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Uncanny mechanics: industrial design and the threatened body

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ABSTRACT

The relation between the body and technology is well known, yet this complex relationship's relevance to industrial design is less known. Freud's well-known 'The Uncanny' stood as a classic theory among psychologists and social scientists. In this article I will stress the importance of Freud's theory in better understanding the connection between the designer and the end-user. This bond will be highlighted via case studies dealing primarily with the 'other body,' the unhealthy or hurt body. Furthermore, Freud's theory will echo current trends of social or inclusive design.

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Nathanael was stupefied-he had seen only too distinctly that in Olimpia's pallid waxed face there were no eyes, merely black holes in their stead; she was an inanimate puppet.

(Hoffmann, 1967: 210)

Preface: das Unheimliche then and now

During the 2012 London Olympics Oscar Pistorius, a 1986 born South-African athlete, competed in several events as an equal to his competitors, instead of competing at the Paralympics. Pistorius, nicknamed 'Blade Runner' for his special prosthetic legs which he wears in various athletics competitions, stands in the midst of a heated debate focusing on the fairness of his participation in the London Olympics alongside 'healthy' competitors.¹ In a somewhat similar fashion, American model Aimee Mullins comes to mind. After losing both her legs to a childhood disease, Mullins became a prestigious athlete (among others, she participated at the 1996 Paralympics) and a well-known model. In her famous TED lecture,² Mullins proudly presents the audience with 12 pairs of artificial legs which imbue her with 'superhuman' strength and abilities. Why do these extraordinary athletes cause such a mix of emotions, ranging from awe, pity, jealousy, grief and fear of the realization they are better than the rest of us, due to their technological limbs? Does Pistorius symbolize the metamorphosis from the quiet, suffering-yet-managing individual, into the disabled individual, functioning even better than his 'healthy' counterparts? And what is the role of the industrial designer in this dilemma, resolving around the fractured, technological body

versus the healthy body? In this article, I will address these issues of industrial design and the enhanced body. I will start by presenting the connection between Freud's theory of the uncanny and industrial design, and then proceed to illustrate this connection with several examples extracted from the daily work of industrial designers, which I gathered during my PhD field work. The theoretical concept standing at this article's center will be Freud's 'das Unheimliche' ('The Uncanny' or literally 'unhomely'). While researchers from various disciplines used this concept in order to explain an array of socio-psychological phenomenon – from urban spaces, through robots, puppets and medical objects – I will add another brick to 'das Unheimliche's theoretical wall vis-à-vis industrial design.

Freud describes the 'uncanny' as:

The uncanny is that class of the frightening which leads back to what is known of old and long familiar [...] The German word '*unheimlich*' is obviously the opposite of '*heimlich*' ['homely'], '*heimisch*' ['native'] – the opposite of what is familiar; and we are tempted to conclude that what is 'uncanny' is frightening precisely because it is *not* known and familiar [...] We can only say that what is novel can easily become frightening and uncanny; some new things are frightening but not by any means all. Something has to be added to what is novel and unfamiliar in order to make it uncanny. (Freud 2001 [1919], 220–221)

