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ABSTRACT
Socio-cultural theories of 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 proficiency through involvement in continuously unravelling situated activities. However, this view is rarely expressed within Computer-Assisted Language Learning where practitioners often fail to consider implications of system design. This is in part due to the lack of a holistic and integrative framework 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) framework, and explore its application to a historical study on Computer-Assisted Language Learning software development. In sum, we argue that the CASE approach will greatly assist Computer-Assisted Language Learning initiatives in quality-driven system design.

Categories and Subject Descriptors
K.3.1 [Computers in Education]: Computer-assisted instruction; D.2.10 [Design]: Methodologies; H.1.1 [Systems and Information Theory]: General Systems Theory

Keywords
learner-computer interaction, situated task analysis, computer-assisted language learning

1. INTRODUCTION
Research in Computer-Assisted Language Learning (CALL) is witnessing a transitional shift away from cognitivist perspectives on “communicative” CALL (involving drill-and-practice exercises that focus on accuracy and fluency) towards more socio-cultural, “integrative” CALL activities (addressing the importance of social agency) [19]. Despite this apparent transition, Task Analysis methodologies and User-Centred Design principles in Computer-Assisted Language Learning continue to focus on traditional cognitivist models of interaction and associated criteria, such as task performance, ease of use, and ease of learning [28]. There is increasing consensus within the Human-Computer Interaction community that purely cognitively-grounded task analysis methodologies are ill-equipped to capture, model and evaluate computer-mediated activities as they exist within socio-cultural communities of practice [8, 22, 29]. This problem is central to CALL system quality and is commonly referred to as the “social-technical gap” [1].

As illustrated by [19], recent CALL research has questioned the relevance and importance of Human-Computer Interaction. We believe, however, that integrative task analysis methodologies capable of addressing both cognitive and socio-cultural perspectives in learner-computer interaction are central to overcoming the widening social-technical gap in the language learning domain. Due to the increased complexity and interdisciplinarity associated with developing learning systems, CALL requires a flexible, adaptive and holistic framework for guiding task analysis at various phases of design and evaluation. Such frameworks are central to addressing recent criticisms regarding the general quality of language learning systems [15, 19, 30, 24]. One frequent criticism concerns difficulties associated with interdisciplinary research and development, notably different research and development methodologies, levels of training, experience and expertise. CALL software development is highly idiosyncratic, suffering from a lack of cost-estimation, project traceability, and reusability practices [15].

Promoting the importance of Software Engineering in the context of CALL, Farmer, Gruba & Hughes [15] argue for continued research into CALL software quality improvement (SQI). Here, software quality is defined as “...the degree to which all system/product deliverables correctly address the operational and functional requirements of each identified project stakeholder, and is delivered on time, on budget, and is maintainable over an extended period.” [15, p.95]. In addition to suggesting that CALL developers focus on a core set of software quality attributes that all CALL systems are likely to exhibit, [15] provide five fundamental and practical principles for SQI in CALL; three of which are concerned with requirements engineering and task analysis. If our basic conception of task analysis is the activity of understand-
ing how people make decisions and perform work, then the above definition of software quality inextricably links the role of task analysis to CALL software quality.

Finally, due to an increase in computer-mediated collaborative work in language learning environments [19], the ability to elicit, model and evaluate cognitive and social-oriented learner requirements must be seen as a major contribution towards improving “integrative” CALL system quality.

2. MOTIVATION AND THEORY

Developing CALL tools involves design and evaluation of complex systems. Systems are categorised as complex due to emergent patterns of behaviour resulting from subsystem interactions and relationships. Complex systems also possess three additional key attributes: openness, accessibility and non-linear relationships. First, information flow and interactions between system boundaries in complex systems are dynamic and in constant flux (openness). Second, elements of the system are restricted to a limited view of the system as a whole (accessibility). Third, relationships between elements are non-linear, limiting reductionist discussions of cause and effect mechanisms in system design. Therefore, designing and evaluating complex systems cannot be reduced to a static, hierarchical behavioural representation. Rather, CALL system design and evaluation requires more integrative and holistic frameworks.

