Author's copy. Accepted for Robophilosophy Conference 2024.

Interaction Minimalism: Minimizing HRI to Reduce Emotional Dependency on Robots

Jack CONTRO, Martim BRANDÃO
King's College London, UK

Abstract. In this paper we show that with the increasing integration of social robots into daily life, concerns arise regarding their impact on the potential for creating emotional dependency. Using findings from the literature in Human-Robot Interaction, Human-Computer Interaction, Internet studies and Political Economics, we argue that current design and governance paradigms incentivize the creation of emotionally dependent relationships between humans and robots. To counteract this, we introduce Interaction Minimalism, a design philosophy that aims to minimize unnecessary interactions between humans and robots, and instead promote human-human relationships, hereby mitigating the risk of emotional dependency. By focusing on functionality without fostering dependency, this approach encourages autonomy, enhances human-human interactions, and advocates for minimal data extraction. Through hypothetical design examples, we demonstrate the viability of Interaction Minimalism in promoting healthier human-robot relationships. Our discussion extends to the implications of this design philosophy for future robot development, emphasizing the need for a shift towards more ethical practices that prioritize human well-being and privacy.

Keywords. Human-Robot Interaction, Emotional Dependency, Surveillance Capitalism, Ethical Design, Responsible Robotics

Introduction

The integration of social robots into everyday life, from smart toys to home assistance devices, raises important questions about their emotional wellbeing on users. This paper addresses two key questions: 1) Are deployed social robots likely to engender emotional dependency among users? and 2) How can such dependency be mitigated through design and governance? In this paper we argue that the economic motivations underpinning surveillance capitalism incentivise the design of robots that promote emotional dependency. In response, we introduce the concept of interaction minimalism—a design principle aimed at minimising unnecessary human-robot interactions to prevent such dependencies. Through hy-

pothetical design examples, we explore the viability of this approach in fostering healthier human-robot relationships, positioning interaction minimalism as a critical consideration for future social robot development.

1. Risks of Emotional Dependency in Social Robots

1.1. Humans Can Establish Emotional Attachment to Robots

In the field of Human-Robot Interaction (HRI), compelling evidence shows that humans can forge emotional attachments to robots they interact with [1,2,3]. Research by Scheutz et al. [1] documents various instances of such interactions, from US military personnel becoming attached to combat robots, to civilian encounters with robots like the Roomba and robotic dogs. These emotional bonds are often facilitated through anthropomorphization and the ascription of agency, or perceived autonomy, to the robots [1]. A case example is a landmine-defusing robot, designed to resemble a stick insect, which elicited a compassionate response from military officers who deemed its destruction in tests as "inhumane" [4]. This reaction exemplifies anthropomorphization, where humans attribute agency and feelings to the robot, as well as empathising with it as if it were a living being [1].

Scheutz et al. [1] posit that the ascription of agency is pivotal in understanding the emotional connections that form from humans to robots, exemplified by the Roomba vacuum cleaning robot. The Roomba, known for its autonomous floor cleaning capabilities, boasts a simplistic disk-shaped design yet garners descriptions from owners such as "hardworking" or "helpful" [5]. These attributes are ascribed not just due to its practical functionality but also because of its perceived autonomy. This autonomy allows the Roomba to navigate home environments independently, making decisions about where and when to clean or how to circumvent obstacles. Thus, it earns a sense of presence or character within the household, transcending its physical mechanics to evoke emotional responses from its human users [1].

Furthermore, Lacey et al. [6] contend that emotional connections can be deliberately designed to elicit specific responses from users, highlighting the use of cuteness in robots as a manipulative design pattern. By employing features such as large eyes, round shapes, and soft contours, designers aim to lower barriers to trust, foster emotional engagement, and enhance user interaction [6]. Although the stated goal is to boost user engagement and integration into daily life, this approach can also serve to mask the robots' surveillance capabilities [6].

These examples illuminate the multifaceted nature of emotional connections from humans to robots, underscoring the significance of acknowledging their existence and the role of robot design in shaping them. The emotional ties between humans and robots differ fundamentally from those between humans and animals, as the latter involves reciprocal feelings and agency. In contrast, human-robot interactions are unidirectional, with robots programmed for specific responses that lack genuine emotional depth [1]. This one-sided nature of the relationship opens avenues for emotional manipulation, where the bond can be influenced through strategic design choices [6,1].

