

Virtual Humans

Interactive virtual worlds provide a powerful medium for experiential learning. The overarching goal is to enrich such worlds with virtual humans—autonomous agents that support face-to-face interaction with people in virtual environments—thereby making them applicable to a wide range of training tasks that currently require labor-intensive live exercises, role playing or are taught non-experientially. ICT's virtual human work promotes fundamental advances in artificial intelligence, graphics and animation. Agents must perceive and respond to events in the virtual world, they must have and express realistic emotions, and they must be able to carry on spoken dialogues with humans and other agents, including all the non-verbal communication that accompanies human speech.

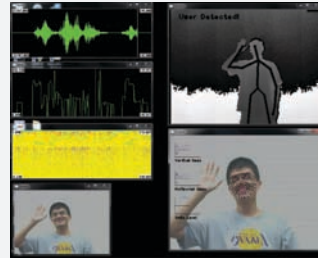
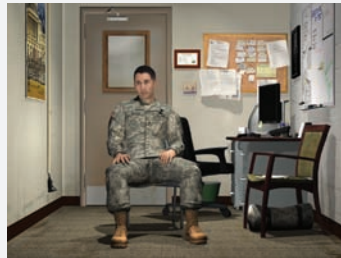


Photo Credit: Steve Cohn

Integrated Virtual Humans

Integrated Virtual Humans integrates, transitions and disseminates research by focusing on designing a modular Virtual Human architecture, adapting third party technology, and developing robust modules and tools. One of its main efforts is the ICT Virtual Human Toolkit. The ICT Virtual Human Toolkit is a collection of modules, tools and libraries that supports the creation of question/answer characters, with an emphasis on natural language interaction, nonverbal behavior and visual recognition. At the core of the toolkit lies innovative, research-driven technologies which are combined with other software components in order to provide a complete, basic virtual human. The ICT Virtual Human Toolkit was created with the goal of reducing some the complexity inherent in creating virtual humans. The toolkit is an ever-growing collection of innovative technologies, fueled by basic research performed at ICT and its partners. Through this toolkit, ICT hopes to provide the virtual humans research community with a widely accepted platform on which new technologies can be built.

Cognition and Emotion

Emotions play a key role in the believability of a simulation and the extent to which students feel immersed. This effort develops models that allow synthetic characters to derive an emotional response to events in the world and respond with behaviors consistent with that emotional state. The project then uses the virtual human agents to investigate how people interpret emotional behavior and how these interpretations influence (directly or indirectly) memory and decision-making. Other research efforts include the development of machine learning techniques to characterize expressive behaviors, computation models of social attribution theory and social influence theory, and psychological studies that validate these models.

Natural Language Processing and Dialogue Management

The purpose of this project is to advance the state of research in natural language processing, specifically for virtual humans. Focus areas include: techniques and architectures for dialogue systems in different domains and genres; development of better components for dialogue management and natural language understanding and generation; interaction between language processing and other aspects of virtual humans, including emotion, cognition, visual perception, speech recognition and non-verbal behavior generation; corpus development including data collection, transcription, and annotation; dialogue evaluation; culture and activity specific aspects of dialogue; multi-modal and multiparty dialogue; and non-cooperative dialogue.

Virtual Human Embodiment

Researchers demand much from their virtual human creations. They must be responsive, believable and interpretable. This project's research seeks to: model gaze, gesture, posture, facial behavior and the factors that cause and influence such behavior in a virtual human body; study the impact of the virtual human's nonverbal behavior on immersed humans decision making and beliefs; and model cross-cultural differences in nonverbal behavior. This approach has evolved into a general character animation system called SmartBody, an open source modular framework for realizing virtual humans and other embodied characters.

Multimodal Perception and Understanding

When people interact with each other, it is common to see indications of acknowledgment given with a simple head gesture or explicit turn taking with eye gaze shifts. The recognition of visual feedback is a key component of human communication, and novel multimodal interfaces need to recognize and analyze these visual cues to facilitate more natural human-computer interaction. This a multi-disciplinary research topic that overlays the fields of computer vision, human-computer interaction, machine learning and artificial intelligence, and has many practical applications in areas as diverse as robotics, education and entertainment.

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