



ELSEVIER

Disponible en ligne sur

**ScienceDirect**  
www.sciencedirect.com

Elsevier Masson France

**EM|consulte**  
www.em-consulte.com



ORIGINAL ARTICLE

# Sex toys, sex dolls, sex robots: Our under-researched bed-fellows<sup>☆</sup>

N. Döring<sup>1,\*</sup>, S. Pöschl<sup>1</sup>

*Ilmenau University of Technology, Institute of Media and Communication Science IfMK, Ehrenbergstrasse 29 (EAZ 2217), 98693 Ilmenau, Germany*

Accepted 1st April 2018

## KEYWORDS

Sex toys;  
Sex dolls;  
Sex robots;  
Sexual products;  
Positive sexuality;  
Sexual pleasure

**Summary** In the 21st century, sexual products such as sex toys, sex dolls and sex robots are openly marketed on the Internet. The online retailer Amazon alone provides literally thousands of sexual wellness products. The Internet has done with sexual products what it has already achieved with pornography: it has expanded and diversified the market, made sexual products more accessible and affordable, and thus normalized their use. Research, though, is lagging behind: in comparison to the large body of pornography studies, research on sexual products, their users, uses and outcomes is scarce. The present paper therefore reviews both the state of technological development and the state of research regarding sex toys, sex dolls and sex robots marketed on the Internet. For each of these three groups of sexual product, we first present the range of products available and then provide data on their users and use. Finally, outcomes of sexual product use are discussed based on theoretical assumptions, available data and selected user experiences. Operating within a Positive Sexuality Framework (Williams et al., 2015) and a Positive Technology Framework (Riva et al., 2012), both rooted in the Positive Psychology Approach (Seligman and Csikszentmihalyi, 2000), the paper argues that sexual products have the potential to improve sexual well-being in various populations. Health professionals working in the field of sexuality need to be well-informed about the ever-evolving market of more and more technologically advanced sexual products. It is their call to foster both, the health-related use of existing sexual products and health-related development of future sexual products.

© 2018 Elsevier Masson SAS. All rights reserved.

DOI of original article: <https://doi.org/10.1016/j.sexol.2018.05.003>.

<sup>☆</sup> La version en français de cet article, publiée dans l'édition imprimée de la revue, est disponible en ligne: <https://doi.org/10.1016/j.sexol.2018.05.003>.

\* Corresponding author.

E-mail addresses: [nicola.doering@tu-ilmenau.de](mailto:nicola.doering@tu-ilmenau.de) (N. Döring), [sandra.poeschl@tu-ilmenau.de](mailto:sandra.poeschl@tu-ilmenau.de) (S. Pöschl).

<sup>1</sup> <http://www.tu-ilmenau.de/mkmp>.

<https://doi.org/10.1016/j.sexol.2018.05.009>

1158-1360/© 2018 Elsevier Masson SAS. All rights reserved.

Please cite this article in press as: Döring N, Pöschl S. Sex toys, sex dolls, sex robots: Our under-researched bed-fellows. Sexologies (2018), <https://doi.org/10.1016/j.sexol.2018.05.009>

## Introduction

In the 21st century, sexual products such as sex toys, sex dolls and sex robots are openly marketed on the Internet. The online retailer Amazon alone provides literally thousands of sexual wellness products. The Internet has done with sexual products what it has already achieved with pornography: it has expanded and diversified the market, made sexual products more affordable and accessible (Daneback et al., 2011; Döring et al., 2017) and thus normalized their use. Research, though, is lagging behind: in comparison to the large body of pornography studies (including review papers and meta-analyses), research on sexual products, their users and uses and their outcomes is scarce.

The present paper therefore reviews both the state of technological development and the state of research regarding sexual products marketed on the Internet. Three main research questions (RQ) are going to be answered:

- RQ1: what types of sexual product (sex toys, sex dolls and sex robots) are available today?
- RQ2: who buys them and how do they use them?
- RQ3: what are the outcomes of sexual product use?

