Chapter XXV
Cultural Historical Activity Theory

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ABSTRACT

This chapter reviews the origins, approaches and roles associated with the use of cultural historical activity theory (CHAT) in information systems (IS) research. The literature is reviewed and examples are discussed from IS and related fields of human-computer interaction (HCI), computer supported co-operative work (CSCW) and computer supported collaborative learning (CSCL), to illustrate the power of CHAT in IS research as well as its link to appropriate research methods. After explicating the value of its use, the chapter concludes by discussing theoretical and methodological implications of applications of CHAT in examining real-world problems in IS research.

INTRODUCTION

The mission of information systems (IS) research is to study the technological, human, social and organizational aspects of IS. The extant IS research literature shows that all aspects of any IS are shaped and in turn shape a highly complex and constantly changing social context (e.g. Avgerou, 2001; Walsham, 1993). The nature of the object of study in IS research has thus led to the need for theoretical frameworks to provide a basis for research into complex and dynamic socio-technical contexts into which IS and IT enter.

Cultural historical activity theory (CHAT) has the potential to provide a robust meta-theoretical

framework for understanding and analyzing many areas of IS research and practice. The strengths of CHAT are grounded both in its long historical roots and extensive contemporary use. CHAT offers a philosophical and cross-disciplinary perspective for analyzing diverse human practices as development processes in which both individual and social levels are interlinked (Engeström, 1999b; Kuutti, 1996). With its recent emphasis on networks, interactions and boundary-crossings between activity systems, CHAT helps in exploring and understanding interactions in their social context, multiple contexts and cultures, and the dynamics and development of particular activities.

This chapter explores the descriptive, analytical and interpretive power of CHAT for IS research. We begin by introducing CHAT's philosophical and conceptual background. The concreteness of our own grasp of CHAT's theoretical ideas is grounded in our own intervention research within health care organizations. Applications of CHAT in IS research and the related fields of human-computer interaction (HCI), computer supported cooperative work (CSCW) and computer supported collaborative learning (CSCL) are discussed. Empirical examples of the research approaches, methods of data collection, and modes of analysis that are appropriate within a CHAT framework are also presented. The relations between CHAT's methodological endeavors and other theories are briefly discussed. We conclude with an outline of theoretical and methodological implications regarding the application of CHAT in examining real-world research problems in IS research.

CULTURAL HISTORICAL ACTIVITY THEORY (CHAT)

Cultural historical activity theory (CHAT) or Activity Theory as it is also known, traces its roots from the Soviet Union in the 1920s as part of the socio-historical school of Russian psychology.

Its basic foundations were laid by the insights of Russian psychologists Vygotsky, Leont'ev and Luria into the dynamics of thought and consciousness (e.g. Leont'ev, 1978; Luria, 1976; Vygotsky, 1978). Their arguments arose in response to the need to transcend prevailing understandings of psychology, child development and learning studies that were then dominated by behaviorism (Skinner) on one hand, and psychological theories that they regarded as individually oriented rather than socioculturally oriented on the other hand, including Piaget's developmental theory and psychoanalysis (Engeström, 1987). In doing so, they sought to go beyond the individual to the social. Engeström (2001), a leading contemporary theorist of CHAT, describes the theoretical tradition of CHAT as passing through three generations or phases: the first phase focused on mediated action, the second phase focused on the individual in collective activity, and the third phase which currently focuses on multiple, interacting activity systems and boundary-crossings between them. We provide a brief introduction to 'three generations of activity theory' in the following subsections.

First Generation Activity Theory: Mediated Action

The culturally mediated nature of human activity is one of the most important concepts of CHAT. Vygotsky (1978) introduced the elementary concept of *mediation*: the idea that humans' interactions with their environment cannot be direct but are instead always mediated through the use of tools and signs. Vygotsky particularly criticized the dominant psychological theory of behaviorism that attempted to explain consciousness or the development of the human mind by reducing 'mind' to a series of atomic components or structures associated primarily with the brain as 'stimulus – response' processes, a perspective that set the metaphor for early theories of communication as well as behaviorist psychology.

Vygotsky argued that the explanatory principle for the human mind must be sought in society and culture as they evolve historically rather than in the human brain or individual mind unto itself. To Vygotsky, consciousness emerges from mediated human activity. Mediation occurs through the use of different types of tools and material, semiotic and ideational artifacts that include culture and language (Vygotsky, 1978). On this basis, Vygotsky posited that there must always be an 'intermediate link' – *mediation* - between stimulus and response. Thus 'the conditioned direct connection between stimulus (S) and response (R) was transcended by "a complex, mediated act"' (Figure 1A). Vygotsky's idea of cultural mediation of actions is commonly expressed as the triad of subject, object and mediating artifact (Figure 1B) (Engestrom, 2001, p. 133-134 citing Vygotsky, 1978). The term 'mediating artifacts' is understood as encompassing tools, signs and all types of material, semiotic and conceptual artifacts.

In mediated action, the *subject* refers to a person engaged in an activity; an *object* (in the sense of motive or motivation towards a future-oriented objective) is held by the subject and motivates the existence of activity, giving it a specific direction. Mediating artifacts are used by the subject to effect a change in the object of the activity; they expand the subject's possibility to manipulate and transform the object, but also restrict what can be done within the limitation of available tools, which in turn often motivates improvements to existing tools or invention of new means (Verenikina & Gould, 1998). In this process, the tools also exert reciprocal influence on the minds and actions of the persons using them. This means that the transformative aspect of human activity is not only a tool-mediated transformation of material things, but also the transformation of the subject him/herself. In Vygotsky's model, the unit of analysis remained individually focused: mediation by and with other human beings and social relations was not theoretically integrated (Engeström, 2001). Leont'ev and Engeström extended the Vygotsky's fundamental concept of mediated action from the individual to collective activity.

