Towards a Wave Approach for Value Sensitive Design in Social Robotics

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ABSTRACT

Even though a broad range of social robots are currently available on the market, social robots are not yet an integral part of companies, healthcare providers, or public institutions. This might be due to the fact that the prevalent developer perspective immanently focuses on technological advancements, whereas a human-centered view remains underrepresented. In this paper, we argue that a human-centered perspective which integrates values and beliefs of relevant technology stakeholders needs to complement existing approaches to social robot design. Therefore, we propose to apply value sensitive design (VSD) to improve the process of social robot development and design. Even though VSD has become popular in recent years and it represents an established approach to foster innovative technologies, it has not yet been widely applied in the context of social robotics. Concretely, in this paper we will outline the added value of using VSD for social robots and we will explain how to utilize this methodology to enrich research and practice in social robotics.

CCS CONCEPTS

• Human-centered computing • Interaction design • Interaction design theory, concepts and paradigms

KEYWORDS

value sensitive design, social robots, wave approach, methodological guide, design methodology

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1 INTRODUCTION

Social robots have become more and more present in today's societies. However, despite their deployment in organizations like companies, health care facilities or public institutions, social robots have not yet become sustainably integrated into society at large [1] in which social robots are supposed to be embedded. In order to facilitate the uptake of social robots, stakeholder values—what is important to individuals and organizations who have "a right, share, claim or interest in a system" [2]—need to be sufficiently considered.

In fact, technologies such as social robots are not value-neutral per se [3], [4]. For example, the humanoid robot Pepper was developed according to the manufacturer's design principles (e.g., safety, affordability, pleasant appearance) [5]. Indeed, these principles represent values that the manufacturer implicitly embedded in the robot system. This was realized, for instance, by means of design choices such as round edges to assure safety, limited technical components to assure affordability, and Manga-like large eyes to realize pleasant appearance [5]. However, is unclear to what extent the values that were implicitly embedded by the manufacturer indeed align with the values that the various user groups of Pepper actually deem important. However, undoubtedly, incorporating stakeholder values contributes to successful technology deployment [6], whereas the lack thereof may elicit detrimental outcomes (e.g., [7]).

Various human-centered design approaches have been proposed to foster acceptance of robots and human-robot interaction (HRI) (e.g., [8], [9]). Thus, a positive trend towards more user involvement in the development of social robots has emerged (e.g., [10]–[12]). One of such approaches particularly considers the values of technology stakeholders, namely value sensitive design (VSD).

VSD is an established theory-based approach to technology design [13]–[15]. It follows the tripartite methodology by Friedman et al. [13] and thus combines conceptual, empirical, and technical investigations to iteratively implement specific values in the design of new technologies [6], [13], [15], [16]. Even though VSD researchers acknowledge the key role of iteration for VSD and the importance of an alteration of the three core types of investigations (i.e., conceptual, empirical, and technical), contemporary VSD research does neither sufficiently apply these investigations in an iterative manner [16], nor does such work provide guidelines on how to realize the respective iterations in research practice. Consequently, we outline how to actually conduct an iterative VSD cycle. Here, we propose what we call a "wave approach" that encompasses conceptual, empirical, and technical investigations both on a general and on a specific level. Thereby, VSD is more easily applicable in social robotics.

2 HUMAN-CENTERED DESIGN APPROACHES IN SOCIAL ROBOTICS

In the early years of social robot development and HRI research, most researchers have merely turned to the existing literature when building a new robot platform. For instance, a diverse body of research on affective computing has been integrated in the process of designing a social robot for human-robot interaction [17]. To provide another example, control strategies for safe motion have been developed by leveraging proxemics theories [18]. Likewise, an attention system based on theoretical models concerning visual search has been developed [19]. These examples illustrate that commonly, the design and development of social robots has been technology-driven, with end users involved only to validate a priori theoretical assumptions. As social robots and human users will eventually not only co-exist, but also interact with each other as companions on a regular basis, designing user-friendly robots is paramount. In order to assure a positive user experience, HRI researchers have started to consider user-centered design, an approach that puts end users' needs in the foreground during the design cycle [20]. To illustrate, potential users have been involved in the identification of household tasks and possible designs of a mobile fetch-and-carry robot [21]. Further, designated end users were involved in the evaluation of a socially assistive robot [22]. Moreover, researchers investigated the impact of engaging end-users in the prototyping process on their attitude towards an educational robot [11]. Previous research has combined user-centered design with agile development and explored evaluations of stakeholders that would eventually use a receptionist robot [10].

