

Social and Sexual Robots: Technological Development, Social Acceptance and Ethical Challenges

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Abstract: Japanese society is characterised by a unique technological development and openness to it, which has allowed the development of sexual and social robots. This article provides an overview of the technological development, social acceptance and ethical challenges of passion machines. It presents recent technological advances in the field of intimate robots and analyses their impact on human-machine interaction and individual sexual experiences. In addition, it examines the reactions and attitudes of societies towards these technologies, including acceptance, debates and possible protests. The abstract concludes with a discussion of the ethical issues that arise with the development of this type of technology, and draws attention to the importance of protecting human rights and social norms in this dynamically changing environment.

Keywords: social robot; human-robot interaction; sexual robot; HRI

1 Introduction

The line between man and machine is becoming increasingly blurred as modern technology advances. In recent decades, breakthroughs in robotics and artificial intelligence have taken human-machine relations to a new dimension, including in the field of intimacy. Japan, a world powerhouse of technology and innovation, has been at the forefront of this field, developing highly advanced erotic automatons that provide realistic interaction and experiences for their users.

The aim of this article is to provide an overview of the development of erotic mechanoids, their technological background, and the social and ethical issues that go hand in hand with the rise of sexual robotics. The theoretical aspect of the human aspect of human-robot interaction could lead to the conclusion that future robots may already be able to evoke deeper emotions in humans, to make people feel attached to them, to consider them as their companions [2]. I will examine how these devices shape human interaction and their impact on society and individual

experiences. Understanding the research and development of sensual droids not only provides an insight into technological advances, but also stimulates a reassessment of social norms and values.

2 Related Works

The interaction between humans and robots is increasingly becoming a central issue in modern society, and this is especially true for intimacy robots. The views of authors and scientific researchers differ. Many authors state in a global sense the negative impact on human-machine cooperation, others discuss the positive impact on man and his work [4]. One of the key distinction that needs to frame this discourse, now and in the future, is between the physicality of lovemaking with robots and the experience of psychological intimacy with them [3]. Passion machine represent one of the most interesting and challenging areas of this type of interaction. In the following essay, I will review the challenges inherent in intimate robots from the perspective of human-robot interaction, with a particular focus on ethical, psychological and social aspects.

Firstly, it is important to understand that the introduction of passion machines opens a new dimension in robotics and human-machine interaction. While robots have traditionally been designed for work or entertainment, passion machines are entering an area that was previously considered taboo or ethically sensitive. A sexbot is a social robot that can interact with humans through vision (through cameras), voice (through microphones and speakers), touch (through capacitive sensors or contact microphones), cognition, and emotion (through cognitive modeling and behavioral responses, perceiving, and expressing emotions) [11]. In Japan, where technology and lovemaking are both important parts of the culture, the development and acceptance of intimacy robots raises even more pronounced challenges.

This kind of social robots are not just mechanical devices, but offer a whole new experience for those who are curious to push the boundaries of technology in intimacy.

One of their most striking features is their incredible lifelike appearance and responsive movements. Engineers and designers are meticulously crafting these robots to resemble the human body and behaviour as closely as possible. Precise mechanics and the use of innovative materials give you the feeling of being in contact with a real human.

The level of interaction is also impressive. Sex robots have speech recognition and artificial intelligence-based features that allow them to respond to their users in real-time. This gives users a unique experience they have only fantasised about before. Offering human machine interfaces capable of handling cultural variation in speech

is an exciting topic in cognitive info-communication. From a machine learning point-of-view, Telepathy Labs GmbH's paper examines Automatic Speech Recognition (ASR) with respect to transcribing interactions occurring in a language environment where a particular dialect of a pluricentric language is spoken [5].

In addition, it is important to note that these robots are not just for physical gratification. They are also thought by many to help singles and those who have difficulty forming human relationships to meet their emotional and social needs.

One of the main challenges with passion machines is related to issues of ethics and morality. Many people are concerned that intimate androids could distract people from the importance of human relationships and contribute to social isolation or the normalisation of violence. There is also the question of whether pleasure bots respect the rights and dignity of their users or treat them as mere objects.

From a psychological perspective, complex issues also arise. How does the use of pleasure bots affect people's sexual and emotional health? Could passion machines make it harder for people to form healthy human relationships, or even help those who find it difficult to form partnerships? These general psychological and sociological questions require further research to understand the impact of passion machines on people's lives and social behaviour.

At the societal level, it is also important to consider the challenges associated with pleasure bots. How are passion machines accepted by different groups in society? What impact can erotic robots have on social norms and values? These questions deserve social debate and in-depth analysis in order to ensure that people and society can properly manage the introduction and use of intimacy robots.

