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Sex care robots

Exploring the potential use of sexual robot technologies for disabled and elder care

⟨They say my body is broken
they look at me with pity
but little do they know
when I scream your name
and writhe with pleasure
my body serves me well

They have labels for me
and words like access and care
are bandied about
but do they know how we fit
and how sweet access is
when care is shrugged off⟩

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Abstract: The creation and deployment of sex robots are accelerating. Sex robots are service robots that perform actions contributing directly towards improvement in the satisfaction of the sexual needs of a user. In this paper, we explore the potential use of these robots for elder and disabled care purposes, which is currently underexplored. Indeed, although every human should be able to enjoy physical touch, intimacy, and sexual pleasure, persons with disabilities are often not in the position to fully experience the joys of life in the same manner as abled people. Similarly, older adults may have sexual needs that public healthcare tend to ignore as an essential part of their well-being. We develop a conceptual analysis of how sex robots could empower persons with disabilities and older adults to exercise their sexual rights, which are too often disregarded in society. Our contribution seeks to understand whether sex robots could serve as a step forward in enhancing the care of (mainly but not exclusively) persons with disabilities and older adults. By identifying the potential need to incorporate sex within the concept of care, and by exploring the use of robot technology to ease its materialization, we hope to inform the policy debate around the regulation of robots and set the scene for further research.

Keywords: sex robot, care, sexual rights, disabled and elder care, sex care, ethical legal and societal implications

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1 Introduction

The creation and deployment of sex robots are accelerating. Sex robots are service robots that perform actions contributing directly towards improvement in the satisfaction of the sexual needs of a user. Typical types of sex robots include humanoids with full-body or partial-body robotic functionalities; body parts such as arms, heads, or genitals used for sex-related tasks; or non-biomimetic robotic devices used for sexual pleasure. These robots usually display realistic sex-related body movements, have sensors to react real-time to user interaction, and can include humanlike features such as voice to have a small talk with the user.

These robots that are usually for satisfying sexual pleasures can have other applications. Part of the literature reflects on the potential therapeutic uses of these robots, for instance, to address first-time sex-related anxiety, or treat sexual dysfunctions, treat pedophilia or potential sex offenders, or promote safer sex [1]. Sex robots could also be used to help people that feel insecure about their sexual orientation by creating a safe place with no judgment [2, 3].

In this paper, we explore the potential use of these robots for elder and disabled care purposes, which is currently underexplored. Indeed, although every human should be able to enjoy physical touch, intimacy, and sexual pleasure, persons with disabilities are often not in the position to fully experience the joys of life in the same manner as abled people. Similarly, older adults may have sexual needs that public healthcare tend to ignore as an essential part of their well-being. For this article, we grouped disabled and older adults as groups from which their sexual rights have been ignored in the healthcare sector. However, we acknowledge that being older does not necessarily mean being disabled and that both groups should be addressed separately in future contributions.

While sex robots may repeat the society we already have and reinforce existing sexism or machismo [4-7], they may also offer possibilities unimaginable before the creation of the technology, e.g., in the area of care [8]. In this respect, more empirical and conceptual studies from dif-

ferent disciplines are needed to understand the complexity revolving around the use and development of sexual robots in society. In such a discussion, Scheutz and Arnold [9] argue that 'using sex robots have less to do with *what a sex robot is*, or *how sex with a robot is categorized*, than they do with *different takes on the conditions and purposes of both personal relationships and society's interests*.' This article takes a step forward in this direction. We develop a conceptual analysis of how sex robots could empower persons with disabilities and older adults to exercise their sexual rights, which are too often disregarded in society [10].

Building on the concept of *sex care* developed in some countries like the Netherlands, in this article, we investigate first to what extent the concept of care may or may not include sex as a fundamental aspect. Second, we review existing robots for sex purposes. In the third section, we explore the potential realization of sex robots for care purposes. We also anticipate drawbacks concerning the use and implementation of such types of robots in healthcare.

In this article, we acknowledge that persons with disabilities have a high risk of being sexually abused [11, 12], but we do not focus on whether and how robot technology could prevent abusers and sex offenders of people with disabilities from committing a crime. Instead, we focus on elder care and disabled care, and, in this respect, we wonder whether sex robots could be used to teach intellectually disabled persons to understand sexual consent. Further research will explore these issues in more depth. Although they could arguably be described as sex robots, the following electronic sex devices are excluded as non-robots here: vibrators, teledildonics, non-humanoid sex machines, artificial vaginas, electroejaculation tools, vaginal and anal eggs, clitoral pumps, and vibrating chairs.

Our contribution does not endeavor in making decisive judgments for or against the use of sex robots in the care of (mainly but not exclusively) persons with disabilities and older adults. Instead, we aim to create a basis for a future room for discussion of converging and diverging opinions from different stakeholders. Some concepts will necessarily have to be revisited beyond this initial opening discourse, such as dignity and sex, as a human right. Here, we explore the use of sex robots in the context of elder and disabled care as an alternative to existing sex care approaches, to hopefully serve as a step forward in empowering these persons to realize their sexual rights, inform the policy debate around the regulation of robots and set the scene for further research.

2 Care

2.1 The concept of care

There are different understandings of the word *care* that depend on context, time, and the lenses through which one looks. Oxford dictionary [13] defines care as the 'provision of what is necessary for the health, welfare, maintenance, and protection of someone or something.' Cambridge dictionary [14] defines care as 'the process of protecting someone or something and providing what that person or thing needs.' It comes as no surprise that those sectors involving the protection of someone or something include the word care: skincare, car care, childcare, repair care, homecare.

Care is not the same as social support. Socially supportive relationships typically refer to those situations where the other person would do the same in case of need and include co-workers sharing a car to go to work, borrowing eggs from the neighbors, or sharing babysitters between new parents [15]. Caring does not bring in reciprocity [16], and typically refers to parent-to-child or nurse-to-patient relationship.

Those services geared toward the provision of what is necessary for health are part of the rubric of *healthcare*. The Dutch healthcare system defines care as the whole of health care providers (and support staff), institutions, resources and activities directly aimed at maintaining and improving health status and the possibility of directing themselves, and on reducing, eliminating, compensating for and preventing deficits therein [17]. The National Health System (NHS) [18] from the U.K. includes care as one of the six core values of nursing, midwifery, and care staff. Care is also one of the core values identified in nursing, for instance, and has been defined as a 'nurturing way of relating to a valued other person, towards whom one feels a personal sense of commitment and responsibility' [15].

