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Should We Be Thinking About Sex Robots? From Danaher, J. and McArthur, N. (eds) *Robot Sex: Social and Ethical Implications* (Cambridge, MA: MIT Press, 2017) – final pre-proof version

# 1

## Should We Be Thinking About Sex Robots?

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The fourth skinjob is Pris. A basic pleasure model—the standard item for military clubs in the outer colonies.

—*Blade Runner*

### 1.1 Introduction

There is a cave in the Swabian Alps in Germany. It is called the Hohle Fels (rough translation “hollow rock”). Archaeologists have been excavating it since the late 1800s and have discovered there a number of important artifacts from the Upper Paleolithic era. In June 2005, they announced a particularly interesting discovery. They announced that they had unearthed the world’s oldest dildo.

The object was 20 cm long and 3 cm wide. It was estimated to be 28,000 years old. It was made from highly polished stone. It was, as Professor Nicholas Conard of the dig team remarked, “clearly recognizable” as a phallic representation. The fact that its size and shape were reasonably lifelike led some to speculate that it may have been used for sexual stimulation and not just for religious or symbolic purposes.<sup>1</sup>

Of course, we can never know for sure. The past is often unrecoverable. But artifacts for sexual stimulation have long been a staple in human life. Dildos have been found in ancient cultures in both the East and West. And the technology of sex has advanced over the centuries. In 1869, the American physician George Taylor invented the first steam-powered vibrator. It was used at the time as a treatment for women suffering from hysteria. The first electrical vibrator for consumer sale was produced by the company Hamilton Beach in 1902.<sup>2</sup> At around the same time, the first manufactured sex dolls became available, though the idea of the sex doll has a much longer history—one that can be traced back to the myth of Pygmalion and to Dutch sailors’ *dames des voyages* in the 1700s.<sup>3</sup> Since the early part of the twentieth century there have been further developments in the technology of sex, from artificial vaginas to lifelike silicone dolls to teledildonics.

This book is about another development in the technology of sex, namely: the creation of advanced sex robots. It features papers from a diverse set of contributors, each of whom focuses on a different aspect of the philosophical, social, and ethical implications that might arise from the creation of such devices. The contributions are speculative and analytical in nature. They are intended to raise questions and provoke answers. Some do so by taking a strong view on the topic, but all are written in the shadow of an uncertain future.

I do not wish to recapitulate or summarize what the contributors have to say in this opening chapter. Instead, I want to set the stage for the remainder of the book by asking and answering a few preliminary questions: What are sex robots? Do any exist right now? Why should we care about their creation? I take each question in turn.

## **1.2 What Are Sex Robots?**

“Robot” has become a familiar term and robots have become a familiar concept. The term was first used in Karel Čapek’s play *R.U.R. (Rossum’s Universal Robots)*. Čapek used the term robot to describe an artificial humanoid being made from synthetic organic matter. The term was quickly adopted by scientists and science fiction writers, perhaps most famously by Isaac Asimov in his *Robot* series of short stories and novels. In the process, the concept evolved away from

what Čapek originally intended. It was no longer used to describe humanoid artificial beings. It was, instead, used to describe virtually any embodied artificial being. The most common real-world examples of robots are to be found in industrial manufacturing processes. The International Federation of Robotics defines an industrial robot as “an automatically controlled, reprogrammable, multipurpose, manipulator programmable in three or more axes, which may be either fixed in place or mobile for use in industrial automation applications.”<sup>4</sup>

Obviously, sex robots are not quite the same as industrial robots. In previous work I have proposed a definition of “sex robot” that brings us back a little bit closer to Čapek’s original intention.<sup>5</sup> The definition holds that a “sex robot” is any artificial entity that is used for sexual purposes (i.e., for sexual stimulation and release) that meets the following three conditions:

**Humanoid form**, i.e., it is intended to represent (and is taken to represent) a human or human-like being in its appearance.

**Human-like movement/behavior**, i.e., it is intended to represent (and is taken to represent) a human or humanlike being in its behaviors and movements.

