Dynamic lighting system colors 3-D environments

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An automatic lighting system that can speed up the development of interactive stories and videogames can enhance players' experiences, too, by adding more tension and emotion to a scene, says the Penn State researcher who developed the system.

ELE, Expressive Lighting Engine, is an intelligent system that allows game developers to use lighting to direct attention to particular objects or characters, create mood and provide visual depth, said Magy Seif El-Nasr, an assistant professor in the Penn State School of Information Sciences and Technology (IST). As well as automatically placing lights to illumine a scene, ELE also selects their positions, colors and angles.

"Lighting in game engines is static and restrictive, and it doesn't change with interaction," she said. "ELE draws on cinematic and theatric lighting design theory and enables game designers to fully use lighting's subtle but powerful effects."

Seif El-Nasr and Chinmay Rao, a graduate student at Penn State, reported at the Siggraph Poster Session in Los Angeles (Aug. 6-12) that ELE can guide players to important elements in 3-D scenes. The researchers determined this through tracking the eye movements of users playing a simple level of a first-person shooter game. With ELE's lighting choices, users more successfully scanned scenes and identified enemies.

This built on one of Seif El-Nasr's earlier user studies, the results of

which she reported at the American Association for Artificial Intelligence's July meeting. In that study which also involved eye tracking, players of the game Unreal Tournament missed "seeing" the enemy so couldn't respond fast enough to enemy attacks. Those results appeared in a paper titled "Light AI" authored by Seif El-Nasr.

In addition to benefiting users, ELE also helps game designers, she noted. Current lighting design is time-consuming, often requiring weeks of tweaking. That makes it difficult to adapt a scene's lighting to reflect changes in a scene's tension or action.

ELE can respond quickly, said Seif El-Nasr who tested the system on the Unreal 2.0 engine (used in Unreal Tournament 2003 and 2004).

Because the system is dynamic, ELE also can be used to change the level of difficulty in a game. Characters can be lit up to be obvious for novice players, for instance. For more experienced players, the lighting could include more shadows, Seif El-Nasr said.

Another benefit of the automatic system is that designers who want to override ELE can do so.

"ELE allows artists to control its behavior at a high level or a low level," the Penn State researcher said. "Additionally, ELE supplies artists with a language to write rules for specific lighting changes or set up."

While developed initially for 3-D environments, ELE can improve simulations used in educational and military training simulations, Seif El-Nasr said.

Penn State's Intellectual Property Office currently is seeking patent protection on the software methods embodied in ELE.