TOOLS TO SUPPORT INTERACTION AND COLLABORATION ANALYSIS

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Abstract: Analysis of interaction between computer artefacts and learning actors in the context of collaborative problem solving is a tedious process, which needs to be supported by appropriate tools. In this paper we present tools, recently developed, that can support interrelation and synchronization of various streams of field data. A key characteristic of these tools is their support for a multi-level structure of annotations, through which the problem-solving activity can be interpreted and presented. This multi-level representation can be inter-related to the raw field data, and can drive the navigation of the researcher in the activity data. An example of use of these tools for analysis and evaluation of a collaborative problem solving activity is presented in the demo that accompanies this paper.

1. INTRODUCTION

In this paper we describe the functionality of a new integrated environment of analysis of learning, which integrates multiple sources of behavioural data, e.g. multiple logging and monitoring devices.
The main emphasis of this environment is on the analysis of situations involving more than one *learning actors*. Special attention has been put on scenarios of synchronous computer-supported collaborative learning, in which the actors are spatially dislocated, a factor which imposes additional complexity in the analysis task. The environment has been originally integrated in the new collaborative modelling environment ModellingSpace[1] Avouris et al. (2003b), Dimitracopoulou and Komis (2003) and used in related studies (Komis et al. 2003). However the design specifications of the tools handle more generic requirements.
In the following section the main features of the environment are presented, followed by a discussion on the implications of this research.

2. METHODS AND TOOLS OF ANALYSIS

During a field study, data in various forms may be produced. These may often be in the form of logfiles and of video or audio recordings. Many methodological frameworks have been proposed for further analysis of these data. However there seems to be a lack of widely available tools to support this process. In this frame we developed tools to support analysis and interpretation of field data in studies of collaborative problem solving. In the rest of the paper, we provide a brief introduction to these tools and their typical use.

2.1. Playback and annotation of event logfiles

The first use of the analysis tools is related to the off-line presentation and annotation of logfiles, which have been produced during learning activities. These logfiles contain time-stamped actions and text messages of the partners engaged in problem solving, in sequential order, in the form

[1] Funding from Project IST-2000-25385 “ModellingSpace” is acknowledged [www.modellingspace.net].

<*time, actor, event, attribute*>. These logfiles are generated by the tools used during problem solving. The activity can be reproduced off-line using the *playback and annotation tool*. The annotation is done using the OCAF scheme (Avouris et al. 2003a). OCAF is particularly suitable for analysis of collaborative problem-solving activity. It puts emphasis on the objects of the jointly developed solution; every object is assigned its own history of events (actions and messages) related to its existence, as a sequence entries that refer to an actor and an action, according to functional types: I (Insertion of the item in the shared space), P (Proposal), C (Contestation of a proposal), R (Rejection of a proposal, X (Acknowledgement/ acceptance of a proposal), M (Modification), T (Test/Verification).

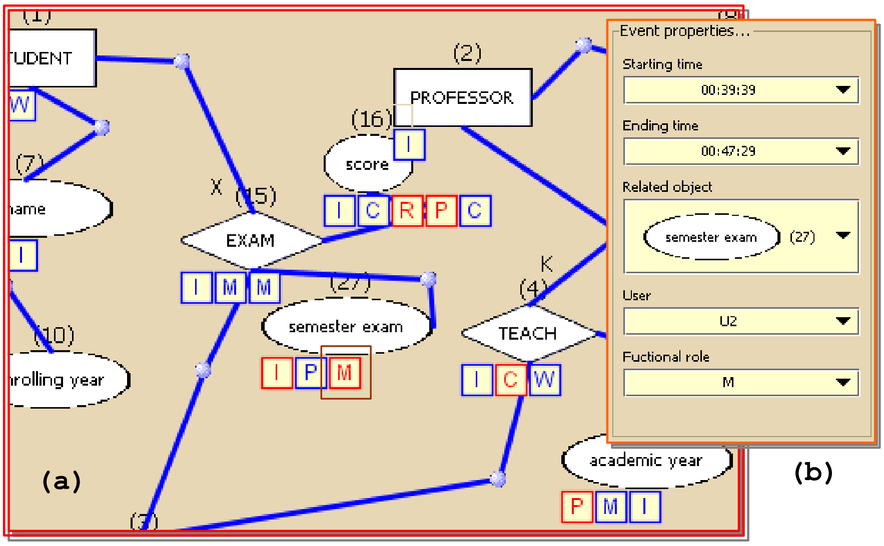

Figure 1. (a) A jointly built model, annotated according to the OCAF scheme. In window (b) the event M of user U2 is associated to the object "semester exam"

An example of use of the playback and annotation tool is shown in fig. 1, applied in one of the solutions produced during collaborative generation of entity-relationship diagrams of an academic department. Each object of the solution (entity, relation, attribute) is annotated by functional types, colour-coded to indicate the actor of the event. These represent the history of the corresponding part of the solution. This annotation of the solution is useful for analysis of contribution of partners, in fig.1 one can see that object (score) has been a subject of negotiation in greater extend than objects (professor) and (teach).