1.2. Humans Can Establish Emotional Dependency on Robots

In addition to emotional attachment, we propose that individuals can develop an *emotional dependency* on social robots, which is a distinct and more problematic form of human-robot relationship. While emotional attachment is a prerequisite for emotional dependency, the latter has detrimental consequences for the human involved. Emotional dependency on social robots goes beyond mere emotional attachment and can lead to physical and psychological negative outcomes for the human. In this paper, adapting from the definition of gaming addiction by the WHO [7], we define "human emotional dependency" on a robot as a relationship with:

- *Diminished control over the interaction with the robot.*
- *Increasing precedence of the robot over other activities and interests.*
- *Persistence of this interaction despite negative outcomes.*

Existing findings in the HRI and HCI literature are consistent with the given definition [2,8,9]. Specifically, several case studies involving Paro [2,8]—a therapeutic tool designed like a baby seal for use in nursing homes—serve as evidence that humans can become emotionally dependent on robots. A notable case, reported by Wright [2], involved an elderly resident named Ito, who formed an intense bond with Paro. This bond led her to prioritize interactions with Paro over communal activities, socializing with other residents, and even essential daily routines—significantly impairing her social functioning in the care home. Ito's behavior mirrors the symptoms of emotional dependency, displaying a chronic preference for and fixation on Paro, resulting in significant personal and social impairment. This reflects the characteristics of emotional dependency as defined previously, marked by diminished control over interactions with the robot, increasing precedence of the robot over other activities, and persistence in interaction despite negative consequences. The case also provides important insights into the realm of emotional dependency in the context of dementia care. Paro's design, which primarily responds to petting and its name [2], illustrates how relatively simple robots can lead users to form emotional dependency with them. This suggest that robots with advanced capabilities could potentially foster deeper or more extensive emotional dependencies across a wider demographic. Moreover, there is evidence presented by Laestadius et al. [9] regarding humans establishing emotional dependency on a chatbot, thus suggesting that integrating sophisticated natural language processing onto social robots could further raise the risk of emotional dependency on social robots.

Emotional attachment is not a sufficient condition for dependency, however. For example, the relationship between military personnel and demining stick insect robots [4], and between Roomba users and their Roombas [1,5] do not fit the definition of emotional dependency, but rather that of emotional attachment. This is because these relationships lack the key characteristics of diminished control, increasing precedence over other activities, and persistence despite negative outcomes. In the case of the military personnel and the demining robot, their

emotional response was one of empathy and a sense that destroying the robot was "inhumane". However, there is no indication that this attachment led to diminished control over their interactions with the robot, that it took precedence over other activities, or that it persisted despite negative consequences. Rather, it seems to have been a momentary emotional response based on anthropomorphization of the robot. Similarly, while Roomba owners may ascribe agency and positive attributes to their robot, such as describing it as "hardworking" or "helpful", this does not necessarily imply an emotional dependency. The emotional attachment appears to enhance the user experience and integration of the robot into the household, but there is no evidence presented that it leads to the problematic characteristics outlined in the definition of emotional dependency.

2. The Negative Aspects of Emotional Dependency

The phenomenon of emotional dependency on technology is well studied in the context of the internet and gaming, and it offers a compelling parallel to understanding emotional dependency on social robots [10,11]. Both internet use and social robot use, involve a deepening reliance on digital means for social and emotional fulfilment. While this use may offer temporary relief or engagement, it may also inadvertently displace traditional human interactions. This parallel is crucial for understanding the broader implications of emotional dependency in the context of HRI, especially when examining the *displacement hypothesis* [12,13,14]. This hypothesis posits that engagement with digital platforms might substitute for meaningful human contact, thus heightening feelings of loneliness and amplifying existing psychosocial issues [13].

