Android Science

Journey through an uncanny valley

We might be more responsive to robots designed to look human rather than mechanical, but other factors may determine what causes us to accept or shun these virtual humans.

Recent evidence indicates that androids are better able to elicit human norms of interaction than less humanlike robots or animated characters," says Karl F. MacDorman, associate professor at the Indiana University School of Informatics. "However, there's a heightened sensitivity to defects in near humanlike forms — an uncanny valley in what is otherwise a positive relationship between human likeness and familiarity."

The so-called "uncanny valley" theory was proposed in 1970 by robotics pioneer Masahiro Mori. It suggests that the more realistic and humanlike a robot appears, the more positively a human will react to it, but only to a certain point where the resemblance actually causes a sense of repulsion or eeriness — perhaps even the beholder's grim realization of human mortality.

An expert in human-computer interaction at the school's Indiana University–Purdue University Indianapolis campus, MacDorman seeks to chart new ground in researching the uncanny valley based on previous and ongoing research in which he has been involved. And he believes there is no single explanation of this phenomenon.

One recent study MacDorman was part of sought to determine whether the uncanny valley is a necessary property of near-humanlike forms. The 56 participants (young adult Indonesian college students, professionals, and government workers) were presented with 14 short video clips depicting different kinds of robotic devices engaged in various activities in different settings. The range of devices included a mechanical arm, walking humanoid robots, android heads, and full-bodied androids engaging in social interaction. They also viewed a clip of a human female.

The participants were individually asked to rate the video clips on scales gauging mechanical versus humanlike, strange versus familiar, and eeriness.

"Contrary to an earlier experiment with morphed robot-to-human images, what we found does not indicate a single uncanny valley for a particular range of human likeness," MacDorman says.

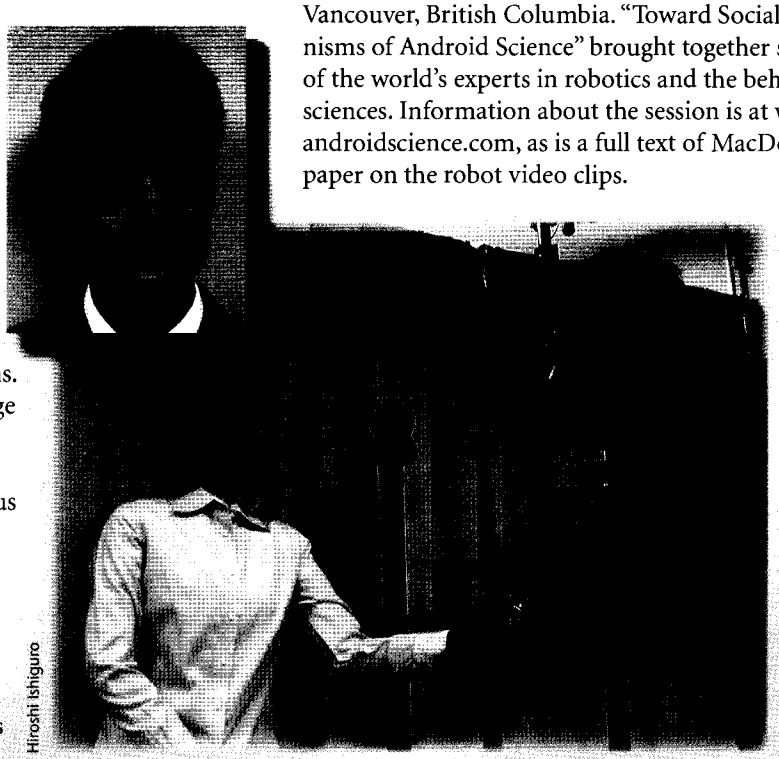
"Rather, the results suggest human likeness is only one of perhaps many factors influencing the extent to which a robot is perceived as being strange, familiar or eerie," he adds. "This is important because it implies that factors other than human likeness could be manipulated to overcome the uncanny valley. This is also what David Hanson (well-known creator of android faces and CEO of Hanson Robotics Inc.) found in an experiment using still images."

The California-born MacDorman and Hiroshi Ishiguro, with whom he collaborates at Osaka University, suggest such factors might include facial and bodily proportions, movement quality (fluidity or jerkiness), and contingency and timing: whether the robot can closely attune its voice, gestures, and gaze without making too many pregnant pauses or rapid-fire reactions to people it's interacting with.

Why then is there a need for continuing robotics research on the development of more humanlike androids?

"Android science has great potential to help cognitive neuroscientists and social and cognitive scientists understand human beings as well as improving medical training," MacDorman says. "We might be using androids, but what we're really studying is ourselves — what motivates us and how we interact with one another as humans."

MacDorman and Ishiguro organized a symposium last July at the 28th Annual Conference of the Cognitive Science Society in Vancouver, British Columbia. "Toward Social Mechanisms of Android Science" brought together some of the world's experts in robotics and the behavioral sciences. Information about the session is at www.androidscience.com, as is a full text of MacDorman's paper on the robot video clips.



Jason Sisk

Hiroshi Ishiguro

Repliee Q1, a full-bodied android, shakes hands with Yasukazu Nagatomi, a project associate from Osaka University. INSET: *Karl MacDorman*