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**Multimedia Artefacts That Help Us Learn:
Perspectives of the UNIBASE Project on Distance Learning**

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Introduction

There is a social and economic need for educational technology. Traditional education and training systems were shaped to meet the needs of an industrial society. The new information society needs people that learn and adapt quickly. The concept of life-long learning will be a major requirement and a major change agent in the next century [1,2,6]. Global access to information and technology changes the relationship between people and knowledge, and suggest new ways of supporting learning activities. Multimedia technology has the potential to help us capture and amplify powerful natural processes of learning [2], so it seems a good candidate for the task. There is an intuition that much can be gained from interacting with innovative multimedia materials - such as videos, animations and virtual reality simulations.

However, many multimedia environments are not adequate for the purposes of learning. Video clips and animations often seem to offer an excess of information and illustration that learners are obliged to accept and watch for a set period of time. This makes it difficult for them to abstract all and only the information relevant to the task in hand. If multimedia has a role to play in open and distance learning, then it must have a genuine pedagogical value sustained by effective learning activities and effective interactivity [12]. While many images and sounds are attractive to viewers and hold their attention or interest for a long period of time, these effects have to be distinguished from the real impact that multimedia enhancements could have on the efficiency and effectiveness of information processing in learning environments [17]. A learning environment is one in which there is something for learners to do, it is not an information system just for browsing. It is an active environment that involves the learner in a challenge or sets him or her on a mission. One of the main problems with current technology is that its emphasis often leaves behind cognitive and affective aspects of human interaction. There has been too much emphasis on the technological properties of multimedia products without an adequate concern for the characteristics of those who interact with them or the interactive learning process itself.

This paper addresses these questions and brings some contributions, describing our experiments in the UNIBASE project.

What Helps Us Learn

A learner experiences a situation, real or imagined, transforms it into meaning, designs a response, and acts to create a new relationship with that situation. We are capable of performing complicated simulations and of using our memory, our rapid retrieval system, and our unconscious rules of inference, to attain extremely high levels of skill, such as playing chess, speaking a language or editing a film sequence. These skills require many years of experience and learning. Nevertheless, when using them, we compress years of experience and learning into split seconds. To understand the complex task of learning and how different media and learning environments could provide a more adequate support, we will look at some theories on cognition.

Norman [9] identifies two modes of cognition: *experiential* and *reflective*. While the first usually leads to a state in which we perceive and react to events in an effortless way, the latter relates to comparison and contrast, to thought and decision making. These concepts relate to cognitive psychology's *automatic* and *controlled* processes. Brenda Laurel [10] also describes two modes of interacting with a computer in a different, but similar way: *experiential* and *productive*. Experiential and reflective modes do not capture all the thought, nor are they completely independent, but seem to be the extremes that technology forces us towards. Both modes are essential for human performance, but require very different technological support. Many tools fail by providing reflective support for experiential situations, or experiential support for reflective situations.

Along with differentiation in cognitive profiles, it has been suggested [16] that every student has a mixture of four basic learning styles, namely: *Reflector* - learning best by reflective observation; *Pragmatist* - learning best by engaging in practical applications.; *Theorist* - learning best by abstract conceptualisation; *Activist* - learning best through activities and experiences. Perhaps because mental schemes are so important for us, and so necessary for orderly interaction with others, people are very reluctant to change them. So, we argue that in the design of multimedia materials, the accommodation of different individual cognitive preferences becomes an important factor for the success of a project.

In addition to different cognitive profiles and learning styles, different phases for the learning process can be identified. We decided to focus on a specific model that supports many of the teaching-learning strategies mentioned above, and is described as a "classic" learner centred pedagogy model with three phases: initial *conceptualisation* of the subject and its

domain; *construction*, where the learner actively engages with the subject, while relating to his or her own knowledge framework; *dialogue*, where the learner expresses aspects of the emerging understanding and relates this to the understandings of fellow learners and tutors.

These styles and phases can provide support for a basic framework from which to approach multimedia design possibilities for a learning project.

Media and Learning

There are different media that can transmit the same information. But the medium is not a neutral carrier, it affects the way we interpret and use the message, and the impact it has on us [9]. Each technological medium has properties that make it easier to do some things better than others. For example, let us compare printed text with television. Reading affords control of pace and reflection, but is relatively slow and difficult, and it takes considerable training and practice to learn to read. Watching television is relatively easy, you don't need previous training or practice, and it does not take much mental effort. But is event-paced, materials flow continually, there is no time for reflection, no time to ponder or reconsider. The nature of the experience makes you passive to its process. Furthermore, these media do not afford the same kind of prolonged debate and argument possible with an interactive medium, as those that support our communication with another person. The Web, for instance, with its ability to accommodate different media, can accommodate high-level interactivity through e-mail, news, videoconferencing and, as its main feature, provides us with multimedia and hypermedia capabilities.