**Some degree of artificial intelligence**, i.e., it is capable of interpreting and responding to information in its environment. This may be minimal (e.g., simple preprogrammed behavioral responses) or more sophisticated (e.g., human-equivalent intelligence).

Defined in this manner, sex robots are different from existing sex toys and sex dolls. Most existing sex toys do not have a humanoid form. They are, typically, representations of discrete body parts or orifices. These partial representations may have some humanlike movement, but they do not have much in the way of artificial intelligence (although this is certainly changing with the rise of “smart” tech and the Internet of Things). Sex dolls, on the other hand, do have a humanoid form, but are passive, inanimate, and unintelligent. Sex robots have more going on.

Though most of the contributors to this volume accept the preceding definition of “sex robot,” the three conditions can be disputed. For instance, there is no particular reason why robots that are intended for sexual stimulation and release have to take on a humanoid form or be humanlike in behavior. One could imagine (if one’s imagination is willing) sex robots that take on an animal form. Indeed, there are many sex toys for sale that already do this. Nevertheless, the conditions of being humanlike seem important for two reasons. The first is that

one presumes the major drive behind the development of sex robots will be the desire to create an artificial substitute (or complement) to human-to-human sexual interactions. In other words, it is plausible to think people will be interested in creating sex robots because they want something that is close to the “real thing.” The second reason is that many of the most interesting philosophical and ethical issues arise when the robots take a humanoid form. The representative and symbolic properties of sex robots are often alluded to in the debate about their social acceptability.<sup>6</sup> That debate tends to focus on what the development of sex robots says about our attitudes toward our fellow human beings. It is only when the robots have humanlike form and behavior that these debates are enjoined.

The definition is agnostic on one important issue: whether the robots are embodied or not. Certainly the paradigmatic sex robot would tend to be an embodied animatronic agent, like Pris the “pleasure model” in the movie *Blade Runner*. But the definition could encompass virtual beings too. With the emergence of virtual reality technologies, like Oculus Rift and Google Cardboard, and haptic technologies (i.e., technologies that replicate and transmit touchlike sensations via a network), it is possible to have immersive sexual experiences in virtual reality. The pornography industry has already developed films (using real human actors) in VR.<sup>7</sup> And the Dutch company Kiiroo already sells haptic dildos and artificial vaginas for use by couples in long distance relationships. At the

moment, neither of these developments would involve sex robots as we define them—they both involve real human actors or couples engaging in sexual interactions remotely (although they probably should not be called “interactions” in the case of VR pornography due to the asymmetrical nature of the relationship). However, if someone used the same technology to enable sexual interactions with a virtual being, it would fit the definition.

### **1.3 Do Any Sex Robots Exist Right Now?**

The simple answer is “yes”—with the caveat that those in existence right now are relatively crude and unsophisticated. There are plenty of humanoid robots in existence, and many of them have been designed with gendered and highly sexualized characteristics. Most of these, however, are not designed or used for sexual purposes. There are only two intentional sex robots that I know of that are currently in existence: TrueCompanion’s Roxxy/Rocky and RealDoll’s prototype models. I will discuss both in some detail in order to convey a sense of what is currently out there and how the technology might develop.

TrueCompanion’s Roxxy robot was first unveiled to the public at the 2010 AVN Adult Entertainment trade show in Las Vegas. The Roxxy robot was the invention of Douglas Hines and was billed as “the world’s first sex robot.” It received a good deal of attention at the time of its unveiling.<sup>8</sup> If you are so

inclined, you can easily locate videos of Roxxy online, including several videos from the manufacturer that demonstrate some of her features.<sup>9</sup> She takes the form of a human female and is customizable in several ways. You can choose among different faces and hairstyles, and different behaviors and personalities. Roxxy comes in two basic models: RoxxySilver and RoxxyGold.<sup>10</sup> The “silver” model—priced at \$2995 at the time of this writing—can engage in “sex talk.” The “gold” model—priced at \$9995 at the same time—has preprogrammed personality types and can “hear” you when you talk. The personality types include “Frigid Farah,” “Wild Wendy,” “S&M Susan,” “Young Yoko,” and “Mature Martha”—all names rich in sexual overtones and innuendo.

