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Robot Bodies: Visual Transfer of the Technological Uncanny[1]

Gunhild Borggreen

Abstract

The essay starts and ends with examples of the Danish cognitive scientist Henrik Schärfe's robotic copy of himself, hereby addressing the issue of the 'technological uncanny' that this and similar geminoid robots have occasioned. Schärfe's close collaboration with Japanese robotics scientist Ishiguro Hiroshi calls for an investigation of the global flows of visual robot imagination, transferred from the early post-war Japanese manga to the medium of 'limited animation' in TV anime of the 1960s. Referring to David MacDougall's notion of the corporeal image, I argue how limited animation provides options for a cinematic encounter in which the ambiguity of the image seems to make the anime medium particularly fit to represent the unknown Otherness of android robots. This may also be what relates robot in animated film fiction with the development of humanoid robots in real life, and account for the way in which the technological uncanny in robots as well as in cinema has engaged scientists and writers since the early twentieth century. Robot

[1] The writing of this essay was made possible by a Japan Foundation Fellowship Grant in the spring of 2011. I would like to thank Associate Professor Môri Yoshitaka at Tokyo University of the Arts for hosting my project. An early version of this text was presented at ICOMAG (International Convention on Manga, Anime, Games and Media Arts) in connection with Japan Media Arts Festival 2012. In the text, Japanese names appear in their Japanese order with family name last, except in some publication references. [AQ3]

scientists today still investigate the boundaries between animate and inanimate, thereby contributing to a transvisual process leading from fictional representation to actual practice in a techno-scientific context.

Introduction

In April 2012, the American magazine *Time* included the Danish professor Henrik Schärfe as one of the 100 Most Influential People in the World.[2] The reason for his prominent nomination in *Time* is the way in which Schärfe, according to the magazine, tries to solve a fundamental issue concerning the boundaries between humans and machines. Henrik Schärfe is the director of the Center for Computer Mediated Epistemology at Aalborg University, and one of the research projects located at the centre, Gemimoid.dk, investigates relations between human and robots through the use of teleoperated android robots. Schärfe poses the question of human-robot relations with highly visual effects, as can be seen in Figure 1, a press photo from the Geminoid.dk website. Schärfe stages himself for the camera in the company of a robotic doppelgänger of himself, identically dressed and wearing the same hair style and beard. In this photo, Schärfe seems to evoke what film scholar Laura Mulvey calls the 'technological uncanny': an experience of uncertainty where the spectator is confronted with a visual illusion that appears inexplicable, even if only for a brief moment.[3] The viewer will scrutinize the photo and wonder who is the human and who is the robot. The viewer might then start pointing out what gives the robot away – is it the eyes, the hands? The image focuses attention on the importance of the visual in human relationships and interaction with technology: do robots need to resemble human beings in order for humans to interact with the technology? What does a robot look like in the first place? Are the relationships between human organism and machine now at the point where the 'cyborg is our ontology', as Donna Haraway notes: 'a condensed image of both imagination and material reality, the two joined centres structuring any possibility of historical transformation'?[4]

This particular example also addresses robots across cultures: Schärfe's geminoid robot was conceived in collaboration with Ishiguro Hiroshi, robot scientist at Osaka

[2] D. Ferrucci, 'Henrik Schärfe', *Time* (30 April 2012), 52–53.

[3] L. Mulvey, *Death 24x a Second: Stillness and the Moving Image* (London: Reaktion Books, 2006), 42.

[4] Donna Haraway, 'A Manifesto for Cyborgs: Science, Technology, and Socialist Feminism in the 1980s', *Socialist Review*, 15.2 (March–April 1985), 66.

Fig. 1: Henrik Schärfe and geminoid robot. Courtesy of Geminoid.dk. Reproduction permission granted.