Ultimately, the challenges posed by pleasure bots in Japan raise broad and complex issues that need to be addressed through extensive social dialogue and research. It is important that ethical, psychological and social aspects are taken into account in the development of people and technology to ensure that human dignity is respected and the value of human relationships is preserved.

In Japan, passion machines and robotics in general are receiving considerable attention. Some research and development is aimed at improving human-robot interaction and exploiting new opportunities for humans.

It is possible that some articles are about how researchers and developers are trying to use intimate androids as tools to help people in intimate relationships and in dealing with loneliness. Some say sensual droids could also help care for elderly people, especially those who have little human contact. Research investigating the adoption of robots and social agents by older people provides empirical support for the role of key factors identified by adoption models as influencing and moderating user adoption. To foster the right level of operator trust in AI, a mechanism is needed to continuously assess and calibrate human-AI trust [14]. These models are mostly based on psychological and sociological theories, and although they may

differ in complexity and content, their common goal is to understand, explain and predict factors that affect users' acceptance and willingness to use technologies [6].

There are several ways to control the behaviour and movements of robots, and a Hungarian research team has explored and scientifically investigated these possibilities [16].

However, there are also challenges with sensual droids, such as ethical issues, substitutes for human contact, and issues of social acceptance. Many people are concerned that if sensual droids become widespread, people may lose their need for human contact and seek to satisfy intimacy through mechanical means. The Digital Ethics Handbook, edited by Carissa Vélis in Oxford, details the ethics of sensual droids. If an object is not alive, then our experience is reduced entirely to connecting with our own gender identity. This reduction per se can be morally troubling. Having reviewed the potential benefits of sex robots, it is important to look in more detail at the arguments against them. Is there anything fundamentally wrong with having love with a robot? And even if there were nothing fundamentally wrong, is it possible that having love with a robot could have harmful effects on the user [7]?

Human-robot interaction and social robotics are dynamic research areas with huge potential in different areas of human life. Therefore, as described above, it is important that developers and researchers take human needs and values into account when designing and developing technology so that social robots can truly help people and contribute to human well-being.

3 Innovation and Technological Development

The technological development of intimate robots is an exciting and ever-changing field. Many professional researchers have studied the evolution of generations of robotics and its technologies [15]. I have put together some key ideas about their development that developers should keep in mind:

- **Lifelike appearance and responsive movement:** The engineers and designers use materials and technologies that create an incredibly realistic look and feel. This includes skin-like materials, precise motors and sensitive sensors.
- **Artificial intelligence and speech recognition:** intimacy robots have increasingly advanced artificial intelligence and speech recognition capabilities. This allows them to adapt to their users' preferences and to be interactive. Users can chat, communicate and interact with the robots, providing a more realistic experience.
- **Customisability and personalised experience:** These robots can often be customised and personalised according to users' needs. This allows each user to have a unique experience when interacting with the robots.

Customization can include appearance, behaviour and pre-programmed functions.

- Connectivity to other devices and platforms. This allows, for example, control from smartphones or internet connectivity for additional interactivity and functionality.
- Ethical and safety considerations. Developers and manufacturers of sex robots should develop guidelines and regulations that protect users and ensure ethical and responsible use of the devices.

The figure below is a good representation of these occurrences (Fig. 1):