As it can be argued that language learning is primarily a social phenomenon [23, 10], we propose that analysis of learner-computer interaction in CALL cannot be separated from the socio-cultural context of use and corresponding communities of practice. This principle is often referred to as the situatedness of an activity [3, 1]. Whilst acknowledging the need for greater attention to structural aspects of CALL software design [15], the ability to capture the situated, social intelligence of an activity satisfies a critical gap in the CALL literature.

Our approach (CASE) provides a conceptual framework for describing and evaluating situated language learning activities. It has been applied to examine both social and physical requirements of learning object design [17, 16]. Sociocultural theory argues that individual cognitive psychological phenomena are dependent upon culturally historic systems of mediation [23]. Learner-centred computing is therefore a subject-motivated, goal-oriented social process requiring increased focus on the ecological validity and legitimacy of interaction within a situated activity [10, 21]. This point is critical, as it provides an initial distinction between action versus goal-oriented task analyses, and their respective applicability to CALL.

The primary motivation behind our work is qualitative improvement in CALL system design. Improving system quality is the result of a range of holistic, context-specific processes and practices that require correct and unambiguous elicitation and specification of stakeholder requirements [15]. Effective requirements engineering demands a robust, adaptive, and integrative framework for conducting task analysis and communicating findings throughout the software development life cycle [2]. Here, CASE provides a descriptive framework for isolating salient requirements of learner-computer interaction.

The focus in CASE on holistically describing, rather than decompositionally analysing learner practice, stems from the learner-centred design (LCD) view that developing fit-for-purpose learning systems requires contextual knowledge of users and the activities in which they participate [13, 33]. Previously established learner-centric criteria, such as negotiation, motivation, cooperation and coordination, and communication [29, 33] reflect qualitative rather than analytic attributes of interaction. We briefly outline the importance of these attributes to CALL software design and evaluation.

Negotiation is concerned with examining conflict within an activity and is essential to understanding degradation in shared-knowledge representation, goal structures and subject motivation [11]. 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 sociocultural paradigm, including Activity Theory, this process is known as a breakdown. In contrast to cognitivist action-oriented perspectives of interaction, where a breakdown constitutes functional disjunctions in task performance, constructivist goal-oriented learning theories see breakdowns as crucial learning opportunities that should be manipulated rather than avoided [21, 23].

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 [31]. In collaborative environments, understanding the existing motivational forces (individual and social) greatly contributes to our knowledge of the learning practice [10, 26]. Cooperation and Coordination are closely linked to work practice synchronisation and mutual awareness [34]. Understanding these factors assists with understanding the dynamic nature of individual roles and relationships between actors, and their use of tools within an activity [26]. 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 learner-centred design are simultaneously pre-conditions and corollaries of increased situation awareness by the learner. In learning environments, situation awareness is seen as the ability to monitor the changing characteristics and social norms of an activity as it dynamically unfolds. Furthermore, supporting situation awareness in interdisciplinary CALL activities often requires developers and practitioners to isolate and investigate specific areas, or levels, of learner-computer interaction.

3. THE CASE FRAMEWORK

HCI practitioners involved in complex system design and evaluation are today faced with addressing an increasingly large array of human factors issues. A consequence of increased diversity in applications and usage contexts has been the explosion of problem-specific theoretical models [4]. Whilst such models provide rich descriptions of particular phenomena under investigation, they frequently lack transferability to new domains of investigation. Integrating existing theoretical models within a holistic framework remains a significant obstacle within HCI and CALL disciplines alike. It has been argued that the continued success of HCI theory and practice will depend upon the increased integration as opposed to proliferation of theoretical models [35].

CALL provides a fertile environment in which to conduct HCI research. Its transdisciplinary nature necessitates both empirical scientific rigour and social relevance in research findings [14]. Furthermore, frequent topics arising
in CALL studies include computer-supported collaborative work, computational linguistics, information retrieval and user modelling, distance and mobile learning, user-centred design, and more recently, software engineering [15]. As such, approaches to task analysis in CALL require a holistic and integrative framework that encourages and supports research methodologies that transgress disciplinary boundaries.