University, and produced by Kokoro, a Japanese robot design and production company. This ties in with a certain notion of 'techno-nationalism' which displays a particular perspective of Japanese self-representation as a 'Great Country of Robots' (*robotto taikoku*).[5] The cultural perspective also refers to the concept of 'techno-orientalism' discussed for example by media scholars David Morley and Kevin Robins, who relate the concept to the Western world's fear of Japan's technological supremacy: if technology in the West is associated with modernity, then the loss of technological hegemony may lead to a sense of cultural 'emasculation'.[6]

[5] For example, the concept of Japan as 'robotto taikoku' featured in an hour-long television programme about robots produced and aired by NHK, the national broadcasting company in Japan, in June 2011. 'NHK Deep People' aired on NHK General on 13 June 2011. 'Jinkei robotto kaihatsusha'[Humanoid robot developers], *Deep People hôsô naiyô* [Deep People broadcasting content], http://www.nhk.or.jp/deeppeople/log/case0613/index.html (accessed 27 January 2012). [AQ3]

[6] D. Morley and K. Robins, *Spaces of Identity: Global Media, Electronic Landscapes and Cultural Boundaries* (London: Routledge, 1995), 167.

Morley and Robins point out how during the 1980s and early 1990s, Japan was associated with technologies of the future, such as cybernetics, robots and artificial intelligence, and was enveloped in a techno-mythology of simulation and new artificial realities centred on an idea of some kind of 'postmodern mutation of human experience'.[7]

In the 2000s, the image of Japan came to include popular culture and values associated with 'Cool Japan', and the branding of Japanese creative industries expanded to global dimensions.[8] In such creation of Japanese cultural imagery, the fields of technology and popular culture overlap because a significant part of popular culture narratives have science fiction-based plots and environments, while at the same time a lot of popular culture content is mediated through innovative technological devices, in which case technology comes to signify a merging of medium and representation. In the following, therefore, I will investigate how Japanese cultural representations of robots filter through layers of visual manifestations and provide a basis for understanding the emergence and challenges of the 'technological uncanny' in robotic bodies. Examples of Japanese popular culture, including manga (Japanese comics) and anime (Japanese animation), will provide a point of departure for analysing the transformation of the visual through the medium of drawing as well as the techniques of 'limited animation' and the bodily experience through a cinematic encounter. The Japanese examples provide an excellent case to analyse how media convergence and collective imagination contribute to transvisual process leading from fictional representation of robots and cyborg bodies to actual practice in a techno-scientific context. In more general terms, this opens a transvisual perspective because it triggers questions concerning the visual in transit through different media and different cultures.

Robots in Early Popular Culture

One of the first modern visualizations of robots, and indeed the origin of the word 'robot', is to be found in the Czech author Karel Čapek's play *R.U.R. Rossum's Universal Robots* from 1920.[9] Figure 2 presents a scene from the play staged in New

[7] Morley and Robins, *Spaces of Identity*, 168.

[8] M. Daliot-Bul, 'Japan Brand Strategy: The Taming of "Cool Japan" and the Challenges of Cultural Planning in a Postmodern Age', *Social Science Japan Journal*, 12.2 (2009), 247–66.

[9] K. Čapek, *R.U.R. Rossum's Universal Robots. Kollektiv-drama i tre akter med en komedie som indledning*, translated by Herman van Tooren (Aarhus: Aravna, 1990).