However, importantly, user-centered design mainly focuses on gaining insights into users' needs in a specific application context. This use case, in turn, is commonly a priori determined by researchers [23]. Thus, end users have typically been involved merely to demonstrate positive user experience in the context of a pre-defined use case. Moreover, concerns have been voiced regarding the involvement of end-users in that they might potentially envision "unwanted" design features [24]. Thus, to mitigate potential negative consequences associated with a strong emphasis on end-user opinions, recent research [25], [26] has tried to extend the focus from primary users (i.e., end-users) to secondary resp. tertiary users (i.e., users who use the technology at odd times or indirectly, that is, users who are affected by someone else's use of the technology). Nonetheless, to date, potential end users are merely involved to serve the purpose of delivering inputs for design features and/or to fulfill the benchmark to test and evaluate a system.

To overcome this restricted perspective regarding human participants, participatory design has also inspired the development of social robot applications. Compared to the traditional user-centered design approach that considers end-users as a source for designers to formulate design requirements satisfying user's needs, participatory design aims for higher user involvement in the design process by viewing users as equivalent partners to the robot designers in the design process. Through various methods [27], participatory design empowers users to make design decisions, thereby enabling them to co-design the system. Accordingly, users are viewed as part of the design team who not only support the ideation of the system design, but who are also involved in the system development process. Previous work has shown that social robot applications targeting seniors benefit from participatory design in particular. To illustrate, elderly individuals co-designed a socially assistive robot that shall prevent and detect falls at home [28]. Moreover, research also focused on the benefit of mutual learning [29] during the co-design process of a social robot [12]. Building upon this work, research proposed the mutual shaping approach that is not only based on mutual learning, but also emphasizes the potential impact of a robot's deployment context [23]. Using a case study, these authors applied the mutual shaping approach with therapists to explore the use of a socially assistive robot for rehabilitation.

Obviously, this literature review reflects the breadth of user involvement [29], thereby documenting the shift from treating human participants as mere "product testers" vs. engaged co-designers of novel technologies that are eventually relevant to their needs. Despite this clear paradigm shift, user involvement has mainly been limited to the exploration of user needs regarding robot functionalities and their usage.

While this focus is important, another aspect that shapes user needs is still under-researched, namely values. Values are defined as principles and underlying assumptions about what is important and desirable in life to particular groups [13], [30], [31]. Recent research has called for integrating values in technology design and developed corresponding approaches [4], [9]. In particular, value sensitive design [4]—an established, theory-based methodological approach that explicitly embeds values in technology—has been applied to various technology designs [16], including conversational agents [32] and social robotics [15].

3 VALUE SENSITIVE DESIGN

Over the past decades, researchers have investigated how systems can be designed to foster human values. VSD is one of the approaches that accounts for integrating values into technology design [4]. Since values are defined as principles and underlying assumptions about what is important and desirable in life to particular groups [13], [30], [31], they represent subconscious needs, shared by members of a group (e.g., safety) [33], guiding their behavior (e.g., use or avoid certain technologies) [34]. Applying VSD to social robots rests on the assumption that embedding stakeholder values (e.g., empathy or collaboration [13]) into social robots will help overcome psychological and societal barriers to robot deployment [6], [13], [15], [16].

The VSD approach suggests a range of methods as a toolkit to take values into the focus of technology development [4]. Researchers are advised to carefully select suitable methods for their VSD study context. Existing VSD research has shown that considering values in technology development can be a driving force of technology acceptance. For example, considering sustainability can foster acceptance of smart grid technologies, whereas a failure to consider particular values, such as privacy may represent a barrier to technology acceptance [35].

