Cleland, Kathy (2011 - upcoming) "Not quite human: traversing the uncanny valley" in Hodge, B., Kelly, P. and Semler, L. (Eds.) What was the Human? Melbourne: Australian Scholarly Publishing.

[unpaginated manuscript draft]

Not quite human: traversing the uncanny valley

Kathy Cleland

From early automata to contemporary robotics and digital animation, human beings have always been fascinated by life-like human simulations. With advances in computer graphics, robotic technologies and artificial intelligence programming, robots and animated digital characters are becoming increasingly human-like in both appearance and behaviour. However, there are a number of difficulties for roboticists and artists who want to create believable robots and animations that have human-like appearance, behaviour and emotions. It is not easy to achieve the 'holy grail' of the perfect human simulation. Human appearance, particularly facial expressions and fluid physical movements, and believable and appropriate social interaction and behaviour are proving to be far more difficult challenges to conquer than simulating human intelligence. Artificial Intelligence (AI) programs such as IBM's Deep Blue can beat even the best human chess players but no one has yet created a robot or a digital animation that can pass as human. And the real problem is not just that these near-human creations don't pass as human but that they can generate decidedly uncanny responses in audiences.

The uncanniness of human-like simulations is not a new phenomenon. Sigmund Freud's 1919 essay *The Uncanny* describes the inherent uncanniness of waxwork figures, like-like dolls and automata, and includes a lengthy discussion of E.T.A. Hoffman's 1816 story *The Sandman* where a young man becomes infatuated with an uncanny life-like doll. But what exactly is it about these 'almost human' simulations that arouse feelings of uncanniness? Why do they disturb us? Both Freud and Ernst Jentsch (whose 1906 "On the Psychology of the Uncanny" Freud references extensively) suggest that uncanniness is generated by our sense of unease when the boundary between living and non-living is put in question. According to Jentsch, uncanny feelings are awakened "when there is intellectual uncertainty whether an object is alive or not, and when an inanimate object becomes too much like an animate one" (Freud 2003: 135).

Looking at simulated humanoid entities makes us reflect on the boundary conditions of exactly what it means to be human and the qualities that characterise human appearance and behaviour. The more human our humanoid creations look, the more we expect from them. When humanoid robots or virtual characters fail to look and behave as we expect humans to behave, whether this is a result of technical limitations or programming glitches, they typically come across as being unconvincing, stupid, socially inept and even downright creepy. Technical problems lead to social problems.

Feelings of uncanniness are also generated by humans who appear inhuman or out of control of their mental or physical faculties. Freud quotes Jentsch's discussion of the

uncanny effect "produced by epileptic fits and the manifestations of insanity, because these arouse in the onlooker vague notions of automatic—mechanical—processes that may lie hidden behind the familiar image of a living person." Freud also links this sense of uncanny unease with primitive fears of demonic possession (Freud 2003: 135).

Freud's ideas about the uncanny have been taken up more recently by Japanese roboticist Masahiro Mori in his essay about "bukimi no tani," translated as the uncanny valley (Mori 1970). Mori arrived at his hypothesis of the uncanny valley while conducting psychological experiments where he measured human responses to robots that incorporated varying degrees of anthropomorphism; and his ideas have also been applied in the film and animation industries. Mori argued that positive human responses to human-like entities increase as those entities become more realistically humanoid in their appearance and behaviour up until a certain point when these entities become almost human. At this point, Mori argues, it is the non-human characteristics that tend to stand out, we start to notice the 'not-quite-right' facial expressions, the flat skin tone, the strangely lifeless eyes and the disjointed movements. These 'almost human' entities appear more like animated corpses or zombies than the healthy human beings they are supposed to resemble. At this point human responses dip from feelings of empathy into the disquiet of the uncanny valley. Creating a healthy looking human simulation remains the ultimate challenge in beating the uncanny valley (Mori 1970).