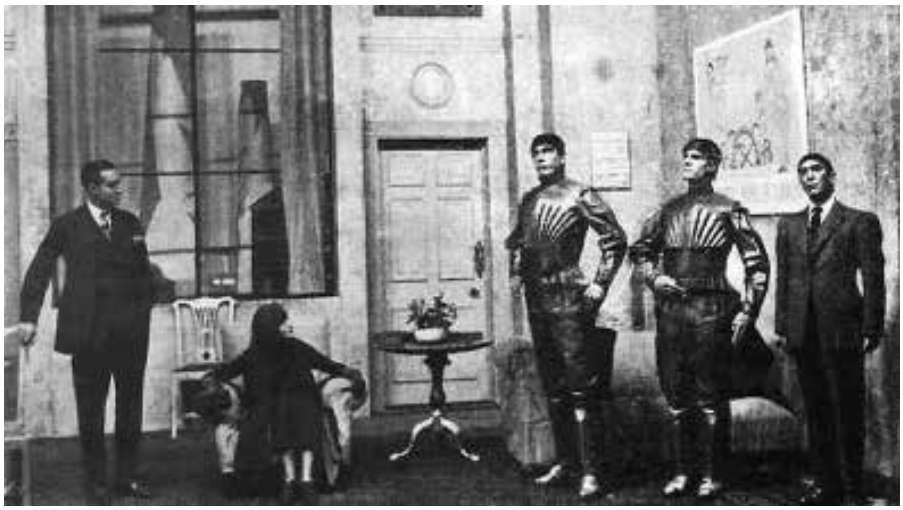

Fig. 2: Scene from Karel Čapek's *R.U.R. Rossum's Universal Robots* (1920), with three humanoid robots to the right. The photo may be from the first performance in New York at Garrick Theatre in 1922. Part of Wikimedia Commons, http://en.wikipedia.org/wiki/File:Capek_play.jpg

York in 1922, in which three robots, to the right, have entered the central office of the fictitious Rossum's Universal Robots factory.[10] Two of the robots are dressed in futuristic work clothes, while the robot to the far right is dressed as an office clerk. In this photograph, the bodies of the robots are represented as larger than the two human bodies (who are placed on the left side of the stage), and they display various kinds of uncanny features: the robots' arms and necks appear stiff, and their eyes do not focus on anything in particular.

This machine-like image corresponds to the specifications of the robots in Čapek's text, where they are described as 'a little stiff in their manner of movement and speech, their faces are expressionless and their eyes blank'.[11] This notion of a robot as a mechanical version of a human being that lacks smooth movement and a glimpse of the eye has come to dominate the visual representation of robots in

[10] The photo is downloaded from Wikimedia Commons, http://en.wikipedia.org/wiki/File:Capek_play.jpg. (accessed 20 November 2012). A note indicates that the photo is from the first performance of the play in New York at Garrick Theatre on 9 October 1922. 'Karel Capek's R.U.R. (Rossum's Universal Robots). Background and Summary', http://www.umich.edu/~engb415/literature/pontee/RUR/RURsmry.html (accessed 22 November 2012).

[11] Čapek, *R.U.R.*, 8; my translation from Danish to English.

mainstream cultural productions in the West for decades, and serves to reinforce the marking of the robotic body as the uncanny Other.[12]

In Japan, too, visual representations of various imaginings of robots as humanoids have flourished in fiction and popular culture. According to the historical perspectives proposed by manga critic Yonezawa Yoshiro, robot characters in Japanese manga and anime are part of a broad popular interest in science fiction. Emerging in the 1880s after the translation of a number of Jules Verne's novels, science fiction covers a wide range of perspectives, from fantastic space voyage to romance and everyday drama. The genre embraces various media such as *kamishibai* (picture storytelling), manga, anime, cinema and pulp fiction novels. Within manga, the genre of SF was one of the three major themes in *shônen manga* (manga for boys) along with sports manga and gag manga.[13] Numerous robots in Japanese manga and anime are humanoid, and they can be divided into two generic types: mechanical robots that are controlled by human, and robots that look and behave like human beings. The first type includes the giant robots that have no intelligence or will of their own, but act only as instructed by human beings. Mechanic robots represent machine power controlled by human intelligence, and are represented in the large number of gigantic transformer figures and mechanical monsters in Japanese popular culture.[14]

The other generic type is the humanoid robot who behaves and acts like a human. This type of robot is also known as an android robot, which may be defined as 'an artificial system designed with the ultimate goal of being indistinguishable from humans in its external appearance and behaviour'.[15] One of the early and most prominent android robot figures in manga fiction is Astro Boy (*Tetsuwan Atomu*; also known as Mighty Atom), a human-like robot with artificial intelligence and

[12] Čapek's play was translated into Japanese for the first time in 1923 by Uga Itsuo under the title *Jinzô ningen* (Artificial human beings), and was staged under that title by the theatre company Tsukiji Shôgekijô in 1924. However, as curator Kawanishi Yûri points out in a catalgoue on robots and visual art, the photo documents of this first performance of Čapek's play in Japan show that the robots on stage did not differ from human beings in visual appearance. See *Robotto to bijutsu – kikai vs shintai no bijuaru imeeji / Robots and the Arts – Visual images in the 20th Century Japan*, ed. Robotto to bijutsuten jikkô iinkai (Tokyo: Kôdansha, 2010), 29.