Therefore, turning something into 'the uncanny' stems from it being familiar on the one hand, yet novel and unrecognized on the other hand. This combination between the familiar and the unfamiliar is the cause, according to Freud, of our unnerving feelings when countering the uncanny. Industrial designers, in my eyes, and especially those dealing with medical or paramedical objects, and especially prosthetic or 'enhanced' limbs, are embodying the uncanny in their daily work. It is important to note, that in this article I will not delve into the complex world of prosthetic limbs, but rather the socio-cultural phenomena depicting the uncanny as a border designers are reluctant to cross. This article, which is part of a post-doctoral research conducted at the Royal College of Art (RCA), strives to add another brick in the ongoing research focusing on the user's body (the sick, disabled or 'different' body) as an inherent part of the industrial designer's work ethics and daily processes (Bichard and Gheerawo 2010; Clarke 2010; Ventura 2013). This agenda, rising to the surface in current academic debates, focuses on the importance of the end-user, as well as strengthening and even recreating the bond between the designer and his/her community. Further research is being conducted while focusing on the user, yet in this article I will mainly focus on the designer as a focal point in the design process. One should bear in mind that during the design process of prosthetic limbs, various professionals are involved, including physiotherapists, engineers and clinicians, working alongside the designer. However, by focusing on the designer I wish to highlight the power (or lack) of design as a material common denominator capable of bridging the gap between the broken and the healthy body. In the following pages, I will show how industrial designers penetrate the user body and enhance or modify it, while all along tread lightly on the threshold of creating an uncanny design, which will result in an uneasiness and even fear among the consumer and his/her immediate surroundings. Understanding various theories dealing with the user's body will lead, I hope, to better user-oriented design, and further still, to better socially situated objects.

The technological other: on design and the uncanny

When we proceed to review the things, impressions, events and situations which are able to arouse in us a feeling of the uncanny in a particularly forcible and definite form, the first requirement is obviously to select a suitable example to start on. Jentsch has taken as a very good instance 'doubts whether an apparently animate being is really alive; or conversely, whether a lifeless object might not be in fact animate' and he refers in this connection to the wax-work figures, ingeniously constructed dolls and automata. To these he adds the uncanny effect of epileptic fits, and of manifestations of insanity, because these excite in the spectator the impression of automatic, mechanical processes at work behind the ordinary appearance of mental activity. (Freud 2001 [1919], 224)

When citing Jentsch, Freud accurately describes the uneasiness we feel when seeing humanoid figures, resembling us, yet devoid of life. These lifelike figures, according to Freud, originate these feelings since they are 'uncanny,' i.e. resemble us, yet differ from us in an inherent fashion. This paragraph, among other, written by Freud and originating from an earlier account by Jentsch, urged me to try and explain industrial designers' attitudes focused on the consumer's body, as an object of uncanny.

The example standing at the core of this article is a part of my PhD research which included participant observations, various qualitative interviews, as well as content analysis, over a period of two years. In the heart of this research stood three Israeli industrial design studios chosen by several criteria (such as number of employees, international recognition, awards won, etc.). In this research, I focused on the intricate connection between the designer, the client and the end-user. Concisely, the design process begins by a brief provided by the client, which is then handed to the designer, who then proceeds to learn the end-user's various needs and constraints. Later on, the designer's concept is integrated with the works of other professionals including engineers, marketing experts, physicians and others.

During the 1990s researchers from different disciplines started recognizing the importance of consumers' preferences and behavior in the design of new products, technologies and user-oriented graphic design (Beyer and Holtzblatt 1998; Holtzblatt et al. 2005). A few years later, contextual and user-oriented design was being used in the marketing world, as well as industrial innovation and design. However, only several years later, the demand for qualitative, rich, 'from the native's point of view' data (contrary to focus groups or statistics analysis) was sought after by consumer-product corporations (Tsai Lu 2010).

Design ethnography was developed as a research strategy during the end of the 1990s, and targeted the gap between the consumer's world and that of the manufacturer. Salvador, Bell and Anderson (1999) claim that following the debates in the studio, targeted at meeting the manufacturer's demands, the designer is less and less oriented toward meeting the consumer's demands in tandem. In order to bridge this gap, while creating a close and personal connection with their potential consumers, designers adopted the guidelines of classic ethnography (mainly, a short stay in the field while conducting concise interviews and product-oriented observations – what is sometimes termed 'rapid ethnography'). Following these guidelines, the designer is transformed into a 'part-time anthropologist,' gathering data while staying, shortly, in the field. After leaving the field, designers process their gathered data and implement it to better plan and design future product. In my eyes, this approach presents a fair amount of problems, inasmuch as the designer functions as an anthropologist, while gathering specific data in order to design a better product, this 'dual role' may fall between the drops. However, a fully credited anthropologist is better suited to maintain

a deep and longer connection with the field. Surprisingly, not many corporations have yet realized design ethnography's potential in creating a better product.