From video demonstrations, the degree of artificial intelligence seems limited. Roxxy can initiate preprogrammed verbal responses to environmental stimuli, but does not learn and adapt to the user’s behavior. Nevertheless, the user can program the robots’ personalities and “swap them online” with others. The manufacturers claim that this is “the same as wife or girlfriend swapping without any of the social issues or sexual disease related concerns!”<sup>11</sup> Roxxy’s movements are also too limited to be considered humanlike. She can gyrate and move “her private areas inside”<sup>12</sup> when being used. She can swivel her head and move parts of her face when talking. But she cannot walk unassisted or move her limbs. According to the webpage, she has a heartbeat and circulatory system, and



her visual appearance is certainly humanlike, though no one would ever confuse her for a real human being. There is apparently a male version of the robot too, called *Rocky*, though no pictures are available of him.

I should mention that some people are skeptical about Roxxxxy. As best I can tell, TrueCompanion does genuinely offer her for sale from their website, and actively seeks interested investors in the technology. Also, the manufacturer clearly does have some kind of prototype that was demonstrated at the 2010 expo and in the associated online videos. Yet, despite this, it seems that, in the seven years since her launch, no real-world purchasers or users have surfaced, and one of the leading figures in the world of robots and sex (David Levy) has written an article that disputes the credibility of the claims made by Douglas Hines.<sup>13</sup> Since I have not attempted to purchase Roxxxxy/Rocky, and since I know of no one who has, I remain agnostic on this issue.

The other candidate for sex robot status is the prototype currently being developed by RealDoll. RealDoll is a product made by Abyss Creations, a company that was founded in 1995 by the artist and musician Matt McMullen. It specializes in sculpting lifelike silicone sex dolls, complete with fully articulable limbs. RealDoll is a successful business.<sup>14</sup> It sells these dolls for more than \$5,000 each, with prices often much higher if the customer wants to customize it to meet their own preferences. It caters overwhelmingly to a male audience. According to

McMullen fewer than 10% of the customers are female. The vast majority of the dolls exhibit stereotypical, porn-star-esque features (indeed RealDoll has a deal with Wicked Entertainment whereby it recreates some of their stars in doll form). But it does make dolls for more diverse tastes, including male dolls and transgender dolls. This is interesting insofar as the preference profile of RealDoll customers could well be something that carries over into the sex robot era. In other words, we might expect the sex robot market to cater to a majority male audience and for the robots to match certain stereotypical norms of beauty/sexuality. This could provide fodder for critics of the technology, something discussed in more detail in several of the contributions to this book.<sup>15</sup>

RealDoll is currently developing a robotic prototype it hopes to start selling sometime in 2017. McMullen has already previewed the prototype in several documentary films.<sup>16</sup> The plan is to create a model with a moving head and face, which can talk to the user through an AI personality. Following the lead of Apple's *Siri*, Microsoft's *Cortana*, and Google's *Assistant*, RealDoll's AI will be cloud-based and will learn and adapt to its user's preferences. This suggests a more significant and serious engagement with the latest AI technologies than is apparent from TrueCompanion's robot. Nevertheless, McMullen's current plans are modest. He is not developing a version of RealDoll with moving limbs. Robots with humanlike motor skills are being developed by other companies (the

best known probably being Boston Dynamics), but we are still some distance away from a robot that integrates those movement features with humanlike appearance and touch, and advanced AI.