## Second Generation Activity Theory: From Individual to Collective Activity

In recognition of the importance of the collective aspect of human activity, Leont'ev (1978, 1981) expanded Vygotsky's concept to provide a distinction between an 'individual action' and 'collective activity'. This distinction is evident in his analysis

Figure 1. (1A) Vygotsky's model of mediated action and (1B) its common reformulation as a triad of subject, object and mediating artifact (adapted from Engeström 2001, p. 134). (© 2001, Yrjö Engeström, Journal of Education and Work, 14(1). Used with permission.).
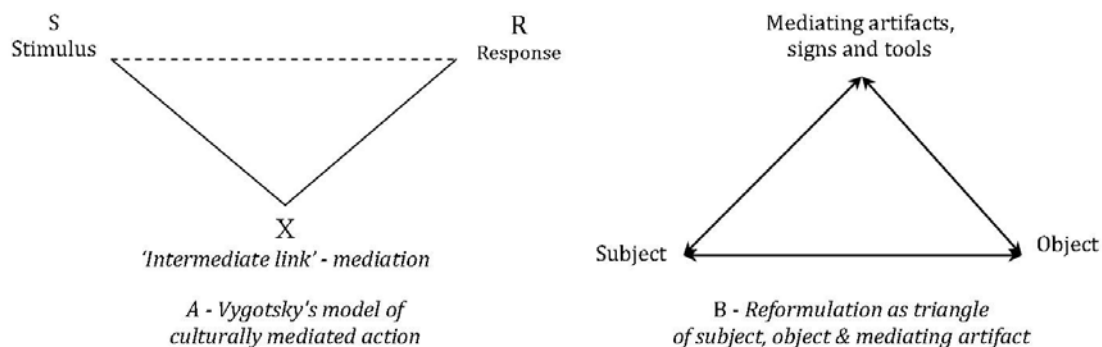
Figure 2. The hierarchical structure of activity (adapted from Kaptelinin & Nardi, 2006, p. 64). (© Kaptelinin, Victor, and Bonnie A. Nardi, Acting with Technology: Activity Theory and Interaction Design, page 64 © 2006, The Massachusetts Institute of Technology, by permission of The MIT Press.)
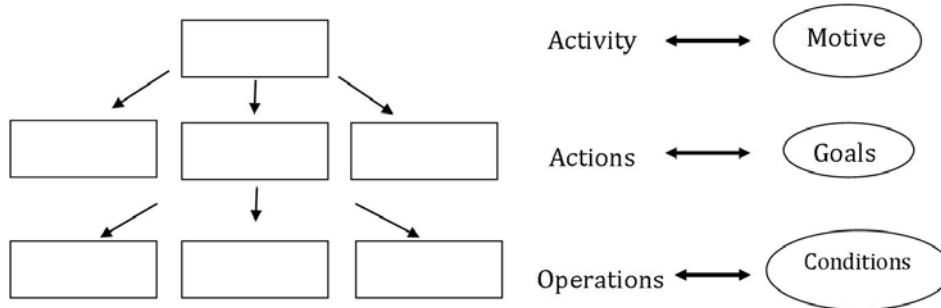
of the structure of activity and its hierarchical levels (see Figure 2) in which activities consist of goal-oriented *actions* that are completed through *operations* determined by specific *conditions*. An activity is defined by a motive (the object of activity) and develops over time and historically in social praxis. Actions are consciously planned towards specific goals and occur in a limited time span; actions are not meaningful in themselves unless they are part of an activity. Operations do not have their own goals; rather they provide means for execution and adjustment of actions to particular situations.

Incorporating Vygotsky's model of mediated action, we illustrate Leont'ev's expansion to depict collective activity by using an example of interaction during a doctor's consultation with a patient. A doctor (*subject*) is engaged in an *activity*, for example, diagnosing a patient. An object – the patient and her/his sickness - confronts the doctor and *motivates* his/her activity, giving it a specific direction. The object requires actions including understanding the patient's illness through to recording the patient's information for keeping his/her medical history. To achieve the object, these goal-oriented *actions* are taken by the doctor with mediating artifacts that include tools, instruments and the history-taking interview with the patient. Different actions and strategies may be

taken to achieve the same goal, such as asking the patient about how long s/he has experienced pain (if any), incidence of chronic disease in the family, and listening to the patient's heartbeats. More than one goal may be achieved by the same action. For example, asking the patient's family health history can result, at the same time, in revealing the relationship between the patient's current illnesses with a particular chronic disease in the family and the patient's historical health-related information. On the level of operations, the doctor may routinely use his/her stethoscope to hear the patient's heartbeats, and a computer or pen and paper (or both) to record the patient's information.

Leont'ev's model of the structure of activity helps to conceptualize the inter-relatedness of levels of mediated action oriented by specific goals that constitute an activity dynamically, and how they are linked to the shared object of that activity. Leont'ev's model was subsequently criticized for its emphasis on the 'what' side of activity (what is being done) and insufficient attention to the 'who' and 'how' side of the activity (by those engaged in carrying out the activity) (see e.g. Davydov, 1999). Leont'ev's depiction of the structure of an activity does not indicate the roles and responsibilities of individuals involved in carrying out the collective activity.

Drawing on the works of Vygotsky (1978) and Leont'ev (1978; 1981), among others, Engeström (1987) developed his concept of an *activity system* for understanding how people are embedded in a sociocultural context with which they continuously interact. The complex interactions of individuals with and in their working and learning environments can be examined using a historically evolving collective activity system. An activity system comprises the *object of activity*, the *subject* involved in the activity, *tools* and *artifacts* relevant to the activity, *rules* and *procedures* that shape participation in the activity, the *community* relevant to the activity and the *division of labor* entailed in carrying out the activity. In Engeström's conceptualization, Figure 3 depicts the core features of an activity system.

In an activity system, a *subject* may be an individual or a collective subject such as a team whose agency is motivated towards the solution of a problem or purpose (an *object* or object of activity). As in the earlier models of Vygotsky and Leont'ev, the *object* thus refers to the 'raw material' or 'problem space' toward which the subject's activity is directed; the object is transformed through activity into *outcomes*. The relations between the subject and the object are mediated by *tools, artifacts*, *rules, procedures*, *the division of labor* and the *community*. *Tools* or *artifacts* refer to culturally produced means for changing the environment and achieving goals. The *division of labor* refers to both the horizontal actions and interactions among the members of the community and to the vertical division of power, resources and status. The *community* refers to the participants who share the common *object* that shapes and gives direction to individual actions and the shared activity at hand. Within any community engaged in collective activity, there are *formal* as well as *informal rules* and regulational *norms* and relational *values,* each of which afford and constrain the internal dynamics, accomplishments and development of an activity system.