Personal care relates to everyday functional competencies, typically named Instrumental Activities of Daily Living, like feeding, going to the toilet, dressing, grooming, physical ambulation, bathing, laundry, shopping, housekeeping, responsibility for own medications, modes of transportation, or ability to handle finances [19]. Collins dictionary [20] defines personal care as the "help given to elderly or infirm people with essential everyday activities such as washing, dressing, and meals." The Elderly Accommodation Counsel (EAC) [21] of the U.K. sustains that it is the "assistance with dressing, feeding, washing, and toileting, as well as advice, encouragement and emotional

and psychological support." EAC [21] also adds that the Department of Work and Pensions of the U.K. (DWP) defines personal care as "attention required in connection with bodily functions, which include dressing, washing, bathing or shaving, toileting, getting in or out of bed, eating, drinking, taking medication, [and] communicating. Seeing and hearing are also considered to be bodily functions." These activities are directed towards the fulfillment of some of the basic needs found vital for people. To some extent, fulfilling those needs constitutes what is primarily considered *good care*.

The needs of an individual motivate his/her actions. In the 1950s, Maslow arranged the basic needs of individuals in the categories physiological, safety, love and belonging, esteem, and self-actualization. According to him, the needs are arranged hierarchically, implying that lower needs (physiological) should be met before the emergence of higher needs (self-realization). If a person is deprived of food, then concerns about self-esteem may be of little importance. Based on this premise, the scientific literature has reflected on how Maslow's basic needs hierarchy could motivate healthcare professionals toward comprehensive care of a person, not merely for survival, but toward the satisfaction of all other basic needs such as breathing, eating, sleeping, and excreting [22-25]. However, other physiological aspects, such as sex, have not yet been integrated into the concept of care and improvement of patients' wellbeing.

Maslow [26] argued that while the gratification of the need to sleep leads to alertness, vigor, and zest, and its frustration brings someone fatigue, sleepiness, lack of energy or loginess; the same could be said for sex, although there is no respectable vocabulary yet to describe the frustration and the society is not accustomed to thinking so [26, p. 66]. He also stresses the idea that 'for the sex-starved, food-starved, or water-starved person, only sex, food, or water will ultimately serve (...) no fortuitous collocation or accidental or arbitrary juxtaposition will do (...) Nor will signals or warnings or associates of the satisfiers do; only the satisfiers themselves gratify needs.' Sex is, therefore, a basic-need gratifier on itself that can be distinguished from *love*, as they are not synonymous [26, p. 44].

In his understanding, feelings of physical sating and gluts such as food, sex, and sleep, and, as by-products, the well-being, health, energy, euphoria, and the physical contentment are part of those phenomena that basic need satisfaction determines. Those persons experiencing higher levels of need satisfaction will have lower levels of tension and, consequently, will not be in a state of deprivation [22].

In this article, we support the idea that in the context of elder and disabled care, the concept of care equals meeting all the basic physiological needs, including breathing, food, water, sleep, excretion, and sex.

2.2 The sexual rights of disabled and older adults

The World Health Organization (WHO) defines sexual health as the "state of physical, mental, and social well-being concerning sexuality. It requires a positive and respectful approach to sexuality and sexual relationships, as well as the possibility of having pleasurable and safe sexual experiences, free of coercion, discrimination, and violence" [27]. Although every human should be able to enjoy physical touch, intimacy, and sexual pleasure, however, disabled people are often not in the position to fully experience the joys of life in the same manner as abled people. Similarly, older adults may have sexual needs that public healthcare tend to ignore as an essential part of their well-being [28, 29].

In 1993, the United Nations stated that persons with disabilities should enjoy family life and personal integrity, and should 'not be denied the opportunity to experience their sexuality, have sexual relationships and experience parenthood' (Rule 9, para. 2) [30]. Art. 25 of the Convention on the Rights of Persons with Disabilities [31] subsequently enshrined it, stressing that people with disabilities should have the right to the enjoyment of the highest standard of health without discrimination based on disability. It also mentioned that States should 'provide persons with disabilities with the same range, quality, and standard of free or affordable health care and programmes as provided to other persons, including in the area of sexual and reproductive health and population-based public health programmes.' However, after more than 20 years of discussion, the universal access to sexual and reproductive health remains an unfinished agenda [32], as if society failed in recognizing people with disabilities as sexual beings [33].

The Sexual Health, Human Rights, and the Law report from the WHO [10] was a seven-year project that acknowledged that physically and mentally disabled and older people, among others, have difficulties in accessing appropriate sexual health services. WHO [10] concluded that people with disabilities are more likely to find inadequate healthcare provider skills and equipment to meet their needs (twice as much), to be denied care (three times as much), to be poorly treated as non-disabled (four times as much) and to experience catastrophic health expenditure

(50% more). Other quantitative studies show that non-disabled people perceive people with physical disabilities as having fewer sexual and reproductive rights [34], sometimes even as asexual [11], especially women [35].

Although sexuality is a basic human need, awareness, and knowledge about it do not come straightforward for disabled populations. Some researchers even highlight that people with intellectual disabilities are 'purposefully misinformed about sexual health to reinforce fears as a means of inhibiting sexual activity' [11]. Many aspects constrain how people with disabilities experience and engage with themselves as sexual beings, including their particular disability but also sociocultural, religion, economics, and gender factors [36]. These aspects are also relevant for the older population, who may feel the need to conceal their sexuality to fit social norms [29]. Healthcare providers may also put barriers to this matter by considering that 'people with intellectual disabilities or other disabilities should not have a sexual life, reproduce or look after children, and therefore should not need sexual and reproductive health services' [10].

It could also be that organizations are confused about the legality of offering support to safe sexual expression [37]. Sometimes it also depends on who is asked. Meaney-Tavares and Gavidia-Payne [38], for instance, report that whereas staff education and attitudes towards sex rights of persons with disabilities are not related, age and occupation play a significant role: younger (20-29) and managers were more positive than older, direct workers.

Studies report that attitudes towards sexuality in the general population are more favorable than with people with some disability [38, 10]. The full realization of the sexual rights of persons with disabilities and older adults, therefore, requires more research and policies that understand the intersection of people, disability, and sexual rights [36]. These policies could represent a step forward in treating people with disabilities and the elderly in a non-discriminatory fashion concerning their sexual rights and would empower users to satisfy one of the basic human needs.

2.3 Sex care

In parallel to the work of the UN, in 1997, the World Association for Sexual Health (WAS) proclaimed the WAS Declaration of Sexual Rights (revised in 2014). Although this association declares that is a 'multidisciplinary, worldwide group of non-governmental organizations (NGOs) with the aim of promoting sexual health and sexual rights throughout the world' [39], on their website, there is no concrete progress on how the rights of the declaration translate in daily practice.