2.1. Displacement of Human Social Interactions

The core of the displacement hypothesis is the concern that time and emotional energy invested in technologies detract from human relationships. Emotional dependency on robots, much like excessive Internet use [14,15], could lead to a reduction in face-to-face interactions, thus diminishing the quality and quantity of human social contacts. This displacement could exacerbate feelings of loneliness, as interactions with robots, despite being potentially emotionally gratifying to some extent, do not provide the depth and reciprocity of human relationships [13]. Nowland et al. [13] highlight that "when social technologies are used to escape the social world and withdraw from the 'social pain' of interaction, feelings of loneliness are increased". This insight directly parallels concerns with robot interaction, where dependency might serve as an escape rather than a pathway to genuine social engagement.

2.2. Enhancement of Loneliness and Social Isolation

Further, relationships of emotional dependency formed with robots, while seemingly addressing loneliness on the surface, may actually deepen loneliness as in the case of digital interaction [13]. The one-sided nature of these relationships, where the emotional investment is not reciprocated, can highlight the absence of

genuine social connections, leading to an increase in loneliness. Nowland et al. [13] illustrate how digital interactions can both alleviate and exacerbate loneliness, depending on their nature and the users' approach to them. Similarly, dependency on robots for emotional comfort might initially mask feelings of loneliness but ultimately highlight the lack of human companionship.

3. The Tech Industry is Likely To Build Robots That Create Emotional Dependency

3.1. The Economic Context of Social Robot Development

The context in which technology is increasingly being built since the start of the 21st century has been that of "surveillance capitalism", a term coined by Zuboff [16], which is an economic model characterised by the extraction and selling of personal data through continuous monitoring.

The model of surveillance capitalism, initially confined to digital platforms, now extends its reach into the physical realm, implicating devices such as smart TVs, smart toys, and digital personal assistants [16,17]. According to Zuboff, products like Google Home and Amazon Alexa are not merely personalization tools but serve as mechanisms for the systematic extraction of behavioral data, repurposed in markets that speculate on future behaviors [18].

In this context, the essence of surveillance capitalism emerges from its reliance on a broad spectrum of collected data. This includes not just basic interaction logs but also estimates of emotional responses, behavioral patterns, and even physiological indicators [16]. The critical point here is that the scope of data utilization extends far beyond the enhancement of user interfaces or device functionalities [16]. Instead, it ventures into domains with significant implications, such as targeted advertising, political strategy formulation, and military applications [16]. This strategic shift towards comprehensive data utilization underscores the economic incentives driving the collection of such detailed information, indicating that social robots could become pivotal instruments in the systematic exploitation of data collection, potentially leading to engineered scenarios of emotional dependency on technology[16].

3.2. Emotional Dependency as a Means to Increase Data Extraction from Users

As just described, in the landscape of surveillance capitalism every technological product presents an opportunity for further data extraction and behaviour manipulation because these activities allow companies to make extra revenue. In this context, social robots present themselves as yet another opportunity for such activities. In other words, companies developing social robots have strong economic interests in maximizing data extraction and behavior manipulation capabilities in these robots to the extent possible. One way of maximizing data extraction is by increasing emotional connection and dependency on social robots, as this will by definition lead to longer interaction times and more opportunities for data extraction.

Evidence supporting industry's interests in these directions include, for example, a Google patent proposing robots that adjust their personalities based on user data [19]. This exemplifies the industry's move towards highly personalized interactions based on in-depth human data analysis, despite significant privacy concerns and the risk of fostering emotional dependency among users. Our concern is that the greater the emphasis on designing robots to maximize human interaction, the higher the risks of emotional dependency and the displacement hypothesis.

4. Interaction Minimalism: A Design Philosophy for Human-Robot Interaction without Emotional Dependency

In the evolving landscape of HRI, we have shown that the development of social robots is ripe for excessive data extraction and emotional dependency. The current trend in HRI to design for user experience—and particularly for human acceptance, trust, and engagement [20,21,22]—while enhancing the potential for integration of robotic technologies into daily life, also raises significant ethical concerns regarding privacy, autonomy, and the nature of human-technology relationships. Therefore, drawing inspiration from the concept of Minimum Viable Datafication [23], which advocates for the restrained collection of data to fulfill explicit, immediate needs while promoting ethical governance and engagement, we propose a parallel design philosophy for social robots: Interaction Minimalism.

