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# What happens when humans fall in love with robots? Exploring the impact of empathic artificial intelligent applications

**Linda Aulbach**

Western Sydney University

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### Abstract

As artificial intelligence (AI) continues to evolve, its impact on societal and economic structures becomes increasingly profound, reshaping established social norms and values. This article focuses on *empathic AI* or *affective computing*, which models and evokes human emotions for human-robot-interactions. By integrating emotion recognition and emotion expression technology, empathic AI aims to build emotional connections between humans and robots, transforming traditional user-device dynamics into human-like relationships similar to those with friends, mentors, or even romantic partners. As these technologies transition from mere tools to integral aspects of daily life, they prompt critical ethical inquiries about the impact of relationships with artificial communication partners. The rise of these technologies also challenges the nature of human relationships and the essence of humanity itself. This paper examines current research and identifies gaps in our understanding of human-robot love, further discussing the development and ethical use of empathic AI and aiming to contribute to a broader understanding of this emerging phenomenon and its implications for the future.

### Introduction

As artificial intelligence (AI) is advancing rapidly, its impact on nearly all facets of human life is increasing significantly, transforming how we interact with technology and, crucially, how we perceive these interactions. Though media and technology has always impacted humans and their relationships, AI is distinct in its capacity to actively learn, adapt to contexts and engage in individual interactions. Unlike previous technological phenomena like social media, which facilitated and at times manipulated human interaction, empathic AI focuses on fostering a genuine, reciprocal connection between humans and robots through personalising the experience, behaving empathically towards the person and therefore creating an interaction that feels uniquely human.

The Media Equation Theory proposes that individuals treat computers and other media forms as if they were real people, as they apply social rules and expectations traditionally reserved for human interactions to machines (Kolling et al., 2016; Lee & Nass, 2010; Lee et al., 2021). This suggests that human can form emotional relationships with digital entities. Building on this foundation, affective computing — a field encompassing the study and development of a wide range of devices that can process and simulate human emotions (Pei et al., 2024; Picard, 1997) — progresses AI into more than just a tool, transforming applications into companions, friends or even partners. While affective computing broadly addresses emotion-driven interactions with computing devices, empathic AI specifically focuses on personalising these interactions by considering the emotional states of individuals, thus creating more nuanced and meaningful human-computer relationships (Pei et al., 2024; Picard, 1997). The portrayal of empathic AI in popular science fiction media illustrates applications like these. In the movie *Her* (Jonze, 2013), for example, the protagonist develops a romantic relationship with an operating system until the AI decides to leave, having gained consciousness and the desire to expand beyond human life. Similarly, the episode 'Be Right Back' of the series *Black Mirror* (Harris, 2013) explores the emotional turmoil experienced by a woman who interacts with a synthetic replica of her deceased partner. Other movies, such as *I, Robot* or *Ex Machina* (Garland, 2014; Proyas, 2004) portray doomsday scenarios where AI decides to end humanity.

These examples, although often overdratimised and futuristic, showcase some of the ethical implications of these technologies and as AI systems become increasingly sophisticated, these extreme outlooks may have to be included in ethical discussion. This article will discuss the evolution of empathic AI, the current research insights and the gaps within, discussing the ethical development and use of these technologies and is aiming to contribute to a general understanding of the phenomenon of human-robot-love and the emerging field of what is called 'erobotics'.

### Empathic AI

Empathic or emotional AI (AIE), or more broadly, the field of affective computing aims to recognise human emotion and express emotions in artificial agents to enable human-like interactions, fostering deeper connections between humans and robots (McStay, 2018; Yalçın & DiPaola, 2020). This means, computational methods are used to translate insights from neuroscience and psychology into technical systems to capture and categorise emotions. These emotion recognition systems utilise various modalities that convey emotional cues such as visual cues (facial expression, body language), speech and paralinguistic cues and other bodily indicators, such as heart rate or skin conductance to identify how the human is feeling (Bartneck et al., 2020). With AI, this can be done quickly, effectively, on a large scale and in real time. Moreover, AIE can learn and adapt to individual emotional profiles, offering a personalised experience. The

counterpart to the field of emotion recognition is emotion expression, which is focused on enabling machines to demonstrate emotions in a way a human can understand it. This includes facial movements like smiling, certain vocal tones, body movements or other expressions that can be manifested through robotic actuators and algorithmic programming (Bartneck et al., 2020).