It appears we are quite willing to suspend our sense of disbelief when human-like characteristics are displayed in entities that behave in human-like ways but are clearly non-human, for example, cartoon-like entities such as Bart Simpson or robots like *Star War's* R2-D2 and C-3PO. We are happy to fill in the gaps and project features and qualities into these abstract humanoid representations, however, when those gaps are filled in for us by simulations that try to be more realistically humanoid but don't quite get it right, our responses are far less positive. Rather than generating feelings of engagement and empathy, these simulations generate feelings of disquiet and repulsion.

The disturbing and alienating effects of the uncanny discussed by Freud, Jentsch and Mori can be clearly seen in contemporary audience responses to humanoid robots and digital animations. Japanese roboticist Hiroshi Ishiguro, based at Osaka University, has created a number of ultra life-like humanoid robots including one modelled on his young daughter. The goal of Ishiguro and his team at Osaka University is to create a perfect humanoid robot that overcomes the uncanny valley. However, his creations, while impressive, still come across as more than a little creepy. Repilee 1, the android twin of his young daughter, which he calls "my daughter's copy" reportedly made his daughter cry. "My daughter didn't like my daughter's copy," Ishiguro told a journalist over the phone. "Its movement was very like a zombie" (Tucker 2009). His more recent creations including Repliee Q2, based on a female Japanese television presenter, and his new Geminoid, a tele-operated robot copy of Ishiguro himself, have more life-like skin textures and movements but they have still not fully emerged from the uncanny valley. Even more unsettling is the giant robot baby CB2 which is130cm tall, weighs 33kg, and is covered in a strange greyish putty-like silicon. CB2 has been designed to learn from its environment and its human interactors and YouTube footage shows the robot baby blinking and looking around with strangely blank black

eyes as it responds to human touch and its uncoordinated body flops around as it tries to learn to stand. Rather than evoking the strong feelings of protective care and empathy that we would normally feel for a human baby, CB2 is a bizarre creation, and its strange vocalisations, appearance and freakish size make it the poster child for the robotic uncanny.

Similar feelings of uncanniness are provoked by human simulations in digital animation. In an article in *Wired* magazine, journalist Paula Parisi calls a resurrected digital clone of Marilyn Monroe a "digital Frankenstein" commenting that in her reanimated form, the digital Marilyn has "a propensity to slip at a moment's notice from strikingly beautiful to alarmingly grotesque" (Parisi 1995). Similarly, animator Ward Jenkins describes Robert Zemeckis' digitally animated film *The Polar Express* as a: "living-dead land" with "freakish half-dead soulless children" and characters that look "bizarre" and "unconvincing" (Jenkins 2004).

What is most uncanny about these 'nearly human' simulations is that they resemble unhealthy humans, or humans who are not truly alive. As Mori states in his essay on the uncanny, it is the appearance of the healthy human that is the goal to be strived for in trying to beat the uncanny valley. The uncanniness of today's robots and digital animations is that they look like sick humans, or humans who are not in full control of their mental functions or physical movement—they resemble mechanically possessed zombies, or dead things digitally animated. As Freud and Jentsch point out, unhealthy humans and humans that appear possessed or in some way mechanical, call into question their status as fully human and provoke strong feelings of intellectual uncertainty, disquiet and anxiety.

It is also very likely that there is a neurological basis underpinning these feelings of uncanniness that goes deeper than intellectual uncertainty about whether something is human or non-human, living or dead. We react on a subconscious neurological level to signs that something is 'not quite right' when we watch human movement and body language and when we look at human faces and facial expressions. Our reactions are based on thousands of years of human interaction where human physical agility and being able to correctly read human facial expressions and interpret emotions and intentions have been vital evolutionary survival skills. We use these same skills to read and evaluate humanoid robots and digital simulations.

Indeed, in *The Media Equation: How People Treat Computers, Television and New Media Like Real People and Places* (1996) Byron Reeves and Clifford Nass argue that there is no essential or functional difference in how the brain responds to 'real' people in the physical world, and how it responds to media images and artificial entities. According to Reeves and Nass our 'old brains' have not yet caught up with our new media technologies and they do not have the sophistication to distinguish between a real physical object in the world and a media image or robotic simulation. Their research suggests that humans are neurologically 'hardwired' to respond to computer images and robots in the same way that they respond to real life people and places. This does not mean that we can't tell the difference on a rational conscious level, but rather that people tend to unconsciously respond in essentially the same way to screen images of a person or a virtual computer persona as they would to a real person. Ingrained physiological responses (such as reacting to facial expressions and

emotions) and social responses (such as a tendency to be polite) are carried over from the physical world into our interaction with virtual characters and robots.