In the context of social robots and HRI, several works have already emphasized the need for VSD for social robots [8], [9]. Here, existing research has mainly taken into account the notion of values from an ethical and moral perspective (e.g., [15], [36]). In fact, VSD research typically explores values that are deemed desirable from a collective ethics perspective, such as sustainability [37]. At the same time, research that focuses on the empirical identification of values pertaining to specific perspectives and stakeholder groups is still scarce [38], [39]. Consequently, researchers have called for an empirical approach to identify values of potential relevance to stakeholder groups of a particular technology [39]. In a healthcare context, for example, patients' values might be investigated, and likewise, medical staff might be interrogated to find out that patients may deem compassion relevant, whereas medical staff members might emphasize values like collaboration or efficiency. This example already highlights an inherent problem that might emerge in the analysis of stakeholder values: The respective core values might be in conflict. Such potential conflicts between values endorsed by various stakeholder groups must be considered to avoid detrimental effects on technology acceptance [40]. For instance, social robots should embody and display stakeholder values in their communication and behavior in such a way that social robots can ultimately be accepted and successfully integrated in a variety of contexts. The point is: Ignoring stakeholder values altogether in the deployment of social robots may foster fear, alienation, or a loss of human dignity [41]. Thus, a VSD approach emphasizes the need to carefully reflect on the values relevant to various stakeholder groups.

Experts in VSD have (a) emphasized the iterative nature of VSD to ensure that conceptual, technical, and empirical investigation are sufficiently represented within the complete VSD process, (b) identified a lack of research applying this iteration, and (c) called for methodological guidance to lower barriers to VSD [4], [16]. However, to date, specific guidelines as to how to go about this iteration are missing. Thus, we outline recommendations for VSD in the next section.

4 A WAVE APPROACH TO VSD

To address the lack of guidance on how to exactly realize iterations of conceptual, empirical, and technical investigations in VSD, we suggest what we call a wave approach to VSD. Figure 1 illustrates the approach.

We will outline it briefly in the following: On a general level, the wave approach differentiates between a conceptual, technical, and empirical wave, which translate into value identification (conceptual wave), value embedding (technical wave), and value evaluation (empirical wave). On a more specific level, we can identify various phases within each of these waves that alternate regarding technical, empirical, or conceptual focus. As to the phases on the specific level, our approach suggests empirical phases to be most present in VSD research, starting and ending the overall research cycle, and also appearing in between each conceptual or technical phase.

The wave approach starts with context specification in the value identification wave. In this phase, the context of use and potential stakeholders are analyzed empirically. To complement the list of stakeholders, researchers can also consult literature [4]. During the conceptual investigation, the focus of the literature review is on identifying and defining stakeholder values relevant to the context. We appeal to triangulate the findings from the conceptual phase with empirical insights when it comes to stakeholder value analysis. In particular, an empirical analysis enables stakeholders to voice contextual values and their priority of key values. A technical investigation that retrospectively [4] analyzes values already embedded in the robot can additionally give insights into stakeholders' views on these value and their implications. Finally, value tensions might emerge at various levels, for example, between stakeholder groups. Such value tensions should be resolved [4] before proceeding to the next wave.

The second wave concerns value embedding. Here, values identified in the first wave are translated into design requirements for human-robot interaction and technically builds the value-sensitive robot artifact. This wave also comprises three types of investigations. Conceptually, design requirements can be investigated (e.g., value hierarchy [42] and design patterns for human-robot interaction [43]) and empirically co-derived with stakeholders (e.g., in a series of mutual shaping workshops [23]). Next, the defined requirements are implemented into a technical robot artifact, i.e., a technical investigation phase focuses on proactive design [4].