From these two examples, it is apparent that humankind has taken its first steps toward sophisticated, humanlike sex robots. The visions of science fiction authors and moviemakers are, nevertheless, still beyond the horizon. We can expect the technology to develop further and for converging advances in animatronics and AI to be utilized for sexual purposes. The current trend for single-use sex robots may not continue. I suspect that it won't and that the future will be more akin to that depicted in the Channel 4 TV series *Humans*,<sup>17</sup> where domestic robots are used for multiple purposes, including on occasion sexual purposes. How prevalent and ubiquitous the technology will become is up for debate. Some futurists make strong predictions, suggesting that sex robots are poised to take over the adult sex work industry,<sup>18</sup> or that they will be “everywhere” by 2050.<sup>19</sup> This may happen, but as other contributors to this volume point out there are several hurdles that stand in the way. These hurdles are probably not technological in nature—the technological advances are likely to continue; they are, rather, psychological, sociological and normative. It is these hurdles that form the focus for the remainder of this book.

## 1.4 Why Should We Care?

Is it worth taking the development of this technology seriously? Or should we just laugh it off as some outlandish fantasy that, even if it does become a reality, is likely to appeal to a small minority?

Obviously I and the other contributors to this book think that the subject is worthy of serious consideration. We would not have invested so much time and energy in this book if we did not. We think there are issues of genuine philosophical and practical interest arising from the development of sex robots. These issues range from the analytical and metaphysical to the ethical and sociological. Many of them are assessed in greater depth in the individual chapters that follow. Here, I simply wish to sketch some of the terrain in which those chapters are located.

One of the first issues raised by the prospect of sophisticated sex robots is the analytical nature of sex itself. Does one “have sex” through autostimulation or must another individual be involved? Questions of this sort have fascinated philosophers and sexologists for quite some time. They are also questions of practical import. For better or worse, many cultures and religions hold the status of “virginity” in special regard. For young people, their “first time” is a moment of personal and societal significance, and many try to carefully skirt the boundaries between “real” sex and other forms of sexual activity in order to avoid

breaching religious or cultural norms. Consequently, figuring out whether or not sexual activity with a sex robot would count as “real” sex is going to be a matter of some importance to them. Of course, virginity is really more a social construct than it is a natural kind—something frequently used to police and shame—but that does not make the debate about the status of particular sexual activities any less significant. If we assume (as most of the contributors to this volume do) that sex robots are not going to be persons in the philosophically rich sense of the term “person,” then engaging in sexual activity with a robot seems to occupy an interesting and contested territory: It is like autostimulation in some ways, but it also involves an interaction, possibly reciprocal, with a humanlike entity. So where on the spectrum does robot sex lie?<sup>20</sup>

Another issue raised by the prospect of sophisticated sex robots has to do with the connections between sexual intimacy and other forms of intimacy. Will it be possible for people to have a meaningful intimate relationship with a robot—one that goes beyond mere sex? The suspicion among many is that it will not. Meaningful relationships require some degree of emotional reciprocity. If a robot is a mere automaton—if it has no inner life of its own—then it cannot reciprocate in the appropriate way. But this, of course, raises important questions about the possibility of machine consciousness and what happens when the outward behaviors of robots are such that they can “pass” for humans. Spike Jonze’s

movie *Her* depicts an intense intimate relationship between a man and an unembodied AI. It seems odd from our present standpoint. But is this where our future lies? Will intimate relationships with robots come to be seen as something within the normal range of human sexuality? Chapter 11 (by Hauskeller) and chapter 12 (by Nyholm and Frank) both touch upon these questions.

This is where philosophical speculation joins psychological reality. We already know that humans form intimate attachments in unusual ways. The objects and subjects of human affection are highly malleable. There is already a subculture that prefers “relationships” with sex dolls to those with human beings. Davecat, a nickname adopted by a Michigan-based man, is a well-known advocate for synthetic love.<sup>21</sup> He is a member of an online community of iDollators who view their dolls not merely as sex toys but as life partners. He has appeared in several documentaries about the lifestyle. Davecat owns two RealDolls: Sidore and Elena. He calls Sidore his “wife” and they wear matching wedding bands. Elena is his mistress. He shares an apartment with both and has constructed elaborate stories about how they came to meet and share their lives together. Some people find his expression of sexuality bizarre—the fetishising of an inanimate object. But Davecat says there is a much deeper connection between himself and Sidore:

It seemed perfectly normal for me to treat something that resembles an organic woman the same way I'd treat an actual organic woman ... With Sidore, her draw was instantaneous. There was never a moment when [she]—or any Doll, for that matter—was merely an object to me.