Drawing on Reeves and Nass's thesis that our 'old brains' respond to human simulations as if they were human, then it is not surprising that when those humanoid simulations don't look quite right, rather than putting the disturbance down to a mere technical issues, we respond in the same way as we would to a human that looked unhealthy, sick or zombie-like—we feel uneasy and disturbed. Roboticist David Hanson speculates that the experience of the uncanny valley phenomenon can be traced to a hardwired neurological response—a neurological "emergency alarm"—as our brains respond uneasily to images of humans who look sick, unhealthy or zombie-like (2003).

Even if the uncanny valley can be overcome in terms of appearance and movement, the display of appropriate emotions and social responses will continue to be challenging. Researchers and theorists such as Rosalind Picard from the Affective Computing Group at MIT suggest that the development of believable, life-like robots and virtual characters also depends on creating humanoid simulations with an emotional, affective dimension that incorporates appropriate interpersonal behaviours and social responses. The more human-looking a virtual character or robotic entity is, the more audiences will expect them to act and behave and communicate in a human-like manner (Picard 1997).

This is a tough job. Even without visual cues, getting a humanoid simulation to engage in a believable conversational exchange with a human has proved to be a very difficult task as is evidenced in the so-called Turing Test. Alan Turing set out his famous test for computer intelligence in his influential 1950 essay "Computing Machinery and Intelligence" where he describes the scenario for an 'imitation game' to test whether a computer can successfully imitate a human being. The test is based on an earlier imitation game where an interrogator tries to guess the gender of two participants (one male and one female) by asking them questions and assessing their typewritten replies (the participants are hidden from view). In Turing's version of the game, he replaces one of the human participants with a computer and suggests that if the interrogator cannot tell the difference between the human and the computer purely from their answers, then the computer can be said to be intelligent. So far, no computer has successfully fooled a human interrogator over a lengthy period of interaction.

Once visual cues are added in, things are even more complex. In humans, emotion is displayed by facial expression, voice (and vocal intonation), gesture and body language. Humans learn to understand these affective cues as infants long before they learn to understand spoken words and to form rational thought processes. However, while emotion and affect are natural and integral components of social relationships and communication for humans, giving digital simulations the ability to recognise and display emotion is a very complex problem. It is much easier to program computers to process higher level cognitive skills such as rational thinking and complex mathematical computation than to create fluid movements, believable facial expressions, emotions and appropriate social responses.

Avoiding the uncanny valley

The most obvious way for animators and roboticists to avoid the uncanny valley is by making their creations more abstract and less naturalistically human looking. Mori recommends designing aesthetically pleasing robots with a human appearance and human-like movements, but still maintaining a clear degree of visible artificiality. Another strategy is to play up the alien and non-human aspects of humanoid simulations for example the Gollum character in Peter Jackson's *The Lord of the Rings* and the humanoid Na'vi race in James Cameron's *Avatar*. The advantage of incorporating clearly artificial non-human elements is that audiences will be more accepting of non-human appearance, movements and behavioural lapses.

The uncanniness we experience in response to robots and digital animations may also just be a transitional phase. New technologies and technological forms, particularly when they are still in the glitchy development phase, are far more likely to generate responses of uncanniness than technologies that we are already habituated to. It is likely that as robotics and animations technologies improve and digitally animated human characters and robots become more familiar, and pass into the terrain of everyday experience, they will increasingly lose their power to startle and disturb us, and will become part of the fabric of our technologically saturated 21st century lives.

