Supporting the HCI community: methods, tools & techniques

Some observations on the use of Cultural Historical Activity Theory (CHAT)

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Abstract

This paper describes the experience of using Cultural-Historical Activity Theory (CHAT) as a tool to evaluate and analyse computer systems designed to support collaborative writing.

Keywords

Cultural-Historical Activity Theory, Analytical Tools, Collaborative Writing.

INTRODUCTION

The purpose of this paper is to discuss the utility of Cultural-Historical Activity Theory (CHAT) as a tool to support the HCI community. The paper will describe some of the perceived strengths and weaknesses of CHAT and provide some advice for HCI researchers who might be considering using it in the future.

The motivation for this paper comes from a study of collaborative writing undertaken by the authors. Part of this study involved identifying a suitable theoretical basis for evaluating the usability of synchronous collaborative editors. The theory was required to explain the actions of both individual and groups of users and the social aspects of their interactions. CHAT was chosen as proponents argue that is ideally suited to account for contextual issues and social aspects when assessing usability of systems (Nardi 1996a), (Kaptelinin, Nardi, & MacAulay 1999). The aim of the study was not only to explore the process of collaborative writing, but also to evaluate the utility of CHAT as an investigative tool.

The first part of this paper provides a brief description of the basic principles of CHAT. (The interested reader will find more detailed discussions of CHAT in Bødker (1991), Nardi (1996b) and Hasan, Gould & Hyland (1998). The second part deals with the problems faced when attempting to understand and apply CHAT to a problem domain, namely collaborative writing.

WHAT IS CHAT?

CHAT has its foundation in the work carried out by Vygotsky (cited in (Verenikina & Gould 1998)) in the early part of the twentieth century in the former Soviet Union. Vygotsky sought to construct a theory of human consciousness based on the interaction between the mind and the environment. He proposed, "…consciousness is constructed through a subject's interactions with the world and is an attribute of the relationship between subject and object." (Verenikina & Gould 1998, p. 8). This initial theory was expanded upon by Leontiev (cited in (Verenikina & Gould 1998)).

It is important to note that CHAT is not a theory as such, as Kaptelinin, Nardi, & MacAulay put it 'Activity theory is a general conceptual approach, rather than a highly predictive theory.' (1999, p. 28). It provides general guidelines rather than strict, verifiable postulates.

Principles of CHAT

CHAT takes activity as the unit of analysis and defines an activity, in its most basic form, as the interaction between a person (subject) and an object in their environment through the use of mediating artefacts. Based on this, five basic principles have been postulated and are discussed below. As mentioned previously, the limitation on space precludes an extensive discussion of CHAT.

Object Orientedness

CHAT objects are similar but not quite the same as the object-oriented (OO) concepts found in the discipline of Information Systems. Objects in CHAT are more akin to objectives rather than the entities described in the OO of Information Systems. The significance of objects is that they provide the starting point for identification of activities.

Hierarchical Structure of Activity

CHAT organises activities into a hierarchy of activities, actions and operations. In relation to HCI, the hierarchy is used to explain the progression of novices to expert users and the extent to which change can cause disruption to ease of use of a system.

Internalisation

Internalisation relates to a persons ability to internalise external processes at a conscious level and perform manipulations of the process in the mind.

Mediation

The subject of an activity interacts with the object through tools or artefacts. Tools can be either psychological, such as language, or material, such as a hammer.

The concept of mediation is one of the attributes of CHAT that makes it attractive to HCI researchers. In CHAT, computers can be portrayed as tools that mediate a person's interaction with their environment for the purposes of achieving some outcome. The computer can be thought of as an internal or psychological tool in that it helps the user organize their thoughts or accommodate abstract concepts, such as the organization of ideas that accompany writing a document. In another situation, the computer can also be thought of as an external or material tool in that it, in combination with a printer, can produce a hardcopy version of the same document. Bødker (1991) differentiated between 'instrumental means', which are mediating artefacts that operate directly on the object, and 'communicative means', which is essentially the use of language and signs to coordinate work.

Development

Activities are dynamic in that they can change over time. The changes can be brought about by such things as changes in the environment requiring new practice, a desire by subjects to find a better way of doing things or by an incompatibility arising with an associated activity.