Operating within a Positive Sexuality Framework (Williams et al., 2015) and a Positive Technology Framework (Riva et al., 2012), both rooted in the Positive Psychology Approach (Seligman and Csikszentmihalyi, 2000), the paper looks at negative and positive outcomes of sexual products. Implications for health professionals working in the field of sexuality are discussed in the conclusion.

## Methodology

The study is based on literature research, subject-matter description and self-reports from users.

## Reporting the state of research on sexual products

To identify scientific studies of sexual products, we searched the literature databases ACM Digital Library, IEEE Xplore, Google Scholar, PsychInfo and PubMed with the keywords "sex(ual) product", "sex toy", "love/sex doll", "love/sex robot" and "sexbot". This search resulted in 18 publications from the last 10 years. Not a single review paper or meta-analysis was found.

## Presenting the range of sexual products

In order to demonstrate the range of sexual products marketed on the Internet, we searched the online retailer Amazon and online sex shops (e.g., Adam & Eve, Adultshop, Ann Summers, Eis.de) as well as online sales-portals for sex dolls (e.g., Dolls Club, RealDoll, RS Dolls, Sinthetics) and sex-robot vendors (e.g., Realbotix, TrueCompanion, Sex Bot Company).

## Providing data on users, uses and outcomes of sexual products

We present data from our own survey on sex toys and sex dolls with a German national online sample of adults aged 18–69 years ( $N=2000$ ), who gave informed consent. Data collection was conducted in November 2016. In addition, we use online product reviews written by users that describe uses and outcomes with plausible authenticity (King et al., 2014). Concerning research ethics, we only included publicly available product reviews, and fully anonymized them.

## Sex toys

Sex toys can be defined as sexual enhancement products with the intent of improving the nature and quality of sexual experiences (Rosenberger et al., 2012). In contrast to pornography, sex toys are material objects. Some sex toys look like human body parts (e.g., vibrator/dildo in the form of male human genitals, masturbator in the form of female human genitals, a foot or a mouth), while others have non-human forms (e.g., vibrator/dildo in the form of an animal's genitals, a dolphin or a banana). Sex toys are directly used on the body during sexual activities.

## Range of sex toys

Many sex toys emulate genitals and are supposed to be used on the genital and anal area (e.g., vibrator/dildo, masturbator, penis ring, anal beads). Other groups of sex toys are marketed as erotic lingerie/costumes (e.g., sexy police/nurse uniforms) or BDSM equipment (e.g., handcuffs, whip). The spectrum of sex toys keeps widening, including technologically advanced sex toys (Bardzell and Bardzell, 2011): so-called teledildonic technology that lets the partner operate the sex toy from a distance (e.g., Nora vibrator and Max Fleshlight by Lovense) are available, as well as vibrators with an integrated video camera (e.g., Svakom Siime Eye). Advanced sex toys can also be connected to and synced with media such as an MP3 player (e.g., music-driven vibrator by OhMiBod) or a virtual-reality pornography system (e.g., Onyx2 Fleshlight by Kiiri).

## Users and uses of sex toys

Our national online survey revealed that a majority of the German Internet population – 65% of women and 63% of men (no data on trans\*people available) – has already used a sex toy. Sex toy use was about equally popular in solo sex (48%) and in partnered sex (54%). These findings are in line with previous studies in the US (Herbenick et al., 2010; Reece et al., 2010).

## Positive and negative outcomes of sex toy use

In the literature, some negative outcomes of sex toy use are discussed: e.g., negative impact on self-image because of the partner's sex toy use (Watson et al., 2016), and risks of transmitting infections via shared sex toys (Anderson et al.,

2014). However, research also identifies greater sexual pleasure, sexual satisfaction and safer sex as positive effects of sex toy use, moreover far outweighing the negative effects (Herbenick et al., 2010; Reece et al., 2010; Reisner et al., 2009).