The elements of an activity system are not static; they do not exist in isolation from one another. Rather, they are dynamic; their continuous interactions with each other constitute the activity system as a whole (Barab, Barnett, Yamagata-Lynch, Squire & Keating, 2002). Accordingly, the analysis of any activity system must consider the dynamics amongst its constitutive elements. Each element of an activity system (Figure 3) relates to other elements and aspects with tensions and contradictions between them. Contradictions serve as motive forces for transformative change within the activity system itself (Cole & Engeström, 1993). The analysis of contradictions in an activity system helps practitioners to focus their efforts on the roots and causes of tensions and problems. Doing so can give rise to rethinking the object itself, redesign of technological systems and/or design of new tools and other

Figure 3. The structure of a human activity system (adapted from Engeström, 1987, p. 78). (© 1987, Yrjö Engeström, Orienta Konsultit. Used with permission.).
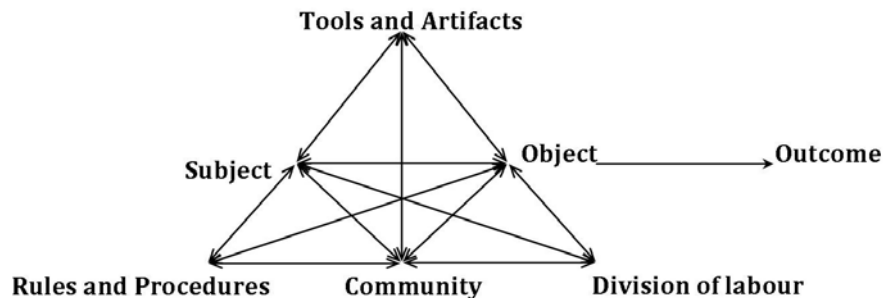
mediating artifacts, and reformulation of rules or divisions of labor. Activity systems change and develop by resolving their historically evolving internal contradictions. In these regards, CHAT elaborates a conceptual apparatus for understanding and contributing to developmental processes of organizations and practices.

## Third Generation Activity Theory: Multiple Interacting Activity Systems

The third generation of activity theory aims to exploit and challenge the latent potentialities of CHAT by building on and expanding upon the previous two generations. It goes beyond the limits of a single activity system and takes as its unit of analysis the plurality of different activity systems that mutually interact, promoting multiple perspectives and voices, dialogues, networks and collaboration between activity systems (Yamazumi, 2006) and boundary-crossings between activity systems (Tuomi-Gröhn & Engeström, 2003). Engeström (2001) initially models these perspectives in a network of minimally two interacting activity systems (Figure 4); that is to say, two activity systems comprise the minimum unit of analysis. For example, in relation to a doctor's consultation with a patient, the object moves from an initial state of unreflected, situationally given 'raw material' (object-1, the problem of the patient) to a collectively meaningful object constructed by the activity system (object-2, an outlook on the patient's multiple problems), and toward the emergence of a shared object that is jointly constructed between multiple activity systems (object-3, a collaboratively constructed understanding about the patient's life situation and care plan). Figure 4 highlights the emerging shared object between the minimum unit of analysis of two activity systems A and B (there may be more), showing how inter-organizational expansive learning can occur.

The fact that activity systems interact and overlap with other activity systems implies that the elements of an activity system are always produced by some other activity. Likewise, the outcomes of an activity are usually intended for one or more other activities, either as means, objects or as new subjects of the latter (Korpela, Mursu, Soriyan & Eerola, 2002). In health care work practices, for example, there are always at least two interacting and overlapping activity systems: the activity system of health care services delivery and that of the health information system (HIS). The two activity systems interact and overlap in the sense that the health care services delivery system produces data that are to be collected through and in HIS, and both activity systems involve overlapping subjects (e.g. doctors and nurses). However, the interactions and overlaps between health care services delivery and HIS contribute to contradictions within and between the elements of each activity system as well as between the interacting activity systems. These contradictions carry historically accumulating structural tensions that emerge in the execution of day-to-day tasks and provide impetus for people to change their activities and simultaneously change themselves (Engeström, 2001).

Seeing each person as a full participant in his or her activity contexts, CHAT aims at reconstructing contexts in practice so that individuals, their collaborative partners, and the activities in which they are jointly engaged are continually transforming and developing in mutually integrative ways. In the same manner, communities and contexts are constantly changing and being changed, which results in changed opportunities for development. This approach differentiates CHAT from other studies of context, for example, cultural or cross-cultural studies in which culture and context are seen as variables that influence development (Robbins, 2005). From the CHAT perspective, context is not simply a situationally created space; context is conceptualized as an entire activity system, integrating the subjects, the object of activity, the tools, the community, its rules and norms, and divisions of labor into a

