teacher assigns – do we focus on the role-as-assigned, or on the role-as-performed? And, how can we characterise 'role' over time? Certainly, both the expected role and the performance can shift according to not only designed intent but emergent necessity. 'Scripted versus emergent' tends to imply that the designer does have omnipotence in seeing their design vision implemented, or at least that the designer's acts are somewhat predictable in outcomes, which directly contradicts what both [Rittel and Webber \(1973\)](#) and [Simon \(1969\)](#) used to characterise the nature of design. At the level of a design decision, there is a 'scripted versus emergent' choice to be made, namely, how much structure and of what sort to attempt to impose on how learners will interact with one another. Within the CSCL field, technology provides many opportunities to impose constraints on interaction, and to attempt to foster particular possibilities for certain behaviours. Yet, as described earlier, collaboration and learning are contingent upon factors other than designed elements of the environments in which they take place. Hence, we should attempt to learn from the ways in which roles are scripted (or scriptable), emergent (and/or unscriptable), and both simultaneously, depending on one's conceptualisation of what a 'role' is. To do so we need to be fastidious about whether we are discussing role-as-intended versus role-as-enacted, realising that while those may overlap, they are sometimes not the same things.

Furthermore, we need to remember that regardless of whether a role is assigned or not by a teacher or learning environment designer, there are still roles-as-intended and roles-as-enacted. The notion of scripted roles in CSCL tends to focus on either a set of tasks to be completed by all learners at different points in time in an activity, or on tasks to be completed by only certain learners in an activity, complementary to those of other learners. This differential notion of role implies that the 'assigned' role is to some extent only sensible when contrasted with some other behaviour, either earlier/later behaviour, or the behaviour of others within the activity. Is not any intentionally created activity to some extent foisting an assigned 'role' on a participant, in terms of having a designed intent for the range of actions that might be carried out by the participants, or experience they might have during participation? This subtlety means that we should be especially aware of the ways in which roles may be truly emergent, in the sense that they unfold over time, versus the ways they may not have been differentially assigned, but are nonetheless 'scripted' by the designer's intent or assumptions. To use the language of experimental psychology, we can think of roles as both an interventional variable as well as an outcome variable; and in the language of ethnomethodology, we can say roles are both a form of discursive practice as well as a form of discourse-in-practice for CSCL. In short, the role can be seen as both an explicit, locally manipulated imposition, as well as an implicit framing imposition, and the intended/enacted distinction holds whether or not differential roles are assigned.

Thus, we see that roles are more than a 'yes or no', 'emergent or scripted' choice made by a designer. The question of how learners behave in the social settings of CSCL distils down in many ways to the question of roles; roles as proposed (or not), roles as taken up (or not), roles as performed (or not), roles as evolving (or not). The disparity among definitions and uses of the word depends as much on disciplinary differences, the question of grain-size and time-scale, and designed versus enacted as it does upon the preferences of the author. This is not a cause for despair; rather, these differences help highlight key questions for advancing research in CSCL, and are a reflection of the interdisciplinary, problem-driven nature of the field.

4. The future of CSCL research

What are the key questions that roles help pose for CSCL? Four key areas of productive difference about the nature of roles that deserve empirical and theoretical investigation can be distinguished: (a) design and roles, (b) emergence and roles, (c) group processes and outcomes, and (d) the relationship between group and individual level phenomena.

4.1. Design and roles

Given that designers hold sway over roles without entirely controlling them, how can we theorise the relationship between design and roles? This issue manifests in the discussion of how much and what type of structure to provide in collaboration. Dillenbourg (2002) reminds us that collaboration is by nature an emergent, rather than fully scriptable, human activity, and warns against the dangers of over-specifying collaboration by using the same types of structure that scaffold individual activity. Kirschner, Strijbos, Kreijns, and Beers (2004) additionally highlight that the intentionality of design is distributed over several agents, including not only instructional designers but also teachers and learners. We are only at the birth of understanding what it means to capture and validate design knowledge for wicked problems, and the problem of specifying roles, with all its attendant complexity, is a prototypical case for the difficulty of giving design knowledge which is just flexible enough to be general while being specific enough to be meaningful (Hoadley, 2005; Hoadley & Cox, 2009).

4.2. Emergence and roles

A second key question is: how do we resolve the tension between studying roles as stable patterns, and studying roles as emergent by-products of group processes which change over time? To a great extent this is a question of grain-size and timescale, but it also helps us ask: if roles are an emergent property, what are they an emergent property of? From what do they emerge? Studies of phenomenology, moment-to-moment discourse and gesture, and micro-scale cognition might have quite different preconceptions of what roles are emerging from. CSCL researchers need to make progress on ways to identify and communicate about not only their definitions of roles, but also their assumptions about where roles come from, and how they might emerge. Clearly, the methodological challenges of researching roles hinge on what counts as a pattern we might call a role, and what types of change or evolution we privilege as an object of study.