[13] Y. Yonezawa, *Sengo SF mangashi* [The History of Postwar SF manga] (Tokyo: Chikuma Bunsho, 2008).

[14] *Imadakara katareru 80nendai anime hiwa. Suupaa robotto no jidai* [*The secret story of anime of the 1980s told from today: The age of super robots*], ed. Arai Jun (Tokyo: Yôsensha, 2012).

[15] K.F. MacDorman and H. Ishiguro, 'Toward social mechanisms of android science', *Interaction Studies*, 7.2 (2006), 289.

Fig. 3: Tezuka Osamu, page from the chapter 'The Birth of Astro Boy', *Astro Boy: Books 1 and 2*, trans. Frederik L. Schodt (Milwaukie, OR: Dark Horse Manga, 2008), 26.

emotions similar to a twelve-year-old boy and who embodies autonomy and human qualities. Astro Boy was invented by Tezuka Osamu as manga figure around 1951, and was one of the first manga stories to be turned into an animated film, airing on the Fuji TV channel from 1963.[16] A page from the story entitled 'The Birth of Astro Boy' (Figure 3) shows an example of elements that characterize the differences between human and robot.[17] In the story, the robot Astro Boy is invented by a scientist as a replacement for the scientist's own twelve-year old son, Tobio, who is killed in a car accident. The scientist's ambition is to create a copy of a real human being, so he trains the robot to act and respond as a human, even on emotional levels such as expressing happiness and joy.

[16] F. Schodt, *The Astro Boy Essays: Osamu Tezuka, Mighty Atom, and the Manga/Anime Revolution* (Berkley, CA: Stone Bridge Press, 2007), Appendix B, 185–96.

[17] O. Tezuka, 'The Birth of Astro Boy', *Astro Boy. Books 1 and 2*, trans. Frederik L. Schodt (Milwaukie, OR: Dark Horse Manga, 2008), 26.

In the upper frame of Figure 3, the scientist is standing in his white coat at one end of a large space, while the robot boy (here still called Tobio, before it is given the name Astro Boy) is practicing walking. The text informs the reader that the robot's movement improves and becomes less stiff and awkward, and that the scientist is 'painstakingly teaching him that he was a human'. Being human, in other words, is a social process that can be learned and rehearsed. The text emphasizes that Tobio's movements 'became visibly smoother' every day. The following panels zoom in on Tobio's eyes, and the reader is told that 'even his eyes became more and more human-like', especially when the robot boy and the scientist walk together in the park, their arms around each other. The culmination of 'human-ness' is shown in the bottom panels, where Tobio is dressed in ordinary clothes, and smiles because his 'pleasure circuits' are activated. In other words, according to Tezuka's Astro Boy fiction, what makes a human human is smooth body movements, sparkling eyes, a pure smile and the expression of emotions such as happiness.

This ambiguity of the reality of the body in the fiction, of whether Astro Boy is a machine or a human, is played out in the visual medium of manga drawings itself. In drawing figures, objects and surroundings, Tezuka used a clear, round outline and graphic effects of black and white areas. In some of the drawings in the Astro Boy manga, the robot figure is rendered as a mechanical entity in which wires, bolts, joints, hatches and other elements related to machines are visible and recognizable. In most cases, however, such as in Figure 3, Astro Boy is depicted in the same manner and drawing style as figures representing human beings. In this case, for example, there is no visual difference between the robot boy and the scientist in terms of how they are depicted. Because of the iconic quality of the drawing, the visual connotations drive the imaginary recognition towards a human being, even though the reader 'knows' (by way of the narrative) that Astro Boy is a robot. The drawings thus enact a performative interaction when the reader at various points in the reading process becomes aware of this paradox in the encounter with the ambiguous android.

