ABSTRACT

Socio-cultural theories on language learning examine the impact of social interaction within cultural environments upon cognitive development and learner performance. Such theories emphasise the emergence of learner strategies and subsequent linguistic proficiency through involvement in continuously unravelling situated activities. However, this view is seldomly integrated within Computer-Assisted Language Learning (CALL) system design efforts as practitioners currently lack a holistic and integrative model for capturing, modelling and evaluating cognitive and social requirements of learner-computer interaction. In response, we propose the CASE (Cognition, Activity, Social Organisation and Environment) meta-design model. Exploring the specific components of the model, we underscore the relevancy of Activity Theory and Scenario-Based Design to CALL system design. Finally, we posit that the CASE model approach will greatly assist CALL initiatives in quality-driven system design.

Author Keywords
meta-design, situated task analysis, CALL

ACM Classification Keywords

INTRODUCTION

Recent trends in Computer-Assisted Language Learning (CALL) have seen a gradual shift away from cognitivist perspectives on language instruction (such as drill-and-practice exercises) towards more socially-oriented, computer-supported collaborative work (CSCW) activities. Despite this movement, current task analysis (TA) methodologies and User-Centred Design (UCD) principles in CALL continue to focus on traditional cognitivist models of interaction and associated criteria, such as task performance, ease of use, and ease of learning [Plass, 1998]. There is increasing agreement within the human-computer interaction community that purely cognitively-grounded TA methodologies are ill-equipped to capture, model and evaluate computer-mediated activities as they exist within sociocultural communities of practice [Carroll, 1996, Kaptelinin and Nardi, 2003, Quintana et al., 2001]. Within CSCW practice, this is commonly referred to as the social-technical gap [Ackerman, 2000].

Recent research in CALL has questioned the relevance and importance of Human-Computer Interaction (HCI) in effective CALL system design [Chapelle, 2001]. We believe, however, that integrative TA methodologies capable of addressing both cognitive and socio-cultural perspectives on learner-computer interaction are central to overcoming the widening social-technical gap in CALL. Subsequently, due to increased complexity and transdisciplinarity of learning systems design, CALL requires a flexible, adaptive and holistic meta-design model for guiding TA at various phases of system design. In response to criticism of the general quality and appropriateness of CALL software design [Gruba, 2004, Farmer et al., 2004], the ability to elicit, model and evaluate cognitive and social learner requirements is seen as a major contribution towards improved CALL system quality.

The proposed CASE meta-design model (Cognition, Activity, Social Organisation and Environment) provides a conceptual framework for describing and evaluating situated language learning activities. First, sociocultural theory states that individual cognitive psychological phenomena are dependent upon culturally historic systems of mediation [Vygotsky, 1986]. Learner-computer interaction is therefore a subject motivated, goal-oriented social process [Donato and McCormick, 1994, Hoven, 1999], requiring increased focus on the ecological validity and legitimacy of interaction within a situated activity [Donato and McCormick, 1994]. Second, utilising an accessible, flexible and common task analysis notation methodology, CASE provides increased support for collaboration and communication between stakeholders within transdisciplinary environments.

THEORETICAL CONTEXT

The principal motivation behind our work is quality improvement in CALL system design. Improving the quality of system design can not be achieved through any singular
process, rather it is the result of a range of holistic, context-specific processes and practices. Moreover, the term is inherently ambiguous and multifarious, reflecting different stakeholder needs and perspectives. Nevertheless, central to all software quality improvement strategies is the correct and unambiguous elicitation and specification of stakeholder requirements within the software ecosystem [Farmer et al., 2004]. Moreover, effective requirements engineering requires a robust, adaptive, and integrative framework for conducting task analysis and communicating findings throughout the software development life cycle (SDLC) [Balbo et al., 2004].

The focus in CASE on describing, rather than analysing learner practice stems from the fact that in developing fit-for-purpose learning systems, it is essential to know your user(s) and the activities in which they participate [Preece et al., 1994]. Furthermore, the model reflects previously established criteria in the literature for learner-centred design (LCD) practices through its focus on negotiation, motivation, cooperation and coordination, and communication [Quintana et al., 2001, Soloway et al., 1994].

