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9 Emotions, Risk, and Responsibility

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9.1 Introduction

Technologies such as biotechnology, energy technologies, and digital technologies are frequently highly controversial. While such technologies often contribute to people's well-being, they can also have negative side effects or risks, which can create social disruption. Think about, for example, the polarizing effects of social media or the risks of energy technologies for health and nature. These potentially negative consequences of technologies require approaches for decision-making on how to responsibly innovate risky technologies. Technology is not value-neutral; rather, design choices imply value choices. That is why approaches to risk ethics need to include ethical values in approaches to responsible decision-making about risk (Asveld and Roeser 2009; Hansson 1989, 2012, 2013; Roeser et al. 2012), and approaches to philosophy of technology have argued for a long time that we need value-sensitive design and responsible innovation (Friedman and Hendry 2019; van den Hoven, Vermaas, and van de Poel 2015). These approaches aim to ensure that value choices are made explicitly and that these value choices are based on sound ethical considerations.

This chapter will examine the contribution that emotions and values can make to responsible innovation of risky technologies.[1] The guiding idea is that emotions can play an important role in ethical decision-making about risky technologies (e.g., Roeser 2006, 2012a, 2018). The chapter will develop this idea further and expand it to approaches of responsible innovation. The focus will be on the following key stakeholders: universities, industry, policy makers, and the public. The central idea to be investigated in this chapter is that embedding emotions and values in the innovation of risky technologies can enhance the quality of deliberation and decision-making regarding technological risks, can help to overcome stalemates, and can lead to morally and socially more acceptable and responsible technological innovations.

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9.2 Risk, Emotions, and Values

Technological developments in, for example, energy production, robotics, biotechnology, and communication technology are taking place at a rapid pace and can have a profound impact on society, by changing our ways of life in often unpredictable ways and introducing new and unprecedented risks. For instance, it was arguably difficult to predict that social media would often negatively affect the well-being of users (Bailey et al. 2020). Public debates about such technological developments are frequently emotionally charged, resulting in stalemates between proponents and opponents (Jasanoff 2012; Siegrist and Gutscher 2010). These debates and stalemates can be explained by the fact that technological developments involve scientific information that is typically uncertain (Bammer and Smithson 2008; Slovic 2000) and because the evaluation of technology and risks involves deeply personal values and interests. Furthermore, because of their impacts on society and the environment, technological developments give rise to ethical considerations (Asveld and Roeser 2009) and emotional responses (Roeser 2010a; Slovic 2010).

The field of risk ethics has argued that decision-making about risk requires ethical reflection and public deliberation (e.g., Hansson 1989, 2012; Roeser 2007, 2018; Shrader-Frechette 1991). Mainstream approaches to risk focus on quantitative information, overlooking implicit and frequently problematic value choices (Roeser et al. 2012). Such quantitative methods also typically involve consequentialist approaches such as risk-cost benefit analysis (Sunstein 2018). However, these approaches usually overlook important issues such as distributive and procedural justice, fairness, and autonomy (Asveld and Roeser 2009).

Emotions can play an important role in highlighting such ethical issues and in deliberation about risk. However, emotions are typically considered problematic in decision-making, especially in the context of risk, as they are seen to be opposed to rationality (Dual Process Theory; e.g., Kahneman 2011, also see Sunstein 2005). Even in approaches to participatory risk assessment, emotions are not explicitly included (Roeser and Pesch 2016). While some scholars argue that emotions should be included for democratic reasons (Loewenstein et al. 2001), or because they work as an "affect heuristic" (Slovic 2010), they still think that emotions need to be corrected by rational and quantitative approaches (Slovic 2000).

In contrast to such approaches, one of us has developed an alternative approach to risk and emotions (e.g., Roeser 2006, 2018). While quantitative information is necessary in order to assess *scientific* aspects of risk, this is not sufficient to assess *ethical* aspects of risk, such as fairness, equity, and autonomy. Rather, assessing these aspects requires explicit ethical reflection, which should also involve emotions (Roeser 2006).

The plea for involving emotions in ethical reflection is grounded in a theory of risk emotions that draws on psychological and philosophical emotions research that emphasizes cognitive aspects of emotions (cf. Frijda 1986; Lazarus 1991), concerning moral emotions (Nussbaum 2001; Roberts 2003; Roeser 2011), and political emotions (cf. Kingston 2011; Nussbaum 2013; Staiger et al. 2010). Rather than seeing emotions as irrational states that disturb thinking, this approach takes people's emotions as a gateway to values (Roeser and Todd 2014). Seeing emotions primarily as irrational, biased gut reactions is a too limited view of emotions. Rather, moral emotions, in particular, can point out important moral values that should be addressed in decision-making about risky technologies (cf. e.g., Roeser 2006, 2012a, 2018). Hence, emotions are a form of practical rationality and a potential source of moral wisdom (Roeser 2006, 2009, 2010a, 2011). In that sense, emotions can be seen as "gateways to values": emotions can be an epistemological route for assessing and being sensitive to values. This is the case in more personal interactions, but also concerning political issues, as well as in the context of ethical decision-making about risk. Therefore, emotions should be explicitly included in deliberation about risky technologies, as they can draw attention to ethical considerations that get overlooked by quantitative approaches to risk. Emotions such as sympathy, empathy, compassion, enthusiasm, and indignation can highlight ethical aspects of risk such as autonomy, justice, and fairness (Roeser 2006, 2007, 2010a,b). For instance, experiencing an apprehensive emotion about a technology can highlight that the technology infringes on one's own or other people's well-being.