Figure 4. A shared object emerges between two or more interacting activity systems engaged in inter-organizational learning (adapted from Weber, 2003, p. 171). (© Emerald Group Publishing Limited 2003, Used with permission.).
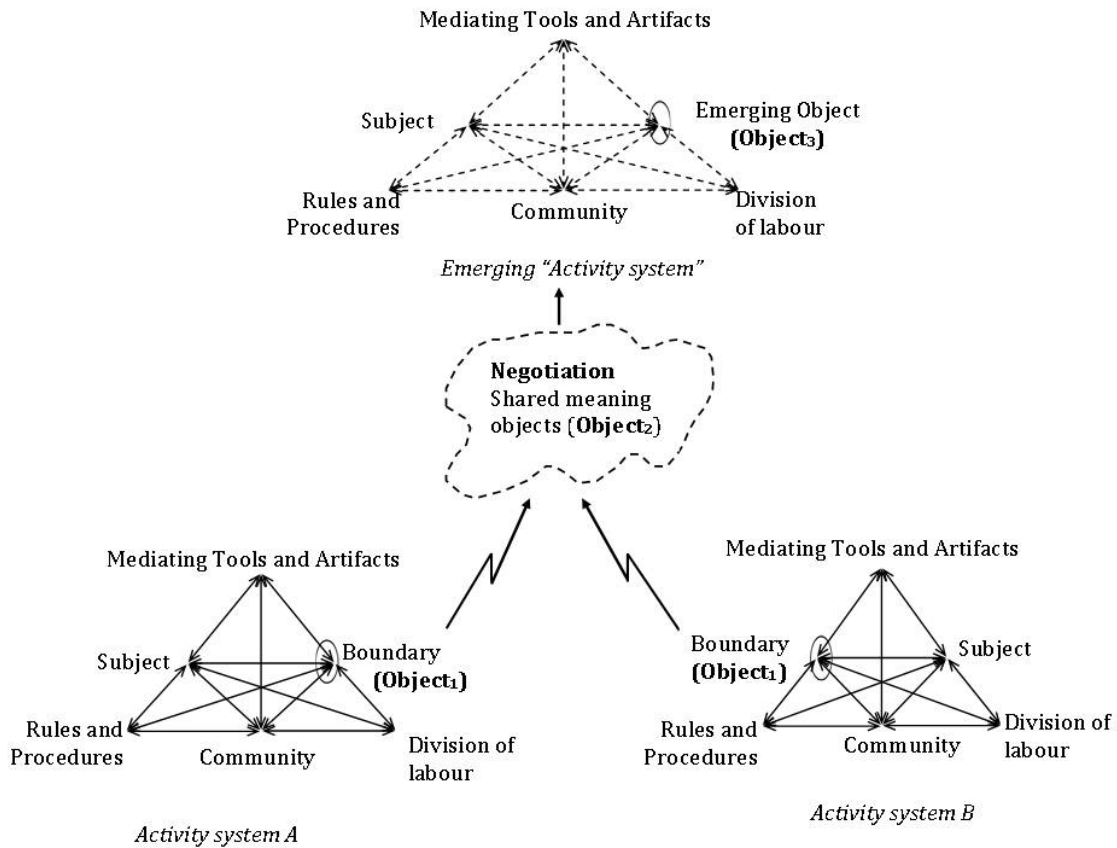
unified whole. Thinking of context this way has led to specific theoretic-empirical methodologies such as developmental work research (DWR) and the Change Laboratory, an application of CHAT in work, technology and organizations (Engeström, 1991, 2005).

Developmental Work Research

Developmental Work Research (DWR) is a CHAT-based interventionist methodology that is specified for studying change and development in work practices and the organization of human labor. The approach is particularly oriented to understanding collective work practices that are undergoing processes of change (Miettinen, 2005). DWR combines active and reflective participation of workers in the analysis of problems and formulation and prototyping of new models with research monitoring of the change interventions over time; ideally, evaluation is carried out jointly by local participants and researchers. In applying general CHAT principles specifically to work practices. DWR incorporates the central proposition that the historical development of activity systems proceeds in 'expansive cycles of learning' instigated by cycles of disturbance, emergence, transformation and resolution of the internal contradictions within and between activity systems (Engeström, 1999c).

An expansive learning cycle entails six stages of generating change (see Figure 5). The *first* stage is engagement of participants in an activity system in questioning and criticizing aspects of existing practice (praxis). The *second* is an analysis of the situation to identify systemic tensions or contradictions within and between activity systems. One type of analysis is historical, which seeks to explain the situation by tracing its origins and evolution. Another type of analysis is empirical, which seeks to explain the situation by constructing a picture of its inner systemic relations. The analysis serves as a basis for planning a solution toward the contradictions in present praxis. The *third* is modeling a new approach (an interven-

tion or prototype) to address the problems and tensions identified in stages one and two. Such modeling involves sketching the zone of proximal development (ZPD) for the collective activity system (see discussion below). The *fourth* stage involves an examination and testing of the model to establish its potential and limitations. The *fifth* is the implementation of the model (prototype) in order to concretize its application in practice. The *sixth* stage involves evaluation and reflection upon the intervention and a consolidation process where the outcomes of the model become a new form of practice. Figure 5 highlights the iterative phases of expansive learning cycles.

