Feminist value sensitive design of self-tracking technology based on female body data

Jinchan Chen[1], Li Zhang[2]

[1]School of Art and Design, Guangdong University of Technology, Guangzhou, Guangdong, China
1250395904@qq.com
[2]School of Art and Design, Guangdong University of Technology, Guangzhou, Guangdong, China
lizhang116@gdut.edu.cn

Abstract

Self-tracking technology is widely used in the field of digital health to track physiological data of the body to predict physiological processes. More and more women are using self-tracking devices for health-related management, such as menstrual management, pregnancy management, or gynecological disease prevention, to better understand their health status. However, in digital health tracking applications that consider gender in advance, there are still generalized and objective value presuppositions based on the male body, resulting in some data content that does not truly reflect the changing physical experience of women. To address this problem, we use value sensitive design (VSD), a method that emphasizes the integration of ethical values into the design process, and feminism, a theory that helps reveal the gendered power structure of things and aims to construct a discourse system of gender equality. The two combine to form a framework that promotes reflection on existing gendered tracking application devices. They also improve the match between women's physical experiences and quantitative data. Finally, we illustrate this approach with a case study of a period-tracking app called Meet You, revealing important value needs for those with irregular periods and demonstrating insights that are conducive to reflection and design.

Keywords

Menstrual body data; self-tracking technology; value sensitive design (VSD); feminism

Introduction

We have entered a digital society, and digital technologies are transforming the economy and society, especially in the area of women's health. Self-tracking technology has become dominant in the field of digital health, with health-tracking apps and devices dominating women's health management markets. According to Research and Markets, the global women's health App market is expected to reach $9.42 billion in 2028. The market is expected to grow at a compound annual growth rate of 21.8% between 2021 and 2028. This huge market size reflects the importance women attach to their health in their daily lives. These tracking apps quantify a woman's physiological data into visual data that they use to learn about her body and health. However, this kind of digital health tracking of women implies the generalization of the male body and the value presupposition of female stereotypes. This paper tries to put forward some countermeasures to solve these problems in order to better promote the application of female body data.

Methods: Feminist value sensitive design

Value sensitive design and feminism

With the rapid development of the digital field, value-sensitive design (VSD) has become an effective method for solving the ethical problems of user autonomy, unbiasedness, privacy, and trust in technology (de Reuver et al., 2020; Mok & Hyysalo, 2018; Strikwerda et al., 2022). VSD is based on a methodology of conceptual, empirical, and technical tripartite investigation, which can conceptualize these problems and develop new design solutions. The core points include identifying the value of stakeholders and possibly solving the value tension (Friedman et al., 2013). This helps to identify the fundamental values held by underserved user groups, assess whether these values are supported in the design, identify and end negative impacts on society, and allow stakeholders to reflect and discuss them (Popa et al., 2021). The logic of its application is to assume that many technology-related problems are due to the lack of participation in certain values in the design, and we need to examine these values in order to properly use them in design (Donia & Shaw, 2021).

However, because VSD is descriptive rather than normative, it has often been criticized for lacking a normative basis (Costanza-Chock, 2020; Mander-Huits, 2011). VSD requires designers to intentionally encode values in the designed system, but it doesn't propose any specific value set at all. This means that in VSD, to a large extent, it depends on well-meaning professional designers to integrate value into the design through moral imagination. This is one way to explain why the ethical issue of gender bias persists in health-tracking products designed for specific gender groups. In view of this problem, some scholars have put forward a wealth of opinions. Borning and Muller (2012) suggest that VSD highlight the voices of researchers and designers because their perspectives and positions can provide a more authoritative and impartial survey tool to address the question of the value. It is also suggested to learn its research methods from feminism, which has the common goal of promoting social justice and

