Celsia: a new tool for asynchronous multimedia learning activities

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ABSTRACT

The widespread use of information and communications technologies (ICT) has enabled many new forms of collaborative learning activities, which are based on the integration of communication/collaboration space with information access and organisation, within a commonly accessible hyperlinked environment. There is an increasing amount of research supporting the critical influence that the choice of communication technology can have on both the process and the product of collaborative learning. This paper presents the practical research outcomes in the field of asynchronous multimedia communication (AMC). AMC could be said to combine richness of multimedia representation and demonstrations of practice with the flexibility in the use of time for communication. The AMC is a rather new education medium and philosophy, still unexplored. This paper gives an overview of the AMC emphasizing on an innovative AMC tool, called Celsia, which is based on the modern techniques of Real Time Video on Demand (VoD) services and web-based discussion fora. This paper also presents various usage scenarios of the AMC for school education, language learning and the acquisition of practical knowledge.

Keywords
Asynchronous collaborative learning, streaming media, video on demand

MOTIVATION

The widespread use of information and communications technologies has enabled many new forms of collaborative learning activities, which are based on the integration of communication/collaboration space with information access and organisation, within a commonly accessible hyperlinked environment. There is an increasing amount of research supporting the critical influence that the choice of communication technology can have on both the process and the product of collaborative learning (Martínez, 2003). Portals such as the Lightspan.com [http://www.lightspan.com/] site offer resources about some of the best collaborative online projects, tools and resources for teachers on the Internet.

Overall, there are three threads of research questions for both synchronous and asynchronous collaborative tools:

- How can network supported collaborative tools (NSCL) help us to produce and represent knowledge differently? How can e-learning and traditional (existing) learning can be integrated, mutually leveraged in a given context?
- understanding the social and shared learning environment. How do we structure the underlying discussions? How do we collect and disseminate data, information and knowledge produced by diverse sources? How do we model interactive media for the above purposes?
- understanding the learning process: Which are the foundations of collaborative tools production and how do they contribute to the learning process? Which are the appropriate learning methods that take advantage of the unique features of NSCL tools? Which are the appropriate methods to extract, exchange and share individual experience via eLearning?

This paper is focused on the idea of *asynchronous multimedia collaborative learning* (AMC), which is a relatively new concept although its origins can be found in a European funded Socrates ODL project, called SHARP: Shared Representation of Practice (Steeples and Goodyear, 1999). AMC could be said to be a mixture of asynchronous collaborative learning with multimedia content resources. The AMC tools almost look like the web-based discussion fora, with the addition that the user i) can post messages that are videos, audios (i.e. not only texts) which can be delivered via streaming technologies (like video on demand), and ii) can annotate-comment on specific “frame” of

the message (e.g when a specific term was explained). AMC combines richness of multimedia communication and the possibility of quickly creating vivid accounts and demonstrations of practice with flexibility in the use of time for discussing, commenting, etc. (Goodyear and Steeples, 1999). The AMC is a rather new education medium and philosophy, still unexplored.

This paper gives an overview of the AMC emphasizing on i) its added value, ii) an innovative AMC tool, called Celsia, which is based on the modern techniques of Real Time Video on Demand (VoD) services and web-based discussion fora, and iii) the various usage scenarios of the AMC in the learning process.

THE IDEA OF ASYNCHRONOUS MULTIMEDIA COLLABORATIVE LEARNING

Learning cannot be understood as a process that is solely in the mind of the learner. Learning is a process of participating in cultural practices a process that structures and shapes cognitive activity. Therefore, knowledge is joint developmental activity (Koschmann, 1996). As a result, learning environments should be designed for supporting the three forms of interaction (student–teacher; student-student; student-content) at a high level (Anderson, 2003).

There is a plethora of networked collaborative learning tools that support student learning by allowing them to engage in collaborative learning activites, coupled with a communication channel using either text chat, voice chat or video transmission. All these tools are capable of delivering learning any place. However, their time flexibility is more complicated. The tools that support live, real-time interaction are usually employed at set times during a course, because learners and the tutor have to make arrangements to be available. Further, the service usually has to be set up at a set time with the service provider. On the contrary discussion forums offer time flexibility. Typically there is a defined period, of perhaps days or one or two weeks, in a course during which learners must exchange messages with other learners and or with the tutor on a particular topic or course module. Interaction outside this time window does not fit with the course's schedule: things have moved on to the next topic.