4.1. Defining Interaction Minimalism

The core tenet of Interaction Minimalism is functionality without dependency. This principle advocates for designing products that fulfill their intended purposes without leading to unnecessary interactions or creating emotional dependencies. Interaction Minimalism as a design approach is thus not merely a design constraint but a proactive step towards fostering human autonomy, encouraging the cultivation of human relationships, and ensuring that devices remain tools for enhancement rather than sources of dependency.

From this foundational principle, two essential concepts naturally follow:

First, by prioritizing functionality without dependency, the approach inherently encourages human autonomy and connections. This implies that products should not only aim to minimise dependency but also actively promote self-reliance and foster connections within the human community. The philosophy highlights technology as an enabler of human interaction rather than a barrier, motivating users to engage more with each other rather than becoming isolated within a digital ecosystem.

Second, the commitment to minimalism in interaction leads to the principle of minimal data extraction. This stance is a direct extension of minimizing unnecessary interactions, advocating for the collection of only essential data. By focusing on immediate functional needs over speculative data harvesting, this approach aligns with the ethos of Minimum Viable Datafication [23]. It ensures that technology respects user privacy and serves them with the least amount of data

intrusion, reinforcing the overarching goal of Interaction Minimalism: to make technology a tool for empowerment rather than a means of exploitation.

4.2. Using Interaction Minimalism to Reduce Emotional Dependency on Robots

The underlying principle of employing Interaction Minimalism to mitigate emotional dependency on robots is predicated on the hypothesis that minimizing interaction opportunities proportionally reduces the risk of dependency formation. Under this design philosophy, robots are engineered to execute their functions with efficiency and discretion, avoiding superfluous engagement with users beyond the scope of their operational requirements. Such a restrained approach to interaction is posited to naturally deter users from anthropomorphizing these devices or attributing emotional qualities to them—behaviors that are integral to the genesis of emotional attachments. However, it is important to note that while Interaction Minimalism can help reduce the likelihood of emotional dependency, it cannot provide an absolute guarantee against its emergence, as the complex nature of human emotions and individual differences in susceptibility to forming attachments cannot fully be accounted for in this proposed design paradigm.

Implementing Interaction Minimalism involves a conscious effort to design interactions that are direct, efficient, and, most importantly, increase rather than decrease human-human contact. This could manifest in various forms, such as:

- **Autonomy Without Isolation:** Robots should support users in their tasks without creating a sense of isolation from other humans. By designing robots that encourage or necessitate human interaction for certain functionalities, designers can ensure that robots act as facilitators of human contact rather than substitutes.
- **Purposeful Interaction:** Interactions with robots should be purposeful and task-oriented, reducing the likelihood of users forming emotional dependency on the devices.
- **Transparency and Control:** Users should have clear understanding and control over how they interact with robots, including the ability to easily modify or limit these interactions. This empowers users, giving them the agency to decide the nature and extent of their engagement with robotic devices.
- **Minimalist Aesthetics:** Robots should be designed with aesthetics that do not leverage anthropomorphic affordances if these do not support interaction in a meaningful way.

4.3. Examples of Interaction Minimalism Design

Following the principles of Interaction Minimalism, we propose an hypothetical implementation of Interaction Minimalism in two example social robot applications.

- **Enhancing Social Bonds in Care Environments Through Robotics**: In line with Interaction Minimalism, robots in elder care facilities could be designed to subtly encourage social interactions among residents, steering focus away from robots themselves and towards human connections. Acting

as background facilitators, these robots could organize group activities or create shared experiences, thus nurturing community bonds. For example, when asked to perform a specific task, a robot might say, "Oh, I know person X does that really well. Let's go find them!" or "Hi person X, person Y here wants help with this. Do you think you can assist them?" This approach not only connects residents with each other but also highlights and reinforces the unique skills and knowledge of individuals within the community. Furthermore, robots could employ proxemics - the study of how people use space in social interactions [24] - to gently bring residents closer together and facilitate conversation. For instance, a robot might position itself in a way that encourages two people to stand nearer to each other or face one another while engaging in a discussion. By subtly manipulating the physical space, robots can create more opportunities for residents to interact and bond without the robot being the central focus of attention. These strategies, resonant with the concept of "prosocial robotics" [25], propose technology's role in bolstering human relationships without becoming a central dependency. By acting as subtle facilitators, robots can enhance the social fabric of care environments, ultimately improving the well-being and quality of life for residents.