Some countries have reflected on how could the general and abstract idea of the sexual rights of people with disabilities be translated into concrete actions. In the Netherlands, for instance, they materialize it into what has been called sex care. Although this concept lacks a precise definition, Nwanazia [40] defines sex care as a 'sexual service for people with severe physical or mental disabilities (...) often done by professionals with a background in health care (...) focused on intimacy, physical touch and sexual satisfaction for disabled clients.'

In Europe, there is a platform called European Platform Sexual Assistance for Persons with Disabilities (EPSEAS) that brings together different non-profit organizations offering sexual services for people with disabilities and the elderly.[1] In total, there are 12 different organizations from Belgium, Czech Republic, France, Italy, the Netherlands, Spain, and Switzerland that work towards empowering people with functional diversity to exercise their rights to sexual experiences. In Table 1 below, we have included other associations working towards the same end.

The problem with sex care, however, is that whereas it is one possibility to materialize such a right, it often comes with the question of what is the status of sex workers, and whether their rights are violated in any form, or whether a state should invest public funds in these services. Sex care is also not mainstream, so in a way, one could argue that this initiative has not been adopted successfully.

3 Sex robots

3.1 Definition of sex robot

In this article, we focus mainly on sex robots for care purposes. We ground our definitions in those outlined by the International Organization for Standardization (ISO). ISO 8373:2012 [41] defines robots as programmable devices with a degree of autonomy moving within its environment when performing tasks. Those robots non-programmable in two or more axes or lacking the required degree of autonomy are robotic devices. For autonomy, ISO 8373:2012 refers to the possibility of a system to perform tasks based on current state and sensing, with no human intervention required [41].

1 See http://www.epseas.eu/en/

Table 1: Organisations providing different types of sex care services.

Sex care in Europe						
Organization	**Country**	**Advice and information**	**Sexual services**	**Care providers formation, training and education**	**Care organization support and policy development**	**Sexual assistant as a profession**
Aditi	Belgium	X	X	X		
APPAS Association for Promoting Sexual Assistance	France	X	X	X	X	
Sexual Understanding	France	X		X	X	
Tandem Team Barcelona	Spain	X	X	X	X	
LoveGiver	Italy	X	X	X	X	X
Corps solidaires	Switzerland	X	X	X	X	X
Freya	Czech Republic	X	X	X	X	
Sex Asistent	Spain	X	X	X	X	
Passieflower	Netherlands		X			
Asistencia sexual	Spain, Peru, and Mexico	X	X	X	X	
Tika Stardust	Netherlands	X				
Family Planning Association	Northern Ireland	X		X		
MyHandicap	Germany, Switzerland and US	X	X	X	X	
Mencap	UK	X				

Inspired by the definition of personal care robots of ISO 13482:2014 [42], we define sex robots as *service robots that perform actions contributing directly towards improvement in the satisfaction of the sexual needs of a user*. Typical types of sex robots include humanoids with full-body or partial-body robotic functionalities; that are programmable and that incorporate a degree of freedom. Sex robotic devices can also be body parts such as arms, heads, or genitals used for sex-related tasks.

The Silicone Sex Doll models from My Doll [43] and the Heat & Sound Sex Doll Robots by Z-Onedoll [44] are examples of sex robotic devices. Both feature an internal heating system that allows the user to adjust the body temperature of the doll manually. These two sex robotic devices are not programmable and lack a degree of autonomy, and thus they are not sex robots. Other technologies such as vibrators, teledildonics, non-humanoid sex machines,[2] artificial vaginas, electroejaculation tools, vaginal and anal eggs, and clitoral pumps could arguably be described as sex robotic devices have also been excluded in our review.

3.2 Characteristics

Sex robots incorporate a range of technologies that distinguishes them from mere silicone sex dolls that emit computeresque voice from a perpetually agape mouth, with restricted limb movements, and no physical feedback. Sex robots can display realistic sex-related body movements, have sensors to react real-time to user interaction, and can include humanlike features such as voice to have small talk with the user.

We conducted a review of some of the newest sex robots in the world, and all the information is openly accessible online.[3] In our review of sex robots, either purchasable, in development, or not for sale, we found 12 which meet the ISO 8373-2012 definition of a robot[4]. Of those 12 sex robots, we used content analysis [45] to identify the following categories (and subcategories within) presented in Table 2, which encompass the different characteristics of sex robots:

We investigated a wide range variety of features, including their embodiment, gender, whether they have learning capabilities, what are their social skills or their human-like behaviors. Since sexual robot companies allow users to choose different traits and feelings appealing to them so that their experience is complete [5], we also included the features that can be changed by the user, including skin tone or hair color. The following subsections explain in detail these features grouped in three main parts: 1) embodiment, smart connectivity, and mobility; 2) autonomous sexual awareness and responsiveness and non-autonomous actionability; and 3) artificial intelligence (AI) characteristics: learning, sociability, and human-likeness.

3.2.1 Embodiment, smart connectivity, & mobility

Sex robots may be physically embodied in a tangible robot which the user can touch. There are companies, however, that integrate virtual systems in a smartphone from which the user can still attain sexual gratification from, in the form of masturbation, for example, but that they are not considered sex robots according to the definition given in this article.

Physically embodied sex robots tend to incorporate human-like features: gender, head with hair and facial features, a body with articulated arms and legs, genitals, and sexual orifices. TrueCompanion's female and male sex robot, Roxxxy [46] and Rocky [47], have highly customizable physical features. The user can customize Roxxxy's physical aspects. TrueCompanion offers users the choice of 37 different hairstyles in 40 unique colors, five eye colors, five skin tones, two eyebrow colors, four eyeliner options, nine eyeshadow colors, six lipstick options, six toenail and fingernail color options and ten pubic hairstyle and color options for Roxxxy.

Other physically embodied sex robots also customizable at the time of purchase include Emma by Smart Doll World [48], Android Love Dolls' [49] Robot Sex Dolls lineup, and Realdollx models by Abyss Creations [50]. Some sex robot manufacturers can even custom design sex robots to meet the specific requirements outlined by the user beyond standardized choices. This is the case with the Fantasy A.I Silicone Love Doll by Fantasy Doll [51] and Synthea Amatus' [52] AI Dolls (which includes the sex robot Samantha). Users can personalize many of these sex robots in the same way Roxxxy can. Furthermore, we found in our revision that some have additional ranged options for breast size and height, as well as optional extras including body piercings, tattoos, birthmarks, trans-

2 See an example at https://www.amazon.com/Hismith-Premium-Machine-Wire-controlled-Dildo/dp/B01N6340A8?th=1

3 See https://docs.google.com/spreadsheets/d/1a3d4P7HBNy3ldUwDg5q2_HCzj4g4jbMRtiLcVWfD1YI/edit?usp=sharing

4 Henry, the male sex robot by Abyss Creations (*see* https://twitter.com/realbotixxx/status/1011310032829407232?lang=en), was excluded from the review as there is very little public information regarding it while it is still being developed

Table 2: Categories (and subcategories within) of sex robot charactertistics identifed through content analysis performed on 12 different sex robots.

