Philosophical Perspectives on Moral Certainty

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Chapter 2

Socially Disruptive Technologies and Moral Certainty

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2.1 Introduction

The work of Wittgenstein has so far received little attention from scholars working in the philosophy of technology, a lacuna recently pointed out by Mark Coeckelbergh and Michael Funk (Coeckelbergh 2018; Coeckelbergh and Funk 2018). An exception is Langdon Winner, who is inspired by Wittgenstein and, borrowing his notion of a form of life, speaks about "technologies as forms of life" (Winner 1989, 11). In this chapter, I relate a Wittgenstein-inspired account of moral certainty to recent scholarship in the philosophy and ethics of technology that studies the phenomenon of "technosocial disruption", that is, the disruption by technology of "social relations, institutions, epistemic paradigms, foundational concepts, values, and the very nature of human cognition and experience" (Hopster 2021, 1). Developments in, for instance, robotics, artificial intelligence, and gene-editing technologies might create conditions in which some certainties, both moral and non-moral, will be challenged and new certainties will emerge. Such technological developments could affect "our fundamental ways of being and acting in the world" (Pleasants 2009, 670), which underlie our epistemic and moral practices and reflect various certainties.

I shall explore ways in which what have been called "socially disruptive technologies" (Hopster 2021) could affect moral agency at its most fundamental level, the level of moral certainty,[1] by considering two different contexts in which technology disrupts moral practices: the introduction of robots in elderly care practices and, at a more speculative level, the use of ectogestative technology for foetal development. As I shall argue, those technologies disrupt moral routines, thereby affecting what moral competence involves in the respective practices and challenging some of the things that "stand fast" for morally competent agents. Furthermore, the possibility of moral disruption suggests a refinement

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1 I address the disruption of non-moral certainty in Hermann (in preparation).

of Wittgenstein-inspired accounts of moral certainty: moral certainty should be understood as being susceptible to technological mediation. Integrating the idea of the technological mediation of morality into an account of moral certainty expands the idea of moral certainty by explicitly situating it in our technological world. The notion of moral certainty, in turn, can inform accounts of "technosocial disruption".

In the next section, I briefly present the relationship between moral certainty and moral competence (Section 2.2). I then introduce the notions of "socially disruptive technologies" and "technosocial disruption" as well as the idea that this disruption can go as deep as the level of moral certainty (Section 2.3). I explore this idea by looking at the ways in which two different technologies might be technosocially disruptive in specific contexts: care robots in the context of elderly care and ectogestative technology in the context of becoming and being a parent. After briefly explicating the idea that moral certainty should be conceived of as being susceptible to technological mediation (Section 2.4), I conclude by summarising the main insights of my analysis (Section 2.5).

2.2 Moral certainty and moral competence

Elsewhere (Hermann 2015) I have defended an account of moral certainty that relates it closely to moral competence. Moral competence is the result of training, which in turn builds upon natural inclinations (see Hermann 2015, 138ff.). For morally competent agents, some things are certain, for example, the moral wrongness of hurting someone for no reason or the moral praiseworthiness of helping someone in need. These are the "axes" around which our moral doubts and justifications turn (see Hermann 2015, 108ff.). Peter Winch (1998, 198) has emphasised the fittingness of the metaphor of the axis, as opposed to the hinge metaphor that has led some interpreters of *On Certainty* to talk about certainties in terms of "hinge propositions". While a hinge is fixed and exists independently of the motion of the door, an axis is determined by the movement around it. An axis has "no existence or meaning apart from the movement" (Winch 1998, 198).