If people like Davecat are already forming what they take to be meaningful intimate relationships with inanimate dolls, imagine what will happen when the dolls can behave and interact in intelligent ways with their users. The chapters from Scheutz and Arnold (chapter 13), Carpenter (chapter 14), and Adshade (chapter 15) delve into some of these issues.

Of course, there may be psychological and sociological impediments to the widespread acceptance of this form of sexuality. Back in 1970, the Japanese roboticist Mashiro Mori developed the “uncanny valley” hypothesis. The gist of the hypothesis was that as robots became more humanlike in behavior and appearance, they would become more acceptable to humans. But only until they reached a point where they became so close to being humanlike that they started to be creepy. In other words, until they reached a point where they were “uncannily” humanlike but still obviously artificial. At that point, there would be a dip (or valley) in their acceptability.

If the uncanny-valley hypothesis is true, it could pose something of a dilemma for sex robot advocates and manufacturers. They will, no doubt, push for more and more humanlike devices. This should, initially, lead to more social acceptability, but then they could fall into the uncanny valley, turning people off and blocking their acceptability for some time. The question would then become how deep and wide the valley actually is. Would it be merely a temporary blip or something more prolonged?

For many years, Mori's hypothesis was little more than that: a hypothesis. There was some anecdotal support for it. The advent of humanlike CGI in films brought with it reports of negative reactions from audiences. The most infamous example of this being the human characters in Robert Zemeckis's 2004 film *The Polar Express*.<sup>22</sup> However, it is really only in the past decade that researchers have started to empirically test the hypothesis. Some initial studies supported its existence,<sup>23</sup> but, as is to be expected, the latest picture from the research is more complicated,<sup>24</sup> with some studies now disputing its existence, suggesting that it is a bundle of different phenomena, or that it can be overcome through repeated exposure or other psychological tricks.<sup>25</sup> This suggests that the uncanny valley might be less of a problem than previously thought. This does not mean, however, that the sex robots will be socially accepted. That depends on factors beyond the



reaction of any individual user. Julie Carpenter discusses these factors in some detail later in this book.

When we turn to the question of social acceptability, the phenomenon's legal, ethical, and moral acceptability are also raised. And there is much to think about in this regard. Indeed, the majority of the papers in this volume take up one or more of the ethical problems that arise in relation to sex robots. These issues can be usefully lumped into three main categories: (1) benefits and harms to the robots; (2) benefits and harms to the users; and (3) benefits and harms to society.

The first category is the most speculative and outlandish. There is a possibility, however conceptually implausible or empirically distant it may seem, that robots themselves have a moral status that ought to be factored into their creation. Robots could be the beneficiaries of their sexual interactions with humans, but they could also be harmed by those interactions. Furthermore, if they do have moral status, what might the implications be of creating an underclass of robotic sexual slaves? Surely this is something we should avoid? The issue is not as clear-cut as it initially seems. Some roboticists argue that robots should always be slaves.<sup>26</sup> And some philosophers argue that there is nothing unethical about this, even if the robots themselves are moral persons.<sup>27</sup> Can these groups be right? The contributions from Goldstein (chapter 10) and Petersen (chapter 9) delve into some of these issues.

The second category shifts focus from the robot to the user. Can human beings be benefited or harmed by the interaction? Sex is an important human good. In addition to being intrinsically pleasurable, physical and mental health and well-being are often found to correlate with increased sexual activity. The importance of sexual activity in the well-lived life is now widely recognized in the emerging discourse on sex rights (see McArthur, chapter 3; and Di Nucci, chapter 5, in this volume). If sex robots can facilitate more sexual activity, we might be inclined to welcome them with open arms. But there can also be a dark side to sex. Some people worry that those who seek out sexual interactions with robots will withdraw from social interactions. This may prevent them from forming normal and healthy relationships with their fellow human beings. Since sociality and friendships are also commonly included in lists of basic human goods there could be a trade-off of human goods when it comes to the user of the sex robot.