According to Julier (2000), assimilating ethnography in the design process will result in innovative, useful and interesting results. Blomberg et al. (1993) follow the same route and claim that ethnography's unique keystones – holistic thinking, open-mindedness, adopting the 'native's point of view,' relying on the 'natural' products of the field, etc. – will highly benefit the designer in better understanding consumers' needs. The main friction-point may arise, according to said researchers, from the fact that while anthropologists delve deeply into the field, designers do so only as a brief and focused effort. Therefore, the designer has to change his/her perspective in adopting an anthropological viewpoint deriving from the way consumers experience reality.

My main thesis in regard to the user's body is that the act of design is an anthropological, socio-cultural and physical praxis, in the midst of which stands the user's body. In this I follow the footsteps of the modernists concentrating on functional, rational design, embedded in economic and industrial, as well as ergonomic considerations. Yet, a design stemming from anthropological thought, centering on the end-user's needs and constraints, will lead to a pluralist and more flexible design praxis, targeted at the ever changing *glocal* (global plus local) reality. By applying these anthropological methodologies, the designer will be able to better understand the user's complex reality and better accommodate the said situation. Conversely, the designed object can become the center of the design process, leading to a more socio-culturally embedded design, which will better suit the user and his/her daily routine. By examining the designed objects we, as viewers or researchers, can reconstruct the designer's decisions regarding the connection between the end-user's body and the designed object.

The relationship between the user and technology has changed significantly in the last two centuries – from a clear system, in which machines rule over humans, during the industrial revolution, to an era in which the boundary between the user and technology is vague at best (Sey 1999). In this postmodern era, man becomes more dependent on the use of communication, media and database technologies, influencing directly his social interaction in the private and public spheres (Knorr Cetina 2001). Furthermore, the human, social and cultural aspects of technology become central in sociological and anthropological research, as our society becomes more and more technological (Bell 2006; Pacey 1983). Amidst this techno-society the designer is positioned as a social agent, an artist/craftsman functioning as a surgeon, using his/her technological savvy to transform the organic body into a techno-organic one. From the user's point of view, the designer possesses magi-technological abilities enabling the 'defective' user to recreate prosthetic limbs, allowing him/her to function even better than his/her healthy counterparts do. The designer studies the human body, and then uses his/her technological abilities to take part in a constant recreation and transformation of the human physiology vis-à-vis technological breakthroughs.

Technology, therefore, serves as a central tool enabling the designer to deal with the 'flawed' body, physically or socio-culturally. Technology's universal and functional nature allows it to bridge over socio-cultural gaps by creating a versatile object suitable for various socio-culturally diverse users. By applying research and understanding the needs of the user, the designer imbues the object with relevant attributes, local as well as global.

Theoretically, the designer's work in bridging the gap between technology and the user's socio-cultural needs correlates with the 'post-human' era. In this era, we live in a constant

interface, physically as well as conceptually, with daily technological appliances present in our immediate surroundings (Morphy 2009). This can be clearly demonstrated by trying to imagine a modern researcher lacking his/her smartphone or laptop, which became vital extensions to our bodies. A crucial part of the changes we experience stem from design as well as technological processes. Furthermore, even changes put forward by the user while using the designed object, are a result of the constant negotiation between him/herself, the technology (design and engineering) and the planning and vision of the designer (Kingerly 2001).