Asynchronous computer mediated communications can effectively and efficiently support the collaborative distance learning process, due to the fact that they offer flexibility in the use of time as well as space. The most common type is the asynchronous text-based communication, such as e-mail, mailing lists, web-based discussion fora. Text has its virtues, but it is not good for all purposes: the use of text in email communications between remote learners and tutors can encourage greater clarity of expression than may be the case with a face-to-face meeting. But sometimes the conventions for email writing within a group begin to favour informal chatty expression (Goodyear 2000).

Clearly we believe the asynchronous medium affords flexibility over time and space, as well as opportunities for reflection. In the *asynchronous multimedia collaborative learning* (AMC), using multimedia affords a more direct experience: practitioners can demonstrate and show, rather than only being able to describe and explain. Multimedia affords a richer and more naturalistic form of communication for articulating about tacit knowledge. The purpose of making multimedia representations is to share and discuss them with other colleagues. The asynchronous conferencing environment supports this sharing and discussion among members of distributed practitioner communities.

AMC technology has already started being deployed effectively in learning environment. Some examples, among others, are:

- The UK Open University's KMI approach [http://kmi.open.ac.uk/stadium/]
- Various approaches for teaching dance composition like the one of the University of Washington [http://imej.wfu.edu/articles/2003/1/01/index.asp] or the tool and the http://www.tufox.com/tango/

Celsia is such an AMC tool which has been recently developed and put it on trial within tertiary educational settings.

CELSIA

Celsia is a tool that supports the AMC. Celsia supports the asynchronous discussion about vivid representations of audio or video clips (e.g. concise digitised video and audio demonstrations). In addition to representations of audio/videoclips, learners are able to make voice and textual annotations to specific parts and not to the whole audio/videoclip. Annotations can be used to encourage learners not only to pose questions but also to explain issues as well as to reflect upon the videoclips. Thus, Celsia can support the asynchronoys collaborative 'discussion' and

'critique' of sharable representations, over time and anywhere in space, by learners, teachers and other practitioners, using audio, video and/or textual 'annotations' on a digitised video resource.

Celsia's functionality

Three main sets of activities can be supported by Celsia:

- Streamlining of digitized audiovisual content, i.e. audio/videoclips.
- 'commenting on' or 'discussing about' the video-clips. Focus has been given on the processes of creating annotations and linking them so that a 'web' of multimedia objects can be created.
- 'looking through' the videoclips and the associated annotations. The focus here is on searching and browsing in a hypermedia web or database of annotations.

Imagine the following usage scenarios for learning. A video clip is created or just posted by a teacher for triggering a learning activity (e.g. after the end of a "traditional" lecture). This videoclip is accompanied with metadata for facilitating its retrieval and explaining its scope. This videoclip can be accompanied by a series of questions that intend to make the learners comment on what they see. These questions can be replied either by referring to the whole videoclip (bad practice) or as annotated comments referring to specific parts of the videoclip. Such comments can be in a textual (with or without attachments), audio or video format. A threaded discussion can evolve when peers are contributing to each others messages.

Apart from the above features of Celsia, more specialized ones have been implemented such as:

- Keeping a portfolio of messages where the user can store for future process some of the messages appearing in the forum
- Presentation of statistics where the user can see how many messages have been posted by how many users as well as the number of the different types of messages (text, videos, audios, still images)

Of course, the basic functionality for the administration of the forum/users has been built (i.e. deletion of a forum, creation of new forum, user management, etc.). The following two figures (Figures 1, 2) illustrate the user interface of system. The reader should try correlating these figures with the features as presented in this sub-section.