social moral values with VSD. Feminism opposes generalized narration and design, focusing on marginalization, which can provide a more comprehensive perspective on value issues (Bardzell, 2010; Bardzell & Churchill, 2011). Friedman et al. (2019, 2021) proposed that the use of ethical theory can provide a more transparent and systematic way to distinguish between true ethical values and pure stakeholder preferences so as not to fall into unconstrained value risk. In some specific fields, such as medical health (van Wynsberghe, 2013), war (Cummings, 2006), and politics (Borning et al., 2005), well-established ethical theories have been drawn upon to regulate technical design. However, VSD's exploration of genderization in the health field has been limited. Therefore, in response to gender bias in women's health tracking, we not only need to be sensitive to the role of values in the design process but also need to prioritize and legitimize certain values as principled judgments for specific situations. Feminism is a social and political movement aimed at eliminating gender discrimination and ending the oppression of women (Delmar, 2018). As the theory and practice of questioning gender oppression, the feminist perspective is an effective theoretical approach for reflecting on design issues. Feminist ethics is an ethical theory aimed at women's liberation that is criticized and constructed from a feminist perspective (Jaggar, 2013). It constructs an ethical theory that emphasizes equality between men and women and criticizes the ethical theory and moral practice that demeans and discriminates against women. Based on the ontological and epistemological interpretation of feminist ethics (Concepcion & Eflin, 2009), and the description of the characteristics of mid-level ethical theories that emphasize principle and constraint (Jacobs & Huldtgren, 2021), We try to take feminist ethics as a normative ethical theory to constrain VSD in order to solve the problem of inequality in the field of gender. Feminist ethics reveal the existing design of gendered power structures, emphasis on emotional care, respect difference, relationship reciprocity, and equal participation (Benhabib, 1992; Burton & Dunn, 1996; Gilligan & Attanucci, 1988; Wicks et al., 1994). It can provide the basis of proof and argument for ethical claims and considerations of equality and inclusiveness.

The feminist VSD discussed in this research is a methodology combining feminist values on the basis of the VSD method. It emphasizes the role of women's experience, which can avoid the problem of being influenced by dualism for a long time and unintentionally embedding the values related to male generalization. Therefore, in the gendered design of gender-specific products, spaces, or experiences, to avoid the gendered design easily falling into traditional gender stereotypes and assumptions, the constraints of feminist moral principles on various abstract values obtained from the investigation will help guide the correct direction of values.

Feminist VSD process

Based on the above discussion of VSD and feminism, the specific design process of feminist VSD will be described in detail in this summary (see Figure 1). Based on the summary of the existing VSD method process, we add the values held by feminism in the field of ethics to be constrained and extend the VSD the tripartite methodology including conceptual, empirical, and technical investigations to the whole design process, encouraging the iterative use of a variety of investi-

gation methods in the design process so that specific values can be fully explored, verified, and realized.
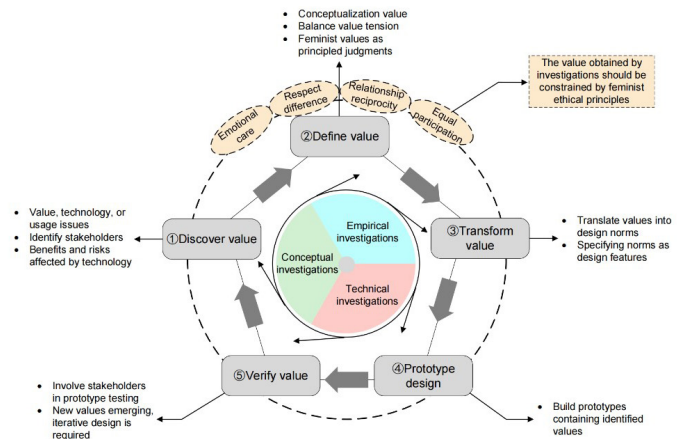