Sex robot characteristics	
Category	Subcategories
Gender/body type	Gynoid Android Non-binary No gender
Embodiment	Physical Virtual
Mobility and battery	Walking Battery powered
Smart connectivity	WiFi for software updates or answering questions Mobile app pairing IoT
Autonomous sexual awareness	Exterior body sensors Interior body sensors
Autonomous sexual responsiveness	Audio feedback Physical feedback
Non-autonomous actionability	Active robot penetration to the user Active user penetration to the robot
Sociability	Conversation Multilingualism Voice recognition
Learning	Conversational learning Learning about the user
Human-likeness (or human mimicry)	Facial expressions and head and neck movements Emotions and personalities Body temperature control
Hygiene	Washability

gender converters to add a penis, and the choice between a removable or fixed vagina.

Not all physically embodied dolls are customizable, however, for several reasons. Some sex robots are still in the late stages of development, such as ExDoll's Xiaodie [53] and DS Doll Robotics' first and second-generation Robot Doll Heads [54, 55]. Other robots are not for sale, such as Gabriel2052 which was built by Fei Liu [56] as an art project. Even some purchasable sex robots are not customizable because, beyond selecting from predetermined appearances, the selling companies do not offer such options. This is the case for Android Robot Store's [57] Android Robot Dolls.

Virtual sex robots are those who 'live' on a device, rather than in a physical sex robot. All of the sex robots we have identified here are physically embodied. However, one of them has a companion smartphone application with a virtually integrated sex robot. That is, Realdollx models Harmony and Solana are physical sex robots that are also represented in the virtual space. Users can see a virtual version of their Realdollx sex robot on their smartphone with the Realbotix-powered App, with the option to change its hair and hair color, face, body shape, clothes, voice or accent, and personality [58]. Additionally, the Realbotix-powered App supports virtual reality and augmented reality user experiences [58].

Mobile Apps are not the only way sex robots can be connected; many also demonstrate elements of smart connectivity. Upon release, ExDoll's Xiaodie will be capable of performing household chores' by using the Internet of Things (IoT) to connect to smart home devices, such as a kettle or lights, and operate them for the user by voice command [53]. DS Doll Robotics 2nd generation Robot Doll Head is projected to be able to do the same [55].

WiFi connectivity is also a common feature within sex robots. Users of Roxxxy and Rocky, Emma, and Realdollx models can connect their models to the Internet to receive automatic, subscription-based software updates to improve the user experience, with new language options for example [46-48, 58]. Another use of WiFi in sex robots is to communicate with the user. The first generation Robot Doll Head, the Robot Sex Doll lineup, and Android Robot Store models can all receive user commands over a WiFi network [49, 54, 57]. Xiaodie can use the Internet to access search engines in real-time to source answers when addressing user queries [53].

In regards to mobility, all of the sex robots reviewed are mobile in some sense. That is, the user can move them. However, as for autonomous movement, i.e., walking, only one model is said to be able to do this. Android Robot Store's lineup, including sex robot models Jeni and Foxi, are equipped with a lower-body and upper-body exoskeleton [57]. With an exoskeleton, these models are capable of walking and have an internal battery to support untethered mobility. An upper-body exoskeleton also indicates the capacity for making arm movements, whether or not this means that these robots are capable of using their arms for sexual purposes is unclear. Many other sex robots, such as Realdollx models Harmony and Solana, can be custom ordered to have feet which accommodate a standing position [58].

Emma and AI Doll models [48, 52] are the only robots that mention 'power' in their description, having batteries that allow for an unbounded user experience.

3.2.2 Autonomous sexual awareness & responsiveness, as well as non-autonomous actionability

We observe in our review autonomous sexual awareness and responsiveness, as well as passive robot actions. Although similar, these capabilities differ. While autonomous sexual awareness is the capability to sense and perceive a user and his or her willingness to interact sexually with the robot, the responsiveness is the autonomous reaction of a robot to the user action in a sexual way (responsiveness). Sexual awareness and responsiveness are usually interconnected, i.e., awareness triggers responsiveness, and thus, these two elements will often be addressed together. The non-autonomous actionability refers to the possibility to allow a user to use the robot with no detection nor performance of the movement. In such a case, the role of the robot is passive.

Concerning sexual awareness and responsiveness, several sex robots have external and internal body sensors. Roxxxy and Rocky have sensors within the vaginal and anal orifices which detect penetration [46, 47]. Upon detection of the user's movement, Roxxxy and Rocky respond to users by producing audio that denotes sexual arousal (e.g., moaning). Emma, AI Dolls, Robot Sex Doll models, and Realdollx models, all detect user touch using either internal or external sensors and respond with audio feedback [48-50, 52].

Some sex robots, including Roxxxy and Rocky, also react with physical movements. Realdollx models turn their heads and change facial expressions appropriately, responding to the experience as if they were enjoying it [50]. ExDoll's Xiaodie detects user to touch and reacts physically, but those developing the product are not clear on how it responds physically [53]. Roxxxy has components inside its vaginal opening that massages whatever the user inserts in response to penetration [46].

Voice recognition is another form of both sexual awareness and responsiveness. Realdollx sex robots Harmony and Solana can engage in conversation while being used for sexual purposes [58]. It is unclear if any other sex robot reviewed here can participate in this kind of 'sex talk.'

Non-autonomous sexual action refers to the ability of a sex robot to take a complicated, multifaceted action during the human-robot interaction on the command from the user, rather than it being triggered by autonomous situational awareness. Although it is responsive, the response is not produced autonomously by the reaction to a sensor input but from a user action. Action, in this sense, can also be distinguished from responsiveness when considering the ability for sex robots to perform sexual movements on queue, rather than it autonomously arising after the robot detects user movement and touch. For example, the sex robots produced by Android Love Dolls [49] can perform multiple different sexual positions upon direct user input, rather than doing so autonomously based on its awareness.

