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Designing Interactive Learning Environments

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Abstract

The trend towards teaching by facilitating learning rather than by direct instruction is an important one. As part of this movement, there is a growing interest in the concept of interactive learning environments (ILEs), where students learn by experimenting with a computer system that simulates some device, system or situation. Although ILEs can act as effective teaching aids they are time-consuming to create. In this thesis, principles that are useful for guiding the development of these systems are proposed, and design issues are explored.

In order to determine what the principles for development should be, the history of teaching by computer is reviewed, with an emphasis on interactive systems that have a learning rather than instructional bias. The important concepts of modelling, discovery learning and fidelity are examined in some detail.

One of the conclusions of the initial survey is that it is not feasible to think in terms of general design primitives that can be used for the development of all interactive learning environments. Since there is a diverse range of possible environments, two specific types are examined. In each case, a framework for design is proposed.

First, the teaching of procedural skills is considered. These skills include the ability to understand the operation of mechanical devices, to be able to carry out tasks with them, and to correctly assemble and dismantle pieces of equipment. Providing a realistic model which can include informative feedback is seen as important. It is demonstrated that a scheme adapted from AI planning can economically provide an appropriate level of fidelity for modelling device operation. A compatible notation for denoting tasks is also developed.

A methodology for the design of ILEs for teaching procedural skills is proposed, complete with graphical specification for both domains and tasks. It is envisaged that such a scheme would allow domain experts and teachers to take a full part in the design process, even if they are unable to write or understand computer programs.

The second kind of ILE considered involves the simulation of human behaviour. Two schemes for knowledge-based simulation are examined: one based on CYC and one on Schank and Abelson's behavioural model. The former is used to outline a system for simulating problem-oriented policing. The latter is extended to facilitate the

development of knowledge-based simulation teaching systems. This second scheme is then applied to the simulation of domestic disputes.

Since many of the problems of simulating real world events by computer software have yet to be solved, a full computer implementation is not yet a realistic proposition. Instead, the domestic disputes model is tested using a 'Wizard of Oz' approach. Results show that a scheme based on the model proposed is feasible, that subjects can successfully use such a system and that, as a result, they believe their understanding of the issues being presented is improved.

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Publications

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