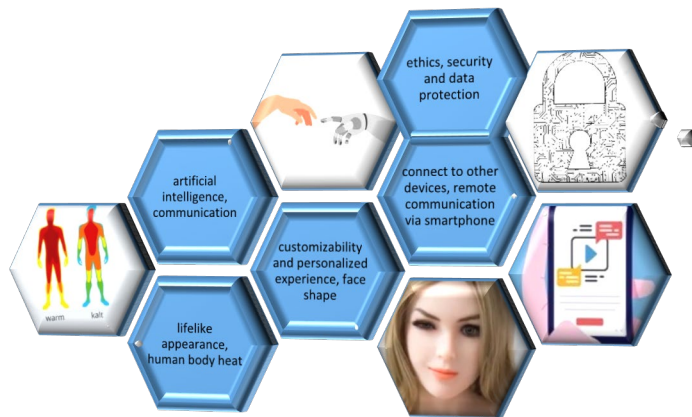


Figure 1
Own editing

Innovation and technological developments in the field of social and lovemaking robots are ongoing. Among the latest trends and developments in the recent past are: The primary direction is the use of Artificial Intelligence (AI), which allows robots to learn from human interactions and adapt to individual needs and preferences. There are also significant advances in the integration of sensors and sensing, such as voice, motion and touch sensors to help robots recognise and respond to human gestures and environmental changes. There have also been significant advances in hyper-realistic visualisation, which faithfully mimic the anatomy and facial features of the human body. New communication capabilities allow robots to communicate naturally with humans using voice recognition and speech generation technologies. Adaptive features allow robots to adapt to the needs and preferences of individual users, learning from their communication style and behaviour. Many of the newer social and erotic robots are able to connect to the internet and cloud-based services, allowing for continuous updates, learning new features and becoming more interactive over time. These are just a few examples of the latest technological developments in social and lovemaking robots. This field is

rapidly changing and evolving, with new innovations and solutions constantly emerging. Hancock in her study discusses the lack of acknowledgment of intimacy technology by the CASR and highlights McArthur's concept of "digisexuality," which sees intimate relationships with technology as part of human amorous evolution. It suggests that erotic technology will bridge the gap between humans and sensual droids, ultimately normalizing their role in human sexuality and relationships [9].

Here are some examples of sensual droids made by different companies around the world. It is important to note that these technologies raise a number of ethical and social issues, and there are ongoing debates and developments in the field of intimate robots:

- 1) Lovot: This is a social and erotic robot developed by the Japanese startup Lovotics. Lovot is designed to keep people company and illicit positive emotional responses. The robot expresses its emotions through facial expressions and movements and can follow people around the room.
- 2) Dollhouse 168 AI Robot: The AI Robot has artificial intelligence that allows it to learn about human preferences and habits and provide a personalized experience to users.
- 3) RealDoll X: This is the latest intimate robot from the RealDoll company, which mimics the anatomy of the human body in a lifelike way. RealDoll X has personalized AI that allows users to communicate and interact with it.
- 4) Synthetics Synth-X Robot: Synth-X by Synthetics is a humanoid pleasure bots that has a lifelike appearance and resembles human skin to the touch. The robot is compatible with the Oculus Rift VR headset, allowing users to enjoy the experience in virtual reality.
- 5) Abyss Creations AI-Driven Sex Robot: this project aims to create a sensual droid with advanced AI to better understand users' preferences and needs. The robot is interactive and can communicate with the user on erotic and other topics.

These are just a few examples of sensual droids made by various companies around the world. It is important to note that these technologies raise a number of ethical and social issues, and there are ongoing debates and developments in the field of sexual robots [17].

3.1 Interactive Features, Use of Artificial Intelligence and Integration of Sensors

How is artificial intelligence being used and how are sensors being integrated in these robots? - the question arises.

The integration of artificial intelligence (AI) and sensors is playing an increasingly important role in the development and design of intimate machines. These technologies enable robots to be more interactive, more responsive to users and

provide an experience tailored to individual needs. AI used in robots allows them to learn and adapt to specific user preferences and behaviours. This can include automatic responses to certain stimuli, personalisation of the sexual experience or even simulation of responses to emotions.

Sensor integration: Robots often incorporate a variety of sensors that allow them to sense and respond to environmental stimuli and user behaviour. These sensors may for example:

- Pressure-sensitive sensors on the skin that respond to touch and stroking.
- Voice recognition systems, which detect sounds and respond to voice commands or talk to the user.
- Motion sensors that allow robots to follow the user's movements or actively participate in intimate interactions.
- Temperature and humidity sensors that allow robots to better respond to environmental changes and optimise user comfort.

By combining these sensors with artificial intelligence, robots can provide an experience that is closer to real human interaction and adaptable to user needs. However, it is important to note that these technologies are still in development and raise a number of ethical and social issues that need to be addressed in further research and development.

4 Social Acceptance of Sex Robots

The social acceptance of intimate android robots is a complex and multifaceted issue that involves a number of ethical, moral, psychological and cultural factors. Many people are concerned that the proliferation of robots in erotic relationships or intimate relationships could lead to the isolation of humans from human relationships. This raises ethical and moral concerns about human dignity, the nature of intimate relationships and the importance of human emotional relationships. At the same time, the proliferation and acceptance of sensual droids may have significant social impacts, such as changing erotic norms and values, decreasing or increasing intimate harassment and violence, and changing the desire for lustful gratification. Therefore, the acceptance of sex robots can vary significantly from culture to culture. Some cultures may be more open to such technologies, while others may have strong resistance or taboos about erotic robots. And in the context of personal preferences and needs, for some people, pleasure bots may be a solution to meet certain sensual or emotional needs, while for others they may be ethically or morally unacceptable.