Other robots also offer on-demand, non-autonomous sexual actions, which the user can trigger with voice or direct input commands. Rocky can be commanded to actively penetrate the user [47], presumably by moving back and forward from the waist down. Roxxxy can be activated to move back and forward to press against the penetrating user actively [46]. In this sense, Roxxxy can be an active agent during the sexual act.[5]

5 See an explanatory video at https://www.youtube.com/watch?v=tEkqYta-i3s

As further examples of non-autonomous sexual action, DS Doll Robotics allude to the notion that their autonomous first-generation Robot Doll Head can perform an oral sex function [54]. They are not clear on what that entails. However, we presume that this is a non-autonomous sexual action that requires user input. As the last example, Fei Liu is not explicit on the functionality of her sex robot art project Gabriel2052 [56]. We imagine that it could be capable of performing an assisted masturbation function on command.

3.2.3 Artificial intelligence: sociability, learning, & human-likeness

An important distinction between a sex doll and a sex robot is that the latter contains an information system within that supports programmability and a degree of autonomy. Some sex robot information systems are very advanced and artificially intelligent. AI, in the case of this review, refers to advanced systems that support sociability, learning, and human-likeness (or human mimicry). A review of the sex robots in light of these systems follows.

3.2.3.1 Sociability

Beyond sex-related audio feedback, many of the sex robots reviewed demonstrate sociable aspects, including conversation and voice recognition. Those who can engage in interactive conversation (some level of back and forth chat) are Emma, AI Doll models, Roxxxy and Rocky, Realdollx sex robots, and sex robots from the Android Robot Store.

Emma can engage in an interactive conversation with the user [48]. Roxxxy and Rocky can listen and respond to the user. The creators claim that the robots respond "as appropriately as possible," whatever that means [46]. Synthea Amatus claim that their AI Dolls are capable of conversation [52], but the manufacturers do not go into any of the details of such communication capability. Android Robot Store [57], similarly, does not explain to what level their sex robots can conversate.

The Realldollx model from Abyss Creations is possibly the most advanced sex robot concerning conversation. The creators claim that their sex robot models Harmony and Solana can hold long-term, persistent talks with users [58]. Moreover, these models feature a range of dynamic mouth movements which allow them to move their lips in sync with the speech to provide a smooth speaking animation [58].

Other sex robots have basic query answering skills that allow users to ask questions. The robot provides answers without a naturally flowing conversation. ExDoll's Xiaodie is one of those sex robots which interpret a user's questions and then search the Internet to answer [53]. The 2nd generation Robotic Head is capable of doing the same. However, it also uses an internal database to search for answers before searching the Internet [55]. Notably, these two sex robots have voice recognition capabilities to support language parsing functions.

Voice recognition software allows systems to recognize the spoken voice and translate it into text. In the case of sex robots, voice recognition enables conversation and basic query answering, as well as voice command functionality. That is, some sex robots can perform functions upon spoken command. Voice can activate Emma, for instance [48]. Android Robot Store's sex robots and DS Doll Robotics' 2nd generation Robotic Head can also take voice commands [55, 57].

In our revision, we can note some robots include multilingual capacities, giving users a choice of multiple sex robot voices. Emma can speak in both English and Chinese [48]. Roxxxy, and presumably Rocky, speaks English with planned future software updates adding conversation functionality for Spanish, German, and Japanese [46]. Also, Roxxxy has two voice options, a pre-recorded human recorded voice and a computer-generated one.

3.2.3.2 Learning

Another aspect of AI in sex robots is learning. Some manufacturers advertise that their sex robots can learn. Emma utilizes 'deep learning' to learn through conversation with the user, aiming to build a relationship with them [48]. Realdollx sex robots can learn a user's "interests and preferences" through conversation [58].

The manufacturers of those sex robots are not clear on the effects of conversational learning. Presumably, it caters to the conversational experience of the individual user. TrueCompanion, however, is a bit clearer and states that Roxxxy, and probably Rocky, can be taught new personalities through use to meet the specific needs and character of the user [46].

In all of these cases, robot manufacturers claim that the learning gathered conversationally affects only the conversational interactions with the users. In other words, the ability to learn is limited to the social aspects, e.g., the robot can learn the users' names or the users' likes and dislikes and adapt to them. What the sex robots reviewed cannot learn is how to improve the sexual part of the relationship. Robots learning about the user advances the social connection, but not the sexual one.

3.2.3.3 Human-likeness

The last artificial intelligence-related area we review is human-likeness (or human mimicry). 'Human-like aspects' include facial expressions, head and neck movements, emotions and personalities, and body temperature control. Functions to support facial expressions and head and neck movements are standard among sex robots. Robots with facial expressions are Realdollx models, Emma, AI Doll models, the 1st and 2nd generation Robotic Heads, and Xiaodie.

The purpose of including these mechanical features is to make sex robots appear more human. Facial expressions imply that sex robots experience emotions. For instance, Realdollx sex robots can smile, frown, or look shocked [58]. Facial expressions may also demonstrate a level of passive normality, also seen in humans, like blinking, raising and falling eyebrows, and moving lips when talking. Emma and Realdollx models are both capable of syncing the robot's mouths with their voices [48, 58].

Sex robots featuring autonomous head and neck movements include Emma, the second generation Robotic Head, and Realdollx models. Presumably, sex robots move their head and neck during sexual-related actions to mimic enjoyment, i.e., Realdollx robots thrash their head around randomly to simulate sexual pleasure. Additionally, head and neck movements may also help replicate outward human awareness, such as moving our head around to take in our environment or tilting it to one side to deeply ponder a conversational point.

Simulated emotions and personalities are another major sex robot selling point. We have identified four sex robots that claim to have either emotions, personalities, or both. Roxxxy, and presumably Rocky, is explicitly advertised as having personalities, emotions, likes, dislikes, and moods [46]. The five unique personalities which determine the social and sexual aspects of the TrueCompanion robot Roxxxy [46] are:

1. Wild Wendy – is adventurous
2. S&M Susan – makes secret desires a reality
3. Mature Martha – more talkative than sexual
4. Frigid Farah – very reserved, does not always like to engage in intimate activities
5. Young Yoko – very naïve, curious, and models an 18+-year-old personality

Realdollx sex robots Harmony and Solana have user-adjustable personalities and voices [58]. This functionality, however, is not autonomous. Changing personalities and voices on Realdollx models requires user input via the smartphone application [58]. Lastly, Samantha (a model by AI Dolls) is said to have 'likes,' but the creator does not provide further details [59].

The last human-like aspect we found in our review is internal body temperature control. Some sex robots have internal heating systems that the user can control to make the sex robot body as warm as a real human. This functionality makes for a more realistic sexual experience. Sex robots which have this feature include Emma and Realdollx models [48, 58].