The first assumption suggests that we need different media to support different learning modes. However, some media can be designed in different ways, in order to augment its traditional capabilities. For example, reflection requires the time and ability to elaborate upon and compare ideas. The right medium should afford adequate time for reflection. Television and video, when properly constructed can be a powerful tool for reflection, if the user can select what is to be seen and control the pace of the material, and it is easy to go back and forth, and to relate to other material. The right support for multiple media integration and interaction styles, combining the best of each world, can provide a powerful environment for learning. Some of the media integration aspects have been addressed in [5,11,13].

The UNIBASE Project

“UNIBASE – Interactive Multimedia for Open and Distance Learning” is a joint project of Universidade Aberta (Open University) and Faculdade de Ciências, involving a multidisciplinary team of researchers from education and computer science. Universidade Aberta is primarily concerned with open and distance learning, covering a wide variety of knowledge domains. Its current educational system is aimed towards the production of videos, that are broadcasted on TV at pre-fixed schedules, text books, and tutor support, usually by phone. As separate media, these have the problems we described before. The materials only have a macro relation, as they cover the same subjects, but students don't have an easy way to interact, relate and study them when they want and at their own pace.

The main goal of our project is to transform distance learning processes, in order to make it more effective. We want to provide students with a long distance multimedia interactive environment that keeps them motivated and helps them learn more, in a better way, making the task more flexible and with reduced costs. Its main objectives and approach strategies are:

- Reuse of the audiovisual archive at Universidade Aberta, through the digitization and processing of video materials [4, 7, 18] to create a video archive. Video data will be classified and indexed by shots and scenes, to facilitate further creation of links with other material (text course manuals, for example);
- Creation of interactive learning materials for open and distance learning, based on the digital video archive and development of the audiovisual component as hypermedia modules. We are developing tools to support easy production and use of hypervideo on the Web, as an extension of HTML, and based on Dynamic HTML and ActiveMovie Technology [14]. So far, on the Web, video could only be manipulated as a VCR (run, stop, pause, ...). With these capabilities of spatial and temporal hyperlinking, we overcome the existing limitation on the interaction and structuring of video, along with other media. This can help to better support reflective mode of interaction with a typically experiential medium. For this integration, some aesthetic and rhetoric aspects have to be considered [5,11,13]. At the moment, we are experimenting with text and video oriented approaches, as to accommodate different styles of learning;
- Evaluation and implementation of solutions for the delivery of this new kind of didactic material, namely through the Web, with specific applications within the Universidade Aberta's system for open and distance learning. This implies the use of its own national infrastructure of information, regional centres and mechanisms for students and academic staff access the system from anywhere, even mobile devices.

In order to support the dialog phase of the “classic” learner centred pedagogy model, tutor supervising and help, the sense of belonging, and sharing experiences and ideas among students we'll use email for personal questions, and newsgroups for open discussion for each course. We've been using these, with good acceptance and success, as a

- support for some of the traditional courses at Faculdade de Ciências, for the last three to four years.
- Creation of effective motivational and pedagogical environments for students to view audiovisual materials. Innovative solutions (technological, pedagogical and organisational) are researched with the aim of changing the instructional paradigm from a perspective of transmission to a perspective of appropriation, whereby use and goals to attain are individualised.

According to [2] there has been a switch emphasis from tutor systems, that emulate a human tutor, to an hypermedia and learner centred approach. This guided discovery approach emphasises using the emerging technology to support the student learning abilities. This is also the emphasis in our approach.

From a technological stand point, the project aims to practice a new set of technologies that are now in their most advanced stage of development, thus having the benefit of testing its qualities in the real world, with real problems. In the future, as we assess the effectiveness of this learning environment, we hope to better understand what really helps us learn and to take a step further.

As we have discussed, the loose integration of media in open distance learning and the lack of effective interactivity with many available educational products restrict the use of multimedia in the learning context. To face this problem, taking into account pedagogical and technological dimensions, a virtual environment is needed to facilitate the learning process that integrates audio-visual media technologies. The reuse of existing materials and the production of reusable materials is a strategic option that makes economic sense and can be an effective solution, if adequately structured to support the learner in an autonomous knowledge construction process.

We are not implying that the processes of traditional university education are wrong. What we are advocating is that interactive multimedia and the Web hold the potential to be an exceptionally fine tool for creating, densely woven, extremely engaging, and highly demanding new course materials. Such materials are rooted in traditional forms of pedagogy, respond to the demands of a specific domain, yet are enhanced by the new technologies.

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