

Bringing Second Life To Life: Researchers Create Character With Reasoning Abilities of a Child

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Troy, N.Y. – Today's video games and online virtual worlds give users the freedom to create characters in the digital domain that look and seem more human than ever before. But despite having your hair, your height, and your hazel eyes, your avatar is still little more than just a pretty face.

A group of researchers from Rensselaer Polytechnic Institute is working to change that by engineering characters with the capacity to have beliefs and to reason about the beliefs of others. The characters will be able to predict and manipulate the behavior of even human players, with whom they will directly interact in the real, physical world, according to the



team.

At a recent conference on artificial intelligence, the researchers unveiled the "embodiment" of their success to date: "Eddie," a 4-year-old child in Second Life who can reason about his own beliefs to draw conclusions in a manner that matches human children his age.

"Current avatars in massively multiplayer online worlds — such as Second Life — are directly tethered to a user's keystrokes and only give the illusion of mentality," said Selmer Bringsjord, head of Rensselaer's Cognitive Science Department and leader of the research project. "Truly convincing autonomous synthetic characters must possess memories; believe things, want things, remember things."

Such characters can only be engineered by coupling logic-based artificial intelligence and computational cognitive modeling techniques with the processing power of a supercomputer, according to Bringsjord.

The principles and techniques that humans deploy in order to understand, predict, and manipulate the behavior of other humans is collectively referred to as a "theory of mind." Bringsjord's research group is now starting to engineer part of that theory, which would allow artificial agents to understand, predict, and manipulate the behavior of other agents, in order to be genuine stand-ins for human beings or autonomous intellects in their own right.

The logico-mathematical theory will include rigorous, declarative definitions of all of the concepts central to a theory of the mind, including lying, betrayal, and even evil, according to Bringsjord.

To test "Eddie's" reasoning powers, the group created a demo in Second Life that subjected their theory to a false-belief test.



In a typical real-life version of this test, a child witnesses a series of events in which Person A places an object (such as a teddy bear) in a certain location (such as a cabinet). Person A then leaves the room, and during his absence Person B moves the object to a new location (such as the refrigerator). The child is then asked to predict where Person A will look for the object when he gets back.

The right answer, of course, is the cabinet, but children age 4 and under will generally say the refrigerator because they haven't yet formed a theory of the mind of others.

The researchers recreated the same situation in Second Life, using an automated theorem prover coupled with procedures for converting conversational English in Second Life into formal logic, the native language of the prover.

When the code is executed, the software simulates keystrokes in Second Life. This enables control of "Eddie," who demonstrates an incorrect prediction of where Person A will look for the teddy bear — a response consistent with that of a 4-year old child. But, in an instant, Eddie's mind can be improved, and if the test is run again, he makes the correct prediction.

A video clip of the "False Belief in Second Life" demonstration is available online at: <u>http://www.cogsci.rpi.edu/research/rair/asc_rca</u>.

"Our aim is not to construct a computational theory that explains and predicts actual human behavior, but rather to build artificial agents made more interesting and useful by their ability to ascribe mental states to other agents, reason about such states, and have — as avatars — states that are correlates to those experienced by humans," Bringsjord said. "Applications include entertainment and gaming, but also education and homeland defense."



This research is supported by IBM and other outside sponsors, and the team hopes to engineer a version of the Star Trek holodeck — a virtual reality system used onboard the starships that allowed users to interact with the projected holograms of other individuals. Such a system could allow cognitively robust synthetic characters to interact directly with human beings, according to Bringsjord.

The proposed research would require the use of two of Rensselaer's stateof-the-art research facilities — the Computational Center for Nanotechnology Innovations (CCNI) and the Experimental Media and Performing Arts Center (EMPAC).

The most powerful university-based supercomputing system in the world, the CCNI is made up of massively parallel Blue Gene supercomputers, POWER-based Linux clusters, and AMD Opteron processor-based clusters, providing more than 100 teraflops of computing power.

Video Clip -- False Belief in Second Life: MOV: <u>www.cogsci.rpi.edu/research/ra</u> ... <u>seBelief.Failure.mov</u> WMV: <u>www.cogsci.rpi.edu/research/ra</u> ... <u>seBelief.Failure.wmv</u>

Source: Rensselaer Polytechnic Institute

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