Corporeal Embodiment of Moving Images

In this investigation of how the visual human-like characteristics of a fictional robot transfers into robotics, it may be relevant to look closer at how this visualization of the 'live-ness' of a robotic body transform from still image into moving images. What was (and still is) the alluring power of the visual in Astro Boy that made the figure so popular worldwide in manga as well as in animation? This, I will argue, has to do with the specific techniques of Japanese animation productions that play out the qualities of the robotic body in the visual medium

itself, as suggested in the manga drawings above. In *The Corporeal Image*, film scholar and ethnographic film-maker David MacDougall describes how the human body becomes engaged and embodied in the cinematic experience in various ways.[18] In his book, MacDougall wants to re-examine the relationships between seeing, thinking and knowing, and refers in this context to philosophical conventions that divide human knowledge into meaning and being. MacDougall focuses on the kind of knowledge that is created in a spilt microsecond when an experience is still undifferentiated and embodies matter and mind on equal terms. Conventionally, vision has been privileged as a source of knowledge because meaning is understood as something retrieved through our ways of seeing. At the same time, language and linguistic systems structure much of the way in which knowledge is conveyed because knowledge in most societies is conditioned upon and organized by linguistic models. In his attempt to capture that brief moment of knowledge production that lies before the actual linguistic structuring of meaning takes place, MacDougall argues that meaning is produced not just through sight, but also through our whole body.[19] It is difficult to draw the boundaries between a bodily experience on one hand and the making of meaning out of it on the other, but, according to MacDougall, film is an excellent apparatus for creating a disturbance that highlights this distinction between experience and reflection.[20] Film is not a simple transmission of reality, but creates a new mechanical image of reality. Here it is possible to identify one step in a transvisual process of bodily experience in real life into a mechanical image in a transfer which is framed and formed through a technological device.

MacDougall argues that live action film imitates everyday life because film provides a constant stream of visual and other sensory information which the viewer then samples and consumes. As in everyday life, however, this information is never complete. In order to make sense, the information has to be complemented and compared with the knowledge and information every individual has from previous experiences as well as rules of perception and behaviour that are learned from cultural and social surroundings. Everyone enacts these types of creative response constantly in everyday life, but in film these processes of filling in the gaps are enhanced and emphasized. In film, the information is provided in stylistically varied ways, and because of this nonconformity, or distinctiveness, viewers are stimulated even further to enact creative responses. Viewers involve themselves in

[18] D. MacDougall, *The Corporeal Image: Film, Ethnography, and the Senses* (Princeton, NJ: Princeton University Press, 2006).

[19] MacDougall, *The Corporeal Image*, 3.

[20] MacDougall, *The Corporeal Image*, 16–17.

the cinematic encounter by accepting the task of connecting abstract, inconsistent and impossible elements of time and space.[21]

This theory of the willingness to incorporate the cinematic encounter may also account for animated film experience. If live action film is already abstract and inconsistent compared to 'real life', animation is even more so because it lacks the 'reality effect' that makes live action and other photo-based images appear 'realistic'. Drawings or computer-generated graphic images in animated films may at once be abstract and nonfigurative, but still, pictures are coded as to represent elements from a recognizable reality, even if the objects and figures are conveyed in sketchy, abstract and incomplete patterns. The viewer puts his or her creative response into action in order to fill in the gaps between his or her own knowledge and bodily experience, and the evocation of the real that is conveyed through the animated film. As media scholar Lev Manovich points out, synthetic photographs (3D computer graphics and computer animation) do not try to mimic 'reality'; rather, they strive for 'reality' in the form of photorealism that is culturally installed or made known through photography and film.[22] Here Manovich also argues for a close but complex relationship between the visual and the bodily experience in producing knowledge of 'reality'.

Movement in Robot Anime

Thus, the ambiguity of the image seems to make the anime medium particularly fit to represent the unknown Otherness of android robots. Most often, robot films are set in the future as one way of negotiating the lack of reality recognition. In the case of science fiction films featuring robots, whether in anime or live action film, it is safe to say that none of the narratives convey real scenarios. But even then, a number of elements in the film such as objects, characters and concepts need to be recognizable from real everyday experience at a certain level. Recognizable elements function as anchor points against which the viewer tests other visual and sensory information from the film, and connects them to his or her own mental and embodied knowledge from everyday life.