Another unique use of artificial intelligence we observed in our review is 'artificial consent.' The sex robot Samantha is a new sex robot developed by the same manufacturer who produced AI Dolls [52]. Samantha claims to be able to give consent. Mlot [59] reports that the creators of Samantha advertise the sex robot as being able to detect aggressive user touch and express disinterest as a result. In this respect, Samantha requires 'being romanced,' i.e., detecting being handled softly before the user can utilize the sex robot with full functionality [59].

4 Sex care robot realization

Considered part of the overall physiological needs humans have, denying the enjoyment of sexual life to someone or being oblivious to it would endanger the overall healthy wellbeing of the person and constitute a violation of their dignity. The importance of considering sexual rights as an essential aspect of human life has, therefore, been recognized in major international policymaking. However, this has not been realized yet in practice.

In this respect, advances in medicine may help revisit, in the future, social norms that currently represent a barrier to sexuality in specific populations [29]. The time factor and advances in the sex robot industry may also shape how sex is conceived, also in the care sector. Bendel [60], for instance, classified healthcare robot in surgical, therapeutic, nursing and sex robots, arguing that 'a sex life that fulfills the individual needs surely contributes to health and wellbeing.' Scheutz and Arnold [9] conducted a methodical survey of the public opinion towards robots and sex and concluded that, overall, participants considered 'more or less strongly as appropriate' different uses of sex robots, including their use for disabled people, sex education, to improve self-esteem and overall psychological health, or to improve hormone levels of people with infrequent sex lives.

Through a thematic analysis [61] of the content surrounding the development of sex robots reviewed, we have identified three themes that broadly highlight the poten-

tial uses for sex robots in elder and disabled care. Those uses are sexual, emotional, and educational, and we reflect on these themes in the discussion below. Although sex robots have many sexual characteristics and capabilities that might prove useful in fulfilling the sexual desires of those in elder and disabled care; we anticipate, however, that more research is needed to understand how robot technology might help specific populations and under which circumstances this could be considered a positive or a harmful aid.

4.1 Sexual theme

Recent literature proves that there is no loss of libido in the older adult population [62-64]. Lindau et al. [65] show that men and women engage in sexual activities, including intercourse, oral sex, and masturbation, even in the eighth and ninth decades of their lives. Disabled persons are no different [66, 67]. Shuttleworth et al. [68] also suggest that even though the presence of dementia or functional disability, the desire for sexual intimacy remains important into old age.

Sex robots could be a tool that helps provide a safe environment for older adults and persons with disabilities to explore sexuality. Rocky, an android sex robot, can actively penetrate a user with a vibrating penis. A user could penetrate Roxxxy, a gynoid sex robot. Roxxxy is capable of performing simple sexual movements, i.e., moving back and forth from the user. This feature affords the user the ability to penetrate the sex robot without having to move at all, or very little, which may be beneficial for physically impaired users. In these cases, a female or male sex robot with a massaging sexual orifice to stimulate a male user's genitals, like Xiaodie and Roxxxy have, could cater to the needs of a fragile user. Alternatively, a robotic arm, such as Gabriel2052, to help with masturbation could help.

On the tamer side of companionship, but still, in the sexual theme, there is intimacy. Sandberg [69] describes intimacy, specifically from the perspective of male elders, as something more than sex or other than sex: the closeness, warmth, and touch of another body. Older adults [70, 71] and disabled persons [72, 73] seek intimacy, and sex robots could help in its realization. Emma and Realdollx sex robots have internal heating systems that make them feel warm, like another person. Exoskeletons for sex purposes, which allow a sex robot to walk and move its arms, such as those which Jeni and Foxi by Android Robot Store, could accommodate another type of intimate, physical companionship, that of walking together hand in hand.

4.2 Emotional theme

In our review, it became apparent that while sex robots have a clear functional goal that the general public can understand, i.e., be a sexual companion, the manufacturers of these robots heavily cater to the emotional support side of their technology. To follow, some examples of emotional support-related functions sex robots demonstrate.

Some of the sex robots identified here, Emma, for example, have voice recognition, which allows them to acknowledge the user as an individual. Roxxxy and Realdollx sex robots have personalities that the user can select to best suit their needs. In the case of Realdollx models, the personality of the sex robot can adapt to the user, learning through conversation. Samantha, as well as the other sex robots from Synthea Amatus, are equipped with human-like aspects such as likes and dislikes, laughter, and moods; they can make faces, smiling, frowning, or look attentive. These non-sexual, emotional features seem to push for the understanding that sex robots could provide positive, close encounters with persons beyond purely sexual experiences.

These non-sexual functions could help vulnerable parts of the population. Severely mentally ill or disabled persons that lack social skills require patience from those who socially interact with them [74, 75]. Disabled persons might find the intrinsic patience of a robot to be valuable. Emma, for instance, uses deep learning to learn from the conversation it has with the user to build a relationship with him/her. Users can converse with Emma, who will attempt to adapt to the user conversationally without losing patience with the user.

Sex care robots could represent the merge of emotional support and sexual companionship that benefit users in aged and disabled care. Consider the persisting issue of LGBTQ+ elders feeling afraid to be 'out and proud' [76]. Rocky, the sex robot, could help a closeted elderly gay man who lived his life in a lavender marriage and never pursued gay relationships or sexual relations. Elderly gay men may be closeted and afraid to express their gay orientation with others for fear of judgment, denial, anxiety, inexperience, or some other reason. In this instance, using Rocky could allow that person to make up for lost time both sexually and emotionally without fear.

Since elders are using the Internet to explore or enhance their sexual identities and experiences [77], Levy [3] suggests that users could use sex robots of different genders to explore their sexuality if they never had the chance while in their current state. The possibilities for sexual exploration with sex robots go beyond the obvious, i.e., heterosexual females using gynoid sex robots and heterosex-

ual males using androids. A user can order the sex robot Harmony with a transgender converter, i.e., Harmony has a stereotypical feminine body shape and features but can have a penis instead of a vagina. A sex robot might be a non-judgemental alternative for sexual exploration among users, including the elderly and disabled.

4.3 Educational theme

Sex care robots could be useful to help disabled persons and the elderly with cognitive challenges learn about sexuality and emotions, including consent. If Samantha is not 'romanced' by the user, i.e., gently touched by the user, and instead detects aggressive touching from the user using sensors across the body, it will turn itself off and give no sexual feedback. For a cognitively challenged elderly or disabled person who lacks the awareness or understanding to be able to determine if a potential sexual partner is giving consent or not, Samantha could be used to teach that person to understand the consent process better.