Figure 1. Feminist VSD process

The first stage of discovery begins with a value, technology, or usage context, explores the problems existing in a particular context, and conducts an in-depth study of the status quo through an analysis of the characteristics of stakeholders, the current status of the product, and the attitude of stakeholders toward the product to find the demands of stakeholders. Specifically, the analysis includes the following elements: identifying direct and indirect stakeholders and the potential impact of their interaction with technology (Czeskis et al., 2010; Yoo, 2017) and mapping harm and benefit to corresponding values. These element analyses can be completed by any of the three surveys. The second stage is the definition of value, which is divided into two steps. The first step conceptualizes the identified values, resulting in a list of values determined by the stakeholder communities themselves. For the value acquired in the design context, we need to rely on the philosophical literature to provide a standard definition of the specific value to guide the empirical evaluation. When the key values are defined, the second step is to balance the value tension. When the key values are defined, we need to examine the potential conflicts or tensions that exist between them. Through the integration of solutions proposed by previous researchers to generate value tension (Flanagan et al., 2008; Poel, 2021; van Wynsberghe, 2013), we think value tension can be solved from the following two directions: (1) compromise and (2) transcend and dissolve. The focus of this study is to take the values of feminism as a specific position by means of compromise to deal with the problem of gender bias still existing in gendered design, emphasizing the attention paid to marginalized groups who are often ignored. Value transformation in the third stage refers to the activities that embody or express these values in system design and convert the value concepts in the second step into corresponding design specifications involving specified design features (Poel, 2013). Specifically, it is to transform ideas, intentions, and concepts into material forms through design activities, thus exerting good design values. "Good design values" are design decisions that are aligned with the needs, preferences, and values of users and that result in positive outcomes for individuals, society, and the environment. In contrast to traditional functional goals, good design values also meet the functional requirements of a given system. The trans-

formation step should be as specific as possible so that the essence of the value is correctly explained. The fourth stage is prototype design. It builds physical prototypes of related technologies based on the design specifications and requirements of the previous step to demonstrate value in technical artifacts. After transferring technologies from the design environment to the field test, design decisions that may become difficult to control and even implicate other values can be recalled in the design environment for examination and modification (Umbrello & Van de Poel, 2021). The fifth stage is value verification. This step is not only to determine that a particular value has been successfully realized in the prototype but also that its realization does not interfere with other design goals. In general, prototype testing requires technical feasibility testing of designed artifacts, which must consider their influence on stakeholder behavior, society, and values in the design (Umbrello & Van de Poel, 2021). Value verification activities are an essential part of the iterative feedback loop, in which implementations are tested using various methods to determine whether they meet the designer's intentions.

Investigation activities are not carried out in a fixed order (Watkins et al., 2013). For example, the "discovery of value" step occurs early in a design project, but it may continue as the design process progresses to the end of the product. Even when technologies initially meet the requirements of value-based design, they can evolve in unexpected ways and have undesirable effects. They may not achieve their intended value or may have unforeseen side effects (van de Poel, 2021). The addition, removal, and change of additional value design features that need to be considered lead to new value options, and the design goes through an iterative phase of transformation and validation.

Application of feminist VSD: Ethical evaluation of the menstrual-tracking app

This chapter will illustrate the application of the feminist VSD method through a period-tracking application. By familiarizing ourselves with the research topic and the initial survey, we arrived at an initial list of direct and indirect stakeholders. We then narrowed it down to a small group of stakeholders involved in the research activities, taking into account resource constraints. In this study, we give priority to the under-represented stakeholder groups, namely irregular menstrual groups, to gain a wider understanding of marginalized or hidden stakeholders.

Value-oriented semi-structured interviews

Based on the value-oriented design method of VSD and feminist ethical values, this study conducted semi-structured interviews with users with irregular periods and paid attention to and determined their statements on the usage status and vision of the period-tracking application as the collected textual data. We chose Meet You, a period-tracking app and the most downloaded app for women's health management in China, as the technical equipment for the ethical evaluation of this study. We post recruitment information on social software and forums, and qualified interviewees conduct online interviews in the form of one-on-one interviews. The interviews lasted about 30 minutes and were recorded and transcribed. The interviews began with closed-ended questions to determine information about demographic charac-

teristics, physical conditions, and the use of period-tracking apps. The interviews focused on what they valued during period tracking to capture their preferences and values. Each interviewer took an average of 30 minutes to complete. The participants who finish the interview will be given a nice gift as a thank you for completing the interview. All interviewees used pseudonyms to protect their privacy.

We finally interviewed 18 interviewees, all of whom confirmed that they had been treated for irregular menstruation before the interview, and had used the Meet You app. The specific demographic characteristics of participants are shown in Table 1.