Figure 5. The iterative phases of an expansive learning cycle (adapted from Gay & Hembrooke, 2004, p. 12). (© Gay, Geraldine, and Helene Hembrooke, Activity-Centered Design: An Ecological Approach to Designing Smart Tools and Usable Systems, page 12 © 2004, Massachusetts Institute of Technology, by permission of the MIT Press.)
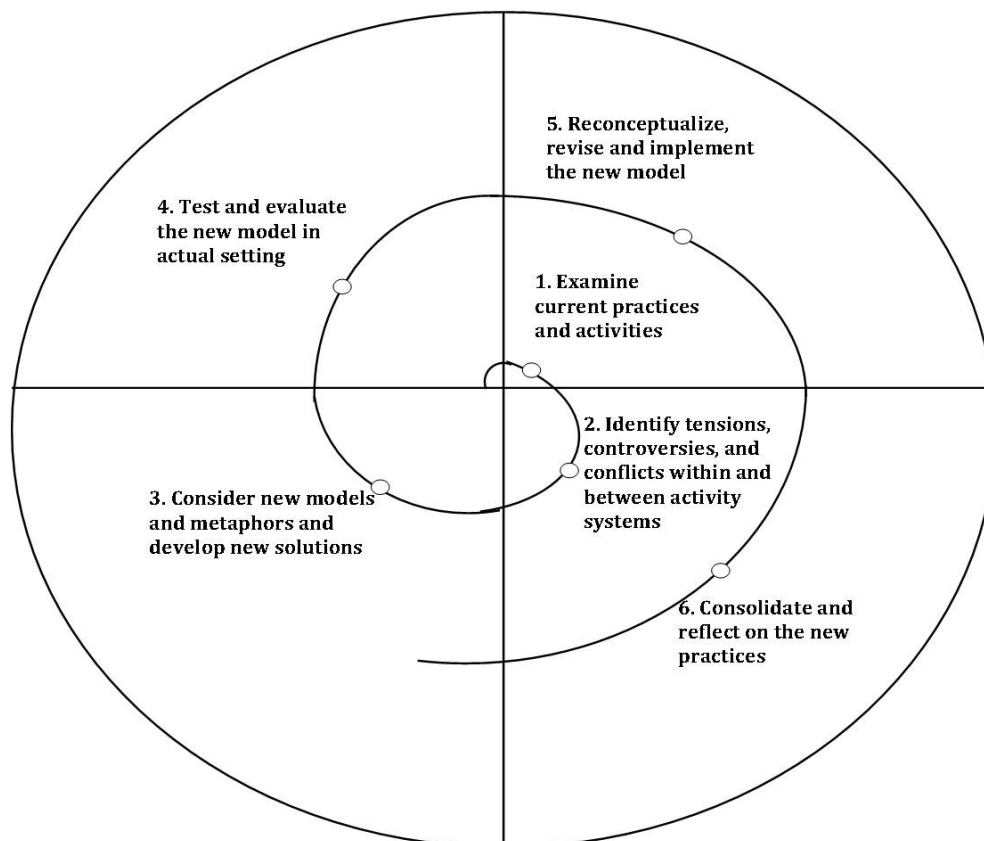
The phases of an expansive cycle do not follow each other automatically. On the contrary, the phases represent possibilities that can only be realized through active developmental research interventions and conscious learning activity. The model helps to surpass the narrow view of change as a step from one organizational or work practice *status quo* to a targeted new state and to grasp the continual qualitative change of the activity system (Virkkunen & Ahonen, 2004). Accordingly, the expansive learning cycle is a tool for understanding the developmental dynamics of an activity.

Zone of Proximal Development

The zone of proximal development known as ZPD is a core CHAT concept that is especially related to transformational learning. Vygotsky (1978) described the ZPD as the difference between what a person can accomplish when acting alone and what the same person can accomplish when acting with support from someone else and with culturally produced artifacts. Vygotsky put forward the concept of ZPD in the context of mass education and literacy campaigns in Russia in the 1920s for children and adults learning 'higher scientific concepts.' Consequently, many researchers have narrowly construed the concept of the ZPD as being primarily concerned with interaction between an expert and novices in which the novices' state of knowledge is advanced through social interaction with the expert (Lantolf, 2000). Yet at the heart of the ZPD, Vygotsky emphasized the *transformation of knowledge* that occurs when someone internalizes concepts, in contrast to notions of 'transfer' or 'transmission' in rote learning. Subsequently, Kuutti (1996) and Engeström (1999b), among others, advocated for a broader understanding of the scope of the ZPD to include peer-to-peer and multi-disciplinary learning beyond expert-to-novice and apprentice-novice modes of learning.

ZPD "is more appropriately conceived of as the collaborative construction of opportunities for individuals to develop their abilities" (Lantolf, 2000, p. 17). Even in those learning situations between experts and novices, as in IS design and implementation processes, novices do not merely copy the expert's ability and knowledge; rather, the knowledge offered by experts are transformed by novices as they appropriate it. During this process the IS design and implementation activities are focused not on the transfer of skills from the expert to the novices (learner) but on collaboration between the expert and the learner that enables the learner to participate in changing IS practices. Constructing a zone of proximal development and/or creating the conditions for a zone of proximal development to emerge is an essential conceptual, analytic and practical step in CHAT methodologies for enhancing formal and informal learning environments and in DWR.

CHAT IN DIVERSE FIELDS WITH RELEVANCE FOR IS RESEARCH

CHAT has been taken up by researchers in diverse fields that have relevance for information systems research. In this section, we briefly discuss some of the recent approaches to research using CHAT as a focus within the HCI, CSCW, CSCL and IS fields, ending with CHAT in studies of pedagogy and technology-enhanced learning. Each of these fields has relevance for IS research.

CHAT was introduced in HCI research in the 1980s (e.g. Bødker, 1989). Since then, CHAT's ideas have provided viable means for analyzing the context and practice of the use of technologies in workplaces (e.g. Kaptelinin & Nardi, 2006; Korpela, Soriyan & Olufokunbi, 2000; Nardi, 1996). HCI is a field concerned with the design, implementation and evaluation of interactive computing systems for human use and with the study of the ways humans interact with these sys-

tems (Gilmore, 1995). Considering the shift from 'command line' computer interfaces to graphical user interfaces (GUI), researchers within the HCI field recognized the importance and relevance of CHAT as a theoretical framework for describing and understanding the individual user's and collective users' context, situation and practice for the purpose of design and evaluation of computer systems (e.g. Bødker, 1991; Kaptelinin, 1992; Kuutti, 1992; Nardi, 1996). In general, the use of CHAT perspectives in HCI research enhance and extend the practical concerns of tool usage by linking the design solutions to sociocultural and psychological aspects of the tool user in his/ her context (Mwanza, 2001).

Researchers within the fields of CSCW and CSCL strive to address how collaborative activities and their coordination can be supported by means of computer systems (Beaudouin-Lafon, 1999). Kuutti (1991b) proposed CHAT as a basis for CSCW research. Since then, many studies following or influenced by CHAT have been conducted (e.g. Bardram, 1997; Blackler, 1995; deSouza & Redmiles, 2003). CHAT helps to understand collaborative activities from a sociocultural perspective in which the concept of activity is used to generate a tentative definition of the basic units of the work practice to be supported (Convertino, Farooq, Rosson, Carroll & Meyer, 2007). In addition, CHAT has proved to be helpful in analyzing organizational situations in order to locate places where new CSCW and CSCL applications could be used (Kuutti & Arvonen, 1992).