I have argued that moral certainties are acquired during the acquisition of moral competence and manifest themselves in the habitual actions of morally competent agents. A person who has mastered the moral language-games of her community usually engages in moral action habitually, without conscious reflection. Wittgenstein (OC, §510) illustrates the unreflective character of certainty by means of the way we take hold of a towel: "It is just like directly taking hold of something, as I take hold of my towel without having doubts". This resonates with the pragmatist view of morality as consisting primarily of practical routines, first expressed by John Dewey (see Swierstra 2013, 203). I would argue that such routines are grounded in moral certainty and can be

understood as part of the acting that lies at the bottom of our moral language-games.[2]

In my book, I have distinguished different components of that acting: (i) "primitive reactions to pain or signs of distress, which are non-verbal and instinctive and can also be found among non-human animals"; (ii) "natural reactions of children and caregivers within the process of moral teaching and learning (for example, a parent's expression of approval and affection in response to good behaviour, the cries of another child which has been hurt, the child's reaction to those reactions, and so on)"[3]; (iii) "the immediate responses of morally competent agents", that is, responses that do not involve conscious thought or explicit decision-making (Hermann 2015, 112). We could say that (i) and (ii) belong to our first, that is, biological nature, while (iii) belongs to our second, that is, socialised/encultured nature. Moral certainty is "partly instinctive and partly the result of enculturation" (ibid., 111). An example of (i) is provided by Wittgenstein: "In its most primitive form it [the behaviour towards someone with toothache; J.H.] is a reaction to somebody's cries and gestures, a reaction of sympathy or something of the form. We comfort him, try to help him" (CE, 381).

Elsewhere I have argued for the heterogeneity of Wittgenstein's examples of certainty (Hermann 2015, 53f.). Likewise, I take moral certainty to take different forms. While some moral certainties, such as the wrongness of killing as such, are universal, others are certainties of particular groups or those participating in particular practices, such as care practices. The certainty of caregivers over particular moral responsibilities that they take themselves to have constitutes an example of this. Rather than thinking of some certainties as being basic while others are not, I prefer to distinguish between different kinds of certainty. The reason for this is that I take certainty to be basic per definition. The moral thinking, feeling, and acting of a caregiver turns around certainties related to his moral obligations in his role of caregiver and related to what constitutes good care, just as the moral thinking, feeling, and acting of any morally competent agent turns around the wrongness of killing as such, and similar certainties.

Moral competence, understood as a complex capacity involving emotional as well as reasoning skills, habits, and dispositions, manifests

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2   "Giving grounds, however, justifying the evidence, comes to an end; - but the end is not certain propositions' striking us immediately as true, i.e. it is not a kind of *seeing* on our part; it is our *acting*, which lies at the bottom of the language-game" (OC, §204). I speak about moral language games in the plural to avoid the idea that there is only one moral language game.

3   It is a "fact of human life" that children can be a nuisance, a fact to which parents naturally react by expressing displeasure. When their children behave well, parents naturally express pleasure (Hanfling 2003, 30; see Hermann 2015, 153).

itself in different contexts or domains. At the most general level, moral competence is the mastery of moral practices, ranging from treating others with respect to justifying an action by reference to moral reasons. Morally competent agents have mastered numerous overlapping moral practices, such as the practice of promising and the practice of helping someone. Moral competence resembles certain practical skills in the way in which it is acquired: "We become morally competent through moral training, that is we learn how to act, feel and think morally through practice" (Hermann 2015, 195).

In concrete contexts, moral competence takes on a more specific form. For instance, in the context of education, it manifests itself in qualities such as patience, empathy, and consistency. A morally competent teacher attends to the individual needs of her pupils, treats her pupils justly, is patient when a pupil needs more time to understand what she is trying to teach him, does not favour one pupil over another based on personal preferences, and so forth. Although not everyone would agree with this description, I expect it to be widely shared by members of contemporary Western societies.

2.3 Technosocial disruption and moral certainty: Two examples

Socially disruptive technologies

The term "socially disruptive technologies" refers to 21st-century technologies that deeply affect human life, including human being's relationship to the rest of nature, core institutions of human societies, and the human condition itself.[4] In a complex interplay with other forces, socially disruptive technologies challenge the status quo, making it impossible to go on as before. Examples of socially disruptive technologies are artificial intelligence, robotics, synthetic biology, and solar geo-engineering. The disruption brought about by socially disruptive technologies "manifests itself in the overturning of stably entrenched norms, practices, as well as concepts" (Hopster 2021, 4). It is important to note that a technology does not in and of itself bring about these effects. Jeroen Hopster coins the term "technosocial disruption" to denote the disruption by technology of "social relations, institutions, epistemic paradigms, foundational concepts, values, and the very nature of human cognition and experience" (ibid., 1). Socially disruptive technologies are those technologies that play a major role in processes of technosocial disruption (ibid.). Hopster (2021, 6f.) identifies seven criteria for "technosocial disruptiveness": (1) depth of impact, (2) range of impact, (3) valence of impact,