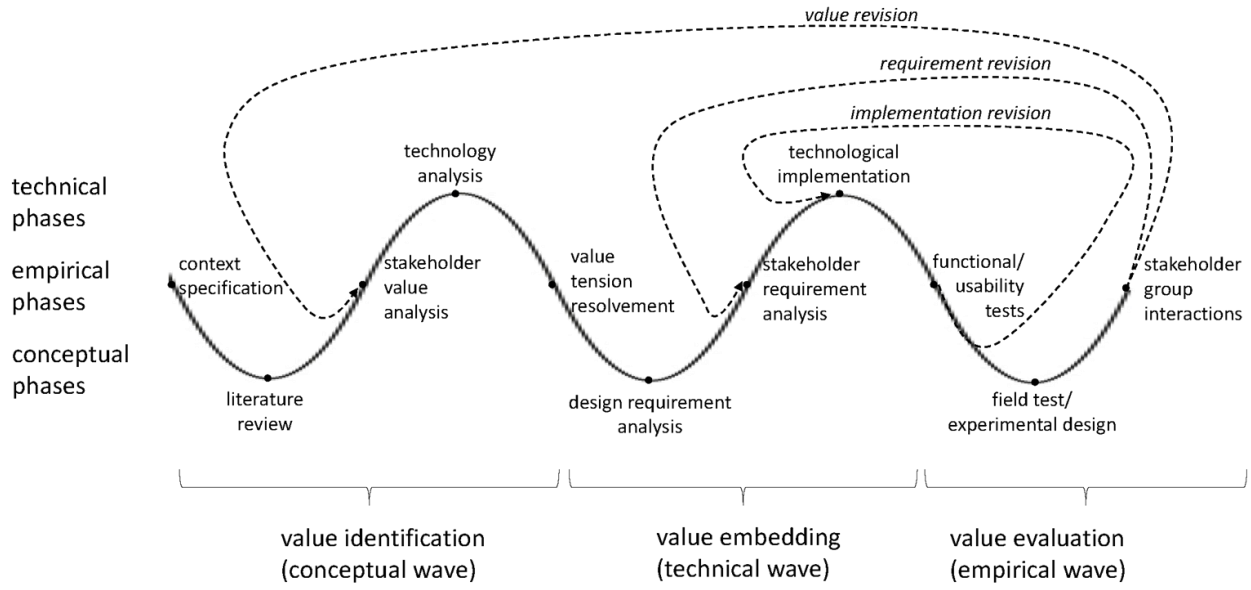

Figure 1: Wave approach to VSD

In the third wave, the developed robot artifact is evaluated comprehensively. First, the robot should meet predefined functional and usability requirements. Meeting usability requirements is particularly important to rule out that a potential lack of usability overshadows positive effects of the VSD. To ensure a functioning and usable technical artifact, established technology development methodologies that emphasize a test-driven, iterative, and incremental development approach can be leveraged (e.g., agile methodology, DevOps). Given a positive evaluation of functional/usability tests, the robot artifact may now be tested with regard to stakeholders' perception of the embedded values. To do so, researchers design experiments and field tests (e.g., [44]). Most importantly, the empirical evaluation shall involve the stakeholder groups identified in the first wave, preferably with real interactions with the robot artifact [45].

Throughout the wave-based design process, we identify three major cases that can lead to a revision of prior phases in the design process: If the empirical evaluation suggests that (1) the wrong values were implemented, a value revision is called for, requiring a new stakeholder value analysis. If the evaluation suggests that (2) the right values were implemented in the wrong way, a requirement revision is necessary. And if the evaluation suggests that (3) the implementation of the right values and requirements were technically implemented in the wrong way, an implementation revision is required.

5 CONCLUSION

Recently, social robotics has started to shift from a technology-centered view of robot design to a human-centered one. However, to design and develop social robots that contribute to human welfare, values and beliefs of relevant stakeholders must be integrated in the robot design. VSD is a technology design approach that particularly integrates stakeholder values into technology design through its tripartite methodology (i.e., conceptual, empirical, and technical investigations). Yet, research lacks guidelines on how to conduct the three investigations iteratively. The present work addresses this gap by proposing a wave approach for VSD. This approach outlines a VSD process comprising of three waves that address value identification, value embedding, and value evaluation, whereas each wave entails various phases that iterate through the three investigations (conceptual, empirical, and technical). The proposed wave approach builds on traditional design processes that include methods such as literature review, design analysis, and field testing, and stresses the iterative nature of the approach. However, the approach goes beyond the traditional view of identifying user needs in that it not only focuses on *values*, but also extends the focus from users—persons directly using a social robot—to *stakeholders*—persons directly interacting with a social robot or being affected by the use of a social robot [4], and initiates a series of activities around stakeholders (e.g., resolving value tensions). The proposed wave approach adds to both VSD research in general and social robotics research in particular, providing guidance on how VSD can be leveraged for designing social robots. The presented wave approach is part of our ongoing research to make VSD more graspable for application to new technologies. Despite its current rather theoretical nature, we are further specifying the VSD wave approach for social robots and the key methods to be used in each wave in ongoing research.