The CASE framework (Figure 1) proposed in [13] assists in the principled integration of various theoretical methodologies during system design and evaluation. CASE aims to facilitate both macro and micro-level analysis of the various subsystem components which constitute CALL systems. According to [4], systems or assemblies are composed of “interactors”, or subsystems, which interact to form complex behaviours. The impact of these interactors may be examined at different levels of abstraction or layers of granularity. Macro-theories are developed to describe the observable holistic behaviour of systems, whereas micro-theories serve to elucidate the low-level behaviours of constituent interactors. For example, the role of multimodal interaction using speech technology on second language acquisition [12] may be described by a particular macro-theory. Specific considerations surrounding system design and evaluation, such as error analysis, cognitive information processing and discourse analysis, may be examined by a series of micro-theories suited to the nature of each interactor.

CASE consists of four primary components, each representing a layer or level of investigation. The distance of each layer in Figure 1 from the epicentre is inversely proportional to its rate of change. For instance, cognitive processes are expected to change rapidly whilst environmental aspects are likely to be relatively stable. This view is supported by similar hypotheses suggesting that cognitive systems are largely biologically based and therefore change on an evolutionary timescale, whilst the outer rings operate with significantly less friction [7, 5]. Likely influential factors impacting situated activities have been elicited and placed within corresponding levels of the framework. Although some of these factors may inhabit various levels of activity, such as roles and relationships (activity and social organisation), their place acts as a mnemonic aid, or checklist, to assist CALL practitioners and developers to direct their attention and resources during system design.

If, as previously suggested, language learning is a social process, it follows that investigations should start by determining salient features of the social environment that impact the learning activity. Because social processes are traditionally ill-structured, dynamic and non-deterministic, describing a problem from the outside-in (environment → human information processing) is likely to result in richer data collection, reflecting a wider range of influential factors surrounding the situated activity. However, this is only a recommendation. In certain instances it may be desirable to start from a particular level and iterate between levels in the framework as existing knowledge deepens and new information is sought. This pattern of knowledge elicitation, categorisation and subsequent abstraction as a new hypothesis is similar in nature to indicator-concept mapping in grounded theory research.

In order to elaborate upon how this process is applied, we briefly examine each of the four components of the CASE framework: cognition, activity, social organisation and environment. Environment modelling is concerned with questions of affordances, artefacts, and conditions. Affordances suggest naturally occurring relations between agents in the environment. We may consider 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 [10]. 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 [26]. 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 true of second language acquisition where modelling changing social conditions has been shown to be an effective indicator of within-learner variance on language learning tasks [31].

Social Organisation modelling is primarily concerned with sociological and anthropological questions about the nature of an activity. This is apparent from the emphasis on culture, conventions, work practice and agency (Figure 1). For instance, when developing new computer-mediated communication activities, is communication likely to cross cultural boundaries, requiring varied learner strategies? Are interlocutors constrained by existing cultural conventions and linguistic competencies that 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?) [21].

Perhaps the most important level within the framework 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, contradictions 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 framework 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 consists 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, action-oriented scenarios.

As previously stated, each of the CASE dimensions related to a specific interactor can be examined with a particular micro level theory. For instance, levels-of-processing [25] could be used to analyse cognitive load and its relation to second language vocabulary recall and retention. Activity and Social Organisation could be modelled using a combination of Activity Theory and Distributed Cognition, as suggested in [26]. Environment modelling could focus on types of communicative interaction within specific spaces. There are four types of interaction spaces in which communication occurs: private (interruptions from outsiders are not permitted), privileged (members-only communication), public (anyone can communicate) and hybrid (private communication in public spaces) [32]. Understandably, each of these theoretical models incorporates different techniques for eliciting salient features of interaction, ranging from closed-item response analyses to rich ethnographic methods such as interviews, direct observation and scenarios.

We propose that salient features demonstrating the greatest degree of interrelatedness can be represented as Areas of Proximal Influence. Figure 3 recognises those dimensional attributes that are most likely to impact interaction, especially within learner-centred domains. Attributes within a dimension may belong to one or more areas. Depending on the type of research questions, investigations can focus on addressing all of the salient features in the four areas, or isolate one of the key areas for further research. We note however that the strengths, or degrees of influence, of these areas are not equivalent. For instance, investigating areas associated most significantly with Social Organisation and Environment is unlikely to assist in understanding second language recall and recognition. In addition, we can classify each of these areas according to some relationship based on the rate and impact of changes in dimensional attributes. We have nominally classified these relationships as immediate (Im), delayed (Dy) and eventual (Ev) (Table 1).