- **Facilitating Collaborative Learning with Educational Robots:** In adherence to Interaction Minimalism, the deployment of educational robots could aim to serve as catalysts for discussion and collaboration among students, rather than authoritative figures or direct information sources. By designing these robots to initiate and guide discussions on various topics, we can promote an educational environment that values egalitarian participation and peer-to-peer interaction. This method aligns with minimizing unnecessary technological interference while enhancing human-to-human engagement and collaborative learning experiences.

5. Research Agenda

The shift towards Interaction Minimalism in HRI introduces a pivotal question: How can the effectiveness of a minimally interactive product be measured when traditional metrics become less relevant or even misleading? Conventional measures of success in social robotics and social media applications often rely on engagement levels, such as the frequency and duration of interactions. However, these metrics do not align with the goals of Interaction Minimalism, which prioritizes the quality and purposefulness of interactions over their quantity.

For example, consider a social robot designed to assist elderly individuals in a care facility. A traditional approach might measure the robot's success based on the number of interactions it has with residents or the amount of time spent engaging with them. However, under the paradigm of Interaction Minimalism, a more successful robot would be one that facilitates meaningful human-to-human connections and encourages residents to engage with each other, rather than relying on the robot for companionship. In this case, a higher number of interactions with the robot itself might actually indicate a failure to promote the desired outcome of enhancing human relationships.

This paradigm shift necessitates a reevaluation of how product success is gauged, moving beyond simplistic and potentially counterproductive metrics. Measuring the effectiveness of a minimally interactive product requires a focus on the quality of interactions and their impact on user autonomy, well-being, and social connectedness, rather than merely quantifying engagement levels.

Futhermore, the complexity of sentiment analysis and user surveys, although potentially insightful, presents challenges in accurately capturing the nuanced effects of Interaction Minimalism on users. These methods, while valuable, often struggle to quantify the subtle, yet profound, impacts of reduced interaction on user wellbeing, autonomy, and satisfaction. The subjective nature of sentiment and the variability in individual user experiences compound these difficulties, indicating a need for innovative approaches to measurement and evaluation.

To navigate this new terrain, there is a need for HRI research to develop and refine interaction benchmarks, metrics, and methodologies tailored to the principles of Interaction Minimalism. This research agenda should focus on several key areas:

- **Development of New Metrics:** Innovative metrics of quality of interaction, that accurately reflect the principles of Interaction Minimalism. These metrics should capture the efficiency, effectiveness, and user satisfaction of interactions without relying on engagement frequency. Potential areas of focus could include the assessment of user autonomy, the enhancement of human-human interactions facilitated by robot interventions, and the overall contribution of robots to user wellbeing.
- **Benchmarking Minimalist Interactions:** Establishing benchmarks for Interaction Minimalism will enable researchers and designers to evaluate how well a product aligns with Interaction Minimalism principles. These benchmarks could include criteria for evaluating the directness and purposefulness of interactions, the degree to which a product promotes user autonomy, and its success in enhancing rather than supplanting human relationships.
- **User Studies for Concrete Design Guidelines:** Conducting user studies that focus on the qualitative aspects of human-robot interaction can provide concrete insights into designing for minimalism. These studies should explore users' subjective experiences with minimally interactive products, investigating how such designs impact their perception of autonomy, connection, and satisfaction. The findings can inform design guidelines that prioritize purposeful interaction while minimizing unnecessary engagement.
- **Standards and Audits for Minimalist Design:** Developing standards for Interaction Minimalism can help ensure that real-world products adhere to its principles. Audits based on these standards can then assess whether products successfully minimize unnecessary interaction and data collection while maintaining or enhancing user experience. This governance approach would facilitate the adoption of Interaction Minimalism across the industry, promoting ethical design practices that respect user autonomy and privacy.

By focusing on these research directions, HRI scholars can contribute to a deeper understanding of how to implement Interaction Minimalism effectively, and how to promote it in real-world products. Interaction Minimalism can be

approached from two angles: design and regulation. On the regulation level, standards and regulations that are based on Interaction Minimalism principles can make it harder for companies to explicitly promote emotional dependency in order to extract more user behavioural data. On a design level, robot developers and designers can follow Interaction Minimalism principles to avoid accidentally engendering emotional dependency in their products. This work is thus crucial not only for identifying what works in minimizing emotional dependency and unnecessary interaction, but also for establishing a framework that supports ethical standards and audits in the design and deployment of social robots. Through rigorous research and thoughtful application of these principles, it is possible to advance the development of social robots that enrich human life without fostering undue reliance or eroding privacy.