When dealing with the injured or disabled body, one usually encounters various stigmas stemming from one's surrounding social environment (Goffman 1963). Furthermore, artificial limbs or paramedical products attached to the person's body might create negative connotations of discomfort, shame, disability or even inferiority, depending on their quality and design.³ Yet, the ever-evolving technology and a more socially conscious design approach can empower the disabled person's abilities in a way to even surpass the 'normal' person. However, as a double-edged sword, these technologically induced products (Cromby and Standen 1999) may enhance this stigma by creating cyborg imageries, aside from an inherent liminal uncertainty stemming from the meeting point between user and machine (Downey et al. 1995). This point correlates with Freud's uncanny, deriving from the ever-growing fear of artificial limbs, resembling more and more their physical equivalents. Thus, contrary to previously crude prosthetics, contemporary ones, using advanced technologies and design, resemble more and more real limbs.

Since the patient is conscious about his/her lost limb and disability, prosthetics are designed to try to numb this loss, while empowering the user's natural abilities as best as possible (Rawdon Wilson 1996). Moreover, our innate, kinetic ability to control our limbs imbues ourselves with power and control over our personal and societal surroundings (Shilling 2008). As we have seen, technology as well as design and aesthetics play a crucial role in this process; i.e. the designer uses, in this case, technological innovation for improving the user's daily activities, especially so in inclusive design.⁴ This is especially crucial when dealing with paramedical design, targeted at bettering the patient's daily activities.⁵ Finally, when various social situations dictate an array of solutions vis-à-vis the product's visibility or concealment, once again technology and design can and should strive to enhance and empower the patient in his/her daily routines.

Many researchers have dealt with the intricate interaction between end-user and machine regarding artificial limbs and body modification, yet, only a few have focused on the industrial designer's ability to empower the patient through the designed object. Beyond focusing on the human body as a site for potential consumption, technological and aesthetic developments situated within the paramedical product bridge between the socio-cultural and the technological in ways surpassing the somewhat limited focus of consumption studies (Baudrillard 2005; Edgley 2006; Featherstone 1991; Lury 2005). In addition, apart from ergonomic researches focusing on engineering or functional perspectives, researchers tackling this issue via an anthropological stance are scarce. In this article we see, then, that designers create paramedical objects crafted to facilitate the users' daily needs. These products are supposed to reenact the users' once natural physical abilities hindered by recent ailments.

Paramedical design holds significant importance when taking into account various socio-cultural attributes, influencing the patient's physical surroundings. The patients are conscious of their physical liabilities (Charmaz and Rosenfeld 2006), by which they lead the designer to develop various ways to blur these liabilities or to bypass them, using design as

a tool to reestablish and reconfigure the 'standard' body. Designers, at Innovation Design⁶ for example (part of my PhD research), use aesthetic and technological tools to save the patient the need to 'play' or 'enact' the image of the healthy person, to use Goffman's terminology (Goffman 1959, 1963, 2001 [1967]).

Similar to the approach presented by Csordas (1994), Balsamo (1996) and Shilling (2008), this research shows that the body (in this case, the end-user's body) is a product of social, cultural and historical processes. However, contrary to broad and extensive sociological or anthropological researches dealing with the socio-cultural aspects of the body, the technological and aesthetic aspects of this subject were somewhat neglected. The end-user's body stands as a central point connecting various worlds stemming from the designer's work: the client's economic perspective, the designer's aesthetic one, and in their midst stands the user, searching for comfort and functionality, since his/her body will integrate socio-cultural as well as technological and aesthetic facets materializing in the designed product.

In order to better understand the difficulty of designing for the user's needs we should view the world of industrial design through the eyes of the anthropologist, and in a theoretical perspective – through the anthropology of the body. However, as I mentioned, although sociological and anthropological researches dealing with the body are in abundance over the last two decades, among which one can find various subjects such as performance (Goffman 1959), the ascetic body or the body as a meeting point of power relations (Hazan 2003), researches focusing on the body as a meeting point of technology, aesthetics and material culture are relatively scarce.⁷

As a result of focusing on the user's body, a relatively new discipline of designers started to use the term 'empathic design.' In this approach, the designer faces the end-user's constraint and difficulties by understanding and identifying with the latter, hence creating a product which will face these effectively (McDonagh 2008). As anthropologists, designers reached the conclusion that their subjective worldview and experiences are not sufficient for understanding the user in a profound way. As we shall see one of the most efficient tools for designers to experience the user's world is using ethnography as a central research method.