REFERENCES

[1] T. Schmiedel, J. Jäger, and V. J. Zhong, "Social Robots in Organizational Contexts: The Role of Culture and Future Research Needs," in *New Trends in Business Information Systems and Technology: Digital Innovation and Digital Business Transformation*, R. Dornberger, Ed. Cham: Springer International Publishing, 2021, pp. 163–177. doi: 10.1007/978-3-030-48332-6_11.

[2] International Organization for Standardization, "ISO 9241-210:2019," *ISO*, 2019. https://www.iso.org/standard/77520.html (accessed Nov. 30, 2022).

[3] D. R. Morrow, "When Technologies Makes Good People Do Bad Things: Another Argument Against the Value-Neutrality of Technologies," *Sci Eng Ethics*, vol. 20, no. 2, pp. 329–343, Jun. 2014, doi: 10.1007/s11948-013-9464-1.

[4] B. Friedman and D. G. Hendry, *Value Sensitive Design: Shaping Technology with Moral Imagination*. MIT Press, 2019.

[5] A. K. Pandey and R. Gelin, "A Mass-Produced Sociable Humanoid Robot: Pepper: The First Machine of Its Kind," *IEEE Robotics Automation Magazine*, vol. 25, no. 3, pp. 40–48, Sep. 2018, doi: 10.1109/MRA.2018.2833157.

[6] J. van den Hoven, "ICT and Value Sensitive Design," in *The Information Society: Innovation, Legitimacy, Ethics and Democracy In honor of Professor Jacques Berleur s.j.*, 2007, pp. 67–72.

[7] S. Nussey, "EXCLUSIVE SoftBank shrinks robotics business, stops Pepper production- sources," *Reuters*, Jun. 29, 2021. Accessed: Jan. 11, 2023. [Online]. Available: https://www.reuters.com/technology/exclusive-softbank-shrinks-robotics-business-stops-pepper-production-sources-2021-06-28/

[8] S. Šabanović, "Robots in society, society in robots: Mutual shaping of society and technology as a framework for social robot design," *International Journal of Social Robotics*, vol. 2, no. 4, pp. 439–450, 2010, doi: 10.1007/s12369-010-0066-7.

[9] J. Seibt, M. F. Damholdt, and C. Vestergaard, "Integrative social robotics, value-driven design, and transdisciplinarity," *Interaction Studies*, vol. 21, no. 1, pp. 111–144, 2020.

[10] V. J. Zhong and T. Schmiedel, "A User-Centered Agile Approach to the Development of a Real-World Social Robot Application for Reception Areas," in *Companion of the 2021 ACM/IEEE International Conference on Human-Robot Interaction*, Boulder, CO, USA, Mar. 2021, pp. 76–80. doi: 10.1145/3434074.3447132.

[11] N. Reich-Stiebert, F. Eyssel, and C. Hohnemann, "Involve the user! Changing attitudes toward robots by user participation in a robot prototyping process," *Computers in Human Behavior*, vol. 91, pp. 290–296, Feb. 2019, doi: 10.1016/j.chb.2018.09.041.

[12] H. R. Lee *et al.*, "Steps Toward Participatory Design of Social Robots: Mutual Learning with Older Adults with Depression," in *Proceedings of the 2017 ACM/IEEE International Conference on Human-Robot Interaction*, Vienna, Austria, Mar. 2017, pp. 244–253. doi: 10.1145/2909824.3020237.

[13] B. Friedman, P. H. Kahn, A. Borning, and A. Huldtgren, "Value Sensitive Design and Information Systems," in *Early Engagement and New Technologies: Opening up the Laboratory*, N. Doorn, D. Schuurbiers, I. van de Poel, and M. E. Gorman, Eds. Dordrecht: Springer Netherlands, 2013, pp. 55–95. doi: 10.1007/978-94-007-7844-3_4.

[14] B. Friedman, "Value-sensitive design," *interactions*, vol. 3, no. 6, pp. 16–23, Dec. 1996, doi: 10.1145/242485.242493.

[15] A. van Wynsberghe, "Designing Robots for Care: Care Centered Value-Sensitive Design," *Science and Engineering Ethics*, vol. 19, no. 2, pp. 407–433, Jun. 2013, doi: 10.1007/s11948-011-9343-6.