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4   See https://www.esdit.nl/

(4) ethical salience of impact, (5) extent of uncertainty, (6) pace of change, and (7) reversibility of impact. For the purposes of this chapter, the first and the fifth criterion are the most relevant.

The first criterion – depth of impacts – concerns the impact on "deeply held beliefs, values, social norms, and basic human capacities" (ibid., 6). Socially disruptive technologies "affect basic human practices, fundamental concepts, ontological distinctions, and go to the heart of our human self-understanding" (ibid.). They provoke different kinds of uncertainty (fifth criterion): predictive uncertainty, "conceptual ambiguity and contestation, moral confusion, and moral disagreement" (ibid., 7). Below I shall consider these criteria in relation to care robots and ectogestative technology.

Moral certainty disrupted

Moral certainty constitutes "the very possibility of acting morally or talking about moral issues" (Kober 1997, 374; see OC, §415). It belongs to the foundation of our moral language-games (see OC, §403). This foundation is not static. Wittgenstein's view of certainty allows for the possibility that something that is certain loses this status and becomes subject to doubt and justification. The famous metaphor of the riverbed (OC, §§96–99) illustrates the dynamic character of certainty. Yet it also suggests that Wittgenstein envisaged the process in which something loses or acquires the status of a certainty as slow and sometimes hardly noticeable. He metaphorically speaks about the riverbank, which "consists partly of hard rock, subject to no alteration or only an imperceptible one, partly of sand, which now in one place now in another gets washed away, or deposited" (OC, §99). In light of the pace that technological development has reached, it seems plausible to assume that this process can (and likely will) occur faster, and that it can even take the form of disruption. The implementation of new technologies seems to be able to shake the ground of the language-game, to cause the foundation to totter. It could affect our fundamental ways of being and acting in the world, including our fundamental ways of being and acting *morally* in the world. Winner recognised this possibility when he metaphorically described the development and implementation of new technologies as the creation of new worlds (1989, 11).

While elsewhere I consider the possible disruption of certainty regarding the empirical world (Hermann, in preparation), this chapter focuses on moral certainty. In the following, I look at two examples of emerging technologies that have the potential to disrupt moral certainty. I describe how, prior to the introduction of the respective technology, moral competence is manifested in those contexts. I then discuss how the technology (likely) affects the respective practices, which are core human practices, and how it (likely) contributes to the disruption of moral certainty in these contexts.

The use of care robots in elderly care

Joan Tronto's (1993, 105-37) four phases of a care practice – *caring about*, *taking care of*, *care-giving*, and *care-receiving* – and their corresponding moral elements – *attention*, *responsibility*, *competence*, and *responsiveness* – express central dimensions of moral competence as it is expressed in the context of providing care for the elderly. In this context, moral competence involves being attentive to the needs of the elderly person one is caring for, taking responsibility for responding to those needs, and carrying out actions competently to meet these needs. On the part of the elderly, it involves guiding the caregivers on how to respond to the needs and thus playing an active role in the relationship. There must be a reciprocal interaction between caregivers and care-receivers, as otherwise it could not be determined whether the needs have been met (van Wynsberghe 2013, 419). For the morally competent caregiver, some things "stand fast". He takes it for granted that the elderly persons he is caring for are worthy of respect and that he must attend to their needs. His interaction with the elderly shows that it is certain for him that they have fundamental needs that must be met.