Designers' growing understanding of the users' needs leads to the inclusive or universal design approach. In this venue, the designer takes into account populations previously ignored by designers: the sick, elderly, disabled, etc. for example, packaging suitable for people with Parkinson's disease; electronic appliances designed to be simply understood; objects in which the material selection, user interface, weight distribution and ergonomics are designed for a variation of populations. In the core of this approach are anti-globalism and anti-capitalist, as well as social justice and human rights movements. As a result, designers are taking into account humanistic aspects of the design process (ergonomics, social attributes, user-oriented design, etc.). Practically, designers treading this path design an object which will be relevant to a much broader market than the usual, well-endowed 1 percent (Coleman et al. 2003; Huppert 2003; Keates and Clarkson 2004).

The uncanny in the studio

In many cases, the designer's biggest influence does not stem directly from himself, but rather from the surrounding populace's reaction to the designed product. Indeed, as we shall see in this article, designers are reluctant to create an object which will create an aura of 'the uncanny.' Designers I interviewed used ethnographic research to better understand the ways

people react to a designed object in their vicinity. Designers research people's responses to a prototype and use their conclusions to better plan the next one, just as fashion designers plan their next collection (Barnard 1996). Fashion, as well as designed objects, is integrated into a visual or cultural language. Furthermore, both designers and fashion gurus put their users in the midst of a complex interaction between themselves and their socio-cultural surrounding (Aspers 2010). These researches are vastly important since a designed object creating a negative social aura around the user will immediately send the designers once again to their drawing boards.

Nadav, a designer from Carpe Diem design studio, describes the ethnographic method he used in a 3D goggles project.⁸ By using a model of the goggles in a public space (a train station), Nadav surveyed the ways people treated his use of the object:

Nadav: [...] after we researched the glasses market and interviewed optometrists, and mapped various significant existing products, we conducted a broad ethnographic research.

Jonathan: Did you take pictures?

Nadav: Yes. This is me using the prototype from the moment I take it out of my bag.

Jonathan: What we are seeing now (on his computer screen) is your prototype?

Nadav: No, we've created a crude model made from cheap glasses we bought at Hacarmel Market [...]

Jonathan: And the thing on the glasses?

Nadav: That's wood, you see? We've used cables and by connecting the device we surface the problematic areas, there's a lot of mess, many cables, etc. In the next scene I put the glasses on, I start to watch a film and all the surrounding people just run away from me [laughs]; we researched several scenarios from beginning to end [...] this was one configuration, next we've checked another configuration model and came to several decisions. For example, in this model, we use external earphones, which make the user look like a cyborg.

Extensive research usually takes part in the design studio, focusing on market evaluation and surveying potential marketing agendas or rival products. In this example, we can see a classic ethnographic research and its relevance and importance to industrial design. Technology, especially in contemporary society, mediates between end-users and their socio-cultural surroundings, in relation to both consumption, as well as the many social interactions he leads. Product and service designers find themselves in the midst of a race targeted at empowering the user's biological abilities (see clearer, hear better, etc.) and enhance his/her natural abilities (Featherstone 1991). Aside from the usual industrial-aesthetic race designers face, they must understand the impact of their designed objects on the user and his/her socio-cultural surroundings. Furthermore, a negative attitude stemming from the user's immediate surrounding will result in his/her abandoning the designed object, materially perfect as it may be.

