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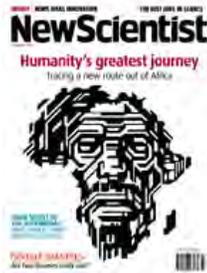
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### Technology

## What puts the creepy into robot crawlies?

27 October 2007

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Jim Giles

WHEN fantasy fans praised *The Lord of the Rings* films for their special effects, they often singled out the character Gollum (pictured). His animal-like hands and feet, combined with his human-like body shape and voice made viewers' skin crawl.

Now the brain mechanisms responsible for our horror at such human-like creatures, and why this response evolved, are being revealed. Understanding this effect could help robot designers predict how people will react to their creations.

The Gollum effect is an example of a phenomenon known as the "uncanny valley". If a robot is clearly a robot - with metal limbs, say - people are rarely troubled by it. But pass a certain threshold in realism, such as giving it skin or a human-like voice, and it starts to seem eerie. The response is particularly pronounced when one feature is conspicuously more or less human than the rest. Animators already exploit this. Gollum's designers, Weta Digital of Wellington, New Zealand, gave Gollum a voice that sounded human, while his body and movements were animal-like.

To investigate how the effect works, Thierry Chaminade and Ayse Saygin of University College London scanned the brains of subjects being shown videos of a lifelike robot picking up a cup, as well as the same movement performed by a less realistic robot and a person. The results reveal there is a network of neurons in the parietal cortex that was especially active in the case of the lifelike robot, Chaminade says.

This area of the brain is known to contain "mirror neurons", which are active when someone imagines performing an action they are observing. While watching all three videos, people imagine picking up the cup themselves. Chaminade says the extra mirror neuron activity when viewing the lifelike robot might be due to the way it moves, which jars with its appearance. This "breach of expectation" could trigger extra brain activity and produce the uncanny feelings.

"A breach of expectations could be the trigger for uncanny feelings" and avoid - people suffering from an

infectious disease. Very lifelike robots seem almost human but, like people with a visible disease, aspects of their appearance jar.

To test the idea, Karl McDorman, who researches human-robot interaction at Indiana University in Indianapolis, recorded the emotions experienced by more than 140 subjects who viewed moving robots of varying likeness to humans. The results show that those which prompt feelings of uncanniness also tend to provoke fear, shock, disgust and nervousness. Since these emotions are typical responses to diseased bodies, MacDorman suggests that the uncanny valley phenomenon may stem from a "fear of one's own mortality" and an "evolved mechanism for avoiding pathogens". "The uncanny valley is about a mismatch in human expectations," he says.

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