As changes in an activity have a strong transformational effect upon cognition [26] (impact, rate of change), we clas-
sify the relationship between Cognition and Activity as immediate (Im). Changes in social structure and conventions will have a slower rate of transformation, but are still likely to strongly impact cognition, and therefore are classified delayed (Dy). Changes in the environment are likely to occur at a very slow rate, with low direct impact upon cognition.

Thus, the degree of influence between Cognition and Environment is eventual (Ev). However, changes in the environment will have a high degree of influence upon social organisation, impacting activity and elements of cognition.

Table 1: Degrees of influence

<table>
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<tr>
<th>Properties</th>
<th>Cog</th>
<th>Act</th>
<th>Soc. Org</th>
<th>Env</th>
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<tr>
<td>Cog</td>
<td>Im</td>
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<tr>
<td>Act</td>
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From Table 1 we see that the strongest degrees of influence are related to the dimensions of Activity and Social Organisation. This is supported by emerging HCI research that establishes the predominance of both Activity and Social Organisation in designing and evaluating learning systems [26, 29, 11, 3, 1], as well as constructivist and social learning theories within the language learning literature [23, 10].

4. A HISTORICAL STUDY

Elsewhere, we have demonstrated the benefits of CASE in capturing and evaluating both cognitive and social learner processes in “integrative” CALL [13, 17, 16]. However, it is insufficient to demonstrate that an approach is applicable merely within the confines of a particular research task and associated conditions. Rather, the strength of any framework rests on its transferability to new domains. Thus, to demonstrate the transferability of our approach, we applied the CASE framework to a historical study that presented the results of a longitudinal examination of “communicative” CALL software design.

4.1 Study Description

Commenting on the differences and driving considerations between user and content-centred Computer-Assisted Language Learning (CALL) software development, [9] provide a broad overview of their experiences developing CALL software. Specifically, their investigation examines the relative successes and failures of nearly two decades of providing CALL software to three target audiences: school-based foreign language learning; business language learning; and language proficiency skills testing. In our analysis we have chosen to focus on the differences between school-based CALL users (curricular CALL) and business CALL users (non-curricular CALL).

4.1.1 Software

Both curricular and non-curricular CALL users were supported by two learning tools, Vocapuces and VerbaPuces. Vocapuces contains over 4,000 French lexical items in context. VerbaPuces comprises over 1,000,000 verbal forms and provides additional training and presentation strategies that users can independently manipulate. In addition, VerbaPuces can be tied to specific lesson plans, transforming the software from a tool to a tutor. The primary difference between the two user groups was the provision of language learning lesson plans. Initially, curricular CALL users responded favourably to the ability to structure their use of the software according to pre-established learning paths. This perceived utility was further reinforced when subsequent software additions enabled alignment of lesson plans to a prescribed textbook. User feedback indicated a strong response to the ability to plan lessons based on their immediate situational needs. In contrast to curricular CALL users with several thousand subscribers per year, the number of non-curricular CALL users remained relatively low (hundreds) and demonstrated a lesser degree of satisfaction. Non-curricular CALL user feedback clearly indicated that they were unwilling to construct their own lessons in response to immediate business needs. In addition, subsequent multimedia enhancements to the software failed to elicit increased interest in the non-curricular CALL community despite favourable reviews.

4.2 Applying CASE

Our analysis of this study consists of three distinct phases. Using the CASE framework as a guide, we isolate a (qualitative) set of relevant learning factors described in the study. Subsequently, we describe how each factor contributes to the observed variance between curricular and non-curricular users. Finally, we formulate qualitative relationships between factors and establish probable Areas of Proximal Influence.