6. Related Work

Our proposal for Interaction Minimalism is influenced by HCI and Smart Cities concepts, notably "Minimum Viable Datafication" (MVD) [23], which influenced our core tenet of minimizing interactions while considering privacy and autonomy impacts. This approach aligns with critiques of surveillance capitalism, as discussed by Zuboff, focusing on personal data commodification and its societal effects [16]. While Powell [23] proposed MVD for the context of smart cities, and focuses on the particular challenges of privacy and urban life, our Interaction Minimalism proposal extends the concerns and design principles from data extraction to also emotional dependency and human-human relationships in the social robotics context.

In this paper we have also discussed the influence of neoliberal capitalism on technology design, and we have advocated for approaches that prioritize human autonomy and dignity. This focus is also present in previous Human-Computer Interaction work by Wolf et al. [26] on design within capitalism, and HRI work by Pierce [27] on *undesign* as design focused on removing a technological affordance or harm—in our case emotional dependency. Our work is also related to the idea of *Anarchist HCI* from Keyes et al.[28], which proposes the creation of technologies supporting autonomy and counterpower.

Finally, our paper uses a definition of emotional dependency adapted from dependency relationships between humans and technology (i.e. computer games [7]). However, there are also definitions of emotional dependency in the Psychology literature [29] focused on human-human interactions, and the investigation of the degree to which these apply in the context of human-robot robot interactions could also be an interesting direction of future research.

7. Conclusion

In this paper we have argued that humans can establish emotional dependency on social robots, and that the technology industry has interests in developing social robots that promote such dependency as a way to increase engagement and

opportunities for data extraction. We then proposed Interaction Minimalism as a design philosophy aimed at addressing the risks of emotional dependency, data extraction and lack of human autonomy. Interaction Minimalism advocates for the reduction of unnecessary human-robot interactions, minimizing data extraction, promoting human-human relationships, and thus safeguarding user well-being. By prioritizing functionality without fostering dependency, Interaction Minimalism seeks to balance the benefits of social robots with the preservation of human values and human-human connections. The proposed shift towards more restrained and ethical design practices reflects a commitment to enhancing human life with technology, while maintaining a critical awareness of the broader impacts on society and individual privacy. Our research agenda towards Interaction Minimalism in HRI is a first step towards this direction, and proposes a focus on investigating concrete methodologies, metrics and benchmarks that can lead to real-world impact, and standards that can contribute to the governance of social robot products.

8. Acknowledgements

This work was supported by the UKRI Centre for Doctoral Training in Safe and Trusted Artificial Intelligence [EP/S023356/1] and The Great Britain Sasakawa Foundation.

References

[1] Scheutz M. The Inherent Dangers of Unidirectional Emotional Bonds Between Humans and Social Robots. Robot ethics: The ethical and social implications of robotics. 2011:205.
[2] Wright J. Robots Won't Save Japan: An Ethnography of Eldercare Automation. Cornell University Press; 2023.
[3] Robinson H, MacDonald B, Kerse N, Broadbent E. The psychosocial effects of a companion robot: a randomized controlled trial. Journal of the American Medical Directors Association. 2013;14(9):661-7.
[4] Garreau J. Bots on the ground. Washington Post. 2007;6.
[5] Sung JY, Guo L, Grinter RE, Christensen HI. "My Roomba is Rambo": intimate home appliances. In: UbiComp 2007: Ubiquitous Computing: 9th International Conference, UbiComp 2007, Innsbruck, Austria, September 16-19, 2007. Proceedings 9. Springer; 2007. p. 145-62.
[6] Lacey C, Caudwell C. Cuteness as a 'dark pattern' in home robots. In: 2019 14th ACM/IEEE International Conference on Human-Robot Interaction (HRI). IEEE; 2019. p. 374-81.
[7] World Health Organization. Addictive Behaviours: Gaming Disorder; n.d. Available online: https://www.who.int/news-room/questions-and-answers/item/addictive-behaviours-gaming-disorder Accessed: January 10, 2024. Available from: https://www.who.int/news-room/questions-and-answers/item/addictive-behaviours-gaming-disorder.
[8] Hasse C. Artefacts that talk: Mediating technologies as multistable signs and tools. Subjectivity. 2013;6(1):79-100.
[9] Laestadius L, Bishop A, Gonzalez M, Illenčík D, Campos-Castillo C. Too human and not human enough: A grounded theory analysis of mental health harms from emotional dependence on the social chatbot Replika. New Media & Society. 2022:14614448221142007.