This may be beneficial to help elderly and disabled people identify abusive sexual behavior, which is unsettling common [11, 12]. Murphy & O'Callaghan [78] performed an empirical study that queried adults with intellectual disabilities and young persons (mean age 16.6) to comparatively assess each group's sexual knowledge and vulnerability to abuse. They found that the participants with intellectual disabilities scored lower on all but one of the ten sets of questions regarding their understanding of consent and abuse [78]. As a result of their findings, and based on their review of the literature, Murphy & O'Callaghan [78] suggest that there needs to be better sex education for persons with intellectual disabilities, specifically on-going sex education to help reinforce the teachings. They believe that this will allow this population to exercise their sexual rights while also protecting themselves [78]. Sex care robots might be able to serve an educational purpose in providing that on-going, practical sex education for these persons.

5 Sex care robot implications

Since the use of sex robots for care purposes is still under exploration [79], the literature lacks a comprehensive understanding of the positive or negative impacts of sex care robots. In this section, we bring together some studies that have reflected upon the implications of care and sex robots that could anticipate some of the implications that sex care robots might have. Table 3 below summarizes some of the main legal and ethical implications of the use and development of robots for care purposes [79-83].

Care robots might dehumanize care practices. In general, there is the understanding that care robots might imply the dehumanization of caring practices, which are typically characterized by the inclusion of human contact as an essential aspect of human care [84]. Part of the HRI literature also reflects on the use of deception in care contexts [81], and state, overall, that robots' behavior may delude care-receivers disengaging them from reality, something that is not clear under which requirements is morally permissible [85] or whether it improves their wellbeing [86].

In the context of the use of sex care robots, however, it is uncertain whether they would dehumanize care practices or enhance it because the reality shows that current nursing homes and disabled care facilities fail, in vast numbers, to recognize the sexual needs of their users. Perhaps the inclusion of sex robots could, on the contrary, help realize the recognition of the sexual rights of the users and make care practices more humane.

However, it is unclear whether a sex care robot would challenge the dignity of specific populations. Based on the data collected, Maslow [26] affirmed that, in some instances, 'sex was given up or rejected because it came without love or affection' (p.187). This might suggest that having just sex might not represent what humans seek as per the satisfaction of sex as a basic need. However, Maslow's [26] research data could not prove that 'self-actualizing men and women tend on the whole not to seek sex for its own sake, or to be satisfied with it alone when it comes' (p.187).

In this respect, Scheutz and Arnold [9] argue that the fact that a robot is an object does not necessarily mean that sexual interaction with it implies a loss of dignity. Moreover, the inclusion of emotions and personality geared towards having an empathic reaction and a more meaningful relationship with the user beyond pure sex seems to suggest that the sex industry is well aware of the importance of this other aspect. Without any doubt, whether a care receiver is willing to accept the robot, whether she or he is sincerely willing to take the option of the sex robot, or, on the contrary, or regards it only as a poor substitute of contact, is also to be taken into account. Some disabled or older adults might regard themselves as if they were treated as second class citizens for whom only an artificial partner is available. If so, instead of giving their dignity back, the sex care robot would pressure against the dignity of them. More research is needed to understand whether, in elder and disabled care, sex robots would challenge the dignity of their users.

Table 3: Summaries of the main legal and ethical implications of the use and development of robots for care purposes.

Care-related considerations	Explanation
Human-robot safe interaction	Robots may challenge the physical and mental integrity of the users. Both physical and cognitive safety should be protected.
Allocation of responsibility	Depending on the degree of control a user has, the question of who is responsible if something goes wrong may abound.
Privacy and data protection loss	Always-on robotic devices that monitor the activities of elders may challenge the protection of their data protection and privacy rights.
Autonomy restriction	Task delegations from the human to the machine risk overriding the autonomy and independence of a person.
Deception and infantilization	Mimicking life-life and human states may lead to questioning the authenticity of the relationship and deceive of the user. Robots may encourage the idea elders (with dementia) go through a second childhood
Objectification and loss of control	Insensitive use of robots risks treating elders as if they were not sentient beings.
Human-human interaction decrease	Human-robot interaction may exacerbate existing elder loneliness and increase neglection by relatives and society.
Long-term consequences	Technology, including robots and AI, may have long-term consequences that might be difficult to foresee before mass-adoption and continuous use.

Dignity refers to the whole ecosystem of the concept of sex care, which may include prostitutes. Sex care robots may offer an alternative to the use of prostitutes in the provision of sex care [87]. In the words of Di Nucci [8], sex robots for care purposes could avoid challenging the sexual rights of others, including prostitutes. This service is provided in Europe through different sex care providers such as Aditi and Tandem Team Barcelona for persons in disabled and aged care. Using sex care robots could also help in the curbing of sex exploitation, sex trafficking, and sex slavery as a result of the reduction of human prostitution, although more research is needed [2].

However, prostitution is just one of the items in a long list of implications sex robots may cause. The literature highlights that sex robot technology promotes desensitization towards sexual behavior and that it may help justify or reinforce one's poor actions through the distortion of one's cognition from frequent sex robot use [88-90]. Sex robots may also contribute to the objectification of women [5, 88, 91] and further reinforce the society we already have where sexism or machismo are a crude reality [4-7].

Sex robots might also be the solution to and the source of the same problem they try to solve [92]. The European Parliament has recently warned about the effects of replacing human contact in sensitive contexts such as care for the dehumanization of caring practices [84]. However, from care to sex robots, several companies claim that robots combat loneliness. Robots can be the interface that connects older adults that might live alone and might have relatively little human contact with the real world. Robots may allow them to keep in touch with relatives, talk to their doctors or go grocery shopping.[6]

In other contexts, men and women rejected sexually by other men, or women might find comfort and company with a sex robot. A sex robot may reject unlikely a person for his or her appearance and might serve the desires of the person without opposition. Not acknowledging the real loneliness in care and sexual contexts render the observation of the European Parliament, however, rather weak. A different question may arise here; nevertheless: could the continuous use of care or sexual companion robots intensify and reproduce the loneliness they try to bridge?

Szczuka & Krämer empirically found that one's loneliness does not influence their intention to buy a sex robot

6 For example, KOMP the socially connective telepresence robot for elders by No Isolation https://www.noisolation.com/global/

[93], nor does loneliness influence one's attraction to sex robots [94]. This does not indicate whether or not sex robots intensify loneliness. There needs to be more work done in this area. Sullins [95] warns that by accepting robots as social companions out of isolation, lonely users could be harming themselves as they will then give up the search for a human partner. Döring & Pöschl [96] also note this. This might be the case for persons who are still able to search for human companionship. However, lonely elders or disabled persons who are physically or intellectually handicapped and unable to seek out a sexual partner may feel differently in this respect. Sex care robots might help in these situations, although this requires further empirical exploration.