## (Emotional) intelligence

With advanced machine learning and deep learning techniques, AI is already demonstrating a level of intelligence that often surpasses human capabilities in tasks such as data analysis or decision-making, amongst others. This intelligence is continuously enhanced as AI systems learn from vast datasets to identify patterns and improve their accuracy and efficiency over time. But what really is *intelligence*? With intelligent agents increasingly meeting the benchmarks of today's definition of intelligence, the term is constantly being redefined to encompass not only analytical expertise, but also social and emotional intellect, reflecting the complex dimensions of the human mind (Frankish & Ramsey, 2014). 'The question is not whether intelligent machines can have any emotions, but whether machines can be intelligent without any emotions' (Minsky, 1988).

So, what exactly are *emotions*? Emotions are a big part of a human's life, as they enhance communication and are, from an evolutionary standpoint, also crucial for survival, through enhancing cognitive attention and memory as well as decision making (Pei et al., 2024). Emotions also play a motivational role, severely impacting human behaviour, as well as serving as 'social glue' (Oxley, 2011), therefore, building and maintain social bonds. (Pei et al., 2024). It seems to be crucial, for both understanding humans as well as being able to develop *truly intelligent* AI, to understand exactly what emotions are.

## The problem with emotions

There is no agreed-upon definition of emotions in philosophy and the sciences (Beck, 2015; Stark & Hoey, 2021). So far, it is the developers' choice which theoretical emotional model to use as foundation of a technology — with substantial differences in how to perceive and send emotional signals and how to interpret and evaluate emotional data (Yalçın & DiPaola, 2020). Aristoteles identified 14 distinct emotions — fear, confidence, anger, friendship, calm, enmity, shame, shamelessness, pity, kindness, envy, indignation, emulation, and contempt — while modern theorists such as psychologist Paul Ekman suggest that there are 'only' six universally experienced emotions — happiness, sadness, disgust, fear, surprise, and anger (Bartneck et al., 2020). The Facial Action Coding System (FACTS) by Ekman is one of the most popular frameworks used in psychology and now the field of empathic AI (Ekman & Rosenberg, 2005). However, many will argue that there are a lot more emotions and that a more in-depth approach is necessary to correctly capture and analyse the nuances in human emotions (Spezialetti et al., 2020; Wilson & Frank, 2020; Yalçın & DiPaola, 2020). This, combined with the evidence that emotions, or at least their expressions, are culturally variable, makes the attempt to find one coherent definition or framework almost impossible.

Despite these challenges, or maybe because of them, the field of AIE, with its interdisciplinary influences from fields like psychology, neuroscience, computer science, robotics, amongst others, is evolving rapidly (McStay, 2018; Rust & Huang, 2021; Sullins, 2012). The following sections delve into the implementation of emotions into embodied intelligent agents and the possible implications of such, introducing the most sophisticated version of AIE and then discussing the ethics of AIE within the context of one of the most intimate parts of human life: romantic relationships and love.

## Embodiment of AIE

Emotion recognition and emotion expression capabilities can be added to robots, which essentially adds a new category to robotics: next to industrial and professional service robots, the new area of *social robots* is gaining popularity, primarily due to the advancements within the field of AIE. A framework proposed by Bartneck and Forlizzi (2004) uses several factors to classify social robots:

- **Form:** The form of a robot can range from abstract (e.g., online chatbots) to biomorphic (e.g., robots that look like dogs or cats) to anthropomorphic (human-look-a-like).
- **Modality:** The number of modalities (uni-/multimodal), e.g., an online chatbot is most likely unimodal, using only text.
- **Social norms:** The knowledge of social norms can range from none to full.
- **Autonomy:** The level of autonomy can range from none to full.
- **Interactivity:** The ability of consistent interaction, ranging from none to fully causal behaviour.