Online product reviews point in the same direction: many positive sex toy reviews can be found online, such as the following about a vibrator (€14) and its effect on partnered sex:

The hottest toy ever – my partner loves it and it’s so much fun in the act – I just tell you, keep the windows shut – the woman just gets off!!! Top quality for a top price!!

There are also, however, reviews criticizing limited quality and pleasure, as the following review of a mouth-like blowjob masturbator (€17) shows:

The feeling is 100 times better than a handjob, but it’s not in any way comparable to sex. The corners of the mouth tear easily the teeth fell out too. You should have lube and it’s best to put it on a heater first. I’d say if the girlfriend is abroad for 2–3 months it’s sufficient. I’ve used it about 20 times, then it broke and I threw it away.

## Sex dolls

Sex dolls can be defined as material representations of the human body for sexual use (Ferguson, 2010). Whereas sex toys are restricted to parts of the body, sex dolls replicate the whole human body.

## Range of sex dolls

Sex dolls come in different materials and price ranges, from very simple inflatable rubber dolls (€10), plastic/latex sex dolls (€500, NMC), teddy dolls made of fabric or plush (€700, Teddy Babes), TPE sex dolls (€2,000, WM Dolls), silicone sex dolls (€2,000–8,000 €, Z-onedoll, RealDoll), up to true-to-life highly customizable silicone dolls (€45,000, Synthetics). Sex dolls can be further distinguished according to gender (male, female, and transgender), age, skin color, and other characteristics.

## Users and uses of sex dolls

According to our national online survey, 2% of women and 9% of men have already used a sex doll. Female sex dolls were most popular, followed by male and transgender sex dolls. Both women and men reported using sex dolls equally often in solo sex and partnered sex. These findings differ from studies based on sex doll owner forums that portrayed doll-owning forum members as predominantly male (Cassidy, 2016; Valverde, 2012).

Besides using dolls for sexual gratification, many doll-owners also report that they treat their dolls as artificial cohabitation partners (Cassidy, 2016; Ciambrone et al., 2017; Ferguson, 2010; Valverde, 2012): Watching TV with the doll, talking to the doll and grooming and clothing the doll are typical activities of doll-owners, who often prefer the term ‘‘love doll’’ to ‘‘sex doll’’.

## Positive and negative outcomes of sex dolls

Strong negative effects are attributed to sex dolls both in public and academic debates: men who buy and use female or even child-like sex dolls could be led to objectify and abuse real women and children just as they do their dolls (Ray, 2016; Valverde, 2012). Men who accept their dolls as social companions could harm themselves by no longer seeking for a human partner. Even innocuous sex doll use could lead to problems for the owner due to stigmatization by family and friends, leading to embarrassment, social withdrawal and guilt (Knox et al., 2017; Ray, 2016). However, the sparse research points to strong positive outcomes as well: sex dolls can provide a lot of sexual and emotional satisfaction, create feelings of comfort, peace and even love, as doll-owners report in surveys and interviews (Ferguson, 2010; Valverde, 2012).

In doll-owner forums, there are a lot of nuanced discussions about the pros and cons of sex dolls. While some owners confirm the problem of social stigmatization, others tell success stories about coming out as a doll-owner to their friends and family and finding acceptance. While some feel anxious about falling in love or becoming over-attached to a doll at the cost of real human contact, others describe the doll as a therapeutic tool that helps them to overcome a traumatic breakup or to cope with seemingly inevitable social and sexual deprivation due to physical and/or mental impairment.

## Sex robots

Sex robots can be defined as humanoid robots that are designed for sexual use (Levy, 2007). They look like sex dolls but are equipped with sensors, actors and artificial intelligence. They are able to display conversation, emotions and preprogrammed personalities. And they can perform partially autonomous behavior such as simulating sexual movement, getting into various sexual positions, and expressing orgasm (Döring, 2017; Sharkey et al., 2017).