Negotiation is concerned with examining conflict within an activity and is essential to understanding degradation in shared-knowledge representation, goal structures and subject motivation [Engeström, 1999]. Negotiation in collaborative activities typically encounters interpersonal and structural conflicts (such as conflicting subject goals in the former, affordance and embedded cognition in the latter). Within the socio-cultural paradigm, especially Activity Theory, this process is known as breakdowns. In contrast to cognitivist perspectives of interaction whereby breakdowns constitute functional disjunctions in task performance, constructivist learning theories see breakdowns as crucial learning opportunities which should be manipulated rather than avoided [Hoven, 1999, Vygotsky, 1986]. Motivation is central to learner-computer interaction as it dictates to a large extent the nature of the activity itself and the marshalling of appropriate cognitive resources [Robinson, 2001]. In collaborative environments, understanding the existing motivational forces (individual and social) greatly contributes to our knowledge of the learning practice [Donato and McCormick, 1994, Nardi, 1996]. Cooperation and Coordination are closely linked to task synchronisation and mutual awareness [Watts and Monk, 1998]. Understanding these factors assists with understanding the dynamic nature of individual roles and relationships between actors, and their use of tools, within an activity [Nardi, 1996]. Communication focuses on stakeholder ability to effectively communicate views and beliefs about an activity, and is central to information flow within any collaborative work practice.

These key characteristics of LCD are simultaneously preconditions and corollaries of increased learner situation awareness. In learning environments, situation awareness (SA) is seen as the ability to monitor the changing characteristics and social norms of an activity as it dynamically unfolds [Endsley and Garland, 2000]. CASE promotes SA in CALL by focusing design attention towards how learners perceive relevant contextual information; construct and comprehend roles and relationships with other actors in an activity; represent, comprehend and communicate information within an activity; and use social cues to plan for future events. Therefore, evaluating learner SA often requires analysts and designers of computer-mediated systems to isolate and investigate specific levels of learner-computer interaction.

CASE is a conceptual model for directing investigations on situated learning activities. As a conceptual model, it inherently supports a range of methods for examining situated practices, and thus ensures the flexibility and adaptivity of the model. Furthermore, its ability to model socio-collaborative work practices and assist with transdisciplinary design efforts is achieved through the integration of Activity Theory [Engeström, 1999] and Scenario-Based Design [Carroll, 1996].

Activity Theory is commensurate with the goals of the CASE as the basic unit of analysis is situated activity. Activity Theory, derived from Vygotskian perspectives on social learning [Vygotsky, 1986], supports constructivist language learning theories as social and individual process are interwoven in the generation of contextualised meaning. It provides a framework for understanding the composition of learner strategies [Donato and McCormick, 1994], is concerned with how real life practices play out in situ and seeks to understand human cognition outside of the boundaries of the individual mind [Nardi, 1996]. In practical terms, because situated activity is the unit of analysis during design, analysts are more likely to consider sociocultural as well as cognitive factors, such as collaboration and cooperation, conflict and negotiation. As Activity Theory maintains that participation within an activity is subject-motivated and goal-oriented. The goal-oriented view provides a holistic framework for examining the impact of learner strategies and setting on language acquisition and production in socio-collaborative CALL environments [Donato and McCormick, 1994]. Finally, Activity Theory is commensurate with LCD as activity occurs within a community of practice, is goal-oriented and is linked to improving learner strategies (such as self-assessment and management in autonomous learning environments).

Scenario-Based Design provides a simple, yet efficient solution for capturing, modelling, and communicating stakeholder knowledge about situated activity. According to Balbo et al. (2004), TA frameworks should not require extensive training, must possess an accessible notation comprehensible by all project stakeholders, and be adaptive to new problem domains [Balbo et al., 2004]. Embodied by the scenario-based design approach, these criteria are especially relevant to transdisciplinary CALL environments as scenarios are capable of capturing and modelling rich and complex social phenomenon from various stakeholder perspectives [Carroll, 2000]. Furthermore, scenarios assist the application of socio-cultural theories (including Activity Theory) during design [Carroll, 1996], by affording
greater reflection in design, facilitating abstraction and categorisation of knowledge, and ensuring focus remains on real life activities rather than cognitive processes [Carroll, 2000].