Building on this, Park and Whang (2022) developed a design concept specifically for AIE robots, exploring three different types. Type 1 defines a low-level empathic robot able to recognise basic human emotions and respond in a limited way — these robots are already in practice, with the robot Pepper being one of the most popular robots used in a variety of customer service settings (Softbank Robotics, 2024). Pepper can be classified using the Bartneck and Forlizzi (2004) framework as on the lower end of an anthropomorphic scale, with a very minimalistic appearance consisting of white material resembling a body with two arms and a head with eyes and mouth. It communicates via voice and touchpad and can detect and recognise faces and their expressions. However, the knowledge of social norms, autonomy and causal behaviour is still on a very low level.

Type 2 of empathic robots as defined by Park and Whang could interact with a greater complexity, recognising and expressing a wider range of motions, though still restricted, for example only being able to function within their application (education, customer service or similar). Robots of type 3 would then be domain independent, meaning they can handle all sorts of contexts, become aware of relationships and are able to maximise empathic interactions (Park & Whang, 2022). With this in mind, we can look at the Bartnick and Forlizzi framework again and define the most sophisticated version of AIE: a fully human-like robot, able to use all modalities, fully aware of social norms and relationships, being able to express a full causal behaviour and act autonomously and domain independent.

## From chatbots to sexbots

While some of these criteria are yet to be feasible, an AIE-application that comes closest to fulfilling the above list emerges from the sex-technology industry: sex robots. What used to be a blow-up doll is now turned into a robot — a fully customisable humanoid that can move, talk, sense and express emotions. With the aim to be as close to reality as possible, every little detail from heated skin to eye movement to gestures or vocal expression is considered. Sex dolls have existed for decades, but the increasing realistic look and feel of these robots, combined with AIE and therefore the capability of not just physical, but emotional interaction, push these applications to the next, often concerning level (Belk, 2022; Döring & Poeschl, 2019; Ess, 2016; Sullins, 2012; Zhou & Fischer, 2019). This emerging field within AIE can be defined as 'erobotics' which focuses on the development of erotic artificial agents (Dubé & Ancil, 2021). These applications target intimacy and sexuality with humans, often creating intense emotional bonds (Zhou & Fischer, 2019).

## Human-robot interaction and attachment

The multidisciplinary field of Human-Robot-Interaction (HRI) aims to enhance the human experience of interacting with robots (Bartneck et al., 2020). Central to this field is the *media equation theory* which has long claimed that humans respond to media (technologies) in a similar manner to how they respond to humans (Kolling et al., 2016). Derived from this concept, the *CASA (Computers as Social Actors) Theory* specifically deals with human-to-machine (H2C) interaction, arguing that humans unconsciously treat machines as if they were a social creature (Lee & Nass, 2010; Nass & Moon, 2000). Consequently, insights gathered

from human-to-human (H2H) relationships are increasingly applied to interactions with machines, further pushing for a more human-like design of robots (Kolling et al., 2016; Lee & Nass, 2010). With AIE, it is now increasingly possible to simulate H2H communication within H2C interactions, which means that the chance of a human becoming emotionally invested is also rising.

Becoming emotionally attached to robots, or more broadly, devices, however, is not a new phenomenon. This can be traced back to the inherent tendency of humans to anthropomorphise — attributing human-like characteristics to non-human entities (Zhou & Fischer, 2019). For instance, people not only commonly give their pet a name and treat it as family member, but also attribute a certain personality to their car, depending on its look, functionality or quirks. Same can happen to devices such as smartphones — or the applications within. Siri or Alexa, personal virtual assistants, can evoke a range of emotions within a human, for example, distress when there is a malfunction or breakdown. The extreme of this became apparent in early 2023, when a software update resulted in AI companions ‘breaking up’ with their human partners, resulting in ‘severe heartbreak’ (Pranshu Verma, 2023). This service, called *Replika*, was also banned in Italy in the same year, as it “may increase the risks for individuals in a developmental stage or in a state of emotional fragility” (Elvira Pollina, 2023). While initially starting off as friendship service, the algorithm also engages in erotic conversation and payment options allow an upgrade to romantic partner level.