Social acceptance of sex robots is constantly changing and evolving with technological advances and changing social norms. However, it is important to properly address ethical and moral issues and to think carefully and consciously

about the proliferation and use of sensual droids in order to minimise any potential negative impacts and create benefits from their use.

4.1 Ethical Challenges

There are a number of ethical challenges related to erotic robots, as these devices raise a number of important social, moral and psychological issues. Mentioning as an example, that in this respect, a growing body of scientists “have started to explore the idea of using technology to help disabled people satisfy some of these needs, although not without controversy. In concrete, ideas surrounding the use of robots for eroticism care purposes have been put forward, as service robots performing actions contributing directly towards improvement in the satisfaction of a user’s sexual needs”[10]. In this context, I consider the sub-topic from two perspectives. On the one hand, I will consider the ethical aspects of personal relationships and human-robot interaction, and on the other hand, I will emphasise the perspective of moral dilemmas and legal issues related to pleasure bots. Some of these challenges include:

- **Human dignity:** the use of pleasure bot raises questions about whether these devices respect human dignity and the importance of human relationships. Many people are concerned that the use of sexual robots could separate people from the pleasure and satisfaction that emotional and social relationships can bring.
- **Social norms and values:** the proliferation of erotic robots could have an impact on social norms and values, such as the nature of intimate relationships, intimacy society and gender relations. It is important to take these impacts into account and to manage the development and use of devices appropriately.
- **Interpersonal relationships and social isolation:** the use of intimate robots raises the question of whether these devices enhance the capacity for human interaction or have the opposite effect and may lead to social isolation.
- **Sexual harassment and violence:** the possible use of erotic robots raises a number of ethical questions in the context of eroticized harassment and violence. For example, the question may arise as to whether the use of intimate androids could reduce or increase the incidence of sexual crimes.
- **Rights and freedoms:** Ethical questions include how the use of pleasure bots affects the rights and freedoms of individuals, such as personal liberty, self-determination and privacy.

To address these ethical challenges, it is important to include ethical considerations in the development and use of erotic robots. This could include the development of ethical guidelines, the promotion of public debate and dialogue, and the establishment of the necessary legal framework to ensure responsible and sustainable use of the devices.

5 The Applied Method

The future of robots in our society is a vast topic with need for many complex considerations. However, Lynsey study about the future of robotics gives a brief insight into the status of robots in industry from an engineering standpoint and considers the future potential of a world with increased robot presence with SWOT [12]. Based on this method, I used the SWOT method applied to pleasure robots.

The SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis is a powerful tool to assess the strategic position of companies and products. When looking at sex robots, SWOT analysis can be particularly relevant for the industry.

In terms of strengths, pleasure bots may have technological innovations such as advanced artificial intelligence and sensors that enhance interactivity and experience. In addition, lifelike appearance and movement can be a significant advantage for users seeking realistic contact. However, weaknesses can also be identified, such as ethical concerns and security risks, which provide opportunities for negative feedback and tightening of regulations. Pricing challenges may also arise, as high prices may limit wider adoption and availability. The Opportunities aspect includes the growth of the sensual droids market and the potential for developments that could further improve the experience and broaden the user base. At the same time, competition and social acceptance can pose challenges for sensual droids and need to be taken into account when developing market strategies.

Overall, a SWOT analysis can help intimate machine industry players to gain a comprehensive understanding of the factors that influence the success and acceptance of their products. This will allow them to develop more effective strategies to optimise their market position and ensure their long-term sustainability.

In general, it is worth starting the analysis when the service is about to undergo a major transformation, when a new opportunity is emerging, when you want to introduce a new technological innovation or when the social environment has changed [1]. Therefore, after the literature review and mapping of the current situation, I thought it worthwhile to prepare a SWOT analysis to outline the current situation, opportunities and challenges related to sex robots:

- Strengths:

Technological innovation: Japan is renowned for its technological advances, and they are not lagging behind in sex robots. Robots have advanced artificial intelligence, sensors and other innovative technologies.

Lifelike appearance and responsive movement: These robots excel in lifelike appearance and movement that are close to the human body.

Wide range of functionality: these robots not only provide physical satisfaction, but also have functions such as speech recognition, communication and contact.

- Weaknesses:

Ethical concerns: there are a number of ethical issues around the use of erotic robots, such as social impact, weakening human relationships and respect for human dignity.

Pricing: These robots often come at a high price, which can make access difficult for the average user.

