In 1970, Masahiro Mori coined the term ‘Uncanny Valley’ in relation to his work on robotics to mean the point at which the humanlike qualities of robots become disturbing and sinister. (Mori, 1970: 33-5)

The quest for realism has been a concern for some people working in robotics, gaming, cinema, broadcast special effects and media arts in the decades that followed Masahiro Mori’s paper on the Uncanny Valley. Designers, filmmakers and artists exploited the Uncanny Valley in the representation of characters and avatars, particularly in the horror genre, while others inadvertently slipped into it in their aspirations to create the authentic human figure and character.¹

In the following loosely connected exchange, Marco Gillies, researcher in Computer Graphics and Virtual Environments at University College London; David Surman, lecturer in Computer Games Design, University of Wales Newport; and Harry Brenton, research fellow in the Department of Biosurgery and Surgical Technology, Imperial College London, were each asked to address questions such as how realism was central to their practice; whether Uncanny Valley can be quantified or is a subjective experience; and if there are any points where the Uncanny Valley effect might be exploited in practice.²

MG: For many years an implicit assumption in the development of computer graphics has been that the ultimate aim is to reproduce reality as faithfully as possible. It certainly seems to be an intuitively reasonable goal, and it appeals to the point of view of engineers and technologists who have often driven computer graphics (I am one of them). We engineers like to have an absolute measure of the effectiveness of our technology, and a comparison with reality seems to provide this (though in practice things aren’t that simple). Despite these advantages, recent years have seen increasing criticism of the quest for realism, questioning whether realism should be the only goal of computer graphics, whether it is a desirable goal at all, and whether it is even possible. As computer graphics is increasingly used across many fields, it is important to get a number of different perspectives on the issue, which is why this exchange is interesting.

DS: In his Uncanny Valley paper Mori conceives of a moment in the development of increasingly familiar and humanlike robots when our sense of fascination and investment gives way to unease and displeasure. In his own words: ‘I have noticed that, as robots appear more humanlike, our sense of familiarity increases until we come to a valley’. Fig. 1, 2 This is, of course, the Uncanny Valley we are referring to here. And to illustrate this moment of collapse – where verisimilitude gives way to a crisis of definitions – Mori cites the corpse, zombie and prosthetic hand as potent symbols of his concept. Mori’s subject of robots is to me interchangeable with photorealistic computer generated characters, and I think his ideas can help us say something about their impact.

MG: The increased criticism of the quest for realism I mentioned comes in many forms. One is the development of non-photorealistic rendering; a group of technologies that attempt to create stylised rather than realistic effects with computer graphics, often imitating traditional media such as painting, drawing or illustration. One of the most popular forms is ‘Toon rendering’ Fig 3, 4 imitating traditional hand animation. The movement away from realism can also be found in the work of many animators, games designers and filmmakers who find that realism does not suit their goals. Many people working in computer graphics – and in particular, applied computer graphics characters – have used the Uncanny Valley theory to suggest that we should not try to create excessively realistic characters. Much of my research is into whether this can
2.3 Uncanny Valley: Realism in visualisation & character design

Brenton, Gillies, Surman

Fig. 1, 2

The Uncanny Valley

movement
still

human likeness

Uncanny Valley

humanoid robot
bunraku robot
healthy person

industrial robot
stuffed animal

corpse
prosthetic hand

zombie

+ familiarity

+ human likeness

50%

+ reaction

similarity to human

Movement

Appearance

1 Industrial robot
2 Android
3 Moving corpse
4 Prosthetic hand
5 Handicapped person
6 Bunraku puppet
7 Unhealthy person
8 Healthy person

1 Stuffed toy
2 Noh mask of thin man
3 Corpse/uncanny valley
4 Decorative robot
5 Doll

Splash image: Face Robot © Softimage Co. 2007 Fig. 1, 2 The Uncanny Valley
really be applied to computer graphics – given that it was developed for robotics – and I am currently working on a series of projects addressing this. If we are to use Uncanny Valley as a concept informing our practice, we may need to change the theory in order for us to apply it.

HB: Photorealistic visualisation is an important area in medical training research. (Stoyanov, 2005) Fig. 5 And there is an ongoing debate about the benefits of a photorealistic approach when learning procedural and technical skills. Some simulations aim to recreate photo-realistically operations such as removal of the gallbladder, whilst others use simple geometric shapes in place of organs and tissue. (ibid) The key issue is whether photorealism improves or impedes the transfer of skill from a virtual environment to an operating theatre. Although some validation studies have shown that trainees who practise on simulators have improved psychomotor proficiency when performing real procedures, further research is required to evaluate the effects of differing levels of realism. (Mathiel, 2006: 104-12) For designers, gauging the correct level of realistic detail to include is a delicate balance between technical constraints and instructional benefits. For example, a high fidelity 3D model might show intricate anatomical structures but be slow to appear on screen and awkward to manipulate.