4.3. Group processes and outcomes

Roles inspire a third question that is at the heart of CSCL: since roles imply the function an individual plays in some larger interpersonal interaction, what are the group processes within which

we look for roles? There is no normative story of group process that trumps all others. Dillenbourg, Baker, Blaye, and O'Malley (1995) highlight some of the challenges of working at the group grain-size, including conflicts between what they term the 'effects paradigm', the 'conditions paradigm', and the 'interactions' paradigm. Each of these paradigms uses a different notion of what process a role is fitting into – in the 'effects' paradigm, collaboration is reduced to a deterministic (or perhaps consistently stochastic) process in which one believes in recipes of collaboration with more-or-less predictable results, whereas in the conditions paradigm one adds the complexity of varying ingredients to the recipes. In the conditions paradigm, one presumes the collaboration task, plus the particular ingredients (this type of student, that type of prior knowledge, and so on) are enough to make meaningful statements about group processes and outcomes. The interactions paradigm instead begins to investigate processes rather than ingredients in studying collaboration and group outcomes – the processes become the key foci for study rather than the 'setup'. This focus on process suggests a radically different role for 'roles' in CSCL, one that is still highly dependent on what one's sense of group processes and outcomes are.

4.4. The relationship between group and individual level phenomena

The fourth key question for CSCL with respect to roles is whether group grain-size and individual grain-size are reconcilable, and if so how. Roles can be viewed as an individually experienced attribute of participation, or as a configurational construct that only makes sense to discuss relationally among a group of people. Stahl (2006) has argued that the small group level is the 'sweet spot' for studying CSCL, and that both cultural grain-size and psychological grain-size phenomena will fall into place once understood in relation to the small group level. But for many, the problem-driven nature of CSCL means that individual outcomes, rather than group ones, are the goal, and theories need to explain what will make individual people learn. For instance, students who are graded primarily on group work may have some capacity in configuration with their collaborators, but some will demand individual performance as an outcome of collaborative learning. Roles exist precisely at this interface between individual and group (indeed, a role is primarily about an individual's relationship to others in a group and to the group itself). How can roles glue our understanding of group-level phenomena to our understanding of individual level phenomena, such as individual cognition?

5. Conclusion

The debate about roles in CSCL is far more than a normal disciplinary scuffle – instead, it is central to the issue of what CSCL is. As an interdisciplinary crossroads, CSCL brings together a wide variety of worldviews. Rather than these views bouncing off one another without impact, they generate valuable conflicts. Within the cultural history of CSCL, people have been willing to come together across these disciplinary lines to solve particular problems of application. Although this design focus is a challenge (since creating outcomes through design is messy and unpredictable), it helps engage scholars across paradigms who might not otherwise interact.

Roles touch on key issues that separate the disciplines within CSCL, and force debate about key assumptions. The issue of teaching versus learning, intention versus enactment, design versus implementation forces us to consider how much control we really have in CSCL, and in learning environments more generally. The grain-size and timescale of the key phenomena of CSCL are key issues in defining, describing, recognising, and studying roles – does

a role refer to something that happens in a moment-to-moment interaction, over the course of a meeting or project, or a stance that might solidify over a significant portion of a lifetime? Finally, roles help us to consider a key issue in CSCL on which many disciplines differ: what is the cause, and what is the effect in learning? What is the intervention, and what is the outcome? The question is not as simple as it might initially seem, when one takes into account the mutually constitutive nature of learning as it takes place through collaboration.

Roles remind us of four key issues that CSCL is richer for facing. The relationship between design and roles forces us to consider the control paradox between teaching and learning. The issue of role emergence forces us to unpack complexity, and to take a stand on what types of seemingly unpredictable outcomes are worth trying to understand, even to predict. The appearance of roles across the panoply of theories and perspectives on group processes give us a chance to try to connect or compare across what might seem to be incommensurable ways of describing collaborative learning. And the responsibility of CSCL practitioners for individual level outcomes drives a daunting, but essential quest to understand how the group and individual level phenomena are linked – roles are probably the primary construct through which these two levels are linked. Though addressing these four issues will likely take the field decades, circling back to concepts like roles that transcend individual disciplines and are linked to practical outcomes will undoubtedly help us achieve greater clarity on not just CSCL, but on learning more generally.

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