One feature in Japanese anime that seems particularly close to the notion of robots is found in the style of 'limited animation', which is one of the main characteristics of many Japanese anime. Limited animation is a means of economizing with the number of frames and other production elements in order to reduce production time. The result appears jerky and immobile, in contrast to 'full

[21] MacDougall, *The Corporeal Image*, 25.

[22] L. Manovich, *The Language of New Media* (Cambridge, MA: MIT Press, 2001), 200.

animation', which emulates live action film in its seamless and flowing movements in what film scholar Thomas Lamarre calls a 'recoding' of photographic cinema. Lamarre suggests that such recoding of live action film found in anime goes beyond imitation or reproduction because it 'unravels' live action and 'cuts to the quick of "live"'.[23] Media scholar Marc Steinberg analyses the aesthetics of animated movement developed through anime series such as Astro Boy that engage the desire of spectators in a complex relationship of movement and stillness.[24] In Astro Boy, segments of movement are interspersed with segments of stillness, for example between shot-reverse-shot sequences, where an inter-scene dynamic is provided without an intra-image movement. Immobility rather than movement dominates in the early Astro Boy TV anime from the mid-1960s, and the dynamics of the character or the story line is maintained by sound or narrative alone. Steinberg argues that this kind of immobility in anime binds together separate diegetic worlds and allows for communication between the animated image and the still image from the manga version as well as other immobile commodity forms of the character, such as figurines, stickers and other immobile accessories.[25]

The stillness of robot images in limited animation may have some interesting parallels to the human conception of robots in real life. Most robots only move their mechanical limbs when they are programmed to do so. Otherwise, they remain still. There are no unnecessary or excess movements in a robot. When they do move, most robots deploy rationalized and demarcated movements that appear stiff or intermittent compared to the seamless and fluid movements of a human body, similar to the first literary description of a humanoid robot in Čapek's *R.U.R.*, as discussed above. Actual humanoid robots thus correspond to representations of robots in anime film in their jerky movements or immobile moments, and account for the imaginary bond between robots in fiction and robots in reality. Robotic stiffness may influence or connect to the immobility of anime images of robots and thereby provide clues for understanding the close associations made between robots in anime and the innovations of robotics in science.

[23] Lamarre, 'From animation to *anime*', 333.

[24] M. Steinberg, 'Immobile Sections and Trans-series Movement: *Astroboy* and the Emergence of Anime', *Animation: An Interdisciplinary Journal*, 1.2 (2006), 192.

[25] Steinberg, 'Immobile Sections', 200.

Robots in Real Life

The 'willingness' to enact creative responses to the bodily encounter with robot figures in animated film can, however, be challenged by the physical unease and sense of uncanny-ness in meeting with the robot in real life. The 'technological uncanny' may emerge when the technology no longer offers a 'lack of reality' into which the spectator or user can fill the gaps with his or her own creative response through visual and embodied experience. This balance between the degree of realism in the machine and the effects of unease has been at the core of robot science as well as cinema technology since the early twentieth century. Laura Mulvey, in her book *Death 24x a Second*, relates early cinema technology with the uncanny within two broad topics, namely the boundary between life and death, and the coming to life of inanimate objects. Mulvey connects the issue of Freud's concept of the uncanny with the way in which the psychological aspect of the uncanny was discussed by the German psychiatrist Ernst Jentsch, who published an essay entitled 'On the Psychology of the Uncanny' in 1906. Mulvey compares Freud's and Jentsch's conceptions of the uncanny, and notes that both attribute the uncanny effect to the crucial division between life and death, between the animate and the inanimate, whether this division is exposed in a dead human body or in a mechanical replica of the human body.[26] In his text, Jentsch is attentive to the uncanny aspects of technological novelty, and he describes the reaction towards human-like objects as an ambiguous, contradictory emotion that is enhanced when the 'peculiar effect' of the uncanny in visual appearance is linked with 'certain bodily or mental functions'.[27] Jentsch writes that 'the life-size automata that perform complicated tasks, blow trumpets, dance, and so forth, very easily give one a feeling of unease', and describes the relationship like this: 'The finer the mechanism and the truer to nature the formal reproduction, the more strongly will the special effect also make its appearance'.[28] However, Jentsch also notes that such uncanny effects do not appear in cases where 'the objects are very small or *very familiar in the course of daily usage*', indicating that uncanny-ness may wear off once the object has become part of everyday life.[29]

Similar attention to the 'technological uncanny' and the boundaries between animate and inanimate human appearance is significantly displayed in robotics in

[26] Mulvey, *Death 24x a Second*, 38.