Film theorist Tom Gunning argues that when a new media technology is experienced for the first time, it evokes a sense of wonder and awe which is often equated with the magical and the uncanny. In his essay "Re-Newing Old Technologies: Astonishment, Second Nature, and the Uncanny in Technology from the Previous Turn of the Century" Gunning links the early "cinema of attractions" with the magic tricks and illusions of variety theatre and with the display of scientific curiosities and marvels in science fairs and expositions. Just as contemporary audiences today marvel at new digital special effects in films, games and technology fairs, so too were early cinema audiences intrigued and delighted by the uncanny magic of still images coming to life and early stop motion animation and special effects.

Robotics and digital animation are still relatively new technologies. In the current cultural moment we have a heightened awareness of the unique new qualities and modalities of these emerging new digital technologies and the images and artefacts they create. We are still watching their development, marvelling over new technological accomplishments and keenly discussing future possibilities and limitations. While these new technologies are in this transitional state, the attention of audiences will continue to be drawn to technical aspects, both the 'wow' features of technical virtuosity and the failures of technological limitations such as the uncanny valley.

However, as Gunning argues, the introduction of new technologies is an evolution from "the spectacular and astonishing" to "the convenient and unremarkable" (2003: 39). As new media become old media, they become part of the fabric of our reality and start to be taken for granted as a 'second nature.' Media theorist Marshall McLuhan makes a similar argument in *Understanding Media* (1967), where he suggests that as media technologies are domesticated and we become familiar with their different modalities, we become increasingly anaesthetised to them. So it is likely that the uncanny valley will increasingly become less of an issue as technological advances in robotics and animation lead to more life-like and realistic human simulations and we become increasingly anaesthetised to small technical

glitches and anomalies. Our hardwired primitive brains may still perceive anomalies but we will cease to be strongly affected by them. Digital animation and robots will become familiar and unremarkable, as perhaps they already are for a younger generation of digital natives who have never known a world without computers, the internet and video games (Tapscott 1998; Prensky 2001).

The pleasures of the uncanny

While it is perhaps more common to focus on the problems associated with the uncanny, it is important to point out that there are also positive aspects as well. Although uncanny objects and experiences typically generate uncomfortable and negative emotions, human beings also appear to be strangely drawn to them and fascinated by them. Why is this? There is no doubt that uncanny entities are interesting and compelling—they represent an intriguing challenge for the human brain because they are difficult to categorise and blur the boundaries between different types of entities (Is it alive or not? Is it human or not? Does it think? Does it feel?) Uncanny objects can generate intensely ambivalent feelings—disquiet and uncanniness go hand in hand with interest and fascination. Our brains and emotions go on high alert as we try to work out what we are dealing with. Are they threats or opportunities? Potentially dangerous or friendly? The uncanny makes us think and it makes us feel. It generates a seductive frisson, a delicious shiver down the spine.

The ambivalent feelings and responses generated by uncanny objects make them highly ambiguous and emotionally charged entities. Rather than seeing this ambivalence and ambiguity as negative characteristics, I would argue that this is precisely what makes the uncanny so fascinating. This is definitely the case in art and literature where the experience of ambiguity and contradiction is a valued characteristic and multiple and unstable meanings are viewed as positive rather than negative. As the English Romantic poet John Keats argued, intellectual uncertainties don't necessarily need to be resolved, there is a fertile creative potential in what he describes as the "negative capability of the artwork which he described as a "capability of being in uncertainties, Mysteries, doubts without any irritable reaching after fact & reason"" (Keats cited in Wu 2005: 1351). There is a pleasure in novelty, and unpredictability. The human brain likes a bit of cognitive friction and uncertainty and this experience can be very productive and creative.

One of the key roles of art is to make us look at things in a new way—to 'make the strange familiar, and the familiar strange,' so it is not surprising that the uncanny is a productive site for artistic practice. Art can make us look at things with fresh eyes and re-evaluate familiar assumptions and preconceptions. It is interesting to note here that the English word uncanny is a translation of the German word *unheimlich* (un-homely) and in his essay on the uncanny Freud himself suggests that the 'familiar made strange' is key trigger for the uncanny, "the uncanny is that species of the frightening that goes back to what was once well known and had long been familiar" (2003: 124). Something that is perceived as familiar suddenly is revealed to be decidedly not familiar—what appears to be human is revealed to be a doll or automaton or an inanimate object displays signs of movement and life-like properties.