Hollywood characters, combining humans and machines, always ensued an uneasy feeling of repulsive fascination, curiosity and interest. One of the points explaining this complex relationship is the fact that watching a part-human part-machine character reminds us of our physiological sensibilities, and that just like the figures in these movies, we can be fractured and reassembled as well (Fraser and Greco 2005; Rawdon Wilson 1996; Sault 1994; Springer

2005). In movies like *Robocop* (1987), *Terminator*⁹ (1984), *Blade Runner*¹⁰ (1982) or the classic anime movie *Ghost in the Shell* (1995), the boundary between humans and machines blurred the line between the 'good' and the 'bad' characters. Aside from the limited technological abilities of the special effects professionals of the period, these characters have become a part of our cultural ethos, symbolizing confusion, otherness, fear and uncertainty in regard to the uneasy relationship between nature or biology and technology, much as Freud's term 'uncanny.'

An even more radical approach can be found in Donna Haraway's 'Cyborg Manifesto' (1991). Haraway claims that modern-age human ontology *is* the cyborg. We are cyborgs in that we are more and more integrating technology in a routine and direct correlation with our physiology (earphones, heart-rate indicators, etc.). Furthermore, our social relations are becoming overly dependent on technological products, so much so as to create a 'post-social' era (Knorr Cetina 2001). In a similar view of the relationship between technology and psychology, Masahiro Mori (1970) phrases the term 'Uncanny Valley': Just as glasses do not imitate the human eye, claims Mori, so should we beware of designing objects too similar to their human counterparts. This cautionary approach is echoed in the words of Freud's uncanny. This perception, as we shall see, will resurface in the words of designers in the remainder of this article.

The research described by Nir is in essence an anthropological one, focusing on people's reactions, while gathering data from the public sphere which stands in direct correlation with the product's users. These data are highly important since the immediate social surrounding (as we can clearly see in regard with fashion and clothing) influences immensely on the user's continuing to use the designed object or not. In this case, the designers tried to prevent creating a *robot-esque*, apperceptible appearance.

Other research methodologies present further difficulties stemming from aesthetic principles, material use or production techniques important for the final stages of the design process, as we can see in Nadav's description:

[...] we have taken a nose-piece, and when putting it on my nose I found out a problem. All the models we've created according to the brief stressed the final weight of the product as 90 grams. After using 90 grams weights in our models and putting the product on the nose, we found out it was too heavy. So, Ariel [another designer] used play dough to create models we then used in the street to see people's reactions to the prototype. We've also conducted a market survey with various optometrists, and later on created various glasses' archetypes such as sporty, colorful, fashionable, technological, textural, minimalist, unique, etc. meanwhile we've been frequenting optometric shops, interviewing sellers in regard to customers' preferences, the problems they face in selling glasses, etc. Afterwards, we had to correlate this data with our own dilemmas, such as: designing the right form for our frame, the size of the glasses, its 'squarishness,' while trying to predict which frame will suit the largest amount of consumers.

Aside from researching for what's lacking in the field, Carpe Diem designers' research deals with ergonomic questions such as a weight ratio which is comfortable for the user, social attributes which influence the behavior of the user in his/her social surrounding and interviews with professionals (in this case optometrists). Apart from the product's technical characteristics, such as weight or structure, designers research aesthetic attributes deriving from various socio-cultural properties, which they intend to broadcast to the immediate surroundings. The designer's experience with the product, therefore, will lead not only to bringing to the fore social, ergonomic, structural or engineer-related issues, but also to a better understanding of the user's world, 'behind his shoulder,' to use Geertz's famous metaphor (Geertz 1973).

Uncanny mechanics: back to Freud

Among all the psychical uncertainties that can become an original cause of the uncanny feeling, there is one in particular that is able to develop a fairly regular, powerful and very general effect, namely, doubt as to whether an apparently living being is animate and, conversely, doubt as to whether a lifeless object may not in fact be animate. (Jentsch 1997 [1906], 11)

As good as nothing is to be found upon this subject in comprehensive treatises on aesthetics, which in general prefer to concern themselves with what is beautiful, attractive and sublime – that is, with feelings of a positive nature – and with the circumstances and the objects that call them forth, rather than with the opposite feelings of repulsion and distress. (Freud 2001 [1919], 219)

Concerning the factors of silence, solitude and darkness [pp. 246–247], we can only say that they are actually elements in the production of the infantile anxiety from which the majority of human beings have never become quite free. (Freud 2001 [1919], 252)

In this paragraph, Freud credulously ponders the relevance of his uncanny to the world of aesthetics. Yet, as we have seen in this article, Freud's seminal work is crucial to the professional work of designers, as well as engineers and medical experts dealing with the injured or disabled body. While the uncanny may be rooted in animistic traditions, its relevance to contemporary worship of material objects is unquestionable.