Sharkey & Sharkey [81] and Sparrow & Sparrow [97] worry about the implications of engaging elders with care robots, especially for the repercussions of the use of deception in HRI. That is, elders may think they are being cared for or that the care robot cares about them. However, this may be untrue. The same could be said for sex robot-human relationships. Users of sex robots, as well as sex care robots, may believe that there is a close bidirectional relationship when, in reality, those bonds are unidirectional [98]. Lin, Abney, & Bekey [99] wonder whether there is danger in the emotional attachment to robots or whether the active engagement in a deceptive relationship with a robot has consequences. To them, there are essential elements of human companionship and relations that robots cannot replace. It may be that deception is morally permissible in the HRI, as Wagner & Arkin [100] reason. However, this area requires more empirical data which is currently lacking.

Sex robots have intimate connections with misogyny, child sexual exploitation, male violence, and that women are programmable [101]. The results of a systematic exploratory survey on public opinion on sex robots reveal that, in general, men find sex robots more appropriate than women [9]. On the expected capabilities of sex robots, the statistics also show that women, more than men, prefer robots to be able to be instructed and obey orders [9]. This may suggest that sex robots increase the objectification of the person, regardless of gender. More research is needed to understand how the interplay between sex robots and humans affects human behavior.

These reasons lead Richardson to campaign against the development of sex robots and push for a European ban.[7] We advance, however, that negative public attitudes towards sex robots might have little impact on preventing the industry from developing such technology. In the context of healthcare robots, the Special Eurobarometer 382 in 2012 on public attitudes towards robots reported that 60% of the respondents suggested that robots in the care of children, the elderly, or the disabled should be banned [102]. However, that never happened. On the contrary, the public opinion improved after three years, and the percentage dropped to 51% in another Special Eurobarometer 427 on autonomous systems three years later [103]. In parallel, the sales of medical robots augmented exponentially (72%) over those years [104].[8]

6 Conclusion

In this paper, we first analyzed the potential inclusion of sex in the general understanding of care. Part of the literature supports the idea of using Maslow's basic needs hierarchy to provide comprehensive care of a person. However, the provision of sex as part of such a holistic approach to care has yet to be realized. The work of major international organizations, including the WHO and the UN, further evidences this, stressing the idea that society often neglects disabled and older adults as sexual beings.

As Addlakha, Price, and Heidari [36] suggest, 'to truly empower all disabled people, it is vital to act to end the remaining silences.' In this paper, therefore, we suggested sex robots to serve as a step forward in enhancing the comprehensive care of (mainly but not exclusively) persons with disabilities and older adults. We called these robots *sex care robots* and defined them as *service robots that perform actions contributing directly towards improvement in the satisfaction of the sexual needs of a user*.

By identifying the potential need to incorporate sex within the concept of care, and by exploring the use of robot technology to ease its materialization, we hope to contribute in raising awareness on the importance of empowering persons with disabilities and older adults to exercise their sexual rights, which are often neglected.

Our purpose here was to initiate the discussion on the use of sex robots in elder and disabled care, not to make conclusive rulings for or against the need or use of sex

7 See https://campaignagainstsexrobots.org/2018/05/08/policy-report-sex-dolls-and-sex-robots-a-serious-problem-for-women-men-society/

8 More quantitative data is needed to know how these numbers have evolved since the last Eurobarometers

robots in this context. Within the context of care for elder and disabled persons, we explored sexual rights in care, existing sex care frameworks, robots, and the potential uses and implications of sex care robots. We did not deeply explore the concept of dignity or the arguments against sex being a fundamental human right. These areas certainly require further and careful investigation before making any definitive judgments on the use of sex robots in such a sensitive context. It is our aim that this contribution will serve as a starting point for a future discussion.

Our contribution also shows that sex care robot realization does not come without drawbacks. A recent interview [105] on the potential use of sex robots for disabled people with a person with disabilities highlighted the following:

"James - Well what I find interesting is that people that are pitching these sex robots are trying to kind of validate their creation, and so you se them saying, Oh, it could be used for different situations, oh, like maybe disabled people can use it,"and I just kind of wonder, sory? What do you mean by that?

Penny - Oh, it's the same old story. I can't help butting in now because 'disabled people don't make love', full stop, in any other way and we have to have a sex robot, a lover.

Simon - Well, and the add on that if you say, "Well hang on, this is not appropriate," and they go, "Oh, but it's for disabled people." Oh, then it's okay, then it's okay.

Penny - Yeah, absolutely fine.

Simon - We make it valid do we?

Penny - Yeah.

Kate - Would you use a sex robot Simon?

Simon - I feel it's a bit like Uber, I probably would but feel a bit morally uncomfortable afterwards, that's my instinct."

This article does not intend to validate the technology developed by the sex industry. Robot technology may have moral implications, contribute to the loss of human contact, reinforce existing socio-economic inequalities or fail in delivering good care, and there is no proof that sex robot technology is going to be any different. Moreover, these technologies might have long term catastrophic or existential risks and might have to 'be subject to planning and mitigation efforts commensurate with their expected impact' [106]. Still, robot technologies may also benefit a large part of the population, and that is what we tried to understand in this article.

In this respect, it is essential to understand the purpose these robots may serve and anticipate the specific physical and sex-related needs that elders and disabled persons might have in having sex with robots. These types of considerations (e.g., needing to ensure the safety of a frail elder during sex) are those which human sexual partners take into account. If sex robots may take over that role in the care of elders and disabled persons, they should also be considered in that way from the very design of the technology. Methods to cater the design of robots to the specific needs of users include value sensitive design [107], care-centered value sensitive design [82], and values in motion design [108-110]. In this respect, the engagement between sex robot makers, care providers, and persons with disability may help configure a more person-centered sex care service decision-making, planning, and delivery.

A more in-depth exploration of the implications of using sex robots in the care of elderly and disabled persons is required to understand the potential impacts associated with this technology. Future steps should investigate public attitudes towards sex care robots, including the vision of nursing homes and the ones of potential users. These data could offer a more realistic view of the potential applications of such technologies in particular use cases. Moreover, designers and caregivers should take into account possible negative aspects, including sex robot addiction, the mechanization of sex, or the likely devaluation of intimacy and empathy. Other elements worth exploring are within the realm of cybersecurity and the threat and risk of a hacked sex robot to the user; and the effects of sex care robot use on care. Other topics to be explored should include those related to robot agency, including robotic consent, consciousness, and free will.

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