Fantasy, suspension of disbelief and the magic circle

The context of how we experience potentially uncanny objects is also a very important factor in determining whether those experiences will be positive or

negative. In *The Uncanny*, Freud relates feelings of uncanniness to a blurring of the boundary between fantasy and reality—magical practices, or something imaginary becoming real can both be sources of the uncanny (2003: 150). However, as Freud points out, these experiences are only uncanny when they occur in the real world. Inanimate objects coming to life in myths or fantasy narratives (e.g. Pygmalion and Hans Christian Anderson fairytales) are not necessarily perceived as disturbing or uncanny, "…many things that would be uncanny if they occurred in real life are not uncanny in literature, and…in literature there are many opportunities to achieve uncanny effects that are absent in real life" (2003: 155-156). In the world of fantasy the usual rules of reality and everyday experience do not apply, we experience what Samuel Taylor Coleridge famously called a "suspension of disbelief" where elements of fantasy and the supernatural are readily accepted by readers and audiences within the context of artistic scenarios.

Also relevant to the idea of fantasy and the suspension of disbelief is the concept of the magic circle that is used in play and game analysis (Huizinga 1955; Salen and Zimmerman 2004). Huizinga uses the term magic circle to describe zones of cultural interaction where the realities and rules of the everyday world may be temporarily suspended:

> All play moves and has its being within a playground marked off beforehand materially or ideally, deliberately or as a matter of course… The arena, the card-table, the magic circle, the temple, the stage, the screen, the tennis court, the court of justice, etc., are all in form and function play-grounds, i.e., forbidden spots, isolated, hedged round, hallowed, within which special rules obtain. All are temporary worlds within the ordinary world, dedicated to the performance of an act apart (Huizinga 1955, p. 10).

Many zones within society can act as magic circles from game environments, to theatrical performances, films, galleries and even technology fairs. Strange 'magical' things can happen in these spaces without necessarily triggering feelings of uncanniness. Or perhaps it is more accurate to say that these spaces allow us to experience and maximise the pleasures of the uncanny while minimising its more disturbing aspects. When the uncanny is experienced within the safe confines (the 'magic circle') of a film, novel, gallery, science expo, etc.) we are free to explore the pleasures of the uncanny without any real threat. Audiences can have physically, intellectually and emotionally 'risky' experiences without the 'real' risk or threat that might accompany that experience in everyday life.

This is clearly demonstrated in David Hanson's exit poll of visitor responses to his realistic android head of Philip K. Dick at a science expo. As Hanson comments, despite the fact that the back of the robot's head was missing so that audiences could see the uncanny robotic interior behind its artificial human-like 'frubber' skin, "…people who interacted with the robot appeared entertained, not disturbed or afraid. The robot held peoples' attention in conversation for many minutes and even hours. People held the android's hand while talking with it, and even spontaneously hugged the android at the end of the conversation. In the exit interviews, 71% said the robot was "not eerie," and 89% "enjoyed" interacting with the robot" (Hanson 2006).

Clearly the context of the encounter and the audience's expectations are very important in determining whether an encounter will be experienced as uncanny or not. Hanson's example above shows that audiences can quickly get over initial feelings of uncanniness if they become sufficiently intrigued and engaged by the interactive encounter. It is also likely that the lack of uncanny responses to Hanson' robot head is due to the fact that the audience clearly knew that the head was robotic from the start of the encounter.

Uncanny responses are far more likely to be provoked when something that was thought to be human is unexpectedly revealed to be non-human. As Freud points out, the uncanny often involves a revelation, a moment of unexpected and shocking awareness as "something that was secret or hidden away com[es] into the open (2003: 132). Clearly foregrounding the non-human nature of a humanoid simulation provides a strong measure of inoculation against uncanniness. Because of this, Hanson's exposed robot head is not as uncanny or disturbing as the scene in Steven Spielberg's film *A.I.* where a robot that perfectly simulates a young woman is suddenly turned off before her head is opened to reveal the inner workings of her robotic interior, or the scene in *Terminator 2* where Arnold Schwarzenegger's terminator character peels back the human-looking skin on his arm to reveal a bloody but non-human mechanistic interior to his horrified audience to prove he is a cyborg not a human. Here, the perfect human simulation is revealed to be an inhuman machine, the display of the interior machinic workings inside the human exterior opens up the uncanny gap between the strange and the familiar, the human and the inhuman.