The introduction of care robots does not only provide human caregivers with technological assistance. It also affects the relationship between them and the care-receivers, the distribution of moral responsibilities, and the self-understanding of caregivers. It thus affects what competent moral agency in the context of care means and what it requires from the caregivers. Care robots are "robots designed for use in home, hospital, or other settings to assist in, support, or provide care for the sick, disabled, young, elderly or otherwise vulnerable persons" (Vallor 2011, 252). In elderly care, they are expected to be used primarily: "(1) to assist the elderly, and/or their carers in daily tasks; (2) to help monitor their behaviour and health; and (3) to provide companionship" (Sharkey and Sharkey 2012, 27). Today, there are robots for lifting patients, mobile remote control telepresence robots that facilitate communication with family members, and multifunctional robots like "Zora". Zora is a small humanoid social robot that can give instructions for daily routines, such as brushing teeth, fostering patients' mobility, for example, by dancing with them, or picking up trash in care facilities (see Niemelä and Melkas 2019).

These robots do not enter care practices that are devoid of technologies. On the contrary, the context of care is one that is already pervaded by technology, including, for instance, mechanical beds or heart monitoring devices (van Wynsberghe 2013, 422). Yet, arguably, care robots can be expected to alter these practices and the relationships in them more fundamentally. They affect the distribution of moral responsibilities among the different actors involved, the self-understanding of human caregivers, and the concept of good care (see Bauer and Hermann,

under review). The care-robot will, upon entering a socio-technical network, "alter the distribution of responsibilities and roles within the network as well as the manner in which the practice takes place" (van Wynsberghe 2013, 412). In the process of redistribution of responsibilities, some responsibilities might be delegated to an artefact (ibid., 418). As Aimee van Wynsberghe argues, the decision-making of nurses and patients becomes "a hybrid affair between the nurse/patient and existing technologies" (ibid.). In the case of a human-operated robot for lifting, for instance, responsibility and competence become "shared endeavours between the human and the robot", and "responsibility for the safety of the practice becomes a hybrid event between the human care-giver and the robot" (ibid., 428). Here van Wynsberghe is inspired by Peter-Paul Verbeek, who argues that moral agency is distributed among humans and machines and is thus a "hybrid affair" (Verbeek 2014, 77).

At this point a short excursion into the idea of technological mediation is in order. According to so-called postphenomenologists, technology mediates human perception and action (Ihde, 1990; Verbeek, 2005).[5] In everyday practice, the mediating effects of technology are often invisible or unnoticed by us. We do not see the technology that in fact mediates how we perceive the world or act in it. Take the simple example of a pair of glasses. My glasses mediate my visual perception. They also mediate my actions, for example, the act of cycling to the grocery store or the act of taking a book out of a bookshelf. The theory of technological mediation helps to uncover this unnoticed structure. Verbeek expands Ihde's postphenomenological theory and argues that both subjects and objects are constituted in interactions between humans and technology. He asks us to abandon the idea of an independently constituted subject that interacts with independently constituted objects (the world around it), thus rejecting the modernist separation of subject and object. As Verbeek (2008, 13) formulates it: "What the world 'is' and what subjects 'are,' arises from the interplay between humans and reality; the world humans experience is 'interpreted reality,' and human existence is 'situated subjectivity'".

As Verbeek has argued, technology also mediates moral agency, which has become a "hybrid affair" involving both humans and technologies. It is this idea that van Wynsberghe takes up when she describes the structure of moral responsibility after the introduction of a care robot. Verbeek discusses the example of obstetric ultrasound, which does not provide a neutral "window to the womb" but helps to constitute child and parents

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5 Postphenomenologists analyse human-world-relations and "the constitution of subjectivity and objectivity within these relations" (Verbeek 2008, 13). They investigate "the actual roles of technologies in human experience and existence" (ibid., 11).

in relation to each other (2008, 15). That technology contributes to the constitution of the foetus as both a person and a patient (ibid., 15f.). The foetus is constituted as a person by being presented visually in a way that makes it appear bigger than it is, and by presenting it independently from its mother's body. An 11-week-old foetus, which is about 8.5 cm long and weighs around 30 g, appears to have the size of a new-born (ibid., 15). It is constituted as a patient by being presented in terms of medical variables. The technology has created a "new moral landscape" (Verbeek 2014, 82) by constituting future parents "as decision-makers regarding the life of their unborn child" (Verbeek 2008, 17). They must decide whether to undergo certain screenings and whether to continue or end the pregnancy based on the results of those screenings. What used to be a matter of fate becomes a matter of decision. The isolation of the foetus creates a new relation between mother and unborn, where the mother is increasingly seen as the (hostile) "environment in which the unborn is living, rather than forming a unity with it" (ibid.).