Table 1. Descriptive statistical results of the samples

Attributes	Category	Population(n = 18)	Proportion(%)
Age	18–22	2	11.1%
	23–30	13	72.2%
	31–40	2	11.1%
	41–50	1	5.6%
	51 and up	0	0
Menstrual condition	occasionally irregular	4	22.2%
	irregular	12	66.7%
	Often irregular	2	11.1%
	Never regular		
Frequency of menstrual application	Record monthly	6	33.3%
	Occasional record	7	38.9%
	Once recorded monthly, not now	5	27.8%
Years of self-tracking (Y)	0 ≤ Y < 6 months	6	33.3%
	6 months ≤ Y < 1	6	33.3%
	1 ≤ Y < 2	3	16.7%
	2 ≤ Y < 3	2	11.1%
	Y ≥ 3	1	5.6%

Data coding and analysis

In the early stages, we collected and integrated literature and legislative policies on the important value of health digital tracking. This paper focuses on validating and supplementing values through empirical investigation to conceptualize values that are important to users with irregular periods. We encoded the text data obtained from the value-oriented semi-structured interview in the previous step; the encoding method was based on the value coding method used by Dadgar and Joshi (2015, 2018) to explore the important values of patients with chronic diseases. The philosophical interpretation of value categories came from a list of human values with ethical significance provided by Friedman et al. (2013) and other references discussing values (Andel et al., 2015). Philosophical interpretation can help us identify, evaluate, and prioritize these values.

After coding the value of the stakeholder description text, we then analyzed and defined the benefits and risks that a period-tracking application provides to potential stakeholders through the revealed values to assess the values that are important to users of a period-tracking application.

Table 2. Value-coding examples of interview texts

Value statement—what users consider important when using a menstrual app	Revealed value	Value category	Value included (or not included) in the current menstrual application design
"I simply type in my menstrual cycle every month, and I can easily see my physiological changes over time…"	Simply record the menstrual cycle	Accessibility: Ease of access to and use of equipment	Accessibility is achieved by allowing free use by different groups, implementing simple operations, and providing easy-to-understand text and images
"I have a bad memory and I need the app to record data for me, which makes me feel safe…"	Monitoring one's health with tools	Health: Refers to maintaining or improving people's physical and mental health and happiness	Health value is achieved by people actively recording their periods, contributing to their physical health
"I was on long-term estrogen medication, but I had doubts about the accuracy of the data when it wasn't documented…"	Data can accurately reflect their situation	Reliability: Refers to the expectation of equipment performance	The application presets the composition of body data as not affected by other factors in advance, resulting in some people's poor expectations
"When I see people in the app community who are going through the same thing as me, it makes me feel like I'm not an anomaly, and it makes me comment below that I'm going through the same bad situation…"	Seek people with the same experience	Trust: Refers to the interactions between people and their experiences of expressing kindness and vulnerability to each other	The app provides a community networking function that allows people who have gone through the same experience to exchange experiences and relieve anxiety
"I have polycystic ovary syndrome and the application prediction has never been accurate or given feedback, and I don't think this software is right for me…"	Information data feedback	Feedback: Influence, improve or strengthen the behavior of the object by transmitting information related to the object	Because the technology is not designed to support irregular menstrual groups, it does not provide additional care and feedback, leaving such groups with no incentive to use it
"I input a lot of data about my body, and I am afraid that my privacy will be leaked out…"	Control and keep your privacy secret	Autonomy: Refers to the degree to which a person can live according to his wishes	Privacy Settings in apps are inadequate, making it difficult for users to control where their data goes

Table 3. Implied value of the period-tracking application and its benefits and risks

Value	Subcategory	Benefit	Risk
Health	Health	Track, record, and predict periods	Privacy may be compromised
	Health	Continue to monitor menstrual changes	Relying too much on quantitative data is prone to health anxiety
Trust	Trust	Provide a platform for sharing personal privacy experiences	Sensitive personal content may be disclosed
	Trust	Provide a window to inquire and buy medicine	Deceptive marketing may occur
Autonomy	Autonomy	Data content set in the application can be input	There are limited recording items to choose from
	Autonomy		There is not enough transparency in how data is obtained, stored, and used
	freedom from bias	Users with menstrual periods can record their periods once a month	People with irregular menstruation may be limited in recording menstrual periods
	Privacy	Users can turn privacy settings on and off independently	Private information may be abused without consent
Feedback	Feedback	Provide visual charts and analysis reports of menstrual conditions	There may be errors in the information, and the content of analysis is not targeted
	Feedback	Provide a wealth of health information	The content quality is uneven
	Feedback	Information reminder	Reminders may not be timely.
Accessibility	Accessibility	Open the mobile app and you can use it	Persons with disabilities may be difficult to use
Usability	Usability	Respond to user queries and provide useful resources	Advertising may appear
	Usability	The navigation system is intuitive in design and provides easy-to-understand icons and characters	
	Usability	Provide a simple operation process	
Reliability	Accuracy	Predict the coming time of menstruation	Can't be completely accurate
	Technical	The algorithm is scientific and effective	An algorithm model for irregular menstruation is difficult to establish
	Technical	Mobile devices compatible with different operating systems	The system may flash back