The five basic principles of CHAT should not be viewed from a reductionist point of view. All five are necessary and should be considered as an integrated whole when considering any activity. Activity theory considers culture in the broadest possible terms. To make it more manageable when considering HCI the concept of culture can be reduced in scope. In the example of collaborative writing, the focus was on writing in the workplace, hence the relevant cultural aspects were the organisational structures and customs and habits of writers in the workplace. However, there is still room for variance in this setting. For example, a group of academics collaborating on a journal article will work in a different manner to say a team of journalists and editors producing a daily newspaper. The workplace culture of the latter is more likely to rely upon a well-defined hierarchy of responsibilities and executive power than the more (hopefully!) open, meritocratic culture of academe. The cultural environment will have a direct influence how the activity is performed.

Community

Engeström (1987) expanded CHAT by introducing the component of community into the base relationship between subject and object. The relationship between community and subject and community and object are mediated through rules and division of labour respectively.

Analysis

In practice, an activity is examined and described in the dimensions described above. Further analysis is then carried out to highlight any problems or areas for improvement. There are two established methods for carrying out this analysis. The first, proposed by Engeström (1987), is based on the concept of contradictions, which identifies and characterizes problems with activities that could serve as a basis for further development of the said activity. Contradictions can occur (a) within a component of the activity, for example the rules for carrying out an activity may be incompatible; (b) between components, for example the subject may be in conflict with the community, or; (c) between different activities. The second, proposed by Bødker (1991), is based on concept of breakdowns, which highlights the escalation of an operation to an action or an action to an activity that may occur due to a disruption in the normal course of events.

ISSUES IN INTERPRETING AND USING CHAT

Language

It can be difficult for English speakers to appreciate CHAT fully due to differences in language. The theory originated in the former Soviet Union and most of the seminal papers are written in Russian. This has caused problems with translation as there are no words in English that capture the original meaning of some of the key terms. The most fundamental of these is the word 'activity', which does not convey the same meaning as the original Russian word '*deyatelnost*'. Verenikina and Gould (1998, p. 7) interpret deyatelnost as '… a concept connoting the function of individuals in their interaction with their surroundings.' Cole (1981, p. viii) defined activity as 'an organizational unit for performing a mental function'.

Philosophy

CHAT has its roots in the Marxist philosophy of dialectical materialism. This philosophy rejects the concept of cause and effect in favour of a view of the world where interdependent sets of relations exist between objects. The materialist element sees the objective, material world as the basis of thinking. The effect of this is on the field of HCI is that it removes the focus from any one component of a system to consideration of the system as a whole, including the user(s) and the social and physical environment. It also emphasizes the way in which all elements of a system can interact to bring about change and development of a system over time. This is reminiscent of the task-artefact cycle proposed by Carroll and Campbell (1989).

A PRACTICAL WAY OF APPLYING CHAT

CHAT provides more of a broad conceptual view than a prescriptive set of steps to follow. Because of this it can be hard for newcomers to the theory to work out how to use it in practice. In order to redress this problem, Kaptelinin, Nardi, & MacAulay (1999) produced a checklist that provided a framework for the use of CHAT as an analytical tool in the field. The checklist was intended to be applied both during design and evaluation phases of computer systems development. It comprises of four sections (Means/end, Environment, Learning/cognition/ articulation, and Development) each containing a number of questions that are intended to help the analyst explore the problem domain and reveal the elements of the activity under consideration.

In our research into synchronous collaborative writing systems, Kaptelinin's checklist was used as an interview guide (appendix 1) in an exploratory study of the nature of collaborative writing in the workplace. Its purpose was to gather data in order to model collaborative writing as an activity according to CHAT and then use this model as a basis for evaluation of existing systems. The study took the form of one-on-one interviews with volunteer writers. Participants were recruited through an email distributed to a University department and were screened for familiarity with desktop computers and writing and English language skills.

The interview procedure saw the interviewer, by way of introduction, explain the purpose of the interview, its conduct and ask for permission to make an audio recording and the participant's consent to proceed. The checklist was used to ensure that all relevant topics were covered and was not used as a prescriptive plan for the conduct of the interview. The interviewer made notes of the interview and, where permitted, recorded the dialogue on audiotape. The interview, whenever possible, took place in the interviewee's normal workplace and generally took no more than one hour.