The uncanniness of the technological double

Another possible reason why we find robots and other humanoid simulations uncanny is due to a fear that these technological doubles may end up competing with and even replacing us. Perhaps, after all, this is the true source of the uncanniness that robots and digital simulations provoke in us. It is not the failure of our technological creations to be human that disturbs us so much as our fear that they will surpass and destroy us—a narrative that has been played out in countless Western science fiction narratives from Mary Shelley's *Frankenstein* and Karel Capek's *R.U.R. (Rossum's Universal Robots)*, to more recent narratives such as *Bladerunner*, *The Terminator* and *The Matrix*.[1]

In *The Uncanny*, Freud links the idea of the double (as seen in mirror images, shadows and other representational images) with ghosts, tracing the origin of the double to the evolution of the idea of the soul as a response to the fear of death. Freud speculates that the existence of a double is at first seen as a protection from death, "an insurance against the extinction of the self," but then "the meaning of the 'double' changes: having once been an assurance of immortality, it becomes the uncanny harbinger of death" (2003: 142).

[1] These typically dystopian representations of robots in Western culture contrast strongly with the more positive depiction of robots in Japanese popular culture (e.g. Astroboy) and this cultural difference is reflected in the general popularity of humanoid robots in Japanese culture. This positive attitude towards robots has been linked to the Japanese tradition of animism that blurs distinctions between organic beings and inanimate objects (Sone 2008).

Today's humanoid doubles are being created through robotic technologies, digital animation, artificial intelligence and genetic cloning. While these new technologies may promise a life beyond the grave (human brains transplanted into robotic bodies; virtual and physical clones), they also represent a threat to traditional religious and humanistic notions of the human. Optimistically, these technological doubles can be seen as prosthetic extensions of the human leading us to a post-human future, but, for some, there is a threat that what is human may be lost in this transition to the post-human, or that the post-human may even leave the human behind entirely.

Jean Baudrillard, the 20th century's leading commentator and critic of simulation technologies, writes of the uncanny fear generated by the double and the clone, particularly when they are materialised as separate and autonomous entities. In his essay "Clone Story" published in *Simulacra and Simulations* (1994), Baudrillard writes:

> Of all the prostheses that mark the history of the body, the double is doubtless the oldest. But the double is precisely not a prosthesis: it is an imaginary figure, which, just like the soul, the shadow, the mirror image, haunts the subject like his other, which makes it so that the subject is simultaneously itself and never resembles itself again, which haunts the subject like a subtle and always averted death. This is not always the case, however: when the double materializes, when it becomes visible, it signifies imminent death (Baudrillard 1994: 95).

In the entertainment industry, digital imaging and animation techniques are already being used to create virtual actors that can act on behalf of or replace their human counterparts. The computer gaming industry is at the forefront in this arena, developing increasingly realistic digital characters based on living actors and other public figures. In video games, the images of actors, sports stars and other celebrities are routinely scanned and then digitally animated as interactive characters, and it is becoming increasingly common for actors and sports stars to negotiate the use of their images in game titles such as HBO's *The Sopranos: Road to Respect* and EA Sport's games such as *NFL Tour* and *Tiger Woods PGA Tour*.

Dead movie stars like Marilyn Monroe, Humphrey Bogart and Marlene Dietrich have also been brought back to life and reanimated using digital compositing and animation techniques so that their virtual clones can perform in new contexts. Virtual actors may come to compete with or even supersede living human actors entirely. In *Media Matrix* (2003), Barbara Creed comments that:

> A digitised film star is a studio's dream—capable of performing any tasks, continuously available, cost effective and causing no scandals, unless of course, the digital star is given an off-screen life in order to keep alive other areas of the film-star industry such as fan magazines, merchandising and promotions (Creed 2003: 161).