Survey results and discussion

Correlation insight

Based on the previous questionnaire survey on women's menstruation, it was found that more than half of them had irregular menstruation cycles, and the score of this group on the application of menstrual tracking was lower than that of the group with regular menstruation. Therefore, this study focuses on underserved people with irregular periods in the application of period tracking. Through the above investigation, we learned that most of the women in the interviews suffered from common gynecological diseases, such as polycystic ovary syndrome and menopause menstrual disorder, and some of them had long-term irregular menstrual periods for unknown reasons. These groups are different from the general group with regular menstruation. Their physical data on menstruation are generally unstable, and there is a certain gap between them and the feedback results of menstrual-tracking applications. Through the analysis of the above survey data, we can gain the following insights into the correlation between women's physical experiences of menstruation and the data content. First, menstrual physical data are strongly influenced by life experiences. Through the survey, we found that people think that the most likely causes of menstrual health problems are diet and rest habits, mental pressure, physical weakness, and other factors that are greatly affected by the outside world. In fact, the proportion of menstrual health problems caused by their own diseases is very small. Therefore, period data also have implications for our daily habits and various physical experiences. Second, the lack of data content feedback will lead to women being prone to health anxiety. While the use of such period-tracking apps has enhanced and expanded people's physical sensory abilities and made it easy for them to clearly view health information, in the discussion, 7 people said that the lack of positive feedback has led to their frustration with the experience, which reveals why more people are intermittent users and some even give up. Preset objective data make people with irregular periods prone to health anxiety, which leads them to record more and reflect less on their physical conditions. Finally, the visual content of the interface deviates from the description of a real menstrual physical experience. When it comes to period-tracking apps that focus on health management, there's no avoiding medical expertise or covering up professional descriptions of the menstrual body. However, the survey found that users reported that images and text in the app reflected gender stereotypes.

Value tension and value verification

By analyzing the benefits and risks of the above values, we find the existing value tension. The most significant source of value tension is the complex relationship between people with irregular periods and service providers of period-tracking apps. Service providers chose relatively homogenous groups in the user research stage, ignoring the needs of groups with irregular menstruation who pay more attention to personalized body data management, which ultimately leads to the poor user experience of this special group. In view of the value tension generated in the process of investigation, we take a feminist stance and balance the value tension in the form of a seminar. During the workshop, we will also discuss solutions for period tracking applications to determine design specifications and requirements, including building a product information architecture suitable for the menstrual irregular population and identifying technologies to support these value needs. In the prototype design, we will refine the existing period-tracking application in detail to maximize the identified benefits and minimize the anticipated risks. Finally, to verify whether the matching between menstrual body experience and data content is improved, we will ask users to use the prototype test and, through user interviews and questionnaires, ask them to rate the embedded value, and then compare whether all advantages in the previous investigation are covered and whether the risks are reduced; this is to test whether the new design meets people's value appeal.

Reconstruct the design framework of period-tracking technology

Feminist VSD can incorporate equal, inclusive, personalized, and diversified viewpoints into the design framework, breaking the previous presupposition that "regular" is equal to "normal" menstrual body so as to build a menstrual cycle–tracking technology applicable to a wide range of menstrual groups. In this study, this approach helped us reveal the values that were important to the use of digital tracking technology for menstrual irregularity. We found that such menstruators use period-tracking apps to monitor menstrual changes and manage health problems. However, period-tracking apps may cause health anxiety for groups with irregular menstruation through pre-preset objective data, and the lack of positive feedback leads to disappointment among these groups regarding usage experience. Currently, such menstrual tracking applications cannot well meet the value demands of health, trust, feedback, autonomy, reliability, and accessibility that groups with irregular menstruation value, resulting in insufficient service for such groups. We recommend the establishment of multiple criteria for measuring menstrual health, with special attention to the impact of the life experience of such menses on their physical health, as well as the importance of feedback on their physical changes to help them pay attention to their physical health. This focus on data tailored to an individual's body could lead to a future of more inclusive body-tracking tools for women.