## Range of sex robots

Sex robots are still in a very early stage of development. They range in price from around €5,000 to €15,000. The sex-robot hardware (e.g., color of hair and skin) and software (e.g., shy or extraverted personality) are customizable to some degree. Recent models of sex robots marketed on the Internet include Harmony (Realbotix), Roxxy Gold and Rocky Gold (TrueCompanion), and Suzie Software and Harry Harddrive (Sex Bot Company) (Sharkey et al., 2017). So far, more female than male and no transgender sex robots are on the market.

## Users and uses of sex robots

Empirical data on sex robot users and uses are lacking. It is reasonable to assume, though, that the majority of today’s pioneer owners and users of sex robots are men, with high affinity for technology and above-average socio-economic status (Döring, 2017). While some pioneer users may feel

pushed toward sex robots by problems of social and sexual deprivation (e.g., due to physical and/or mental impairment), others feel pulled by the new options for sexual exploration and pleasure (Richards et al., 2017; Szczuka and Krämer, 2017).

On the basis of data concerning sex toy and sex doll use, we would expect sex robots to be included in both solo and partnered sex. As some sex doll-owners report strong emotional bonds to their dolls, we would expect a significant proportion of sex robot owners to develop meaningful relationships with their robots instead of just using them briefly for sexual release. Just as sex dolls today are stigmatizing and therefore often hidden from friends and family, we would expect the majority of sex robots to be treated very discreetly by their owners.

### Positive and negative outcomes of sex robots

The main risks attributed to sex dolls are also attributed to sex robots (Döring, 2017): men who buy and use female or even child-like sex robots could be led to objectify and abuse real women and children just as they do their robots (Richardson, 2016). Sex robot use by people with different paraphilias and fetishes could lower inhibition thresholds and therefore increase deviant sexual behavior (Sharkey et al., 2017). People who accept their robots as social companions could harm themselves by no longer seeking for a human partner, and remaining lonely (Sullins, 2012).

Concerning positive outcomes, sex with robots is seen as a safe and healthy complement to sex with humans (Döring, 2017; Levy, 2007). Many problems in human-human sex (e.g., sexually transmitted diseases, unwanted pregnancies, sexual violence, emotional abuse) are avoided with a sex robot. The use of sex robots could increase sexual satisfaction in solo and partnered sex through sexual experimentation. Robots could take care of special and often unmet sexual needs of people with specific sexual tastes or with physical or mental impairments. The use of sex robots could possibly reduce adultery, prostitution and sex trafficking (Yeoman and Mars, 2012). Last but not least, people who (temporarily or permanently) are not able or willing to live with a human partner could improve their situation with a robotic partner (Levy, 2007).

### Conclusion

Against the backdrop of the findings presented here, we draw three conclusions for research and practice.

#### Investigating sexual product use in different populations

Although widely used, sexual products are severely under-researched. There are gaps in research regarding all types of sexual product and especially the more technologically advanced toys (e.g., teledildonics) and sex robots. Other gaps concern all groups of sex product users and especially those besides able-bodied young heterosexual men: people with severe illnesses often suffer from restrained sexual functioning and find sexual products helpful (e.g.,

breast cancer patients; Herbenick et al., 2008), as do sexually active seniors (Katz and Marshall, 2003) and people with disabilities (Rohleder and Swartz, 2012). Their expectations and experiences with sexual products require more scientific attention. Furthermore, we need use and outcome studies that measure the negative and positive effects of different types of sexual product in a balanced way: over-dependence, accidents, data theft and hacking are real risks with technologically advanced sexual products, just as with almost all other technologically advanced products we are using in everyday life. A research-based approach to the risks and benefits of sexual products will help us to avoid both glorification and demonization of high-tech sex gadgets.