Creed quotes Hollywood actor Tom Hanks as being "very troubled" about this idea of digital actors replacing human actors. Hanks comments "… it's coming down, man. It's going to happen. And I'm not sure what actors can do about it" (Hanks 2001 quoted in Creed 2003: 160).

This scenario of a virtual star replacing a human actor is played out in *S1m0ne* (2002) directed by Andrew Niccol. In the film, Hollywood director Viktor Taransky (Al Pacino), becomes so frustrated with the behaviour of his female star (played by Winona Ryder) that he creates his own virtual star "Simone" (short for "simulation one") to replace her. In Simone, Viktor creates his idea of the perfect actress—and the perfect woman—a digital composite morphed together from the digital files of famous actresses such as Meryl Streep and Lauren Bacall. Simone quickly becomes a global star and, despite the fact that she never appears in person, her many fans never doubt for a moment that she is as human as she appears to be. Simone is the perfect fake, Tom Hank's fear come to life.

However, the hype around virtual stars has largely remained just that, hype—novelty gimmicks that have failed to live up to either the promises of their creators or the fears of their technophobic critics. Today's human simulations are a pale reflection of the real thing. From the audience's point of view it is also questionable whether these digitally created performances can ever have the same emotional depth and impact as an original human performance. Jim Rygiel, the Oscar-winning visual-effects supervisor of *The Lord of the Rings* trilogy comments:

> There's talk in my field about creating Bogart and Marilyn Monroe and making movies with them again. But you'll never really be able to do it because you can't capture their souls in a computer. You'll never know how Bogart would've played a scene. And ultimately that's what people pay to see (quoted in Gordon 2004).

The central irony in *S1mOne* is that the digital actor Simone is in fact played by a human actor (the uncredited actor Rachel Roberts)—Hollywood couldn't deliver on its own premise. We are not yet at the point where an animated digital character can pass what we could call the 'Virtual Human' Turing Test, i.e. when the viewer can't tell whether the image they're watching is a virtual human simulation or a real human actor.

And, as Rygiel comments, even if virtual actors do become visually indistinguishable from human actors, they will still differ from human actors in their lack of emotional history and psychological depth. While they may have a human appearance they have no life history and have to make do with emotional repertoires borrowed from their human creators. As Creed comments:

> The cyberstar is not subject to the same experiences as the living star—experiences such as birth, mothering, separation, loss, ecstasy, desire and death. The cyberstar has not been through a process of being civilised, of learning to repress anti-social behaviour or taboo wishes. In short, the synthespian does not have a conscious or an unconscious mind. It is the latter—the unconscious—which is crucial in the formation of the self, and which binds us together as human beings (2003: 167).

'More human than human' …or the birth of the new?

Creating a perfect human simulation is the holy grail of digital animation and robotics. 'More human than human' is the slogan of the Tyrell Corporation that

makes the humanoid Nexus replicants in *Blade Runner*. But why this obsession with the human? Why do we want our new digital creations to replicate the human? Why limit them? Why should they be human? Isn't the birth of the new more intriguing than the replication of the old?

Perhaps the uncanniness we feel when we look at robots and digital simulations is a problem of 'first contact'? Should we should think of robots and digital animations as 'alien lifeforms' presaging an alien digital future? In *The Language of New Media*, Lev Manovich tells us that the "[s]ynthetic computer-generated image is not an inferior representation of our reality, but a realistic representation of a different reality," the reality of the cyborg. Manovich argues that we should not see these digital images as imperfect copies of the human body but as a new reality, a "perfectly realistic representation of a cyborg body yet to come" (Manovich 2001: 202-203).

In the faces of Asian anime-styled virtual characters and robots we see the emerging image of a new and alien life-form whose features bear an eerie similarity to those of an alien species—large head with large eyes and residual nose and mouth. These same characteristics are also typical of neonates. The combination of alien otherness with neonatal cuteness signifies a potent amalgamation of the alien with the neonate, appropriate signifiers for the birth of an alien technological species.

