Foreword

Can cognitive architectures be the driving force behind the creation of the future generations of intelligent learning environments (ILEs)? Information technology and computers in general have evolved dramatically in the past few years, having now a constant presence in all kinds of environments, settings and activities. The rapid deployment of new technologies such as computer games, computer-based social networks, tangible interfaces, social robotics, to mention a few, have made these technologies a leading force in our society. Young people now are able to use computers, consoles and all types of different, and perhaps sophisticated, interfaces in ways we wouldn't dream of before, and ultimately, they are transforming the way we create such computational environments, in particular, learning environments. As such, computer-based learning is becoming more and more adopted in many different areas of learning and training. Nowadays computer-based learning environments embrace new technologies towards the creation of new forms of learning situations where learners are more immersed, engaged, and physically present. However, although such technologies may embody new and innovative tools to explore engagement and motivation, the dream of building computer-based learning environments that are capable of understanding the learner, modelling the knowledge they share with the learners, allowing for collaborative activities in a pro-active manner, is still a dream to be pursued. Furthermore, with the increasing penetration of these technologies into our everyday environments, the demand for more "intelligent" and "easy to use" learning systems is indeed increasing.

Taking on board such new technologies, this book goes back to the core challenges of building intelligent learning environments that in reality can be called "intelligent." By focusing in areas such as new design methodologies, agent-oriented approaches, learner modelling, cognitive architectures for modelling, and others, some revisited problems of building learning environments are again brought into the limelight. Yet, other emerging disciplines are also combined, such as affective computing, social agents, web-based interactive learning, broadening the research here discussed.

The book starts with an introduction made by the editors stressing the importance of relying on cognitive AI for the creation of new cognitive models that are rooted in explicit epistemological and psychological foundations and allow for a direct and explicit creation of computational models that support learning. The agent-based approach, in particular, is one of the most inspiring types of technology that is changing the way tutoring systems are being created. Several sections of the book explore this new approach. One can see the agent-based approach in a quite pragmatic way by considering the different expertises that an intelligent learning environment must have as agents that, together, lead to the emergence of our desired properties. However, a more subtle way of looking at the agent's approach is to consider that the (cognitive) models required for the knowledge representation for the learning environment is achieved through an agent-based architecture, and knowledge, as such, is the property that appears in a society of agents that, together, make the collective intelligence emerge.

But the book is not constrained by the present technologies, as the use of cognitive models as the basis for the creation of learning environments can be seen as having implications in other new areas such as social robotics for learning or serious games.

Another important area covered by the book is the creation of learner modelling techniques. Without a doubt, a good learning environment must take into account the learner's knowledge, motivation and affective state. As one of the most influential names in the area of learner modelling, J. Self argued, "a learning environment must care for the learner." To address such problem and allow for long term learning interactions to be established and maintained with the learners, learner modelling must be researched. Yet, learner modelling is still a difficult and hard topic to address, and in this book, this is done by focusing not only on different modalities to assess the learners' mental states and on different techniques such as the Bayesian networks, but also focussing on different aspects to model such as "emotional states." Indeed, the old days where learning environments stressed the importance of knowledge acquisition and transfer are passed and aspects such as motivation, reflection, emotion and social competence are now core elements when building computer based intelligent learning environments.

What this book shows so convincingly is that to do research in the area of intelligent learning environments one must draw upon a large set of disciplines and it is only by combining know-how from such areas that new methods, techniques and systems will emerge. And then, we will achieve more "intelligent," intelligent learning environments.

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