# Upending the Uncanny Valley

**David Hanson, Andrew Olney, Steve Prilliman, Eric Mathews, Marge Zielke, Derek Hammons, Raul Fernandez, Harry Stephanou**

Hanson Robotics Inc, Fedex Insitute of Technology, the University of Texas at Arlington Automation and Robotics Research Institute, and the University of Texas at Dallas, Institute for Interactive Arts and Engineering
6117 Reiger Avenue, Dallas TX 75214
365 Innovation Drive Memphis, TN 38152-3115
7300 Jack Newell Blvd. Fort Worth, TX 76118
P.O. Box 830688 Richardson TX 75083-0688
david.hanson@human-robot.org, aolney@memphis.edu

**Abstract**

Although robotics researchers commonly contend that robots should not look too humanlike, many artforms have successfully depicted people and have come to be accepted as great and important works, with examples such as Rodin's Thinker, Mary Cassat's infants, and Disney's Abe Lincoln simulacrum. Extending this tradition to intelligent robotics, the authors have depicted late sci-fi writer Philip K Dick with an autonomous, intelligent android. In doing so, the authors aspire to bring robotic systems up to the level of great art, while using the technology as a mirror for examining human nature in social AI development and cognitive science experiments.

## Uncanny can be good

The myth that robots should not look or act very humanlike is a pernicious one in robotics research, one commonly known by the term "Uncanny Valley". Our research, however, furthers the tradition of human figurative depiction that reaches from classical Greek sculpture to "postmodern" contemporary art. By advancing this tradition into the field of robotics with intelligent and highly expressive depictions of humans, we gain a powerful mirror that can help address the question of "what is human". While people do indeed appear to be more sensitive to the realistic human social countenance (vs. cartoonish depictions), this sensitivity can serve as a highly refined metric to assist in exploring human social cognition, in the pursuit of better cognitive science. And, if our engineered realistic robots do satisfy human's discriminating taste for verisimilitude, then we will have developed a powerful toolchest of principles for engineered non-realistic robots as well.

In this paper we will discuss the results of our recent human subject experiments, which strongly contravene the "Uncanny Valley" theory that humanlike robots are innately unlikable.

We also demonstrate our latest robot that contradicts the Uncanny Valley—an android that portrays the late sci-fi writer Philip K Dick (PKD), the mind behind *Blade Runner, VALIS,* and other AI-inspired works. This robot incorporates numerous machine perception technologies and deep natural language processes, in an architecture that simulates the complete conversational persona of the man. The natural language software, as designed by Olney, uses an ontology constructed from the life of PKD, his works, and an enormous amount of common and literate knowledge. This ontology is expanded by an LSA corpus derived from several dozen books and journals of PKD, used to populate the ontology. A substantial set of flexible rules based on a similar statistical and linguistic parsing determines the robot's response to conversational and environmental stimuli (modulated by some random, automated "Iching" coin tossing). Through the cameras in its eyes, the robot perceives faces and facial expressions, using a combined application of Intel Open CV libraries and the Nevenvision Axiom facial feature tracker. Additionally, Cognitec's FaceVacs software enables the robot to identify people known to PKD (family, friends, celebrities, etc). The data from the vision and language software are fused into several categories of models, which drive dynamically blended animations to affect eye contact with people.

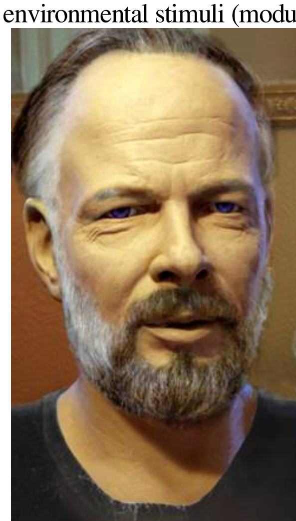

**Figure 1**
Hanson Robotics'
PKD-Android Hardware

In a typical interaction scenario, face detection software will detect a person, and the robot will smile in greeting. The speaker independent speech recognition (provided by Multimodal Software) will accurately detect many thousand of words and phrases, and send this as text to the natural language processing core. The determined response will then drive the facial animation (running through a custom Maya plugin) in sync with a highly realistic synthesized voice provided by Acapela. The facial expressions are highly realistic, using Hanson's proprietary lifelike skin material to affect extremely realistic expressions with very low power. The lightweight low-power characteristics of the hardware make it appropriate for untethered bipeds and mass manufacturing. Briefly, we describe how we are manufacturing these robots for ongoing AI development, cognitive science experiments, as art and entertainment, and for therapy applications.

We feel that for realistic robots to be appealing to people, they must attain some level of integrated social responsivity and aesthetic refinement. We contend that our robots demonstrate clearly, once and for all, that we can better understand social intelligence by rendering the social human in all possible nuance.

**Figure 2.** Hanson Robotics' facial expression hardware models demonstrating ranges of emotional affect.

## Conclusion

We feel that for realistic robots to be appealing to people, they must attain some level of integrated social responsivity and aesthetic refinement. We contend that realistically depicted humanlike robots serve as an unparalleled tool for investigating the full range of nuance in this pursuit. In our experiments, our robots have demonstrated clearly, once and for all, that we can better understand social intelligence by rendering the social human in all possible detail.

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