References

Andel J., Leijten F., Delden H., & Thiel G. (2015). What Makes a Good Home-Based Nocturnal Seizure Detector? A Value Sensitive Design. *PLOS ONE*, 10(4), e0121446. https://doi.org/10.1371/journal.pone.0121446

Bardzell, S. (2010). Feminist HCI: Taking stock and outlining an agenda for design. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 1301–1310. https://doi.org/10.1145/1753326.1753521

Bardzell, S., & Churchill, E. F. (2011). IwC Special Issue "Feminism and HCI: New Perspectives" Special Issue Editors' Introduction. *Interacting with Computers*, 23(5), iii–xi. https://doi.org/10.1016/S0953-5438(11)00089-0

Benhabib, S. (1992). *Situating the self: Gender, community, and postmodernism in contemporary ethics*. Psychology Press.

Borning, A., & Muller, M. (2012). Next steps for value sensitive design. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 1125–1134. https://doi.org/10.1145/2207676.2208560

Borning, A., Friedman, B., Davis, J., & Lin, P. (2005). Informing Public Deliberation: Value Sensitive Design of Indicators for a Large-Scale Urban Simulation. In H. Gellersen, K. Schmidt, M. Beaudouin-Lafon, & W. Mackay (Eds.), *ECSCW 2005* (pp. 449–468). Springer Netherlands. https://doi.org/10.1007/1-4020-4023-7_23

Brian K. Burton & Craig P. Dunn. (1996). Feminist ethics as moral grounding for stakeholder theory. *Business Ethics Quarterly*, 133–147. 2022/12/12. https://doi.org/10.2307/3857619

Concepción D. W., & Eflin J. T. (2009). Enabling Change: Transformative and Transgressive Learning in Feminist Ethics and Epistemology. *Teaching Philosophy*, 32(2), 177–198. 2022/12/12. https://doi.org/10.5840/teachphil200932217

Costanza-Chock, S. (2020). *Design Justice: Community-Led Practices to Build the Worlds We Need*. The MIT Press.

Cummings, M. L. (2006). Integrating ethics in design through the value-sensitive design approach. *Science and Engineering Ethics*, 12(4), 701–715. https://doi.org/10.1007/s11948-006-0065-0

Czeskis, A., Dermendjieva, I., Yapit, H., Borning, A., Friedman, B., Gill, B., & Kohno, T. (2010). Parenting from the pocket: Value tensions and technical directions for secure and private parent-teen mobile safety. In *Proceedings of the Sixth Symposium on Usable Privacy and Security - SOUPS '10*, 1. https://doi.org/10.1145/1837110.1837130

Dadgar, M., & Joshi, K. D. (2015). Diabetes Self-Management Using Mobile Apps: An Empirical Investigation Based On App Reviews And Through Value Sensitive Design Perspective. 2015 In *International Conference on Mobile Business*. Paper, 3.

Dadgar, M., & Joshi, K. D. (2018). The Role of Information and Communication Technology in Self-Management of Chronic Diseases: An Empirical Investigation through Value Sensitive Design. *Journal of the Association for Information Systems*, 19(2). https://doi.org/10.17705/jais1.00485

de Reuver, M., van Wynsberghe, A., Janssen, M., & van de Poel, I. (2020). Digital platforms and responsible innovation: Expanding value sensitive design to overcome ontological uncertainty. *Ethics and Information Technology*, 22(3), 257–267. https://doi.org/10.1007/s10676-020-09537-z

Delmar, R. (2018). What is feminism?. In *Theorizing feminism* (pp. 5-28). Routledge.

Donia, J., & Shaw, James. A. (2021). Ethics and Values in Design: A Structured Review and Theoretical Critique. *Science and Engineering Ethics*, 27(5), 57. https://doi.org/10.1007/s11948-021-00329-2

Flanagan, M., Howe, D. C., & Nissenbaum, H. (2008). Embodying values in technology: Theory and practice. *Information Technology and Moral Philosophy*, 322, 24. https://doi.org/10.1017/CBO9780511498725.017

Friedman, B., & Hendry, D. G. (2019). *Value sensitive design: Shaping technology with moral imagination*. Mit Press.