4.2.1 Cognition

When evaluating the cognitive dimension, we found it instructive to differentiate between cognitive complexity and difficulty, as described in Section 3. As we are interested in between-group variance, factors such as age, intelligence, aptitude and gender are unlikely to play a significant role. Although these factors are highly related to between-learner variance on language learning tasks [31], we assume a similar distribution of these attributes in both the sample populations. In contrast, cognitive load, aptitude, and experience are more probable candidates for variance. With regards to cognitive load (including information processing), we note that the non-curricular group has the additional task of tailoring their lesson plans to meet daily requirements. This introduces additional constraints upon the learning activity. Additional tasks require more cognitive resources, which are likely to impact learning outcomes by means of increased divided-attention, focus-on-form [12], and consciously-held goals [26].

As non-curricular CALL users are exposed to unstructured learning, the lack of task sequencing and learner scaffolding (ie cognitive apprenticeship) will impact their level of experience/expertise and overall aptitude towards the learning activity [23, 6, 21]. Thus, we should expect to see different demands upon procedural, episodic and declarative-semantic memory resources, which are central to the learning process [12]. In addition, we note that differences in content between groups will influence information processing. Decoo and Colpaert [9] introduce the term didacteme to refer to the minimal language learning unit that must be acquired for mastery of a second language. Didactemes may be grammatical, lexical or cultural. Each didacteme differs based on frequency, semantic and morphological groupings,
phonosyntactic complexity, and semantic reply forms. Due to the nature of usage, curricular and non-curricular users differ in their exposure to didactemes of varying complexity. School-based users are supported by a sequence of lesson plans aimed at incrementally exposing learners to increasingly complex learning material. Business users are required to learn second language material based upon their immediate needs, irrespective of task-sequencing guidelines and complexity of the didacteme.

4.2.2 Activity

From an Activity Theory perspective, activities are predominantly subject-motivated and goal-oriented. However, activities exist within a community of practice, which in turn impacts subject-motivation. Activities are therefore polymotivated [26, 11]. Informed by Activity Theory and constructivist learning theories, our analysis of the two activities focused on the learning factors of motivation, control (and support), conflict, collaboration, (agent) relationships and negotiation.

In curricular CALL, users are supported by a number of control structures such as academic support, teacher-led instruction, structured lesson plans and parental supervision. The language learning activity is therefore polymotivated and highly collaborative. Learning is highly regulated by external constraints placed upon the learner. Even in the absence of a teacher (at home learning), the structure of the learning activity maintains a relationship with both teacher and institutional requirements [9]. Although external constraints are also placed upon non-curricular CALL users, there is greater variance in the levels of support, collaboration and negotiation, and relationships. Non-curricular CALL users are more isolated in their activities, requiring greater agency. Self-directed learning implies a lesser degree of cognitive apprenticeship and places additional requirements upon the end user to develop expertise in their practice [23, 10]. Moreover, non-curricular CALL users experience less collaborative support.

When learning breakdowns occur, non-curricular CALL users are unlikely to have sufficient opportunities to participate in negotiation of meaning, which is important as constructivist theories suggest that the generation of contextualised meaning requires an integration of social and individual processes. Accordingly, non-curricular CALL activities are less authentic, more synthetic and less likely to result in effective learning strategies [10]. The variation in social process support mechanisms between the two groups would have been observed had the study authors conducted a social network analysis of the two activities.

4.2.3 Social Organisation

The social organisations of curricular and non-curricular CALL activities differ widely. As described in the previous section, an activity is not only determined by subject motivation, but also by the community of practice in which it occurs. From the study conducted by [9], we notice significant differences between work practices, social networks, and the communities of practice across the two user groups. As communities of practice are inherently bound to socio-historical practices and cultural conventions [27, 10], one should not expect to be able to transfer learning processes and strategies from one group to the other. Although [9] indicate that a user-centred approach was applied during software design, there is no evidence that these basic principles were taken into consideration.