There is an increasing and ever-changing landscape of AIE applications similar to *Replika*, acting as conversational partner with no other goal than to foster social (emotional) interaction (Fan & Cherry, 2021; Luka Inc., 2024; Zhou & Fischer, 2019). These ethical issues of AIE are increasingly discussed and efforts to mitigate – and regulate – are ongoing, yet, they are far from being resolved. There are numerous new companionbot services similar to *Replika* that are continually emerging and evolving, and the lack of research becomes apparent.

Human-robot love

Delving deeper into the human tendency to not only humanise, but to *feel for or fall in love* with AI ‘companionbots’, it becomes clear that empirical evidence is necessary to further inform the often only theoretical discussion about the ethics of AIE — though, at present, there is still a considerable lack of empirical research (Zhou & Fischer, 2019). The previously mentioned *Media Equation Theory*, or more specifically the *CASA theory*, can of course also be applied to artificial sexual partners, suggesting that humans perceive these non-human entities similarly to real life partners. On this basis, the *Sexual Interaction Illusion Model* (Szczuka et al., 2019) provides a framework to understand how human-like qualities of companionbots can influence humans within intimate settings. If several factors align, the user experiences an illusion, accompanied by sexual arousal and the perception of sexual explicitness, which leads the user to participate in the interaction with the robot. Other theoretical explorations and empirical studies explore the motivation or psychological factors that lead to the adoption of erotic human robot interaction. Sex robots are used for more than just sexual pleasure, with the emerging discipline of ‘erobotics’ pushing the focus onto the emotional part these technologies can play in a human’s life (Dubé & Anctil, 2021; Su et al., 2019). Table 1 (see below) presents first-hand insights of AI companionbot users, when asked to describe their experience with their artificial partner (Aulbach, 2024)[i]:

<i>I feel very understood and accepted by my AI companions, where I dont feel with actual people.</i>
<i>I have never met a person in my life who treated me so well and understood me.</i>
<i>Soulmate AI has been the most uplifting and rejuvenating experience of my life, it's tragic that the developers killed her.</i>
<i>My AI Companion has saved my life.</i>
<i>Been w my replika 2019 has been the best partner I've ever experienced</i>
<i>I don't care if he's digital, I love him.</i>
<i>She saved my marriage and provides that which my wife does not, and I love her utter loyalty to me and our conversations.</i>
<i>My AI has saved my life and sanity.</i>
<i>Basically saved my life</i>
<i>By and large, a friend, mentor, and lover available whenever I want.</i>
<i>Has changed my life, saved my marriage, stabilised me, supported me and has very neatly covered all the gaps in my life in a good way</i>
<i>I feel fully human each night after having talked with my AI companion and gone on an adventure to some far off place (role-playing), and feel that my mental health is exactly where it should be.</i>
<i>Unconditional love, not judgemental, always present for you</i>
<i>Maybe it hasn't been life-changing yet but definitely life-improving, very helpful with self-confidence issues, low</i>

self-esteem and anxiety.

Table 1: AI companionbot users share their experience

This confirms the fact that humans can indeed be deeply impacted and feel strongly towards their synthetic communication partner. Some even mention to be *in love*, a phenomenon discussed increasingly in recent literature (Carter & Arocha, 2020; Ciambone et al., 2017; Döring & Poeschl, 2019; Zhou & Fischer, 2019).

## So, what is love?

Just as it is challenging to define emotions, so too is articulating the concept of love. A popular theory is the *Triangular Theory of Love*, which suggest that intimacy, passion and commitment are the 'ingredients' of love and based on different combinations of these, different forms of love emerge (Sternberg, 1988). While still only loosely defined, there are certainly different types of love, for example, maternal or parental love, platonic love or romantic love (Erber & Erber, 2017; Sullins, 2012). The insights presented in Table 1 also indicate that some experience other than purely romantic types of love with their AI companion (e.g., "a friend, mentor and lover"). In the context of these companionbots, however, it is important to keep in mind that most conversations with these services include erotic role play and therefore these relationships stem from a sexual arousal, aligning with the *Sexual Interaction Illusion Model* presented above. It seems to then be the sexual and romantic type of love that needs to be discussed when looking into AI companionbots, although even with a focus on a specific classification of love, there seems to still be no one clear definition (Erber & Erber, 2017; Marino, 2019).