[16] T. Winkler and S. Spiekermann, "Twenty Years of Value Sensitive Design: A Review of Methodological Practices in VSD Projects," *Ethics and Information Technology*, Aug. 2018, doi: 10.1007/s10676-018-9476-2.

[17] M. Scheeff, J. Pinto, K. Rahardja, S. Snibbe, and R. Tow, "Experiences with Sparky, a Social Robot," in *Socially Intelligent Agents: Creating Relationships with Computers and Robots*, K. Dautenhahn, A. Bond, L. Cañamero, and B. Edmonds, Eds. Boston, MA: Springer US, 2002, pp. 173–180. doi: 10.1007/0-306-47373-9_21.

[18] E. Pacchierotti, H. I. Christensen, and P. Jensfelt, "Embodied social interaction for service robots in hallway environments," in *Field and Service Robotics*, vol. 25, P. Corke and S. Sukkarieh, Eds. 2006, pp. 293-+.

[19] C. Breazeal and B. Scassellati, "A context-dependent attention system for a social robot," in *Ijcai-99: Proceedings of the Sixteenth International Joint Conference on Artificial Intelligence, Vols 1 & 2*, San Francisco, 1999, pp. 1146–1151. Accessed: Sep. 15, 2022. [Online]. Available: https://www.webofscience.com/wos/woscc/summary/1743aeba-4ea4-4a02-8794-4f0c7e83b97e-4f0be192/relevance/1

[20] C. Abras, D. Maloney-Krichmar, and J. Preece, "User-centered design," *Encyclopedia of Human-Computer Interaction*, vol. 2. Berkshire Pub. Group, Thousand Oaks, pp. 445–456, 2004.

[21] H. Huttenrauch, A. Green, M. Norman, L. Oestreicher, and K. S. Eklundh, "Involving users in the design of a mobile office robot," *IEEE Transactions on Systems, Man, and Cybernetics, Part C (Applications and Reviews)*, vol. 34, no. 2, pp. 113–124, May 2004, doi: 10.1109/TSMCC.2004.826281.

[22] A. Cesta, S. Coradeschi, G. Cortellessa, J. González-Jiménez, L. Tiberio, and S. Von Rump, "Enabling Social Interaction Through Embodiment in ExCITE," in *ForItAAL: Second Italian Forum on Ambient Assisted Living*, Trento, Italy, Jan. 2010.

[23] K. Winkle, P. Caleb-Solly, A. Turton, and P. Bremner, "Mutual Shaping in the Design of Socially Assistive Robots: A Case Study on Social Robots for Therapy," *International Journal of Social Robotics*, Mar. 2019, doi: 10.1007/s12369-019-00536-9.

[24] D. Cawthorne and A. Cenci, "Value sensitive design of a humanitarian cargo drone," in *2019 International conference on unmanned aircraft systems (ICUAS)*, 2019, pp. 1117–1125.

[25] K. D. Eason, *Information Technology And Organisational Change*. London: CRC Press, 1988. doi: 10.1201/9781482275469.

[26] D. O. Johnson *et al.*, "Socially Assistive Robots: A Comprehensive Approach to Extending Independent Living," *Int J of Soc Robotics*, vol. 6, no. 2, pp. 195–211, Apr. 2014, doi: 10.1007/s12369-013-0217-8.

[27] W. A. Rogers, T. Kadylak, and M. A. Bayles, "Maximizing the Benefits of Participatory Design for Human–Robot Interaction Research With Older Adults," *Human Factors*, vol. 64, no. 3, pp. 441–450, 2022.

[28] H. Eftring and S. Frennert, "Designing a social and assistive robot for seniors," *Z Gerontol Geriat*, vol. 49, no. 4, pp. 274–281, Jun. 2016, doi: 10.1007/s00391-016-1064-7.

[29] B. Fischer, A. Peine, and B. Östlund, "The Importance of User Involvement: A Systematic Review of Involving Older Users in Technology Design," *The Gerontologist*, vol. 60, no. 7, pp. e513–e523, Oct. 2020, doi: 10.1093/geront/gnz163.

[30] E. H. Schein, *Organizational Culture and Leadership*. John Wiley & Sons, 2010.