DS: Asymmetries, imperfections and absences from the culturally agreed consensus of a ‘correct’ body are meaningful insofar as they produce in us almost unconscious judgements which we must rationalise and moderate. (Grodal, 2002) The simplest caricatures reveal how primed we are to find our likeness in abstraction, but at the other end of the spectrum we find the mimesis of realist painting, photography and digital imaging. Here, our drive to read the ‘correctness’ of humanlike representation is evoked. And so the image of health underlies the critique of realism in representational media. We know the proportions of the face and body so completely through the experience of everyday life that a highly realistic image of the human form must comply with these conventions, or else be felt on a deep cognitive level to be unsettling or unacceptable.

HB: In medical training technologies, image realism is only one of several types of realism under consideration. For example, haptic input devices on proprietary VR systems provide tactile force-feedback and allow trainees to practise using authentic surgical instruments (e.g. an endoscope). (Hale, 2004: 33-39) The ‘holy grail’ of current research is...
Uncanny Valley: Realism in visualisation & character design Brenton, Gillies, Surman

2.3 Uncanny Valley: Realism in visualisation & character design

Photorealistic visualisation is an important area in medical training research to combine haptics with 3D models of human tissue that deforms, bleeds, tears and cuts realistically under different conditions. (Faraci, 2005: 137-44) Medicine may be a niche subject area, but it raises important, wider questions about the benchmarks we use to evaluate the word ‘realism’.

MG: It is interesting that the Uncanny Valley also sometimes shows up as part of the narrative in films. For instance, the robotic child in the film AI looks and behaves like an innocent kid triggering his adoptive mother’s maternal feelings of nurturing and protection. The uncanny category shock hits her painfully when she is suddenly reminded that he is actually a soulless machine and a possible killer.

DS: The uncanny concept also circulates in the psychoanalytic theories of Sigmund Freud, ‘…that class of the frightening which leads back to what is known of old and long familiar’. (Ferrell, 1991: 131) Mori’s examples – the corpse, zombie and prosthetic hand – are not dissimilar from the category of things to which Freud attributes an uncanny quality. For Mori, the uncanny is a design concern, a detour in the linear development of progressively humanlike robots, since ‘…human beings themselves lie at the final goal of robotics, which is why we make an effort to build humanlike robots’. (Mori, 1970: 33-5)

MG: Freud also describes a group uncanny reaction after the First World War, when civilians were first exposed to amputee soldiers wearing artificial limbs. After the initial shock people got used to it. Anecdotally, I stood by a ‘hyperrealistic’ Ron Mueuk sculpture of an injured jogger in the middle of a packed art gallery corridor, and saw many people sharing the same unsettled reactions of shock, concern and bewilderment. I suspect that different cultural groups initially share similar uncanny reactions, but that these will lessen over time as
people get used to looking at synthetic humans. Even if the Uncanny Valley does prove hard to measure or quantify, I still believe that psychological research studies should be carried out – as long they are honest about their methodological limitations. One of the worst subsets of people to experiment upon will probably be computer graphics specialists who come into daily contact with avatars.

DS: I also think that as representational media, games have their own realist trajectory, and I have written elsewhere about the newly hybridised production culture of game creation; how games technology intends to encroach on the representational turf held by so-called ‘virtual cinema’ the modeling and use of synthetic or virtual ‘actors’. And in recent years, controversy about the social consequence of games has arisen in response to the growing graphical capability of games technology and its increased integration and visibility in everyday life. When hyperrealistic models of the human form succumb to manipulation, enhancement and erasure at the hands of players, it challenges our notions of verisimilitude and problematises the use of computer animation and gaming technology. (Bouldin, 2005: 45-66)

HB: Perhaps the current trend in computer game engines towards realistic physics engines will be superseded by realistic ‘biology engines’, with deformable and dissectible anatomically and physiologically correct character models. The makers of the game Crysis prefer the term ‘video-realism’ to ‘photorealism’ as it incorporates movement as a criterion for realism, and while citing that the Uncanny Valley is a ‘cause for concern’, they do not elaborate further. Fig. 7 Elaborating on the concerns is an issue that games designers would do well to focus on.

MG: Horror movies (and, by extension, computer games such as Silent Hill) frequently play upon the uncanny. ‘Monsters’ such as Frankenstein’s creature are abhorrent because they embody categories that shouldn’t naturally co-exist: dead / alive, human / beast. I’d love to see a next generation horror computer game that used the Uncanny Valley to create a sense of unease when interacting with seemingly normal characters (rather than just deploying the usual generic zombies with glowing red eyes).
SwanQuake: the user manual

Notes
1. These contributions arise from the proceedings of a seminar looking at issues raised by Masahiro Mori’s concept of Uncanny Valley in robotics for contemporary gaming, film and art held at Dana Centre, London, March 2006 and co-moderated by Hannah Redler, Science Museum and Helen Sloan, SCAN as part of Node.London festival.
3. For more information on Marco Gillies’ work, see.
6. See Edge Magazine (2006) / no. 161, April

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All links: www.swanquake.com/usermanual/UncannyValley

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