2.2. Multi-level logfile and stream data interrelation

In the second phase of analysis the annotated logfile is related to stream data, like video audio or snapshots of the activity, while the analyst can create aggregations of the observed events in a multi-level interpretative structure.
Once an annotated logfile has been built, all stream data sources can be related to it. Also image files can be related to time-stamped events of the logfile, see fig.2.
The original sequence of events contained in the logfile is shown as level 1 (*events level*) of this multilevel structure. A number of such events can be associated to an entry at the *task level* 2. An example of entries of this level is: "student Y contests the statement of Z". In a similar manner the

entries of the third level (*Goal level*) are associated to entries of the previous task level, describing the activity at the strategy level as a sequence of interrelated goals of the actors involved.

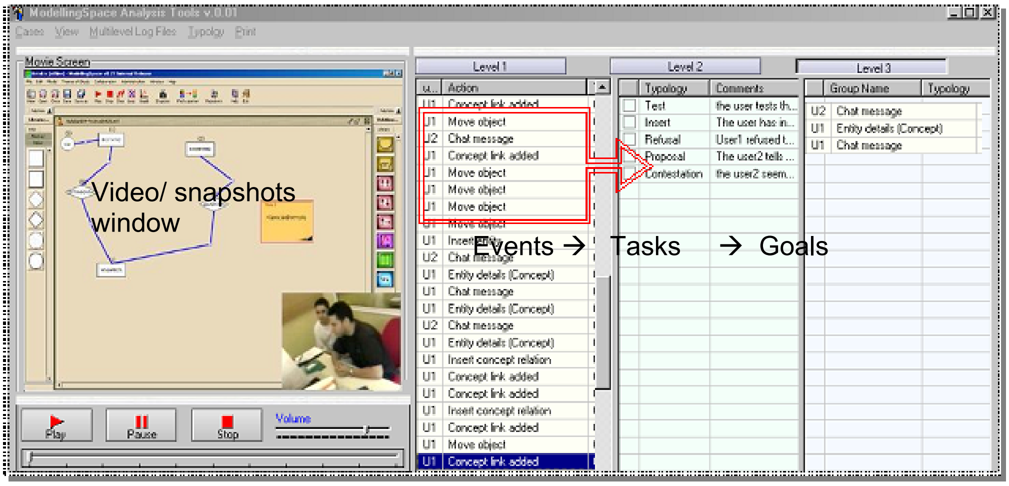

Figure2. Overview of the multi-level model navigation environment

3. CONCLUSIONS

The first annotation tool presented is closely related to ModellingSpace, while the second tool is more general. Through the presented tools stream media, like video or audio can be related to a multi-level model of the activity. The user of this analysis tool can view the activity from any level of abstraction he/she wishes, i.e. to play back the activity by driving a video stream from the task level or the goal level. The developed this way interpretative hierarchical model of the activity is directly related to the recorded field events. This possibility of viewing and annotating a process from various levels of abstraction supports its deeper understanding and interpretation, as shown in various studies, e.g. Avouris et al (2003c)

4. REFERENCES

Avouris N.M., Dimitracopoulou A., Komis V., (2003a), On analysis of collaborative problem solving: An object-oriented approach, J. of Human Behavior, Vol. 19, 2, pp. 147-167.

Avouris N., Margaritis M., Komis V., Saez A., Melendez R., (2003b) ModellingSpace: Interaction Design and Architecture of a collaborative modelling environment, 6th CBLIS, Nicosia 2003.

Avouris N., Margaritis M., Komis V., (2003c), Real-Time Collaborative Problem Solving: a Study on Alternative Coordination Mechanisms, IEEE ICALT 2003, Athens, July 2003.

Dimitracopoulou A.& Komis V. (2003). Design Principles for an Open and Wide MODELLINGSPACE for Learning, Proc. of 6th CBLIS, 2003, Nicosia, Cyprus

Komis V., Avouris N., Fidas C., (2003) A study on heterogeneity during real-time collaborative problem solving, In U. Hoppe (Ed), Computer Support for Collaborative Learning: Designing for Change in Networked Learning Environments, CSCL 2003 Congress: 14-18 June 2003, Bergen, Norway.