Adam Heberling
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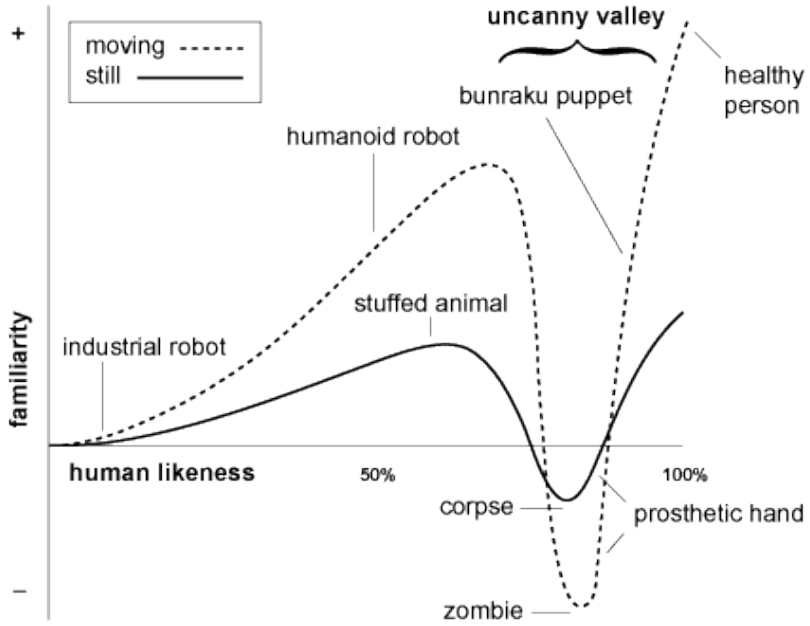
Computer Graphics and the Uncanny Valley

When something begins to looks too human, we begin to notice any small flaws it has, and reject it. This idea behind this emotion was first proposed by Masahiro Mori, a Japanese roboticist, in the 1970. In his model, Mori claims that as a robot becomes more like a human, our empathy towards it increases. However, as a robot becomes very close to looking human, we take greater notice of its non-human features and movements. This drop in familiarity toward the robot is what Mori called the Uncanny Valley. As seen in the chart, that only way to escape the uncanny valley is to create a robot that is nearly indistinguishable from a person.



Masahiro Mori's diagram of the Uncanny Valley

Mori's Uncanny Valley can be applied to not only robotics, but also computer graphics. The increasing ability of computers has allowed us to create three dimensional people that are

amazingly lifelike yet somewhat unsettling. One of the earliest examples of this can be seen in Pixar's 1988 short film *Tin Toy*. This animated short later inspired *Toy Story*, and was about a toy one-man-band and a baby. The baby was made to look realistic, but instead comes across as being frightening.

Billy from Pixar's *Tin Toy*

Since then, other computer animated films have had to face the effects of the Uncanny Valley. *Final Fantasy: The Spirits Within* was the first fully length major motion picture to attempt using photorealistic CGI characters. The movie ultimately failed at the box office, due in part to the characters falling into the Uncanny Valley. Another movie, *The Polar Express*, had the same problems. Film critic David Rooney noted, "*The Polar Express* may succeed via the motion-capture process in replicating human movement by digitalizing the performances of live actors, but it fails to capture the subtlety of facial expressions or to fabricate sympathetic, evocative figures."

In several instances, movies have been able to avoid the valley. Pixar's CGI feature film *The Incredibles* was released at about the same time as *The Polar Express*, yet did not receive the

The Polar Express (left) and *The Incredibles* (right)

same criticism of creepy looking people. While the world in which *The Incredibles* takes place was very realistic and detailed, the actual characters had a very stylized design. They were not so human in appearance as to be frightening, but instead can be placed near the first peak on Mori's chart. A different example is the character Gollum from *The Lord of the Rings* films. He is a photorealistic CGI character that was integrated flawlessly alongside real actors. Through a combination of motion capture and keyframing, animators for Gollum may have been able to jump the Uncanny Valley. Unfortunately, Gollum was not a fully human character, so Mori's model may not be completely applicable.

Now that video games are reaching a point where they can create realistic characters, they are also falling victim to the Uncanny Valley. Much like the movie industry, game designers must decide whether to attempt photorealism or try a different art style. One game attempting to jump the valley is Bioware's *Mass Effect*. During the in-game conversations,

characters' faces will change to show their emotions. Artists have taken special care to capture subtle expressions that indicate feelings like fear or anger. Other games, like Nintendo's *The Legend of Zelda: The Wind Waker*, take an approach similar to Pixar. Characters have a unique, cartoon-like style that is able to avoid the uncanny valley.

In conclusion, the Uncanny Valley presents a real challenge to anyone trying to create photorealistic

Commander Shepard (far right) having a conversation in Bioware's *Mass Effect*

Cel-shaded Link from Nintendo's *The Wind Waker*

CGI characters. There are two ways of avoiding the Uncanny Valley. The first is not attempt photorealism, and instead give characters a more stylized look. The second is to painstaking capture all the details that go into human movement and expressions, so that they are nearly indistinguishable from real life. Following these suggestions will make watching CGI films and video games more pleasant for the viewer and more lucrative for the artists who make them.

References

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Images

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