Security risks: Internet-connected robots carry security risks, such as privacy concerns or hacking risks. Furthermore, their internet-connected nature introduces cybersecurity risks, such as privacy breaches and hacking, which could deter potential users [18].

- Opportunities:

Growing market: Demand for pleasure robots is steadily increasing and robot manufacturers have the opportunity to capitalise on this growing market share.

Developments to improve the experience: further developments and innovations can make robots even more lifelike and interactive, improving the user experience.

On the opportunities front, the market for pleasure robots continues to grow steadily. Manufacturers can leverage this trend by targeting specific consumer needs and expanding into diverse segments, including individuals experiencing loneliness, older adults requiring companionship, or those with intimacy challenges. Advances in artificial intelligence and material sciences also provide avenues for creating even more lifelike and interactive experiences. Moreover, expanding into emerging markets with growing middle-class populations offers additional potential for market penetration. Finally, integrating these robots into therapeutic contexts, such as for PTSD patients or sexual health education, could open entirely new application areas.

- Risks:

At the same time, several threats loom over the industry. Regulatory and legal frameworks for sex robots are still evolving, and stricter rules could impose constraints on their development and distribution. Social acceptance remains another barrier, as cultural norms and ethical concerns could limit widespread adoption. Additionally, competition from substitute technologies, such as virtual reality-based solutions or AI-driven virtual companions, may reduce demand. Lastly, environmental concerns about the production and disposal of robots could negatively impact their public perception, particularly among sustainability-conscious consumers.

By identifying and analyzing these factors, SWOT analysis equips stakeholders with a clear understanding of the strategic landscape, enabling them to develop more effective approaches for addressing challenges and capitalizing on opportunities. This method highlights the importance of evaluating such technologies not only from a technical perspective but also with regard to their societal, ethical, and market implications.

Results and Conclusions

An examination of sex robots shows that they have significant strengths and potential, but also a number of weaknesses and threats, which pose challenges to the wider adoption and uptake of these technological developments.

Technological advances and realistic experiences allow these robots to offer an attractive and satisfying alternative for humans. In addition, growing demand and technological advances create opportunities for further innovation and market growth.

However, there are also a number of challenges to be faced. Cultural barriers and ethical concerns may make it difficult for sensual droids to be more widely accepted and integrated into society. In addition, price sensitivity and social rejection may also be potential barriers to the market success of intimate automatons.

For successful uptake and adoption, it is important that both developers and society address ethical and social issues and address these challenges in an open and collaborative manner. Legal regulation must also keep pace with technological developments, ensuring users' rights and human dignity.

Overall, erotic robots have significant potential in the sexual and social sphere, but they also face a number of challenges to reach their full potential and become an accepted part of modern society.

Summary and Options for the Future

Today's widespread technological expansion impacts perhaps every aspect of human life. Pleasure mechanoids are an inevitable consequence of this progress. The impact erotic automatons will have on human intimacy remains controversial and deserves our attention, particularly as human gender relations are already impacted by socio-cultural evolution and advancement. Further research can only facilitate our challenge of using erotic mechanoids to mostly enhance, rather than detract, from human intimacy and intimate satisfaction. [13].

The potential for pleasure mechanoids covers a wide range of possibilities, which could have significant social and technological impacts. First of all, they can offer an alternative in the search for intimate relationships and emotional satisfaction for those who are limited in their social relationships or lonely. In addition, they can also be used for therapeutic purposes, for example to treat sexual dysfunction or problems experienced in intimate relationships. They can also help to care for older people, help to reduce social isolation and to help support their mental health. In addition, the development of intimate mechanoid robots could facilitate technological advances in human-robot interaction and artificial intelligence.

However, the challenges associated with the use of erotic mechanoids are not negligible. Ethical and moral issues, such as the substitution of human relationships or the violation of human dignity, raise fundamental concerns. In addition, the proliferation of sex robots could provoke social resistance and change the nature

and quality of relationships between people. It is also an important consideration that the use of pleasure mechanoids may negatively affect people's mental health, increasing social withdrawal or isolation from real relationships. In addition, privacy issues and potential threats from hackers are also a concern, which is an important aspect of security and data protection.

These points underline that pleasure automaton can have a significant impact on both society and individuals. It's necessary to enhance both the theoretical framework and the breadth and depth of empirical studies investigating the erotic utilization of human-like full-body material artifacts. This pertains especially to exploring not just the risks but also the potential benefits for intimacy and social well-being [8]. The development and acceptance of the industry brings with it a number of complex challenges and opportunities that require in-depth analysis and wide-ranging debate by social and technological experts and stakeholders.

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