CHAT has been used widely in studies of learning and pedagogy in the context of schools and other educational institutions (e.g. Engeström, 1987; Sue, 1993). Recent studies of education have employed CHAT to examine technology-supported learning environments (e.g. Basharina, 2007; Mwanza & Engeström, 2005; Resta, 2008). Basharina (2007) used CHAT to analyze and describe contradictions that emerged in a WebCT bulletin board collaboration among English learners from different countries and cultures. The analysis laid the basis for devising strategies towards making online interaction more user-friendly. In a study on the task of managing content in e-learning environments, Mwanza & Engeström (2005) used CHAT to examine ways in which teaching and learning activities shape and are shaped by relationships, mediators, motives, and sociocultural influences from the environments in which content is created and used. They developed an activity-centered approach to abstracting contextually and pedagogically-enriched metadata descriptions of educational content and interactions with 'learning objects' that are mediating artifacts (tools, instruments, conceptual frames or scaffolding) in learning. Resta (2008) used CHAT for understanding the complex interactions and issues in the implementation of a laptop initiative in teacher education.

Because a primary purpose of IS is to facilitate work activities, Kuutti (1991a) advocated that the object of analysis in IS should be work activity systems in all their aspects and dynamics. Since then, CHAT has been employed as an underlying framework in IS research for understanding use contexts, interactions, practices and disparate logics in order to deepen design for future-oriented change (e.g. Crawford & Hasan, 2006; Gregory, 2000; Igira, 2008a; Igira, 2008b; Korpela et al., 2002). The main achievement of using CHAT from the point of view of information systems research is the formation of a collectively shared comprehensive perspective, which guides the long-term development of tools as integral components of the activity system in realizing the potentials of its zone of proximal development.

Nardi (1996) suggests that the basic principles and vocabulary of CHAT offer valuable resources for describing human activity. As CHAT is meta-theoretical and philosophical perspective, CHAT concepts and principles have been interpreted and applied in a variety of ways in different contexts. Several IS research groups employing CHAT have formalized particular methodological approaches: The Change Laboratory (Engeström

et al., 1996), the Activity Checklist (Kaptelinin, Nardi & Macaulay, 1999), Activity Analysis and Development (ActAD) (Korpela et al., 2000), and the Activity-Oriented Design Method (AODM) (Mwanza, 2002). In addition to specified programmatic approaches, researchers also constitute theoretical, philosophical and methodological frameworks based on CHAT perspectives for specific research studies. We briefly present these approaches in the following subsections.

The Change Laboratory

The Change Laboratory (CL) implements cycles of expansive learning and development of social practices in carrying out developmental work research (DWR) in specific work settings (Engeström, 2007; Engeström, Virkkunen, Helle, Pihlaja & Poikela, 1996). The Change Laboratory was developed in 1996, as a condensed way to carry out DWR methodology *in situ*. In a particular workplace, a Change Laboratory constitutes a forum for cooperation between expert interventionists and local practitioners. The purpose of a Change Laboratory is to help a work team or members of an organization to encounter the problems they face in their work practices and systematically analyze the systemic causes of these problems and design and implement a new form (a new model) - for the activity to overcome the root cause of daily problems. Participants typically meet during working hours in the context of an intensive workshop.

The Change Laboratory methodology involves arranging a space on a shopfloor in which a rich set of instruments are provided for analyzing contradictions in the work activity and for constructing new models for the analyzed work practice (Engeström et al., 1996). The central tool for the CL is a 3x3 set of surfaces for representing the work activity, building on Vygosky notion of *dual stimulus* (Vygotsky, 1978). The first stimulus is provided by showing the participating practitioners 'mirror data' from their everyday work.

The second stimulus focuses on producing a new model of activity for which a zone of proximal development (ZPD) is defined for potential transformational learning. These processes are supported through the use of a range of devices and procedures such as templates, diagrams, diaries and calendars (to summarize important events), maps (to depict the key parties, roles and places involved), video recorders (to facilitate the documentation and review of critical events in subsequent sessions), and a projector (for displaying video documentation and other visual materials). The CL has been applied in health care services in Finland (e.g. Engeström, 1999c), in projects for integration of ICTs in schools (e.g. Engeström, Engeström & Suntio, 2002) and in telecommunications companies (e.g. Virkkunen & Ahonen, 2004).

The Activity Checklist

Kaptelinin, Nardi & Macaulay (1999) developed an Activity Checklist that makes concrete the conceptual perspectives of CHAT for early phases of systems design and for evaluating existing systems. Accordingly, there are two slightly different versions of the checklist: the "evaluation version" and the "design version." Each version provides a guideline intended to elucidate important contextual factors of human-computer interaction, which researchers, designers or practitioners should pay attention to when trying to understand the context for which the information system is being designed, will be used or is in use. With strong emphasis on IS as tool mediation, the checklist reflects five basic principles of CHAT: *object-orientedness, hierarchical structure of activity, internalization and externalization, mediation, and development*.

An Activity Checklist is structured in four sections, which correspond to four main perspectives on the target technology (Kaptelinin, Nardi & Macaulay, 1999, pp. 33-39). The first perspective concerns *means and ends* – the extent to

which the technology facilitates and constrains the attainment of users' goals and its impact on provoking or resolving conflicts between goals. The second concerns *social and physical aspects of the environment* – the integration of the target technology with requirements, tools, resources, and social rules of the environment. The third is focused on *learning, cognition and articulation* – distinguishing internal and external aspects of activity and support of their mutual transformations with target technology. The fourth focuses on *development* – developmental transformation of the foregoing activity and its context as a whole.

When conducting systems design and evaluation using the Activity Checklist, researchers and practitioners need to consider the following. First, use of the checklist should be combined with other methods such as interviews and observations. Second, rather than using the four checklist sections in a linear manner participants should look for patterns of related items both within the same section and between different sections. Third, participants should familiarize themselves with the checklist by making use of it during the various phases of the design and evaluation processes. Fourth, in order to be able to focus on relevant items and ignore irrelevant ones, potential users of the checklist should clearly understand why and how they are using the checklist in their particular context.