This brings us then to the third category of ethical issues. This one has to do with the benefits and harms to society. “Society” can be interpreted broadly here to include the immediate family and friends of the sexbot user and then society-at-large (a more general and possibly abstract entity). One worry about sex robots has to do with the impact they will have on the other intimate relationships of the user. On the one hand, they could add variety and novelty to

existing intimate relationships, perhaps solidifying them in the process. On the other, they might provoke jealousy and disaffection, causing breakdown and strife. The fallout for society at large then becomes a concern. Will the sexbot user be encouraged to adopt positive or negative behaviors toward their fellow human beings? Or will they come to adopt an objectified and instrumentalizing attitude wherein their fellow human beings are treated as obstacles to pleasure? This is where the symbolic properties of sex robots also become important. The earlier descriptions of Roxxxxy/Rocky and the RealDoll prototype were replete with arguably sexist symbolism. The robots tended overwhelmingly to represent human females, to adopt stereotypical and gendered norms of beauty and behavior, and to perpetuate problematic attitudes toward women. The makers of TrueCompanion seem to revel in the idea of “wife or girlfriend swapping”; they preprogram their robot with loaded personality types (“Wild Wendy,” “Frigid Farah,” and so forth); the bulk of RealDoll’s customers seek out the porn-star look; only a minority of the customers look for something more unusual. What consequences would this have for treatment of women in our society? Some people are very worried—and this is to say nothing of robots that cater to clearly unethical forms of sexuality such as rape fantasies or pedophilia. Litska Strikwerda (in chapter 8) and I (in chapter 7) take up these issues later in this volume.

## 1.5 The Sexbots Are Coming

In short, sex robots are worth taking seriously. They are robots with humanlike touch, movement, and intelligence that are designed and/or used for sexual purposes. They already exist in primitive and unsophisticated forms, and the technology underlying them is likely to develop further. They may eventually become widespread in society, with sexual functions being incorporated into general-purpose robots. Their creation raises important philosophical, social, and ethical questions for users and the broader society in which they live. I hope the brief synopsis of these issues in the preceding paragraphs and pages is enough to whet your appetite for this discussion. All of these issues are addressed in greater depth in the remaining chapters. If you wish to follow my coauthors and I down the rabbit hole, read on.

### Notes

1. All details in this paragraph are taken from J. Amos, “Ancient Phallus Unearthed in Cave,” *BBC News* (July 25, 2005), <http://news.bbc.co.uk/2/hi/science/nature/4713323.stm>.
2. Rachel P. Maines, *The Technology of Orgasm* (Baltimore: Johns Hopkins University Press, 2001).

3. Anthony Ferguson, *The Sex Doll: A History* (Jefferson, NC: McFarland, 2010).
4. <http://www.ifr.org/industrial-robots>.
5. John Danaher, “Robotic Rape and Robotic Child Sexual Abuse: Should They be Criminalized?” *Criminal Law & Philosophy* (December 2014): 1–25, doi:10.1007/s11572-014-9362-x.
6. For more on this topic, see chapter 7 of this volume.
7. For an informative overview of the technology and its prospects, we recommend the *VICE* documentary “The Digital Love Industry,” <http://www.vice.com/video/love-industries-digital-sex-669>.
8. Brian Heater, “Roxxxxy the ‘Sex Robot’ Debuts at AVN Porn Show,” *PC World*, January 9, 2010; Joel Taylor, “Sex Robot with ‘Personality’ Unveiled,” *Metro.co.uk*, January 11, 2010.
9. For information on Roxxxxy’s features, see <http://www.truecompanion.com/shop/faq>; for videos depicting these features, see the TrueCompanion YouTube channel: <https://www.youtube.com/channel/UCwY5KmyS9ZI9Net9Hm-rgvA>.
10. All information taken from the FAQ on TrueCompanion’s webpage.