### Fostering health-related use of sexual products

According to the Positive Sexuality Framework (Williams et al., 2015) and the Positive Technology Framework (Riva et al., 2012), sexual products can offer sexual pleasure and fulfillment that lead to well-being and better quality of life. Health professionals can support their clients by addressing sex product use, thereby normalizing it so as to overcome possible shame and guilt. They can further offer products as additional ideas, and provide support in the product-selection process as well as in establishing healthy and pleasant patterns of use for individuals and couples. This affects the general population (e.g., many women are more insecure and inexperienced regarding solo sex than men) as well as special target groups and settings (e.g., sexual assistance for learning-disabled persons; alternatives for people with sexual dysfunctions; treatment of sexual offenders; prevention of sexual violence).

### Fostering health-related development of sexual products

Last but not least, sexual product development offers ample opportunities for health-promoting design. Health professionals in the field of sexuality should play a larger part in technological development. Conceptual work, collaboration with engineers, or even with the sex industry, which nowadays is also addressing sexual health aspects (e.g., sex toys for pelvic floor exercises), are fruitful possibilities. Instead of just criticizing dystopian visions of harmful sex robots, why not make a joint effort to develop robots with positive impact in terms of sex education, sexual therapy, sexual counseling and sexual well-being for interested target groups? Not as a substitute for human contact, but as a useful and joyful complement.

### Disclosure of interest

The authors declare that they have no competing interest.

### References

- Anderson TA, Schick VR, Herbenick D, Dodge BS, Fortenberry JD. A study of human papillomavirus on vaginally inserted sex toys, before and after cleaning, among women who have sex with women and men. *Sex Transmitted Infect* 2014;90(7):529–31.