The potential impact of care robots is such that it seems justified to classify them as a *socially disruptive technology*. I assume that care robots potentially have far-reaching impact, affecting values such as touch and trust, basic human capacities such as the capacity to care for someone, social norms guiding the interaction between the elderly and their caregivers, and deeply held beliefs about the differences between humans and machines, the importance of care provided by humans, and the needs of the elderly. Robots that enter care practices, taking over all sorts of tasks ranging from lifting people or feeding them to providing companionship, could affect these practices at a fundamental level by challenging the meaning of "good care", and the distinction between humans and machines. The potential impacts of care robots go to the heart of our human self-understanding by challenging what we see as exclusively human capacities (for example, the capacity to take and provide care) and how we conceive of our relationship to machines.

It is currently widely assumed that good and authentic care can only be provided by humans. Machines are associated with coldness and a scenario in which care for the elderly is provided largely by robots typically takes the form of a doom scenario (see Coeckelbergh 2016, 455, who mentions, for example, a scenario by Sparrow and Sparrow [2006]). Machines cannot substitute the experience of the human touch, which can be regarded as an expression of mutual recognition within a dignified relationship (van Wynsberghe 2016, 416).[6] The practice of

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6   This is not to deny the experience of coldness in human-human care interactions, which can surely in part be explained by the dire conditions, including very low salaries, under which caregivers work. I thank Nigel Pleasants for reminding me of the "cold human being".

lifting, for instance, is regarded as being conducive to a trusting relationship between caregivers and care-receivers. It helps to establish a bond between them, in the absence of which patients might not abide by their treatment plan, for example, not take their medicine, etc. (van Wynsberghe 2013, 417, 427). If the task of lifting patients is delegated to a robot, other ways of establishing a trusting relationship between human caregivers and care-receivers need to be found (see ibid., 428).

By affecting the exercise of moral competence in practices of care for the elderly and the self-understanding of human caregivers as morally competent agents, care robots potentially disrupt moral certainty of what constitutes good care and what good care requires from human caregiver. As Swierstra describes the phenomenon of "technology-induced moral change" (van den Hoven, Lokhorst, and van de Poel 2012, 153), "technology destabilizes moral routines, which then provokes ethical reflection and discussion, which then do or do not result in new ethical answers that re-stabilize into new moral routines" (Swierstra 2013, 203).[7] Technology-induced moral change is part of the phenomenon of "technomoral change", that is, the co-evolution or co-shaping of technology and morality (ibid., 205). The implementation of care robots disrupts the habitual ways of thinking, feeling, and acting morally in the context of elderly care that express moral certainty over what one's moral obligations are and what constitutes good care.

The changes in how roles and responsibilities are distributed can be expected to bring about confusion and uncertainty.[8] For some time, human caregivers will probably not know what their roles and responsibilities are. The elderly, in turn, will be uncertain about what to expect from robots and nurses. Human-robot interaction will be troubled by miscommunications, false expectations, a lack of orientation, and so forth, especially if adequate training and knowledge are not sufficiently provided (Niemelä and Melkas 2019, 191). We can imagine a situation in which human caregivers are morally confused and disoriented, not knowing what their responsibilities are and what their role in the care practice is. They would be doubting what it means to be a good caregiver, what good care is, how moral responsibilities are distributed among themselves and the robots, what they owe to the elderly and what the moral status of the robots is.

As the decision-making of nurses and the elderly becomes a "hybrid affair", the moral self-understanding of caregivers also changes. The robots do not only mediate the caregivers' perceptions and actions but also how caregivers see themselves as moral agents in their role

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7   This chapter is a manifestation of such ethical reflection, suggesting that the de-stabilisation of moral routines is already happening.

