Preface

The present volume is the result of a study performed within the SAFE project. SAFE is an R&D project partially funded by the CEC under contract P7061 (D1014) within the Exploratory Action of the DELTA programme. In total 17 partners are involved in the SAFE consortium¹.

The major objectives of the SAFE project are:

- a) to define the architecture of a standardised workbench for the development of technology based learning material,
- b) to explore the potentials of specific types of open learning material and to define the tools that are required to develop open learning material,
- c) to explore and define tools that may support all phases of the development of learning material.

Within SAFE the subproject SIMULATE concentrates on simulation based learning material. Based on an exploration of the requirements and functionalities of simulation based learning environments, the SIMULATE project aims at defining an integrated set of authoring tools for the construction of simulations embedded in an intelligent learning environment.

The SAFE partners directly involved in SIMULATE are: Courseware Europe (The Netherlands), University of Leeds, University of Lancaster (UK), TIFSA (Spain), University of Amsterdam, Eindhoven University of Technology (The Netherlands), and Philips TDS (Germany).

The general topic of SIMULATE is *learning and instruction with computer simulations* and even more specifically, *authoring* for learning and instruction with computer simulations.

¹These partners are: Philips TDS (BRD, prime contractor), Courseware Europe (NL), HCI Centre (UK), Ernst Klett Verlag (BRD), ECC (NL), University of Twente (NL), Technical University of Denmark (DK), University of Amsterdam (NL), Eindhoven University of Technology (NL), TIFSA (E), University of Leeds (UK), University of Lancaster (UK), Computer Technology Institute (GR), Office Workstations Limited (UK), University College of Galway (IRL), Argus Elsevier (NL), and Philips Holland (NL).

Computer simulations are seen as a vehicle for acquiring knowledge and skills in an *active* way, by providing the learner with an *exploratory* environment. In this respect computer simulations used in an educational environment are different from general courseware, because they are not aimed at substituting the individual, experienced, teacher, but offer new teaching opportunities.

The starting point of the project is the observation that in order to be effective, simulations require the presence of an instructor to monitor the performance of the student and to provide support, both directive and non-directive. For open-learning situations this would mean embedding the simulation into an adaptive learning environment, capable of functioning in the above respects as a human tutor.

The SIMULATE subproject will deliver requirements and (global) specifications for an *authoring environment* (also) called SIMULATE (SIMULATION Authoring Tools Environment), that can be used to create simulations embedded in an intelligent learning environment. We have termed a simulation with such an environment an ISLE (Intelligent Simulation Learning Environment).

The subject of the present volume is the description of information relevant for the different *components* that will constitute an ISLE. The volume therefore has the character of an *inventory*.

The present volume is composed of 6 articles. The first article by de Jong presents a *conceptual framework* for instruction and learning with computer simulations. This chapter forms the basis for the rest of this report. It distinguishes four *design components*, components that need to be present in an ISLE: *domain models*, a *learner component*, an *instructional strategy component*, and the *learner interface*. The introductory article also sets a number of *themes*, that characterize the use of computer simulations in an instructional context: *simulation models*, *learning goals*, *learning processes*, and *learner activity*.

The design components will each be discussed in a separate article. Van Joolingen and de Jong discuss domain models, Goodyear et al. learner chara-

cteristics, Van Berkum and de Jong instructional environments and finally, de Hoog et al. interface aspects. First, however, Van Berkum et al. present a short introduction to the four themes mentioned above. These themes will be taken into account in the discussion of each of the design components.

The present volume covers new territory, which means that there is too little background in the literature (both theoretical and empirical) to give answers to all questions raised. When necessary we have included ideas and suggestions in our articles. We hope that, despite these problems, we have succeeded in giving a more structured overview of the field of learning with computer simulations.

We could not have written these articles without the support of many of our colleagues. The preparation of this volume was accompanied by numerous spirited discussions in the consortium, both in meetings and by email. We therefore like to thank our colleagues not directly involved in writing this volume for their contribution: Ken Tait, Malcolm Byard (University of Leeds), John Self, Michael Twidale, Robin Johnson, Michael Pengelly (University of Lancaster), Willem Bulthuis, Hans Schuttenbeld (Philips), Jordi Castells, José-Luis Abreu (PIE), Javier Figuera and José Garcia (TIFSA). Wim Vaags (EUT) provided comments to several parts of this volume.

Peter Goodyear (University of Lancaster) applied some polish to the English of each of the papers.

Ton de Jong