CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
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Project Number
J1712

Project Title
Exploring the Uncanny Valley: Quantitative Test of a Theory on Emotional Responses to Humanoid Robotic Faces

Abstract

Objectives/Goals
The purpose of my study was to quantitatively test the scientific validity of the Uncanny Valley theory (proposed in the 1970s by scientist Dr. Masahiro Mori to explain negative emotional responses of humans to some android robots).

Background: The concept of the Uncanny Valley has been very widely cited, for example, to explain the creepiness of zombies, and the unsettling feelings many people experienced at the movie The Polar Express. Despite its widespread acceptance in popular culture, the theory has been disputed by psychologists and roboticists. Resolving this debate will be crucial to the development of android robots that can successfully interact with humans.

Methods/Materials
I used digital editing methods to create a series of images of robot faces that ranged from very mechanical to very human in appearance. Fifty-two subjects were asked to use a visual analog scale to rate the faces based on how much they would like to interact with each. I analyzed the results using statistical methods to determine standard error and significance of results. Many controls were used to minimize unintended sources of variability.

Results
1. My results show, for the first time, that the concept of The Uncanny Valley is scientifically valid and that it presents a real challenge that must be overcome in developing human-like robots.
2. Children have exaggerated responses to the more mechanical robotic faces, causing a higher positive response to mechanical robots and a deeper Uncanny Valley.
3. People who own robots have less positive responses to the human face.
4. The first peak of the Uncanny Valley curve is actually less positive than originally hypothesized by Dr. Mori.

Conclusions/Discussion
The Uncanny Valley does exist. The complex relationship between the humanness of robotic faces and emotional responses of people to those faces is largely as predicted by Dr. Mori three decades ago. However, because the first peak of the curve is much less positive than he theorized, the approach he suggested (to abandon the development of human-like robots to focus on perfecting non-human robots) is not justified. Instead, the best possible interactions of adult humans with robots will only be achieved by striving to create the most human-like robots, even if they cannot be perfect.

Summary Statement
My project demonstrates for the first time that the Uncanny Valley theory is a scientifically valid explanation for negative emotional responses in people to certain types of semi-human robot faces.

Help Received
Father taught me to use Photoshop software; Mother taught me to use statidtical and graphing software.