8   This paragraph and the following are based on Bauer and Hermann (under review).

as caregivers. For instance, a nurse might come to understand himself as being primarily responsible for making sure that the interactions between the elderly and their care-robots are conducive to the well-being of the elderly, while in the past he understood himself as being wholly responsible for securing the elderly's well-being. This transition will likely be accompanied by uncertainty and feelings of distress. As his roles and responsibilities become unclear, the nurse might undergo an identity crisis. An example of a moral certainty that is challenged in this context is the certainty of good care being necessarily care provided by humans.

Ectogestative technology

The second example of a socially disruptive technology that I want to discuss is ectogestative technology (more commonly known as artificial womb technology), which can potentially disrupt norms, values, and practices related to the beginning of human life. The term "ectogenesis" refers to the "development of placental mammals – specifically humans – outside the maternal body, where this development would normally happen inside" (Kingma and Finn 2020, 356). Ectogestative technology is a technology that facilitates gestation *ex utero* by "replicating and replacing a biological process" (Romanis 2018, 753). Scientists are working on such an artificial womb, which would enable gestation outside of the body of the mother in an environment that closely resembles the natural womb. At the University of Eindhoven in the Netherlands, they are developing a first prototype, intended for use in neonatal intensive care units.[9] They expect to have their prototype ready by the end of this decade, meaning that soon, the first human embryo might be transferred to an artificial womb. While the scientists involved in that research emphasise that the technology is only intended as a replacement for the current incubator and will merely be used for pre-term babies, philosophers, designers, and artists already contemplate more far-reaching uses of the technology. Though full ectogenesis,[10] that is, the development of a placental mammal happening entirely outside the maternal womb, might never be possible, we should use our "technomoral imagination" (Swierstra 2013, 216) to

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9   https://www.tue.nl/en/our-university/departments/biomedical-engineering/the-department/news/news-overview/08-10-2019-multimillion-grant-brings-artificial-womb-one-step-closer/.

10 We can distinguish full ectogenesis from partial ectogenesis, where the latter refers to cases where part of the development happens outside the maternal womb, for example, if a human foetus were to be transferred into an artificial womb at 24 weeks of gestation.

reflect upon ways in which ectogenesis, partial or full, could disrupt fundamental norms, practices, and beliefs.

In the context of becoming and being a parent, moral competence involves acting in the best interest of the child, providing the care that a child needs at a particular stage of development, ensuring the child's safety, attending to its emotional needs, and so forth. A morally competent parent doesn't take his eyes off a child that is playing in the water and doesn't yet know how to swim. He makes sure his child eats enough healthy food, consoles the child when it is hurt, and takes it to the doctor when the situation requires it, assuming that it is possible for him to do so. For a morally competent parent, some things are certain. It is certain for her that she is morally responsible for her child's well-being and that neglecting a child is morally wrong. It stands fast for her that she has the duty to protect her child and ensure that its basic needs are met. In many societies, one parent, the mother, is taken to have a special relationship with the child, which gives rise to special rights and duties. An important theory that defined the institution of motherhood as we know it in Western societies today is the theory of attachment developed primarily by British psychiatrist John Bowlby in the 1950s. Although faced with various criticisms over time, many elements of Bowlby's attachment theory are still prominent in current Western understandings of what it means to be a good mother (Ross 2016, 20f.). The theory contributed significantly to the "now almost commonplace view that good mothering involves selfless, consistent, and continuous care and that adherence to these prescriptions will lead to children's healthy personality development" (ibid., 18).