Construction of the activity model amounted to a subjective assessment of how the interviewee's answers fitted into the abstractions of CHAT. Whilst Kaptelinin's checklist categorized the questions according to their place in CHAT the answers given by interviewees did not always fall neatly into the same categorizations. This required some interpretation on the part of the analyst to determine how to frame the collaborative writing as an activity according to CHAT. Analysis of the resultant model was performed by looking for the contradictions described by Engeström (1987) and breakdowns described by Bødker (1991). From this, conclusions were drawn about the utility of collaborative writing software in meeting the needs of writers in the workplace and suggestions for improvement made. The model of collaborative writing constructed from these observations and was subsequently used as a guide for evaluating the functionality and requirement of SCEs. The model differs from a simple list of requirements in that it describes a number of elemental components of collaborative writing and the relationships between them.

FINDINGS

The use of the checklist highlighted factors in the domain of collaborative writing that would have been difficult to elicit in a traditional usability study of a software interface in a laboratory. Two findings will be examined as examples. The first example finding was that writers have differing views as to what constitutes collaboration. Some consider an approach where individual writers draft sections of a document which are then compiled and edited by a single writer as a collaborative writing exercise. Others reject this idea and believe that true collaborative writing only occurs when collaborators craft the sentences together. The second example finding is

that writers use different techniques and tools during the writing process. Some prefer to write a rough outline of their ideas using pen and paper and then transcribe this to the word processor whereas others prefer to perform all writing directly on the computer. These differing and sometimes conflicting views would lead to quite different requirements of a collaborative writing tool and its subsequent design. Both these findings are examples of contradictions in the style of Engeström (1987).

Briefly, other findings where that: writers had individual preferences for the physical environment and time of day for writing with the implication that synchronous writing would not always be feasible or desirable, and; writing in the workplace requires synchronous collaboration in only very specific circumstances such as when reviewing.

CONCLUSION

The use of CHAT in the study of collaborative writing provided a framework for capturing and describing the contextual dimensions of an activity supported by technology. The strength of CHAT is that, once the basic concepts have been mastered, it provides a means of studying context and social factors and, because of this, it is suited to the field of computer supported collaborative work (CSCW). However, CHAT can be difficult to grasp due to its roots in Soviet philosophy and the Russian language. As such, those unfamiliar with this area can expect to spend a relatively long time coming to an understanding of its basic concepts and how to apply them. Compounding this problem is the lack of a clear methodology on how to apply CHAT, as such, some might find it too vague to be of any use. Kaptelinin's checklist is an attempt to redress this issue.

The scope of our study was limited to investigating the feasibility of tools to support collaborative writing, it did not venture into designing an actual tool. As such, we cannot draw firm conclusions about the use of CHAT as a design tool. However, our opinion is that CHAT is more of an analytical tool; it does not provide much guidance on how to do detailed design of systems.

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APPENDIX 1

Interview plan, adapted from Kaptelinin, Nardi, & MacAulay (1999)

Means/end	Environment	Learning/cognition/ articulation	Development
What process would you follow when writing a document by yourself?	Where and when do you prefer to write?	When writing, which tasks or actions do you do 'inside' your head and which do you need to do 'outside' of you head, eg on paper?	Can you think of anything that would make the collaborative writing process easier or more productive?
Could you explain the goals or sub-goals of each the steps in your process? What are the outputs of each step?	How does writing alone differ from when you write in collaboration with others?	Do you write outlines, draw concept maps, other?	Have you changed the way you write over the last few years? Have you started using new tools or techniques?
What are your motives for writing in collaboration with another or others?	How do you prefer to communicate with your collaborators – face to face, written text, telephone, other?		Have stopped using any tools or techniques?
How do you judge whether a collaborative writing exercise has been a success?	How do you divide the work up among your collaborators?		Do you have a different writing process with people you are familiar with as opposed to relative strangers?
	How do you expect your collaborators to behave? What do you expect from your collaborators?		Are there aspects of the tools that you currently use that divert your attention away from the writing process?
	What do you think that your collaborators expect from you?		
	Describe the tools and techniques you currently use.		
	Is there any piece of technology that would seriously impact your ability to write if it were removed?		

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