Freud's 'uncanny' importance lies, in my eyes, in its ability to cross the boundaries both of time and of its discipline. As we have seen in this article, Freud's assertions are as relevant today as they were a hundred years ago. Furthermore, the text's importance lies in its contribution not only to the discipline of psychology, but rather to the work of architects, designers, engineers, anthropologists and researchers from various other disciplines.

Returning to the question with which I have opened this article, I think that there is not sufficient space to elaborate on the fear mixed with pride and revulsion, based on the need for political correctness, rising from watching unique athlete Pistorius. As Freud says, we fear the unknown, which resembles too much the familiar (i.e. the uncanny). Similarly to fearing the culturally, socially, religiously, physically or ethnically different, we fear the biologically technologically different. Or is this fear stemming from childlike jealousy in that we are becoming less relevant than these empowered persons? Be the answer as it may, industrial design carries a huge importance in this debate. It is the designer's ability and his/her responsibility, aside from designing beautiful products targeted at the higher socio-economic percentile, to create a better daily environment for those who suffer from various physical or psychological maladies. The designer, molding and adjusting technology to the fragile body, can metamorphose these users and bring them back to normal life.

Is this empowerment targeted at the mentally or physically hurt users, and the designer's ability to transcend these users over the mundane and standard reality what is so frightening? I think the fear of the uncanny in the field of industrial design derives from our attitude toward the physically excluded users. Suddenly, through the combination of inclusive design and design anthropology, instead of watching the physically or mentally disabled with content, we view them with a hint of jealousy. And perchance, the fear of the uncanny can promote compassion and solidarity? Nevertheless, designers should surpass their innate fear of the uncanny and harness it toward empathy and better-designed objects.

Notes

1. Pistorius' famous cheetah legs, made from carbon fiber, were designed by engineer Van Philips and manufactured by Ossur, a bio-med company specializing in prosthetics: www.ossur.com.
2. One of her TED lectures can be seen at www.youtube.com/watch?v=JQ0iMucligg.
3. One might stress the difference in attitude between wearers of prosthetic limbs who are proud of their artificial limbs and flaunt them in public, versus other users who are more reluctant concerning their prosthetic limbs. An article focusing specifically on design and visibility versus design and invisibility is currently in progress (Ventura and Bichard, 2016).
4. A good example would be the various projects at the Age and Ability lab in the Helen Hamplén Centre for Design – <http://www.hhc.rca.ac.uk/>; or at the department of inclusive design at Hadassah College – <http://www.hadassah.ac.il/Site/AcEn/Departments/Industrial/about.asp>.
5. An interesting difference in attitudes between the first and third worlds comes to mind. A project such as the Jaipur Foot (<http://jaipurfoot.org/>) serves as an example of a (relatively) cheap and to the point apparatus enabling countless users to work and provide for their families.
6. The studios' names have been altered, following the AAA ethics code: <http://www.aaanet.org/issues/policy-advocacy/Code-of-Ethics.cfm>.
7. An example of an article stressing the opposite approach is Hill (2004).
8. A bit like the Google project, the glasses in this example project a semblance of a 40 inch screen on the inside of the glasses' lenses.
9. The rest of the series is worth mentioning as well, since it focuses on a struggle between two robots, one of which is the newer version.
10. A term used in the film to describe law-enforcers supervising the whereabouts of rogue androids.

Notes on contributor

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