Pregnant women and mothers are judged by reference to high standards. A good mother is expected to make large sacrifices of her own interests for the sake of her children. What exactly is expected from mothers differs among and within societies. A widespread expectation in countries like the UK, the Netherlands, and Germany, for example, is that mothers breastfeed for at least a certain number of months. Due to this societal expectation, women put themselves under a lot of pressure to breastfeed and feel guilty when they are for some reason unable to, experience it as too burdensome, or do not consider it to be best for the child. During pregnancy, women are expected to refrain from smoking and drinking alcohol, to avoid certain foods, such as raw fish and raw milk cheese, and not to engage in high-risk sports. If a visibly pregnant woman drinks alcohol in public, she can expect to be openly blamed and chastised for it. Exactly what pregnant women are supposed to do and to refrain from differs among societies, but the existence of behavioural rules related to pregnancy is probably universal.

In relation to the beginning of human life, several things are certain. It is certain that for each human being, independent life begins at birth, that the gestation of human foetuses requires a maternal womb, and

that every human person has once been in her mother's womb.[11] "I have once been in my mother's womb" is comparable to "I have never been far away from the earth" (see OC, §93). As Lynda Ross writes in the introduction to her book *Interrogating Motherhood*, "we were all born of mothers" (2016, 1). Practices and norms around pregnancy and parenting also reveal *moral* certainties, such as certainty over the mother being the most important person during the first years of a child's life or her having the moral duty to be the primary caretaker of her child. These certainties are not universal but manifest themselves in the practices, rules, and regulations of many human societies. In the Netherlands, for instance, women get 16 weeks of fully paid maternity leave, while men get two weeks of fully paid leave at most. If it were possible for human babies to develop entirely outside of the maternal body, in a technological device, this could disrupt established gender roles, parenting practices, the parent-child relationship, and fundamental concepts such as BIRTH or MOTHER.[12]

Inequalities between mothers and fathers can be traced back at least in part to facts about pregnancy and lactation. The special expectations related to mothers and their role as primary caregiver are related to the fact that usually a child develops in its mother's body for nine months before it is born. In the womb, the foetus can feel the movements and heartbeat of the mother and hear her voice. The mother's behaviour and moods affect the foetus. While women experience bodily changes during pregnancy, including hormonal changes, and can feel the movements of the baby from a certain stage onwards, for men, the fact that they are becoming fathers usually remains rather abstract. Not having this close physical connection to the foetus, they experience pregnancy differently than women. After the child is born, it is assumed that the mother is particularly capable of making the baby calm when it is upset, because it is used to her heartbeat.

Let us return to the first criterion for technosocial disruptiveness mentioned above, depth of impacts, which concerns the impact on "deeply held beliefs, values, social norms, and basic human capacities" (ibid., 6). As mentioned above, socially disruptive technologies "affect basic human practices, fundamental concepts, ontological distinctions, and go to the heart of our human self-understanding" (ibid.). The artificial womb, which should be seen in continuity with other reproductive

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11 It might be more accurate to say that the requirement of a maternal womb for the gestation of human foetuses is losing its status of certainty as the development of ectogestative technology is progressing.

12 I will address the fact that to a certain extent traditional gender roles have already been disrupted by, for instance, modern employment needs and ideas of equality at the end of this section.

technologies, such as the contraceptive pill, in-vitro fertilisation (IVF), and egg-freezing (see Jacobs, Frank, and Hermann, in preparation), has the potential to affect values such as family and motherhood, basic human capacities such as the capacity to create offspring and raise children, social norms regulating the practice of parenting, and deeply held beliefs about the special status of the mother, gender-specific roles, and the fundamental needs of a new-born. It is likely to affect fundamental concepts such as MOTHER, FATHER, PARENT, and BIRTH. The potential impacts of ectogestative technology go to the heart of our human self-understanding by challenging our understanding of the beginning of human life and how we conceive of our relationship to machines.

As mentioned above, socially disruptive technologies provoke different kinds of uncertainty (fifth criterion): predictive uncertainty, "conceptual ambiguity and contestation, moral confusion, and moral disagreement" (Hopster 2021, 7). Ectogestative technology is likely to contribute to the already existing uncertainty about what the respective roles of mothers and fathers should be, how care tasks should be divided, and about what it means to be a good mother, father, or parent. While ongoing changes of our understanding of gender roles and the family are caused by a multiplicity of factors mutually enforcing each other – such as assisted reproductive technologies (Hammons 2008), changes in the labour market, social movements such as the LGBTQ-movement, social media, and so forth – a technology that enabled the development of a human being entirely outside of its mother's body would have unprecedented disruptive effects. Whereas to this point, the aforementioned changes happened rather slowly, with certain elements of, for instance, our image of motherhood turning out to be highly resilient (see Hammons 2008, 278),[13] ectogestative technology has the potential to fundamentally de-stabilise that image.