[31] S. H. Schwartz, "Are There Universal Aspects in the Structure and Contents of Human Values?," *Journal of Social Issues*, vol. 50, no. 4, pp. 19–45, Jan. 1994, doi: 10.1111/j.1540-4560.1994.tb01196.x.

[32] T. Wambsganss, A. Höch, N. Zierau, and M. Söllner, "Ethical design of conversational agents: towards principles for a value-sensitive design," in *International Conference on Wirtschaftsinformatik*, 2021, pp. 539–557.

[33] M. Ros, S. H. Schwartz, and S. Shoshana, "Basic Individual Values, Work Values, and the Meaning of Work," *Applied psychology*, vol. 48, no. 1, pp. 49–71, 1999.

[34] G. R. Maio, *The Psychology of Human Values*, 1st Edition. London: Routledge, 2016.

[35] C. Milchram, G. Van de Kaa, N. Doorn, and R. Künneke, "Moral Values as Factors for Social Acceptance of Smart Grid Technologies," *Sustainability*, vol. 10, no. 8, Art. no. 8, Aug. 2018, doi: 10.3390/su10082703.

[36] M. Smakman, B. Jansen, J. Leunen, and E. Konijn, "Acceptable social robots in education: A value sensitive parent perspective," in *INTED2020 Proceedings*, Valencia, Spain, Mar. 2020, pp. 7946–7953. doi: 10.21125/inted.2020.2161.

[37] D. Cawthorne and A. Robbins-Van Wynsberghe, "From HealthDrone to FrugalDrone: Value-sensitive design of a blood sample transportation drone," in *2019 IEEE International Symposium on Technology and Society (ISTAS)*, 2019, pp. 1–7.

[38] S. Umbrello and A. F. De Bellis, "A Value-Sensitive Design Approach to Intelligent Agents," in *Artificial Intelligence Safety and Security (2018)*, R. Yampolskiy, Ed. Rochester, NY: CRC Press, 2018. Accessed: Jul. 05, 2021. [Online]. Available: https://papers.ssrn.com/abstract=3105597

[39] B. Friedman, M. Harbers, D. G. Hendry, J. van den Hoven, C. Jonker, and N. Logler, "Eight grand challenges for value sensitive design from the 2016 Lorentz workshop," *Ethics Inf Technol*, vol. 23, no. 1, pp. 5–16, Mar. 2021, doi: 10.1007/s10676-021-09586-y.

[40] D. E. Leidner and T. Kayworth, "Review: A Review of Culture in Information Systems Research: Toward a Theory of Information Technology Culture Conflict," *MIS Quarterly*, vol. 30, no. 2, pp. 357–399, Jun. 2006.

[41] Z. Dolic, R. Castro, and A. Moarcas, "Robots in Healthcare: A Solution or A Problem?," Policy Department for Economic, Scientific and Quality of Life Policies, Directorate General for Internal Policies, European Parliament, Luxembourg, 2019.

[42] I. van de Poel, "Translating Values into Design Requirements," in *Philosophy and Engineering: Reflections on Practice, Principles and Process*, D. P. Michelfelder, N. McCarthy, and D. E. Goldberg, Eds. Dordrecht: Springer Netherlands, 2013, pp. 253–266. doi: 10.1007/978-94-007-7762-0_20.

[43] K. Pollmann and D. Ziegler, "A Pattern Approach to Comprehensible and Pleasant Human–Robot Interaction," *MTI*, vol. 5, no. 9, p. 49, Aug. 2021, doi: 10.3390/mti5090049.

[44] M. Strait *et al.*, "A Three-Site Reproduction of the Joint Simon Effect with the NAO Robot," in *Proceedings of the 2020 ACM/IEEE International Conference on Human-Robot Interaction*, Cambridge, United Kingdom, Mar. 2020, pp. 103–111. doi: 10.1145/3319502.3374783.

[45] P. Baxter, J. Kennedy, E. Senft, S. Lemaignan, and T. Belpaeme, "From characterising three years of HRI to methodology and reporting recommendations," in *2016 11th ACM/IEEE International Conference on Human-Robot Interaction (HRI)*, Mar. 2016, pp. 391–398. doi: 10.1109/HRI.2016.7451777.