Conclusion

Our technological 'others' reveal a lot about what we believe is important to the notion of the human. Robots and virtual characters help to define the human –they are our technological reflections—idealised or inverted—held up as mirrors that affirm or challenge our humanity.

In the 21st century humanoid robots and virtual humans are set to become an increasingly familiar part of our everyday lives, but it is unlikely they will ever be able to fully pass as human. Tom Hanks is probably safe, it is the bit player and the extra that have cause to be worried as virtual actors start to routinely take their places in crowd scenes. With improved technology and greater familiarity, it is also likely that even if there is some residual uncanniness evident in our humanoid robots and animations, it will become increasingly less disturbing. We will learn to live with our part-humanoid and part-alien others.

Baudrillard, Jean. Simulacra and Simulation. 1981 (in French). Trans. Sheila Faria Glaser. The Body in Theory. Ann Arbor: University of Michigan Press, 1994.

Creed, Barbara. Media Matrix: Sexing the New Reality. Crows Nest, NSW: Allen & Unwin, 2003.

Freud, Sigmund. The Uncanny. 1919. Trans. Hugh Haughton. London: Penguin, 2003.

Gordon, Devin. "Polar Expedition." Newsweek October 25 2004. 6 October 2006. <http://www.newsweek.com/id/55375>.

Gunning, Tom. "Re-Newing Old Technologies: Astonishment, Second Nature, and the Uncanny in Technology from the Previous Turn of the Century." Rethinking Media Change: The Aesthetics of Transition. Eds. David

Thorburn, Henry Jenkins and Brad Seawell. Cambridge, Mass.: MIT Press, 2003. 39-60.
Hanson, David. "Interpreting the Neural Basis of The "Uncanny Valley"". 2003. online. 2 February 2006. <http://www.hansonrobotics.com/press.php>.
---. "Exploring the Aesthetic Range for Humanoid Robots." Toward Social Mechanisms of Android Science: an ICCS/CogSci-2006 Long Symposium. Vancouver, Canada, 2006. 16-20.
Huizinga, Johan. Homo Ludens: A Study of the Play-Element in Culture. Boston: Beacon Press, 1955.
Jenkins, Ward. "The Polar Express: A Virtual Train Wreck". 2004. blog. 14 December 2006. <http://wardomatic.blogspot.com/2004/12/polar-express-virtual-train-wreck.html>.
Manovich, Lev. The Language of New Media. Leonardo. Cambridge, Mass. ; London: MIT Press, 2001.
McLuhan, Marshall. Understanding Media: The Extensions of Man. 1st Sphere ed. London: Sphere Books, 1967.
Mori, Masahiro. "Bukimi No Tani (the Uncanny Valley)." Energy 7.4 (1970): 33-35.
Parisi, Paula. "The New Hollywood". 1995. Wired 3(12). 5 November 2006. <http://www.wired.com/wired/archive/3.12/new.hollywood_pr.html>.
Picard, Rosalind W. Affective Computing. Cambridge, Mass.: MIT Press, 1997.
Prensky, M. "Digital Natives, Digital Immigrants." On the Horizon 9.5 (2001): 1-2.
Reeves, Byron, and Clifford Ivar Nass. The Media Equation: How People Treat Computers, Television, and New Media Like Real People and Places. Stanford, Calif., New York: CSLI Publications, Cambridge University Press, 1996.
Salen, Katie, and Eric Zimmerman. Rules of Play: Game Design Fundamentals. Cambridge, Mass.: MIT Press, 2004.
Sone, Yuji. "Realism of the Unreal: The Japanese Robot and the Performance of Representation." Visual Communication 7.3 (2008): 345-62.
Tapscott, Don. Growing up Digital: The Rise of the Net Generation. New York: McGraw-Hill, 1998.
Tucker, Abigail. "Robot Babies." Smithsonian Magazine July 2009. 10 November 2009. <http://www.smithsonianmag.com/science-nature/Birth-of-a-Robot.html>.
Turing, A.M. "Computing Machinery and Intelligence." Mind 59 (1950): 433-60.
Wu, Duncan. Romanticism: An Anthology. 3rd ed, 2005.