11. Ibid.

12. Ibid.

13. David Levy, “Roxxxxy the ‘Sex Robot’—Real or Fake?” *Lovotics* 1 (2013): 1–4, doi:10.4303/lt/235685; <http://www.omicsonline.com/open-access/2090-9888/2090-9888-1-101.pdf?aid=15073>.

14. All the information about RealDoll is taken from the following sources: the RealDoll webpage (<https://www.realdoll.com>); Cara Santa Maria, “Inside the Factory Where the World’s Most Realistic Sex Robots Are Being Built,” *Fusion: Real Future* (February 10, 2016), <http://fusion.net/story/281661/real-future-episode-6-sex-bots>; George Curley, “Is This the Dawn of the Era of Sex Robots?” *Vanity Fair* (April 16, 2015), <http://www.vanityfair.com/culture/2015/04/sexbots-realdoll-sex-toys#13>; and Curtis Silver, “The Future of Sex Could be AI Robot Sex Dolls,” *Forbes* (August 19, 2016), <http://www.forbes.com/sites/curtissilver/2016/08/19/realdoll-ai-sex-robot-head-ama/#44bccb852fd4>.

15. In particular the chapters from Danaher, and Danaher, Earp, and Sandberg.

16. Cara Santa Maria, “Inside the Factory.”

17. For further information see: <http://www.channel4.com/programmes/humans>.
18. David Levy, *Love and Sex with Robots* (London: Harper, 2008); and Ian Yeoman and Michelle Mars, "Robots, Men and Sex Tourism," *Futures* 44 (2012): 365–71.
19. Ian Pearson, "The Future of Sex Report: The Rise of Robosexuals," [http://graphics.bondara.com/Future\\_sex\\_report.pdf](http://graphics.bondara.com/Future_sex_report.pdf).
20. See chapter 2 of this volume for more information.
21. Julie Beck, "Married to a Doll: Why One Man Advocates Synthetic Love," *The Atlantic* (September 6, 2013), <http://www.theatlantic.com/health/archive/2013/09/married-to-a-doll-why-one-man-advocates-synthetic-love/279361>.
22. Paul Clinton, "'Polar Express': a creepy ride," CNN.com (November 10, 2004), <http://edition.cnn.com/2004/SHOWBIZ/Movies/11/10/review.polar.express/>.
23. Karl F. MacDorman and Hiroshi Ishiguro, "The Uncanny Advantage of Using Androids in Cognitive and Social Science Research," *Interaction Studies* 7, no. 3(2006): 297–337, doi:10.1075/is.7.3.03mac. Karl F. MacDorman,

“Subjective Ratings of Robot Video Clips for Human Likeness, Familiarity, and Eeriness: An Exploration of the Uncanny Valley,” Proceedings of the ICCS/CogSci–2006: Toward Social Mechanisms of Android Science, (Vancouver, 2006): 26–29.

24. Tyler Burleigh, Jordan R. Schoenherr, and Guy Lacroix, “Does the Uncanny Valley Exist? An Empirical Test of the Relationship between Eeriness and the Human Likeness of Digitally Created Faces,” *Computers in Human Behavior* 29, no. 3 (2013): 759–71, doi:10.1016/j.chb.2012.11.021.

25. The developments are rapid. For a reasonably up-to-date picture, see the *Frontiers* symposium on the topic: *The Uncanny Valley and Beyond* available at: <http://journal.frontiersin.org/researchtopic/2385/the-uncanny-valley-hypothesis-and-beyond#articles>.

26. Joanna Bryson, “Robots Should Be Slaves,” in *Close Engagements with Artificial Companions: Key Social, Psychological, Ethical and Design Issues*, ed. Yorick Wilks (Amsterdam: John Benjamins Co., 2010).

27. Steve Petersen, “Designing People to Serve” in *Robot Ethics: The Ethical and Social Implications of Robotics*, eds. Patrick Lin, Keith Abney, and George A. Bekey (Cambridge: MIT Press, 2012). See also chapter 9 of this volume.