Examples of the application of the Activity Checklist can be found in the design and evaluation of web-based information systems (e.g. Gould & Verenikina, 2003), evaluation of the use of a tangible user interface (TUI) developed to facilitate collaboration between a group of designers and planners (e.g. Fjeld, Morf & Krueger, 2004), and the analysis of empirical data gathered by means of ethnographic research (e.g. Maier, 2005).

Activity Analysis and Development: ActAD

Activity Analysis and Development (ActAD) was developed by Korpela (1997, 1999) based on Engeström's expansive cycle of learning (Figure 5). ActAD provides a methodology for examining sociocultural features that can inform the development of IS and work practices. It is recommended for several uses such as for user teams who want to develop their own work practices, for IS developers facilitating change in people's work practices and for IS and other researchers as a research methodology at the level of work practices.

The ActAD methodology details five steps. The first step involves the identification of the constituitive elements, components and relations of the activity system to be supported by the IS, e.g. the shared objects of work and jointly produced outcomes of the activity for which information and communication technologies are being designed. The second step provides a checklist of questions to guide a structural analysis of the activity system components and aspects that have been identified. This analysis involves understanding the linkages between the components, between the identified activity and other activities, and/or between the identified activity and the wider context in which it takes place. The third step involves developmental analysis in which participants focus on how the central activity should be improved. *Developmental analysis* involves three phases: *History* - how has the central activity and its network emerged and developed up to that moment? *Problems* – what kind of weaknesses, deficiencies and imbalances are there within and between each of it constituitive elements, components and relations? *Potential* – what kind of strengths and emerging new possibilities are there in the internal dynamics of the activity and within and between the components of the activity, other activities and activity systems in the broader social-historical context? The fourth

step is the development of new tools required for improvement of processes based on the information elicited and analyzed in the previous steps. The fifth step involves disseminating the results, evaluating the process and initiating a possible new start.

The ActAD method has been further developed and used as a research methodology for studying IS development work itself as an activity. For example, Korpela et al. (2000) used ActAD as a lens for rapid analysis of the work and services activity chain by nurses in general practitioners' offices in a local health centre. Mursu (2002) used ActAD as an analytical tool regarding IS development practices and problems. ActAD was used by Soriyan (2004) to analyze a hospital software development project in a university HIS research environment. Taking ActAD methodology further, Mursu, Luukkonen, Toivanen and Korpela (2007) developed the Activity Driven Model, an analytic model based on ActAD, activity theory and participatory design. The Activity Driven Model contributes to an integrated analysis of work activity at multiple levels: individual, group, organization and global. While the highest level -- global -- serves as a map to and from which lower level descriptions are traced and reflected, the model is designed to enable zooming in and out between the four levels, as is always necessary. For example, a contextually detailed Activity Driven Model can be used to explore how changes in individual work processes may affect the organizational level.

Activity-Oriented Design Method: AODM

The Activity-Oriented Design Method (AODM) was developed by Mwanza (2001, 2002) based on Engeström's expanded model of human activity (Figure 3). The AODM is intended to support the processes of gathering, analyzing and communicating early systems design requirements focusing on HCI research and practice. It consists of four methodological tools that are applied iteratively in

a six-stage process. The first stage is an eight-step model consisting of eight questions that guide the analysis of the activity system and its constitutive elements and internal dynamics. In the second stage, Engeström's activity system triangle is used to model the work practices of the situation being investigated based on the information obtained in the first stage. The third stage entails the use of an 'activity notation' tool to decompose the activity system analysis produced in the second stage, into sub-activity systems with which IS designers then work. The fourth stage involves the generation of research questions based on the sub-activity systems developed in the third stage. These questions can be used to support data gathering, analysis and systems evaluation phases. The fifth stage comprises a detailed investigation guided by the research questions generated in the fourth stage. The sixth and final stage involves the interpretation and communication of the findings to a broader community of stakeholders, by re-modeling the activity system of the situation undergoing analysis for HCI design.

Examples on the application of the AODM can be found in studies carried out by Mwanza and Engeström for the design and evaluation of an e-Learning environment (Mwanza & Engeström, 2005), and research analyzing interactions among various stakeholder groups involved in e-Learning courses (Greenhow & Belbas, 2007).

CHAT Frameworks in Specific Studies

In addition to the four methodological approaches discussed above, researchers have employed CHAT as a framework for elaborating research in a variety of ways in specific studies (e.g. Jonassen & Rohrer-Murphy, 1999; Martins & Daltrini, 1999). Jonassen and Rohrer-Murphy devised a CHAT-based process for determining the components of an activity system that can be modeled in constructivist learning environments (CLEs). Their framework consists of six steps that provide sample questions and actions

that can be taken. The first step is to clarify the purpose (object) of the CLE as an activity system. The second step is to analyze the CLE activity system following Engeström's triangular activity system model (Engeström, 1987). The third step involves decomposing the CLE activity system into actions and operations to describe its structure. The description of the activity system's structure comprises the interrelationships of all of the conscious and unconscious thought and performances that are focused on the object of the activity (its motive and purposes). The fourth step involves the analysis of tools and mediators (e.g. instruments, signs, procedures, machines, methods, languages, formalisms, laws, etc.) that have been used and their transformations over time. The fifth step concerns the analysis of the context within which the CLE activity system occurs, and aims to elicit information about how learning and related activities are accomplished in the particular context. The sixth step involves analyzing the dynamics of the activity system to assess how its constituitive tools, mediators and participants affect each other, with the aim to discern what other resources are needed to enhance the relations between the constituitive aspects of the CLE.

Martins and Daltrini (1999) describe a CHAT-based framework for software requirements elicitation, consisting of three steps. The first step is to identify procedures performed in the activities of the system engaged in IS research and development. The next step is to identify the subject(s), tool(s), object(s), community, rules, divisions of labor and outcome(s) of the target activity system (following Engeström, 1987). The third step is to decompose the activities into actions and operations based on Leont'ev'**s** model of the individual and collective activity (Figure 2). The actions and operations that are identified expand the basis for deriving requirements for IS system design and development.