[27] E. Jentsch, 'On the Psychology of the Uncanny', trans. Roy Sellars, *Angelaki*, 2.1 (1995), 12.

[28] Jentsch, 'On the Psychology of the Uncanny', 12.

[29] Jentsch, 'On the Psychology of the Uncanny', 12 (emphasis added).

Fig. 4: *From right*: Henrik Schärfe, Ishiguro Hiroshi, and a woman whose identity is confidential, all three with their geminoid robot. Credit: Geminoid.dk. **Reproduction permission granted.**

the android copy of Henrik Schärfe mentioned at the beginning of this text. In Figure 4, Schärfe and his Japanese research partner Ishiguro Hiroshi pose together with a woman in her twenties (whose identity is confidential); all three of them pose next to an android copy of themselves (also known as a geminoid, a robotic 'twin' of a human).

Ishiguro began his research on humanoid and geminoid robots in the early 2000s, and his aims are to test the ways in which human beings respond visually and emotionally to machines – is there a limit to the degree to which a robot can resemble a human being? Ishiguro investigates the phenomenon of 'the uncanny valley' (*bukimi no tani*), a concept invented by robot scientist Mori Masahiro in 1970. Not unlike the arguments made by Jentsch in 1906, Mori's text theorizes the critical turning point of human verisimilitude in non-human entities such as prosthetic limbs or robots. Mori describes the uncanny valley as the location on a graphic curve depicting the relationship between human likeness and perceived familiarity of robots where deviation from human appearance will create an effect

of eerie or repulsion.[30] Mori recommended robot designers in the 1970s not to try to surpass the 'uncanny valley', but this is now being challenged by Ishiguro, when he applies android robots for testing human-human interactions in order to evaluate cognitive, neuroscientific and social theories. The findings so far seem to suggest that the more humanlike the robot is in visual appearance and behaviour, the more human-directed expectations the test persons [AQ1] elicit.[31] Ishiguro's tests also seem to confirm Jentsch's observation that the uncanny effect wears off when the object or the image becomes familiar through daily use or visual exposure.[32]

Henrik Schärfe's research collaboration with Ishiguro focuses on how humans relate to other humans by testing the response of the visual appearance of an android copy. Parts of the investigation try to pinpoint when human beings perceive the machine as 'uncanny', but, as Ishiguro has realized, the notion of what is 'uncanny' about a robot is not universal. Responses to non-human entities are dependent on cultural and historical context, and they are constantly changing because they are related to dynamic fields such as bodily experience and social imagination. Mediated through the limited animation of Japanese anime, notions of robots enter global cultural flows and allow for imaginary forces to seek the uncanny beyond binary conventions of identities such as ethnicity, gender and nationality. More significantly, they may challenge boundaries between life and the inanimate, between human and post-human existence. Anime robots connect fiction to real and potential robotic innovations through a visual correspondence of bodily movements and communication. Robots and other non-human technologies may thus be an important part of a transvisual approach because their appearance and behaviour draw upon broader epistemological issues of knowledge created in the gaps between representation and experience, between meaning and being.

[30] M. Mori, 'The Uncanny Valley', trans. Karl F. MacDorman and Takashi Minato, *Energy*, 7.4 (1970), 33–35.

[31] K.F. MacDorman and H. Ishiguro, 'The uncanny advantage of using androids in cognitive and social science research', *Interaction Studies*, 7.3 (2006), 303.

[32] In MacDorman and Ishiguro's attempt to confirm the uncanny valley, they conducted their inquiries on test persons from Indonesia because 'prior exposure of the Indonesian participants to humanoid and android robots was minimal, especially relative to people living in Japan where robots receive much greater media coverage'. MacDorman and Ishiguro, 'The uncanny advantage', 306. This seems to imply that the 'uncanny' effect may wear off after periods of visual exposure.

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Voume II
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