Chapter 2.3
A Conceptual Architecture for the Development of Interactive Educational Multimedia

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ABSTRACT

Learning is more than knowledge acquisition; it often involves the active participation of the learner in a variety of knowledge- and skills-based learning and training activities. Interactive multimedia technology can support the variety of interaction channels and languages required to facilitate interactive learning and teaching. A conceptual architecture for interactive educational multimedia can support the development of such multimedia systems. Such an architecture needs to embed multimedia technology into a coherent educational context. A framework based on an integrated interaction model is needed to capture learning and training activities in an online setting from an educational perspective, to describe them in the human-computer context, and to integrate them with mechanisms and principles of multimedia interaction.

INTRODUCTION

Interactivity is central for teaching and learning (Moore, 1992; Ohl, 2001)—the active involvement of learners is of paramount importance for a successful learning experience (Sims, 1997). This importance is reflected recently by more interactive resources provided for e-learning environments (Northrup, 2001). Platforms such as the World Wide Web are ideal for making learning resources in various forms accessible without any restrictions in time or location. The current predominant focus on knowledge-based learning using Web-based e-learning environments is partly a result of a lack of interactive multimedia technologies. With the recognition of skills training as being equally important to knowledge acquisition, more work has recently been done on

activity-based learning and training supported by *interactive multimedia* technology.

Multimedia technology has been widely used in computer-based teaching and learning (Okamoto, Cristea, & Kayama, 2001; Trikic, 2001). Central to a learner's interaction with the environment is the interaction with learning content. In particular in e-learning environments, the learner-content interaction is often more central than the learner's interaction with instructors and peers (Ohl, 2001). Our focus here is on the development of *interactive educational multimedia*. A variety of learning and training activities can be supported by a variety of multimedia interaction channels and languages (Elsom-Cook, 2001). The acquisition of, firstly, declarative knowledge and, secondly, of procedural knowledge and skills-based experience and expertise through learning and training needs to be integrated through a coherent multimedia channel and language design.

Support frameworks for multimedia *development* for e-learning environments exist (Heller, Martin, Haneef, & Gievska-Krliu, 2001). However, the focus of these frameworks is mainly on knowledge acquisition-oriented environments. Our objective is to introduce a *conceptual development architecture* for *interactive educational multimedia* supporting *activity-based learning and training*. Our aim is to support the development of *educational multimedia content,* including development activities such as description, classification, and comparison. The development of e-learning technology is a *participative* effort, requiring collaboration and cooperation among those involved. Instructors, instructional designers, and software developers shall benefit from such an architecture.

The proposed architecture is based on three layers, integrating three perspectives of interaction ranging from the educational context to the human-computer interface to the multimedia implementation. An activity model reflects the importance of learning and training activities. Development of educational multimedia content

is usually a complex process—the three layers address the needs of three different stages in the development process. The purpose of the architecture is to provide a standardised description notation for various aspects and a guideline for a multi-stage development process. A database learning environment called the Interactive Database Learning Environment (IDLE) (Murray, Ryan, & Pahl., 2003; Pahl, Barrett, & Kenny, 2004) will illustrate the concepts and terminology of our architecture. Making knowledge about interaction that is inherent in the design explicit is our objective. *Explicit knowledge* is a prerequisite for evaluation and comparison, and also the deployment of content elements in *intelligent educational systems*. Domain and instruction-related knowledge shall be our primary focus.

INTERACTION IN E-LEARNING AND TRAINING SYSTEMS

We can distinguish three central aspects of activity-based e-learning and training systems: knowledge and skills learning and training, human-computer interaction, and multimedia implementation (see Figure 1).

Knowledge and Skills

Pedagogical theories determine the learning process design. The individual learning activities in this process—the learner interaction with content—are often subject-specific. In general, we can distinguish various *types* of *learner activities*. Learning is about the acquisition of knowledge or skills. The *purpose* of acquiring knowledge on the one hand and skills on the other differs:

- **Knowledge:** We refer here to what is often called *declarative knowledge*, namely, facts. The objective of the learner is to be able to *reason* about knowledge. The style of learning is usually classical studying. We use the

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