2.4 Moral certainty in a technological age

Technology has come to pervade all aspects of human life. As a result, the great variety of practices humans engage in is the product of human-technology interaction in which subject and object are constituted. (Elderly) care practices are an example of this. They involve various technologies, including care robots. These technologies are not just neutral instruments used by humans to reach their independently settled goals, but value-laden devices. They are partly constitutive of those goals and contribute to the shaping of the meaning of good care and the norms of the practice. What follows from this for the concept of (moral) certainty?

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13 Hammons' study concerns conceptions of motherhood in the US.

Certainty is located at the fundamental level of human thinking and acting. Accordingly, *moral* certainty is located at the fundamental level of moral thinking and acting. It is what makes practices such as morally justifying, morally praising and blaming, asking for moral reasons, etc., possible. Moral certainties form a moral world-picture that enables humans to make moral sense of the world and act morally in the world. Even at a fundamental level, human thinking and acting can be technologically mediated. Therefore, manifestations of certainty can be thus mediated, and technology is among the possible constituents of certainty. Technology can figure in the process in which something acquires the status of a moral certainty or loses it. We know from the past that scientific and technological developments can lead to the replacement of an old world-picture with a new one, where the new one is not entirely different from the old one but enables new forms of thinking and acting. New technologies like new scientific discoveries change the epistemic landscape. As the two examples discussed above show, they also have the potential to reshape the *moral* landscape. Thereby some certainties disappear, and new ones emerge. Disruptive technological developments create new relationships and obligations, change practices fundamentally, and create new epistemic and moral landscapes.

Appreciating the technological mediatedness of manifestations of certainty provides us with new ways of conceptualising and understanding the processes in which something loses its status as a certainty or acquires that status. It also allows us to conceptualise forms of life as being partly constituted by technology and difficulties of understanding members of a different form of life as in part due to different ways in which the members of those forms of life are differently mediated by technology.

2.5 Conclusion

I hope to have convinced the reader that a Wittgenstein-inspired notion of moral certainty can be fruitfully related to the ideas of socially disruptive technologies and technosocial disruption. Socially disruptive technologies affect fundamental practices and deeply held beliefs, thus disrupting moral agency at its most fundamental level: the level of moral certainty. Especially two of the seven criteria for technosocial disruptiveness – depth of impacts and extent of uncertainty – can be understood as closely related to moral certainty. The introduction of care robots in practices of elderly care affects the exercise of moral competence in these practices and the moral self-understanding of human caregivers. It thereby potentially disrupts some manifestations of moral certainty, for instance, of certainty over one's moral responsibilities and the meaning of good care. The potential impacts of ectogestative technology go to the heart of our human self-understanding by challenging

our understanding of the beginning of human life and how we conceive of our relationship to machines. This technology challenges moral certainty, for instance, certainty over a mother having the moral duty to be the primary caretaker of her child. This certainty is reflected by the ways in which people react in situations where a mother does not fulfil the role of primary caretaker, either because she cannot or because she does not want to. Such situations are conceived of as threats to the healthy development of the baby or child, and remedies are urgently sought. Mothers who voluntarily refuse to function as the main caregiver are being seen as bad mothers and frowned upon.

The two examples not only demonstrate how human practices result from human-technology interaction but also how technosocial disruption involves the disruption of some manifestations of moral certainty. We can thus develop the notion of technosocial disruption further by relating the disruption of deeply held beliefs and fundamental practices, norms, and concepts to the disruption of manifestations of moral certainty. The notion of moral certainty, in turn, can be "updated" by incorporating the technological mediatedness of some of the ways of being and acting in the world as moral agents that manifest moral certainty.[14]

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