Friedman, B., Harbers, M., Hendry, D. G., Hoven, J. van den, Jonker, C., & Logler, N. (2021). Eight grand challenges for value sensitive design from the 2016 Lorentz workshop. *Ethics and Information Technology*, 23(1), 5–16. https://doi.org/10.1007/s10676-021-09586-y

Friedman, B., Kahn, P. H., Borning, A., & Huldtgren, A. (2013). Value sensitive design and information systems. In *Early engagement and new technologies: Opening up the laboratory* (pp. 55-95). Springer.

Gilligan, C., & Attanucci, J. (1988). Two Moral Orientations: Gender Differences and Similarities. *Merrill-Palmer Quarterly*, 34(3), 223–237.

Jacobs, N., & Huldtgren, A. (2021). Why value sensitive design needs ethical commitments. *Ethics and Information Technology*, 23(1), 23–26. 2022/12/10. https://doi.org/10.1007/s10676-018-9467-3

Jaggar, A. M. (2013). Feminist Ethics. In *The Blackwell Guide to Ethical Theory* (pp. 433–460). John Wiley& Sons, Ltd.

Manders-Huits, N. (2011). What Values in Design? The Challenge of Incorporating Moral Values into Design. *Science and Engineering Ethics*, 17(2), 271–287. https://doi.org/10.1007/s11948-010-9198-2

Mok, L., & Hyysalo, S. (2018). Designing for energy transition through Value Sensitive Design. *Design Studies*, 54, 162–183. 2022/12/08. https://doi.org/10.1016/j.destud.2017.09.006

Poel I. R. (2021). Values and Design. *The Routledge Handbook of the Philosophy of Engineering*. https://repository.tudelft.nl/islandora/object/uuid%3Af382aa21-0edc-48b4-8a75-3e0ad97443cf

Poel, I. van de. (2013). Translating Values into Design Requirements. In D. P. Michelfelder, N. McCarthy, & D. E. Goldberg (Eds.), *Philosophy and Engineering: Reflections on Practice, Principles and Process* (Vol. 15, pp. 253–266). Springer Netherlands.

Popa, E. O., Hilten, M. van, Oosterkamp, E., & Bogaardt, M.-J. (2021). The use of digital twins in healthcare: Socio-ethical benefits and socio-ethical risks. *Life Sciences, Society and Policy*, 17(1), 6. 2022/12/09. https://doi.org/10.1186/s40504-021-00113-x

Strikwerda, L., van Steenbergen, M., van Gorp, A., Timmers, C., & van Grondelle, J. (2022). The value sensitive design of a preventive health check app. *Ethics and Information Technology*, 24(3), 38. https://doi.org/10.1007/s10676-022-09662-x

Umbrello, S., & Van de Poel, I. (2021). Mapping value sensitive design onto AI for social good principles. *AI and Ethics*, 1(3), 283–296. https://doi.org/10.1007/s43681-021-00038-3

van de Poel, I. (2021). Design for value change. *Ethics and Information Technology*, 23(1), 27–31. https://doi.org/10.1007/s10676-018-9461-9

van Wynsberghe, A. (2013). Designing Robots for Care: Care Centered Value-Sensitive Design. *Science and Engineering Ethics*, 19(2), 407–433. https://doi.org/10.1007/s11948-011-9343-6

Watkins, K. E., Borning, A., Rutherford, G. S., Ferris, B., & Gill, B. (2013). Attitudes of bus operators towards real-time transit information tools. *Transportation*, 40(5), 961–980.

Wicks, A. C., Gilbert Jr, D. R., & Freeman, R. E. (1994). A feminist reinterpretation of the stakeholder concept. *Business ethics quarterly*, 475-497.

Yoo, D. (2017). Stakeholder Tokens: A Constructive Method for Value Sensitive Design Stakeholder Analysis. In *Proceedings of the 2017 ACM Conference Companion Publication on Designing Interactive Systems*, 280–284. https://doi.org/10.1145/3064857.3079161