Evolving Shared Experience in Distributed Learning Environments

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ABSTRACT
Distributed learning environments such as groupware give two or more users the means for working together remotely on a shared task. This activity is more than the sum of single users working on their own to solve the same task. Although most people will agree about this, there is neither agreement nor much discussion in the literature on how coordination and collaboration skill should be distributed between users and computer tools. We present a new approach that uses a process model adapted from Activity theory to guide our efforts. The model outlines steps towards capturing *crystallised experience*.

Keywords
Distributed learning environments, shared experience, crystallized experience, Activity theory, end-user tailorability

INTRODUCTION
Certain actions like negotiating how to work and coordinating disjoint contributions distinguish group work from the work of single users. User experience is an important asset in individual work. In this article we address user experience in distributed settings and we ask the following questions: What is shared experience and how can it be useful when collaborating in remote settings? Our working hypothesis is that shared experience will be useful for supporting collaboration and coordination in distributed environments. Our experience is based on previous studies in building (Bourguin and Derycke, 2001) and testing (Wasson and Mørch, 2000) single-user and multi-user systems in different settings. The convergence of our ideas, which has evolved independently in two different laboratories, suggests that our approach may apply to other settings as well.

BASIC CONCEPTS AND PROCESS MODEL
We have adapted a set of concepts from Activity Theory (AT) and Computer Supported Collaborative Learning (CSCL). The rationale for this is to help us understand and explain the processes leading to crystallization (as a collaborative activity) and crystallized experience (a system property). Crystallized experience is externalized user (mental) experience materialized in physical artifacts. This is a result of a crystallization process, which in its final stage entails end-user tailoring of a computer system.

The concepts we adopt are the following: breakdown, reflection, knowledge building, and crystallisation. A breakdown according to AT is an inability to reach the object of the activity. After a breakdown the participants may have to switch to another level of participation in order to continue, which we call reflection. Reflection is an activity on a different level of abstraction than the activity that triggered the reflection. We call the former meta-level activity and the latter base activity. At the meta-level, reflection on the base activity is possible.

A person uses his internal (mental) experience for understanding the breakdown and its cause, and (if successful) is able to determine an approach for resolving it. In a cooperative work setting, the meta-activity may itself become the topic of a cooperative activity. When internal experience (reflection) is accompanied or replaced by public talk (debate), group discussion, or other means to externalizing the breakdown situation we refer to this as belonging to the realm of knowledge building**,** a concept and process introduced by Scardemalia and Bereiter (1996). The meta-activity may lead to a transformation of the activity's context. This may result in a reformulation of the task and its elements (object, tools, rules, division of labor, etc.).

In this paper we are primarily concerned with the transformation of tools. However, a tool will often (implicitly) contain a built-in representation of the rules and the division of labor of the activity in which the tool is used. Resolving a breakdown by implementing a work-around inside the tool that caused the breakdown is at the hart of the approach to shared user experience we pursue in this paper. When users are able to modify a tool, this is to a large extent a result of their past

experiences (in designing and using similar tools). Modifications will thus reflect its users' experience. Crystallised experience is shared experience materialised inside a transformed tool. A second goal is to be able to reuse and disseminate crystallised experience in new user activities. As new users reuse a (modified) tool the experience crystallised inside it is also reused. New users may encounter breakdowns and this may require further adaptation of the tool, which again will bring new experiences to the fore. Only to the extent that these experiences are identified, externalised, crystallised and made available as (materialized) parts inside tools can they have a lasting value.

DESIGN ISSUES

A computer system is an artefact supporting some users' activities. We want to create systems that will allow other users to adapt it to their needs by building on the previous users' crystallized experience. From our point of view, each system adaptation contains some amount of experience from its users. We want to develop CSCL environments that can capture user experience useful for collaboration and coordination in groups in the context of distributed collaborative learning. For end users to be able to participate in the crystallization process computer tools have to be adaptable during use, i.e. supporting end-user tailorability (Mørch, 1997). However, the creation of a tailorable system is not a simple problem. We believe that a balance have to be found between users' motivation for realising a modification task and the computational effort to be expended by them for understanding the problem and solving it. First, we need to create a system with an understandable foundation as seen from the users point of view. Second, we want to realise this with existing technology. We have therefore embarked on a component software approach (Szyperski, 1997) for building end-user tailorable systems because one of the biggest obstacles to understanding computer systems is a lack of building blocks that match the users' cognitive thought processes. A framework for this is called DARE (Distributed Activities in a Reflective Environment) (Bourguin G., Derycke A., 2001). DARE proposes a global platform for CSCW allowing users to adapt their working environment at runtime. Users' adaptations are made on task, tool, and role components. According to the processes and concepts described above, we believe that DARE users' experience is crystallised inside the components they adapt while using it.

DISCUSSION

We have embarked on a cumbersome journey from two different starting points. One the one end, we have identified the importance of user experience for understanding the design and use of tools and shared (crystallized) experience for communication and collaboration in distributed settings. One the other end, we have developed a solution framework (DARE) for building computational support for crystallized experience. We have not yet completed our journey and the two paths do not join. However, we have adopted and further developed a set of concepts and distinctions we hope can be useful for other researchers in CSCL and CSCW. We strongly believe that for shared experience to have a lasting value it must be tightly integrated with the artifacts that mediate collaboration. A long-term goal of our work is to record experience that captures domain-oriented base activity and not only the experience for building and tailoring the systems.

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