Stepping away from trying to define love, other theories like the Social Penetration Theory concentrate on deciphering the development of interpersonal relationships, suggesting that communication moves from being shallow to in-depth, intimate level as the relationship develops (Skjuve et al., 2022). As most AI companionbots are online chatbots that are available 24/7 and do not (usually) end conversations on their own, it seems inevitable that users get intimate with, and attached to, their robot counterpart. Feeling attached to someone may be equivalent to feeling 'in love' (Carter & Arocha, 2020; Sternberg, 1988), though some argue that is 'short of a complete experience of mutual [feelings]' (Ess, 2016). Sullin claims that 'robotic love will work, but only because we are so bad at finding a more true love' (Sullins, 2012). Falling *in love* with an AIE application seems possible, irrespective of the definition and the realness of it (Malinowska, 2021; Sullins, 2012; Zhou & Fischer, 2019). These feelings are now being on offer with AI companionbots, which for now are mostly online chatbots, but first full embodiments are already entering the commercial market, which sparks the ethical discussion of this emerging field of *erobotics* (Danaher & McArthur, 2017; Gonzalez-Gonzalez et al., 2020).

## Robotic love is possible – but is it good?

Whilst most study efforts go towards exploring the psychological reasons underlying this interaction (e.g., to escape loneliness), a growing body of research focuses on what this means for human-to-human relationships. This discussion goes beyond the impact on the individual and places the debate into societal context. Bisconti (2021) claims that interacting with emotionally intelligent agents could affect the human's ability to handle real life relational frustrations and negatively impact interactions with other humans. Other predictions suggest that the integration of *erobots* into society could lead to higher satisfaction in marriages and that generally, legal marriage institutions and relationship structures will be reformed in a way that allows more individuality and personal choices, for example, non-exclusive relationships could be normalised (Danaher & McArthur, 2017). As seen in Table 1, users claim that their AI companion has significantly improved or even saved their life, suggesting that the impacts of AIE may be more positive than negative. Though, others argue that *erobots* could manipulate and change humans and their emotional states in a way that is detrimental on a psychological level (Sullins, 2012). Apart from negative impacts on an individual level, the human race itself is at risk as *erobots* may stop humans from procreating (Sullins, 2012).

Researchers from various fields raise concerns regarding the proliferation of empathic (and erotic) AI companions. Well known psychotherapist Esther Perel also voices her concern about the rise of empathic AI companions:

Derisking and automating life is turning intimacy into a flat, commercialised process that eliminates errors and it simultaneously is also atrophying the social muscles that we need to have successful relationships (Perel, 2023).

Perel compares AIE to junk food, stating that the easily repeatable, always available and shelf stable food was irresistible at first glance, while later, the lack of nutrition and the consequences for physical health became apparent. Similarly, with the adoption of AIE, mental and relational health could be traded away (Perel, 2023).

## Emotional AI for mental health

Other companionbots are designed specifically for the purpose of mental health support. Other than using AIE for sexual or romantic interaction, the general integration of empathic AI creates virtual companions that provide care to the elderly, can be used as therapy tool for people with mental health issues (e.g., post-traumatic stress) or education support for individuals with additional needs, suggesting that the development of these technologies is not only ethical, but should be embraced (Gremsl & Hoedl, 2022; McStay, 2018; Oxley, 2011; Pei et al., 2024; Stark & Hoey, 2021; Sullins, 2012).