4.2.4 Environment

Finally, our analysis examined the differences in environmental conditions across the two groups. Specifically, our analysis considered differences in artefacts, interaction spaces and affordances. According to the theory of Distributed Cognition [20], artefacts of the environment are imbued with cognitive properties. These cognitive properties may be a corollary of software design decisions, or may be implied by socio-historical events within the community of practice. In many regards, this perspective extends the view of affordances present in [18, 27]. As both user groups had access to the same software (with exception to lesson plans), it is unlikely that affordances played a significant role in between-group variances. This was the case when curricular CALL users demonstrated no significant difference in performing the same tasks within classroom or “at-home” environments. However, the presence/absence of different artefacts in the environment could possibly account for between-group variance in learner-computer interaction.

In contrast, the interaction spaces in which interaction occurred varied substantially across groups. Interaction spaces are important as they act as zones that (1) define social and organisation practices, and (2) influence information flow between individuals [32]. Evaluating interaction spaces assists with determining how the environment changes shared knowledge representations and mutual understanding within an activity. Firstly we recognise that learner activities for both user groups took place in private spaces – home. However, curricular CALL users also participated in privileged spaces – the classroom. It may even be argued that curricular CALL users maintained a privileged interaction space at home through access to common instructional support mechanisms (lesson plans and teacher feedback). Once again, constructivist learning theories are clear on the importance of supporting learning through mediated social and individual processes. This was clearly lacking in the private space afforded to the non-curricular CALL users.

4.3 Discussion

In our analysis we elicited several factors present in both activities that are traditionally associated with language learning. Furthermore, our analysis revealed several salient, distinguishing features of learner-computer interaction. In the area of cognition, task sequencing and goals (lesson plan), content (didacteme complexity), memory or cognitive resource requirements are differentiated. In the area of activity, we identify motivation, collaboration & negotiation, control and relationships. For social organisation, community of practice, socio-historical practices and cultural conventions emerge. Finally, in environment, information spaces are an important factor.

From Figure 4 we see qualitatively that the most salient differences between the two learning activities lay along the previously established Areas of Proximal Influence (Figure 3). Moreover, our analysis confirms the situated learning view that the areas with the greatest degree of influence are activity and social organisation. This is consistent with our previous hypothesis presented in Table 1. Our analysis of this historical study demonstrates the ability of the CASE framework to qualitatively describe and evaluate computer-
5. FUTURE WORK

Having described the proposed benefits of the CASE framework, we now critique its current limitations. One of the key criteria 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 and evaluation. As such, the focus of our current research is the need for a detailed taxonomy of methods and associated practices which can be applied within CASE.

An important (but often overlooked) aspect of designing and evaluating socio-technical systems is supporting roles and responsibilities within groups. Although it is currently possible to identify and model roles and relationships within CASE, the framework does not permit analysis of dynamic changes in information flow and organisational structure. In addition, epistemic attributes of group interaction such as motivation, ontological features (for example, organisational knowledge) can affect system design. Hence, it is important to model actor knowledge and how subsequent changes impact the social network.

To evaluate the impact of collaboration and group performance in language learning activities, we are currently examining the utility of actor-network theory and social network analysis. Actor-networks are typically used to indicate when changes in knowledge states are likely to impact group decision-making processes. Social network analysis can be used to analyse the relative importance or centrality of nodes within a network. By modelling information flow between actors in a learning environment, their relative roles (goals) and responsibilities (tasks), we can establish boundaries where breakdowns are likely to occur. This information could be added as additional meta-data to existing task modelling structures, such as decision ladders. As existing goal analysis methodologies currently lack such features, the benefits of this research extend beyond their immediate application within CASE.

Currently lacking from the CASE framework is a taxonomy of learning factors, empirically tested across learning domains. Such a taxonomy would provide a rapid view of factors likely to impact learner-computer interaction in a given setting. Further empirical studies could be used to determine dependency and similarity relations between factors. Applying this process within the CASE framework is currently being explored in the classification of learning object properties [16, 17].

6. CONCLUSIONS

In this paper we have described the CASE framework for describing and evaluating learner-computer interaction in CALL. CASE promotes situation awareness in language learning activities by focusing design attention on 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. We have argued that the framework 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 use of micro and macro-level analyses within CALL to describe system behaviour in terms of learner requirements. Finally, we have proposed that the framework’s ability to capture learner requirements for successful participation in situated learning activities represents a significant contribution towards quality improvement in CALL system design.

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8. REFERENCES


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