Environment modelling is primarily concerned with questions of affordances, artefacts, and conditions. Affordances suggest naturally occurring relations between agents in the environment. We might talk about the natural affordances of a classroom (many-to-one conversations), which in turn may direct our investigations to the impact of social organisation and cultural convention on constructing learner strategies [Donato and McCormick, 1994]. Artefacts are those materials and work products that are used by the learning system (books, microphones, monitors etc.). Both Activity Theory and Distributed Cognition maintain that artefacts possess cultural residue [Nardi, 1996]. Analysing artefact structure, historicity and relationships with other agents in the environment may provide key insights into how existing or newly introduced artefacts in the environment influence participation within an activity. This is especially true of CALL where modelling changing social conditions has been shown to be an effective indicator of within-learner variance on stable language learning tasks [Robinson, 2001].

Social Organisation modelling is primarily concerned with sociological and anthropological questions about the nature of an activity. This is apparent in the emphasis on culture, conventions, work practice and agency. For instance, when developing new computer-mediated communications (CMC) activities, is communication likely to cross cultural boundaries, requiring varied learner strategies? Are interlocuters constrained by existing cultural conventions and linguistic competencies which are likely to impact discourse structure (such as the complexity of rhetorical relations, level of linguistic disfluencies, address forms and turn-taking)? Modifying the degree of scaffolding (both social and technological) present within an activity is likely to not only affect agency, but also work practice (does the learner perceive the learning task as a passive or interactive activity?) [Hoven, 1999].

Perhaps the most important level within the model is that of the activity. Here we are interested in capturing and evaluating tool-mediated, subject-motivated interaction. Informed by Activity Theory, we are interested in modelling the relationships and roles in agent (actors and artefacts) collaboration, how this polymotivates actions within the activity, and how in turn, conflicts and learner control strategies impact emerging cognitive tasks. Whilst the environment and social organisation factors are assumed to change at a much slower rate, aspects of an activity are assumed to be highly dynamic and fluid in nature. The socio-collaborative nature of the factors associated with this level are highly likely to be influential in evaluating between-learner variance in a learner activity.

The epicentre of the CASE model is human cognition as human information processing has the highest rate of
change in behaviour and is central to all higher-level meta-cognitive functioning. In CASE, cognition is consisted of three primary factors: task complexity (focus-on-form, divided attention, information priming, associativity of the construct); conscious subject goals (motivation, task prioritisation), and task difficulty (reflecting transient qualities such as intelligence, aptitude, gender etc.). Whereas modelling goal structures and cognitive difficulty will assist in understanding ill-structured, emergent socio-collaborative practices, cognitive complexity is highly relevant to analysing learner-computer interaction in well-structured, fixed scenarios.

FUTURE WORK AND CONCLUSIONS
Having described the proposed benefits of the CASE model, we recognise its current limitations. One of the key criterion which separates a design philosophy from that of a methodology is an associated set of detailed methods and heuristics which can be applied during system design. As such, our current research focus is on the production of a detailed taxonomy of analysis methods and associated practices.

In this paper we have described the CASE meta-design model for describing and evaluating learner-computer interaction in CALL. We have argued that the model provides a systemic and holistic integrative framework for incorporating cognitive and socio-cultural perspectives on computer-mediated activities in language learning environments. Furthermore, we have briefly described the benefits of Activity Theory and Scenario-Based Design in capturing and explicating learner requirements at various levels of investigation within the model. Finally, we have proposed that the model's ability to capture learner requirements for successful participation in situated learning activities represents a significant contribution towards quality improvement in CALL system design.

REFERENCES


Minerva Access is the Institutional Repository of The University of Melbourne

Author/s:
Farmer, R. A.; HUGHES, B.

Title:
CASE: A Situated Task Analysis Framework for CALL

Date:
2005

Citation:

Publication Status:
Inpress

Persistent Link:
http://hdl.handle.net/11343/33819

File Description:
CASE: A Situated Task Analysis Framework for CALL

Terms and Conditions:
Terms and Conditions: Copyright in works deposited in Minerva Access is retained by the copyright owner. The work may not be altered without permission from the copyright owner. Readers may only download, print and save electronic copies of whole works for their own personal non-commercial use. Any use that exceeds these limits requires permission from the copyright owner. Attribution is essential when quoting or paraphrasing from these works.