The 18th IEEE International Symposium on
Robot and Human Interactive Communication
Toyama, Japan, Sept. 27-Oct. 2, 2009

The IbnSina Interactive Theater: Where Humans, Robots and Virtual Characters meet

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Abstract— **Although numerous early attempts towards the use of robotics in conjunction with virtual characters in order to create augmented reality theater and interactive performances have taken place, the state of the art is still in an initial stage on the pathway towards the full exploitation of the technological as well as creative and artistic potentialities that exist. Here we will present the IbnSina Center, a novel augmented reality interactive theatre installation, named after the famous polymath of the 10th century, known as Avicenna in the west. The installation consists of a ten-meter stage, multiple stage sensors, a screen, a pseudo-3D holograph transparency, and a seating area for the audience. The stage is populated by a custom-designed humanlike humanoid robot (the "IbnSina" robot) and by humans and other entities. The screen and the holograph can display static and moving images, virtual environments as well as online virtual worlds populated by characters, or a windowed / blended mix of the above. The robotic and virtual characters can be autonomous, partially-autonomous, puppeteered, scripted, or real-time-controlled by imitation of human body movements (embodied telepresence). Furthermore, multiple modes of participation of distant humans can be supported: not only through videoconference, but also through control of robots and/or virtual characters. The IbnSina center serves as a platform for multiple purposes: artistic, research as well as educational; and most importantly, the centrality of a progressive character such as IbnSina catalyzes the reconnection of the wider region of the UAE to a past during which scientific inquiry and the arts had flourished; and thus, enables the creation of a future for the region which will emphasize such cultural values.**

I. Single-page Paper Accompanying the Video

THE IbnSina Center is a novel augmented reality interactive theatre installation, named after the famous polymath of the 10th century, known as Avicenna in the west. The installation consists of a ten-meter stage, multiple stage sensors, a screen, a pseudo-3D holograph transparency, and a seating area for the audience. The stage is populated by a custom-designed humanlike humanoid robot (the "IbnSina" robot) and by humans and other entities. The *purpose* of the IbnSina Center is *tri-fold: art, research,* as well as *education*.

In terms of *art*, the center enables the exploration of multiple novel expressive means and their combinations, enabling physical, robot-mediated as well as virtual character-mediated participation of locally present or remote humans, and interactions with autonomous and semi-autonomous artificially intelligent entities, within an augmented reality environment. In that sense, it considerably extends upon current work in interactive robotic theatre and arts.

In terms of *research*, the center enables hands-on research in a wide number of related areas: humanoid robotics, virtual worlds and characters, robotic tele-presence, and human-robot interaction are just a few among them. The co-presence of a humanoid together with an extensive sensor network for determining the physical situation around it (body pose, object positions), directly next to a life-size projection of virtual worlds characters, creates a big number of interesting combinations.

In terms of *education*, the center enables the creation of exciting hands-on real-world projects for students, as well as the constructive co-existence of students coming from media arts as well as from technical backgrounds.

A *submitted six-page paper* describes the authors' collaborative work towards the realization of the Ibn Sina center. Nikolaos Mavridis has provided the idea and conceptual design behind the center, has created a monologue script which was used for an animation ("The Dream of IbnSina"), and is leading the software development and the project. David Hanson has designed, crafted and created the Ibn Sina humanlike robot, the main robotic character of the center. The paper starts with a background section, covering interactive robotic theater and arts, and discussing the historical Ibn Sina and his relevance to the region. Then, we provide a description of the theatre, its configuration and equipment, including a detailed section on the Ibn Sina humanlike robot. Later, we discuss the capabilities of the center and finally, we talk about steps taken and future steps, and conclude.

The *submitted video* contains scenes from the animation accompanying the "Dream of IbnSina", scenes with the robot talking in Arabic, and scenes from the robot on stage. It is our hope that the Ibn Sina center will help bring forth the values associated with this historical figure, and thus benefit the region and the world.

Manuscript received March 25, 2009.

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