

Introduction to the special issue on intelligent virtual environments and virtual agents

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1 Presentation

The increasing extent of artificial intelligence added to virtual environments during the last few years has generated outstanding research works in the intersection of these two disciplines. This is the so-called Intelligent Virtual Environments area. Frequently, this intersection takes place through the addition of intelligent agents to the environments. These agents are also known as virtual agents.

The International Conference on Intelligent Virtual Environments and Virtual Agents (IVEVA) is a biennial meeting that provides a friendly environment to discuss ideas of both these areas. In this sense, the conference intends to promote the exchange of ideas between artificial intelligence researchers, virtual environments researchers and practitioners. This exchange between the two disciplines leads to exciting and fruitful discussions. This fruitful context was the environment in which this special issue was conceived. The issue presents, via an exhaustive and selected set of articles, some of the latest developments in key aspects of this area.

2 Overview of the special issue

A substantial effort has been devoted to the development of graphical realism in virtual environments for the specific purpose of improving the user experience. However, now that technology allows us to move in real time in visually impressive virtual environments, we realize that this is not enough. The environments are visually compelling but static and empty, without life. Hence, other difficulties and limitations appear after you interact with virtual environments for some time. Even though the worlds are visually impressive, they lack other aspects of reality that need a certain degree of intelligence. These aspects need to be taken into account in order to realize a more interactive, user friendly and engaging environments.

The incorporation of virtual life in the worlds is the current trend to enhance the user experience. By inhabiting the worlds with virtual characters, we obtain more interesting environments. However, in order to sustain the user's interest, the behaviour of these characters must be believable. Note that believability is not at all the same as naturalism or graphical realism (cartoon characters may be very believable without having either). The creation of this believable behaviour is being explored by researchers through different approaches, like the addition of emotional models, personality models or social behaviour models to the characters. The first three papers of this issue deal with these particular approaches to improve the believability of the characters.

As humans we expect an emotional behaviour from people, especially in certain situations. For instance, if a person is given an unexpected present, we expect her to show surprise and joy. Accordingly, a virtual character showing this kind of emotional reaction is perceived as more believable, as it meets our expectations.

Hongwei Yang, Zhigeng Pan, Mingmin Zhang and Chunhua Ju propose, in their paper 'Modelling Emotional Action for Social Characters', a comprehensive computational model of

emotions that can be incorporated into physiological and social components of emotions. Since interaction between characters can have a major impact on emotional dynamics, the model presents a social-learning component for learning associations among characters, which in turn affects the character's decision-making and social interactions. The model also designs a set of personality progression functions to enhance individual differences. In addition, the authors demonstrate this empirically through a computer simulation of a dynamic environment inhabited by a few characters to test the emotional model. The experiments demonstrate the effectiveness of the emotional model to build believable characters during interaction with the virtual environment.

During the last few years and always with a growing interest, the virtual environments are increasingly being considered a media suited to tell stories interactively. These storytelling systems are generally based on intelligent systems to adapt the story to the application objective and particular characteristics of each of the actors. However, stories necessarily portray a particular point of view. The same historical events can be told as different stories depending on the storyteller's point of view. The story of the same battle between two cities, for example, will be different depending on whether the storyteller identifies himself with the loser or the winner.

In their paper 'On the implications of the virtual storyteller's point of view', Jesús Ibáñez, Ruth Aylett, Carlos Delgado-Mata and Beatriz Molinuevo deal with the implications of showing the storyteller's perspective when telling stories in virtual environments. The authors propose an open and reusable architecture for the construction of virtual guides who tell stories, from their own perspective, about the worlds they inhabit. The system consists of two main components: the structure of a knowledge base to code the narrative about the worlds and a novel hybrid algorithm for the generation of narratives presenting the storyteller's viewpoint. The authors also discuss the results from a study with users carried out to test whether the users consider adding the virtual guide perspective (as text and animations showing emotions) to the guide discourse is significantly better or worse (in terms of several aspects related to believability).

As the number of characters grows, the importance of their social behaviour also grows. For example, how should dozens of characters behave in a virtual bar? Not only the individual characters must be believable, but also their social interactions. That is, characters should show a believable social behaviour.

In their paper 'Simulating socially intelligent agents in Semantic Virtual Environments', Francisco Grimaldo, Miguel Lozano, Fernando Barber and Guillermo Vigeras present a semantics-based multi-agent framework for simulation of groups of intelligent characters. The framework has two main parts. The first one is the Semantic Virtual Environment, which incorporates, to sense and interact with the objects in the scene, Core and Specific Ontologies and a Semantic Layer. The second one is the agent architecture which is represented by the tasks, the social relations, and the conversational skills which are handled by the agents. This architecture incorporates a *Sociability* factor which enables one to easily regulate the creation of different types of social agents, from elitist agents to reciprocal agents.

Largely, the videogames industry is responsible for the progress observed in the area of virtual environments in the last years. The industry's interest to achieve more realistic, faster and credible products to increase their market share with their products, results in investing huge quantities of resources to optimize the existing technology.

In his article 'On Virtual Environments and Agents in Next Generation Computer Games', Daniel Torres reviews, from his privileged position in the videogames industry in BioWare Corp., current trends and challenges in the videogame industry, and also the game-related research and development at university laboratories. He outlines the challenges that both sides face at present, and discusses the way in which a close collaboration would come to compensate the weaknesses of one side, with abilities and strengths of the other. After providing this background, he describes the role that virtual agents and virtual environments play in games, and elaborates on the likely future direction.

Virtual art, a type of art which utilizes interactive graphics via interfaces, has been explored by artists and scientists during the last few years, with very interesting and varied results.

The inclusion of virtual agents in the artistic works adds a great dynamism and opens new perspectives to virtual art.

Isaac Rudomin, Erik Millán, Benjamín Hernández, Marissa Díaz and Daniel Rivera describe, in their article ‘Art applications for crowds’, two different art applications which employ crowd simulation and interface devices. ‘Crowds’ is an immersive art installation with stereo projection based on the authors’ own development of specification of crowd behaviour using XML and images, a proprietary tangible wind interface, and interactive real-time navigation. ‘UnderCrowds’ deals with large crowds, implemented in the graphics processor, and uses a crowd sensor to make the size of the virtual crowd proportional to the number of spectators crossing the said sensor.

In summary, the five papers in this special issue address the central points of the field of intelligent virtual environments and virtual agents. This area has evolved rapidly in the past few years. We hope that the juxtaposition of the papers in this issue (which tackle related questions from different perspectives), apart from illustrating the increasing maturity of the field, will stimulate further research.