CHAT IN RELATION TO OTHER THEORIES AND METHODOLOGIES

Cultural Historical Activity Theory holds several methodological foci and concerns in common with actor network theory (ANT), structuration theory and action research methodology. CHAT, ANT and structuration theory share foci on everyday and historically evolving design, use and continuous adaptation of artifacts and technologies; critical reflection on the production and reproduction of relations between people, things and nature; continuous learning and knowledge and potential for transformation through our interactions and practices; an appreciation of the particularities and contingencies of social contexts and configurations of human-machine and other human and non-human collectives; and design for negotiation between the multiplicities of objects, activities, logics and systems. CHAT and action research share commitments to co-development of interventions for change in organizations and communities.

Among contemporary discussions of the differences and similarities between CHAT and ANT, see for example, Engeström & Escalante (1996), Berg (1997), Bratteteig & Gregory (1999), Miettinen (1999, 2001) and Kaptelinin & Nardi (2006). Comparative discussions between CHAT and structuration theory are offered by Bratteteig and Gregory (1999) and Widjaja and Balbo (2005). As in action research methodologies, CHAT-based developmental work research (DWR) comprises cycles of research, mutual learning and change; yet there are differences between the two methodological approaches (see e.g. Engeström, 1999a; Nilsson, 2000). Considering the different histories and theoretical standpoints between these four theoretical traditions that are actively circulating in IS research, their distinctive perspectives provide contrasting and complementary points of view that offer the basis for fruitful critical dialogue (Miettinen, 1997).

CONCLUDING REMARKS

In this chapter we have reviewed the origins, approaches and roles associated with the use of Cultural Historical Activity Theory in IS research. It is our hope that our discussion demonstrates not only how CHAT has been taken up as a theoretical framework and a repertoire of theoretic-methodological analytical tools for IS research, but also suggests areas in the IS field where CHAT-based approaches can add insights. The thoughtful construction and use of a CHAT framework can orient IS researchers' attention especially toward aspects of the context of an IS as part of a work activity system in organizational and sociocultural context. CHAT provides a comprehensive, holistic and dynamic analytical framework that makes it possible to analyze the complex inter-related factors that shape and are shaped by people, technology and context, which are central to current IS research.

CHAT can be used to model, design and prototype new practices and IS to respond to changing needs and constraints. The integration of multiple dimensions of work processes in the concept of an activity system moves 'from the abstract to the concrete' towards prospective design insights that can thus facilitate change. Cultural-historical and sociocultural theory is also useful in proposing and iteratively generating research questions. An application of CHAT, however, requires an IS research and development timeframe that is long enough to understand activity systems, including changes in objects of activity over time, and their relations to other activity systems. This is of particular importance to the IS field in which research into the complex and dynamic social context of IS is an area that requires further exploration.

Activity theoretical approaches and methodologies in IS research are still emerging. The practical implication of this, put in theoretical terms, is that as future development of information and communication systems and IS tools and their wide and diverse applications require new ideas and knowledge, evolving trends in activity theoretical research on the design, implementation and use of such methods and tools may prove to be a central contribution.

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KEY TERMS AND DEFINITIONS

Activity System and Activity: An activity system is a collective formation with a complex mediational structure that serves as the primary unit of analysis in cultural historical activity theory. An activity is the engagement of individuals toward a certain goal or objective. Activities are not short-lived events or actions; rather, activities 'are systems that produce events and actions and evolve over lengthy periods of sociohistorical time' (Engeström 1987).

Artifacts, Mediating Artifacts: *Artifacts* and *mediating artifacts* encompass tools, instruments, signs and all types of material, semiotic and conceptual means for accomplishing human activity.

Contradictions: Contradictions refer to tensions and disturbances that arise within and between constituents of activities, between different activities or different developmental phases of an activity, and within and between activity systems as they evolve over time. Analysis of contradictions is 'a key to understanding the sources of trouble as well as the innovative and developmental potentials and transformations of activity' (Engeström 2008, p. 5).

Cultural Historical Activity Theory (CHAT): Cultural historical activity theory offers a meta-theoretical philosophical basis and transdisciplinary perspective for analyzing diverse human practices in socio-cultural context and across multiple contexts and networks, as developmental processes in which individual, organizational, societal and cultural levels are dynamically inter-related.

Expansive Learning: Expansive learning is defined by Engeström as follows: 'Expansive learning is initiated when some individuals involved in a collective activity take the action of transforming an activity system through reconceptualization of the object and the motive of activity embracing a radically wider horizon of possibilities than in the previous mode of activity' (Engeström 2003, pp. 30-31).

Information Systems: An information system is defined comprehensively as the use of information technology (manual or computer-based) in a collective work activity, either as a means of work or of co-ordination and communication (Mursu et al. 2007).

Mediated Action, Mediation: The concepts of *mediated action* and *mediation* are grounded in the conceptual view that humans do not interact directly with their environments; rather their interactions are always mediated through the use

of different types of tools, signs and material, semiotic and ideational artifacts that include culture and language and that are evolved over time.

Object of Activity and Object-Oriented Activity: 'Objects of activities are prospective outcomes that motivate and direct activities, around which activities are coordinated, and in which activities are crystallized in a final form when the activities are complete' where is the start of the quote (Kaptelinin & Nardi 2006, p. 66). Object-orientedness characterizes all human activity in the sense of motive or desire, whether the object of activity is material or psychological, individual or collective.

Social Context: The social context passes an entire activity system in which the information systems (IS) operate. It includes the integration of the subject, the object, the tools, the community, rules and division of labor.

Social Practice and Praxis: Praxis, understood as practical wisdom that is grounded in particular, perceptual and concrete experience (phronesis), is inseparably complementary to theory, understood as scientific knowledge that is generalizable, conceptual and abstract (episteme). Research regarding social practice encompasses two senses — scientific focus on activity and interventive meaning related to developing the practice; these are understood as simultaneous and complementary.

Zone of Proximal Development (ZPD): The zone of proximal development refers to transformational learning. Vygotsky (1978, p. 86) defined the zone of proximal development as 'the distance between the actual developmental level as determined by independent problem-solving and the level of potential development as determined through problem-solving in collaboration with more capable peers' and with culturally produced artifacts.