[10] Young K. Understanding online gaming addiction and treatment issues for adolescents. The American journal of family therapy. 2009;37(5):355-72.
[11] Kuss DJ, Griffiths MD. Online gaming addiction in children and adolescents: A review of empirical research. Journal of behavioral addictions. 2012;1(1):3-22.
[12] Valkenburg PM, Peter J. Online communication and adolescent well-being: Testing the stimulation versus the displacement hypothesis. Journal of Computer-Mediated Communication. 2007;12(4):1169-82.
[13] Nowland R, Necka EA, Cacioppo JT. Loneliness and social internet use: pathways to reconnection in a digital world? Perspectives on Psychological Science. 2018;13(1):70-87.
[14] Kraut R, Patterson M, Lundmark V, Kiesler S, Mukophadhyay T, Scherlis W. Internet paradox: A social technology that reduces social involvement and psychological well-being? American psychologist. 1998;53(9):1017.
[15] Naeemi S, Tamam E. The relationship between emotional dependence on facebook and psychological well-being in adolescents aged 13–16. Child Indicators Research. 2017;10:1095-106.
[16] Zuboff S. The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power. 1st ed.; 2018.
[17] Darling K. The new breed: How to think about robots. Penguin UK; 2021.
[18] Zuboff S. Surveillance capitalism and the challenge of collective action. In: New labor forum. vol. 28. SAGE Publications Sage CA: Los Angeles, CA; 2019. p. 10-29.
[19] Anthony G Francis J, Lewis T. Methods and systems for robot personality development. Google LLC; 2015. Patent number US8996429B1. United States Patent. Available from: `https://patents.google.com/patent/US8996429B1/en`.
[20] Bröhl C, Nelles J, Brandl C, Mertens A, Nitsch V. Human–robot collaboration acceptance model: development and comparison for Germany, Japan, China and the USA. International Journal of Social Robotics. 2019;11(5):709-26.
[21] Hancock PA, Billings DR, Schaefer KE, Chen JY, De Visser EJ, Parasuraman R. A meta-analysis of factors affecting trust in human-robot interaction. Human factors. 2011;53(5):517-27.
[22] Bartneck C, Kulić D, Croft E, Zoghbi S. Measurement instruments for the anthropomorphism, animacy, likeability, perceived intelligence, and perceived safety of robots. International journal of social robotics. 2009;1:71-81.
[23] Powell AB. Undoing optimization: civic action in smart cities. Yale University Press; 2021.
[24] Mumm J, Mutlu B. Human-robot proxemics: physical and psychological distancing in human-robot interaction. In: Proceedings of the 6th international conference on Human-robot interaction; 2011. p. 331-8.
[25] Oliveira R, Arriaga P, Santos FP, Mascarenhas S, Paiva A. Towards prosocial design: A scoping review of the use of robots and virtual agents to trigger prosocial behaviour. Computers in Human Behavior. 2021;114:106547.
[26] Wolf CT, Asad M, Dombrowski LS. Designing within Capitalism. In: Designing Interactive Systems Conference; 2022. p. 439-53.
[27] Pierce J. Undesigning technology: considering the negation of design by design. In: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems; 2012. p. 957-66.
[28] Keyes O, Hoy J, Drouhard M. Human-computer insurrection: Notes on an anarchist HCI. In: Proceedings of the 2019 CHI conference on human factors in computing systems; 2019. p. 1-13.
[29] Bornstein RF, Hopwood CJ. Evidence-based assessment of interpersonal dependency. Professional Psychology: Research and Practice. 2017;48(4):251.