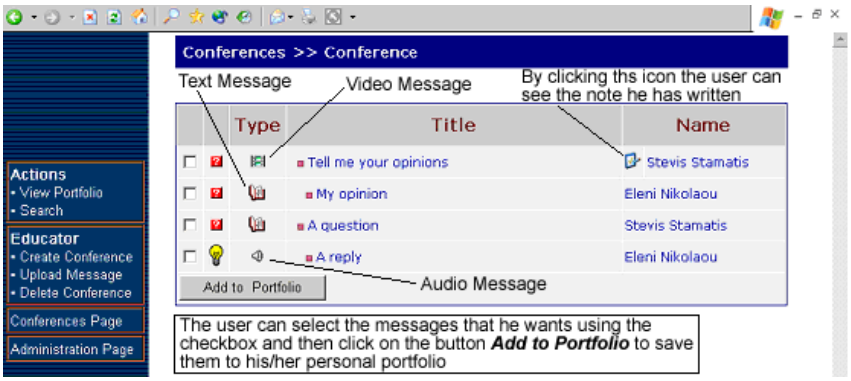

Figure 1. Screen shot with the list of messages at a forum of Celsia

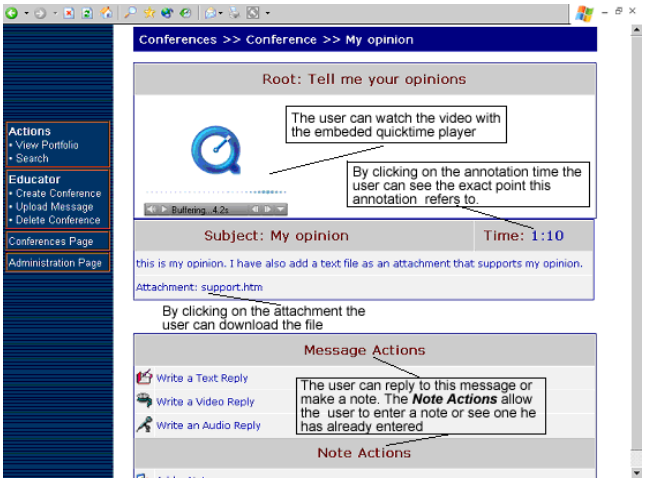

Figure 2. Screen shot of reading a message at a forum of Celsia

Celsia's architecture

One way for describing the architecture of the AMC system is to follow the Rational Unified Process (Rumbaugh, et al., 1999). According to its logical view, the first-level decomposition of the system is performed by specifying the very coarse-grained discrete subsystems in the design model, as they have derived from the use case and analysis model. The decomposition is combined with the enforcement of the "Layered Systems" architecture pattern, which helps organize the subsystems hierarchically into layers, in the sense that subsystems in one layer can only reference subsystems on the same level or below. The communication between subsystems that reside in different layers is achieved through clearly defined software interfaces.

The proposed layered architecture for the AMC system that identifies all first-level subsystems, organizes them into the following layers, as shown in Figure 3:

The application-specific sub-systems are:

- Login Subsystem: The subsystem that is responsible for accepting or rejecting a user.
- User Management: Adding, deleting, activating or deactivating a user or sending mail to a specific user.
- Conference Management: Creating a new conference or deleting an existing conference.
- Message Management: Deleting, adding or viewing a message.
- Statistics Viewer: Viewing statistics about the system or users.

The application-general sub-systems of the layered architecture are:

- Charts Creator.
- Upload File.
- Video/Audio Presentation: Presents an audio or video file.
- Raw Data Management: Performs raw queries to the database.

The middleware-layer sub-systems of the layered architecture are:

- Java APIs (JMF, jfreechart, Oreilly utility classes, e.t.c)

The protocol-layer sub-systems contains the software for the computing and networking infrastructure, are the TCP/IP, HTTP, RTTP protocols. The software system-layer sub-systems are:

- MS ACCESS as RDBMS
- Helix Real streaming server
- Java Virtual Machine.