- Bardzell J. and Bardzell S. Pleasure is your birthright. In: Tan D., Fitzpatrick G., Gutwin C., Begole B., Kellogg W.A. (Eds.), *Proceedings of the 2011 annual SIGCHI Conference on Human Factors in Computing Systems* (Vancouver, BC, Canada). 2011.
- Cassidy V. For the love of doll(s): a patriarchal nightmare of cyborg couplings. *ESC* 2016;42(1–2):203–15.
- Ciambrone D, Phua V, Avery EN. Gendered synthetic love: real dolls and the construction of intimacy. *Int Rev Modern Sociol* 2017;43(1):59–78.
- Daneback K, Mansson S-A, Ross M. Online sex shops: purchasing sexual merchandise on the Internet. *Int J Sex Health* 2011;23(2):102–10.
- Döring N. Vom Internetsex zum Robotersex: Forschungsstand und Herausforderungen für die Sexualwissenschaft [From Internet sex to robot sex: state of research and challenges for sexology]. *Z Sex-Forsch* 2017;30(01):35–57.
- Döring N, Daneback K, Shaughnessy K, Grov C, Byers ES. Online sexual activity experiences among college students: a four-country comparison. *Arch Sex Behav* 2017;46(6):1641–52.
- Ferguson A. *The sex doll: a history*. Jefferson, NC: McFarland & Company; 2010.
- Herbenick D, Reece M, Hollub A, Satinsky S, Dodge B. T09-O-18 Young female breast cancer survivors: their sexual function and interest in sexual enhancement products and services. *Sexologies* 2008;17:122.
- Herbenick D, Reece M, Sanders SA, Dodge BS, Ghassemi A, Fortenberry JD. Women’s vibrator use in sexual partnerships: results from a nationally representative survey in the United States. *J Sex Marital Ther* 2010;36(1):49–65.
- Katz S, Marshall B. New sex for old: lifestyle, consumerism, and the ethics of aging well. *J Aging Stud* 2003;17(1):3–16.
- King RA, Racherla P, Bush VD. What we know and don’t know about online word-of-mouth: a review and synthesis of the literature. *J Interact Market* 2014;28(3):167–83.
- Knox D, Huff S, Chang IJ. Sex dolls – creepy or healthy? Attitudes of undergraduates. *J Positive Sex* 2017;3(2):32–7 [<http://journalofpositivesexuality.org/wp-content/uploads/2017/07/Sex-dolls-attitudes-of-undergraduates-Knox-Huff-Chang.pdf> (accessed May 18, 2018)].
- Levy D. *Love and sex with robots: the evolution of human-robot relations*. New York, NY: Harper; 2007.
- Ray P. ‘Synthetic love lasts forever’: sex dolls and the (Post?)Human condition. In: Banerji D, Paranjape MR, editors. *Critical posthumanism and planetary futures*. New Delhi: Springer India; 2016. p. 91–112.
- Reece M, Herbenick D, Dodge BS, Sanders SA, Ghassemi A, Fortenberry JD. Vibrator use among heterosexual men varies by partnership status: results from a nationally representative study in the United States. *J Sex Marital Ther* 2010;36(5):389–407.
- Reisner SL, Mimiaga MJ, Skeer M, Mayer KH. Beyond anal sex: sexual practices associated with HIV risk reduction among men who have sex with men in Boston, Massachusetts. *AIDS Patient Care STDs* 2009;23(7):545–50.
- Richards R, Coss C, Quinn J. Exploration of relational factors and the likelihood of a sexual robotic experience. In: Cheok AD, Devlin K, Levy D, editors. *Love and sex with robots: Second International Conference, LSR 2016, London, UK, December 19–20, 2016, Revised Selected Papers*. Cham: Springer International Publishing; 2017. p. 97–103.
- Richardson K. Sex robot matters: slavery, the prostituted, and the rights of machines. *IEEE Technol Soc Mag* 2016;35(2):46–53.
- Riva G, Banos RM, Botella C, Wiederhold BK, Gaggioli A. Positive technology: using interactive technologies to promote positive functioning. *Cyberpsychol Behav Soc Networking* 2012;15(2):69–77.
- Rohleder P, Swartz L. Disability, sexuality and sexual health. In: Aggleton P, editor. *Understanding global sexualities: new frontiers*. Abingdon, Oxon: Routledge; 2012. p. 138–52.
- Rosenberger JG, Schick S, Herbenick D, Novak DS, Reece M. Sex toy use by gay and bisexual men in the United States. *Arch Sex Behav* 2012;41(2):449–58.
- Seligman MEP, Csikszentmihalyi M. Positive psychology: an introduction. *Am Psychol* 2000;55(1):5–14.
- Sharkey N, van Wynsberghe A, Robbins S, Hancock E. Our sexual future with robots – a foundation for responsible robotics consultation report; 2017 [accessed July 05, 2017] <http://responsiblerobotics.org/wp-content/uploads/2017/07/FRR-Consultation-Report-Our-Sexual-Future-with-robots.Final.pdf>.
- Sullins JP. Robots, love, and sex: the ethics of building a love machine. *IEEE Trans Affect Comput* 2012;3(4):398–409.
- Szczuka J, Krämer N. Not only the lonely—how men explicitly and implicitly evaluate the attractiveness of sex robots in comparison to the attractiveness of women, and personal characteristics influencing this evaluation. *MTI* 2017;1(1):3.
- Valverde SH. [Master Thesis] The modern sex doll owner: a descriptive future analysis [Master Thesis]; 2012 [accessed May 18, 2018] <http://digitalcommons.calpoly.edu/theses/849/>.
- Watson ED, Séguin LJ, Milhausen RR, Murray SH. The impact of a couple’s vibrator on men’s perceptions of their own and their partner’s sexual pleasure and satisfaction. *Men Masculinities* 2016;19(4):370–83.
- Williams DJ, Thomas JN, Prior EE, Walters W. Introducing a multidisciplinary framework of positive sexuality. *J Positive Sex* 2015;1:6–11 [accessed May 31, 2017]. <http://journalofpositivesexuality.org/wp-content/uploads/2015/02/Introducing-Multidisciplinary-Framework-of-Positive-Sexuality-Williams-Thomas-Prior-Walters.pdf>.
- Yeoman I, Mars M. Robots, men and sex tourism. *Futures* 2012;44(4):365–71.