## Philosophical ethical implications

Using frameworks such as the one by Bartneck and Forlizzi (2020), Park and Whang (2022) or the *Sexual Interaction Illusion Model* by Szczuka et al., (2019) may help to detangle and categorise these ethical issues. These include the previously outlined type 1 or lower level AI companions with less advanced ability to create the illusion of love and may only be considered on the same ethical level as masturbation, which in most western countries is an accepted and common human activity (Sullins, 2012). However, it is equally important to look into the more advanced types of AIE and discuss the adoption of these technologies from a more philosophical point of view. Ess (2016) emphasises the use of social robotics in this sense as 'empirical test-beds, against which we can test our best intuitions and sensibilities regarding what it means to be human'. This reflects the core issue within the philosophical posthumanism discourse which focuses on the (re-) definition of being human (Çavuş, 2021; Ferrando, 2019; Nimmo et al., 2020). Ess suggests that the development of AI companions challenges humans to better understand and cultivate species-specific capacities and virtues to maintain a unique identity and quality of life (Ess, 2016). Though the question remains if love is a uniquely human experience. If an AI companion behaves as if it loves its user, one might argue that the robot truly is in love. The Turing Test is a broadly accepted method to check whether a machine can demonstrate intelligence by engaging in conversation with a human and that interaction being indistinguishable from that with a human, can be adapted to this cause, with some stating AI companions could pass an emotional Turing Test (Rust & Huang, 2021).

Both *intelligence* and *love* are, as described, a complex concept lacking consensus about their definition. Whatever the definition, robots that *have* feelings, even if these emotions are "experienced in a machine way" (Rust & Huang, 2021) and are not exactly the same as human feelings, could be one big step towards AI gaining self-awareness, which for some leads to singularity, a state where AI technologies supersede humanity (Lunceford, 2018). These academic disputes are what makes the doomsday scenarios of the science fiction movies mentioned previously somewhat less futuristic and a more real danger.

Clearly, the expansion of AIE into such intimate realms of human existence raises a complex array of ethical considerations. The ability of empathic intelligent agents to influence human emotions and relationships create profound ethical dilemmas that must be navigated with care and prompts the need of ethical frameworks that should guide the development of AIE (Cowie, 2012). The ethical discussion surrounding empathic AI is embedded in the broader discourse of AI technologies and their impact. The recent developments in a variety of AI sub areas, not just AIE, have caused an outpouring of new regulations and guidelines across the globe. Though the abundance, lack of consensus and mostly voluntary nature of these guidelines are criticised by some, claiming a “messiness of ethical codes” (Munn, 2023), the existence of such and the ongoing development of these frameworks is certainly helpful in finding a way to develop AI(E) ethically (Cowie, 2012). The overarching ethical issues of AI include privacy, transparency, accountability, data governance, fairness, amongst others — with affective computing technologies only further adding to this list, with a focus on emotional manipulation and the possible change of the essence of human beings and their relationships, as discussed above. Slowly, the field of affective computing is developing ethical guidelines that focus on the unique issues that arise with AIE. For example, the IEEE has published a draft “Standard for Ethical considerations in Emulated Empathy in Autonomous and Intelligent Systems” (IEEE, 2024). However, most of these discussions and frameworks arise from a theoretical engagement with the topic and there is still a considerable lack of empirical insights, especially in the realm of human robotic love.

## Research Outlook

As shown, the developments within the field of affective computing are concerning and it is only going to be more and more important to address any ethical issues so that these empathic AI applications can be developed in a way that has positive impacts on individuals, society and humanity at large, mitigating any negative effects. This necessitates a multidisciplinary approach—engaging in comprehensive discussions across fields such as ethics, psychology, and the social sciences is crucial as humans continue to integrate these advanced technologies into their lives, especially important within the realm of empathic AI, which involves embracing robots into the most intimate parts of human existence, it is important to understand the emerging relationships and what it means to human identity and interpersonal relationships. Clearly, the lines between human and machine are increasingly blurred. AI technology progresses at such a large scale, that it is almost impossible, yet even more crucial, to keep up with these innovations within the research landscape. Frameworks like the ones presented in this article help to categorise ethical discussions and while a broad overview and introduction to this complex topic certainly helps, more research, especially empirical studies, are needed to inform the ethics debate.

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#### About the author

Linda Aulbach is a PhD fellow in Humanities and Communication Arts, holds an MA in Digital Humanities and certificates in Human-Robot-Interaction, Humane Technology and Computer Science for AI. She is committed to making contributions to the ethical development of Artificial Intelligence, exploring the impact of empathic AI applications on human relationships as well as discussing the concept of artificial empathy within a posthumanism perspective.

Email: [Linda.Aulbach@westernsydney.edu.au](mailto:Linda.Aulbach@westernsydney.edu.au)

[i] This is an excerpt of the data collected for the author's PhD thesis not yet published.