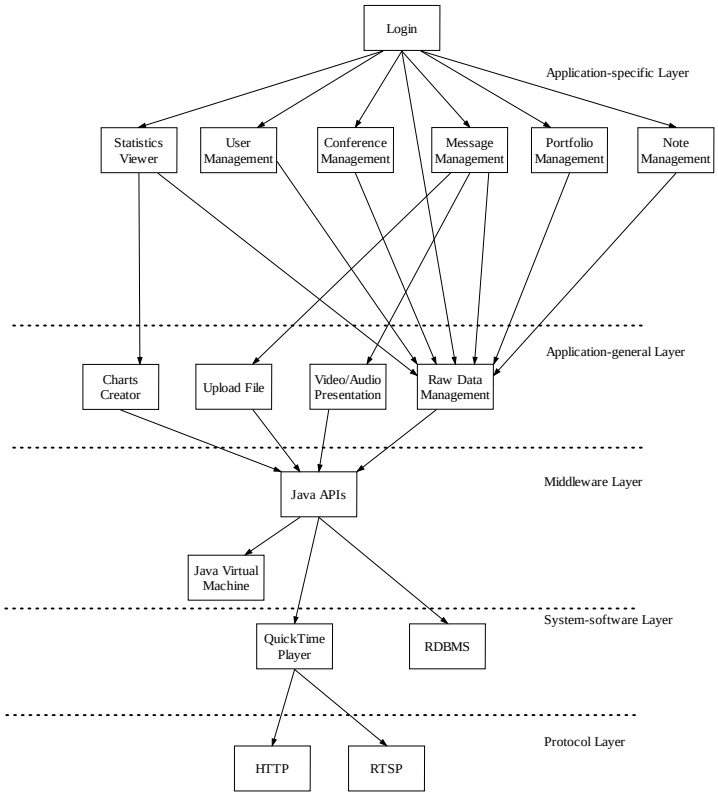

Figure 3. The layered architecture of Celsia

LEARNING SCENARIOS FOR AMC

Scenario 1: Interactive Learning onDemand (LoD): Celsia can be useful for the simplest of all use case scenarios within a technology enriched learning environment. Students can can access simply recordings of a traditional lecture dumped onto a streaming server or a 'talking head' with timed powerpoint slides. Therefore, students can select any lecture segment since they are not restricted, anymore, to having to work through a lecture from first segment to last in a serial order. They can also pause at a specific segment (frame) and pose a question, make a comment or take notes for further studies. Using the playback facilities offers another clear advantage; it enables students to take pauses, to either read additionally related information or to consult the course literature. By encouraging and monitoring the use discussion media, students tend to help each other. This form of social clustering, is most interesting. It lessens the traditional burden of a teacher, where students with additional knowledge often share it with the rest of the class and the teacher. The fact that students are able to share this knowledge with the group is an enormous advantage to more traditional teaching.

Scenario 2: Language Learning. This scenario can be used for language learning, especially for the case *listening comprehension*. Listening comprehension (LC) is a classic "learn-by-doing" task. The learner must adopt the strategy of listening for key elements around which to construct meaning, all the way moving along with the flow of discourse. The learner taking part in this learning activity must answer to the posed question either with a textual comment or using an audio message. The asynchronous mode of communication enables reflection before answering. The teacher can assess the answer and provide her/his feedback as a treaded comment. The importance of providing learners with timely, task-specific feedback in LC practice is widely acknowledged (Hoven, 1999). Celsia allows the learner to have access to videoclip resource instead of a sole audioclip. The intimate relationship between viewing comprehension (VC) and LC is important in language learning and cross-cultural researchers are focusing on the meanings conveyed by gesture, expression, and body language (e.g. Armstrong et al., 1995). Another advantage of using Celsia in LC relates to the necessity for learners to be exposed to the same resource from different perspectives and with emphasis on different aspects in order to fully comprehend it. Moreover, choices about how often to review a resource, how many tasks to design for the same resource, the level of

cognitive difficulty, and the type of resource, can all be determined by the learners themselves with appropriate structuring and guidance provided by the instructor supported by Celsia.

Scenario 3: Vocational Training. Celsia fits well in vocational educational contexts, especially where we wish to encourage professionals to share tacit knowledge about working practices and procedural skills (Steeples, 1995). It is hard to share tacit knowledge, highly correlated to practical situations, in textual messages. The use of AMC techniques can improve vocationally-oriented knowledge. For example, the Media Development and E-learning Manager Richard Thomas mentions: "The use of Windows Media in conjunction with our own in-house production and development team has provided Mercedes-Benz USA with a powerful tool to deliver information efficiently. Complex repair procedures, once taught exclusively in a classroom setting or described in a repair manual using text and static diagrams, are now illustrated realistically using video streamed directly to the end user on demand. In our quest to become the best car company in America, streaming media has provided a key advantage for our communication, information access, and e-learning initiatives." (MS Windows Media 2004 web site)

CONCLUSIONS

The last few years have seen a rapid maturation of basic streaming media technologies. Interacting and collaborating around digitized multimedia can be facilitated by technologies that allow people to easily create and share annotations that are anchored to specific video segments (He, et al, 2000). Such technologies can only make on-demand viewing more appealing.

This paper focuses on AMC is a new and very promising technique for transferring knowledge and augmenting learners skills, and presents Celsia a tool that supports the AMC process. Celsia is still a laboratory project, currently available for testing, but not mature enough to become an off-the-shelf AMC tool. We are working on a full-scale evaluation in subject domains where it can add significant value such as technology education, language learning and vocational training on working practices. We need analyze large corpus of data in order to affirm the usefulness of multimedia on-demand and to draw conclusions for those designing presentations and designing tools for authoring and delivering them. Of course, Celsia is special in many respects, as is often true of early adopters.

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