Of course, this does not mean that emotions are always correct; emotions can be based on misunderstandings and biases and reinforce these (Steinert and Roeser 2020; Sunstein 2010). Sometimes we are mistaken about facts, and the emotion subsides once we learn the correct information. Emotions need to be critically assessed in light of scientific information and rational, logical argumentation, as well as by emotional reflection and deliberation (Roeser 2018, Chapter 6). In other words, emotions can be an object as well as a tool of critical reflection (Roeser 2010c). This approach to risk emotions offers a fruitful alternative to current academic and practical approaches to decision-making about risk that either overlook emotions and concomitant moral values or see emotions as an obstacle to reflection. The emotional deliberation approach to technological risks sees emotions as a *starting point* for moral discussion and reflection about risk (Nihlén Fahlquist and Roeser 2015; Roeser 2012b; Roeser and Pesch 2016).

Emotions can be an important gateway to ethical considerations in value-conscious technology design (Desmet and Roeser 2015; Roeser

2012c; Roeser and Steinert 2019). However, there is no research yet on how emotions can be systematically embedded in the responsible innovation of risky technologies (for an exception, see Steinert and Roeser 2020). Further research is needed on how emotions can be systematically integrated in approaches to responsible innovation in order to address important moral values underlying emotions. In the following sections, we will set out an agenda for such research.

9.3 Emotions and Responsible Innovation of Risky Technologies

Explicitly addressing emotions and integrating them into the responsible innovation of risky technologies requires efforts by all major actors: universities and companies that develop new technologies, policy makers who develop procedures for decision-making on and policies for the regulation of innovations, and the public, concerning ways to participate in decision-making. In this section, we will provide a preliminary discussion of the potential benefits and challenges of including emotions in responsible innovation of risky technologies, and we will highlight avenues for further research. We will discuss the possible role of emotions for responsible innovation of risky technologies for four key stakeholders: universities, industry, policy makers, and the public, by reflecting on potential positive contributions as well as on potential challenges of including emotions.

9.3.1 Universities

Universities, especially universities with engineering and design schools, are key institutions when it comes to developing technologies. Not only do these institutions explicitly contribute to the creation of technology, by developing new technological innovations and providing advice and skill, but they also shape new generations of engineers and designers. This means that universities can play an important role in contributing to more responsible innovation of potentially risky technologies and the shaping of future engineers into responsible innovators.

However, assuming this role requires explicit attention to values and ethical considerations in engineering research and education programs, and an overall institutional commitment to ethics. This entails is a look at how emotions and underlying value considerations can be explicitly included in engineering research and education and, in a more overarching way, at the level of university policies. This also includes investigating and assessing best practices concerning ethics in engineering research, engineering ethics teaching, and university integrity policies, for

example, concerning human research ethics, and requirements for responsible innovation.

Several philosophy and ethics departments at engineering universities, especially in the Netherlands, are leaders in integrating ethics in engineering research and education, as well as integrity policies of universities of technology. However, while there is some practical experience with this, there is not yet a lot of academic research on these topics (for some exceptions cf. Koepsell et al. 2014; Van Grunsven et al. 2021). Furthermore, these approaches have not paid explicit, systematic attention to emotions as gateways to values (although see Sunderland 2014 for the treatment of the role of emotions in engineering ethics education).

Some of the challenging questions about emotions and engineering education and research are as follows: How can engineering scholars be motivated to pay attention to and include emotions and values in their research and education? How can engineering ethics education be improved by not only focusing on theoretical ethical argumentation but also on emotional considerations? How can integrity policies of universities of technology be attuned to emotional concerns in order to create ethical awareness and to bring ethical issues to the fore? These questions are especially challenging because rules, regulations, or policies are general and abstract, while attention to emotions requires context-sensitivity, and because emotions and values are often very personal. The difference between them is exactly one of the reasons why including emotions is important: because this would do justice to context-sensitive features and provide a more fine-grained understanding of the impact of technologies on people's well-being and concerns about impacts on nature.

Without policies there might be no firm commitment, especially because paying more attention to emotions and values requires breaking up the still-prevalent culture of engineering education that focuses on quantitative methods of assessment, such as cost-benefit analysis. Furthermore, policies can be necessary to change the status quo and provide guidance in cases of conflict. However, it can be hard to bridge the gap between general rules on the one hand and context-sensitive and emotional considerations on the other. This requires further research.

9.3.2 Industry

Another important key player in the development of new technologies is industry, especially high-tech companies. The paradigm approach in much of business and economics is the neoclassical approach, according to which rationality is understood as the making of self-interested choices that maximize utility. However, this view is challenged by philosophers and alternative heterodox economic theories, e.g., feminist approaches or

the Austrian and Keynesian school (Chang 2014). For instance, Powell (2010) has argued that the self-interested paradigm in neoclassical economics is neither empirically nor normatively defensible.

Zooming in on companies that develop new technologies: these companies develop artifacts that impact people's life, well-being, and the choices they make. Because of this impact, tech companies would do well to take ethics more seriously. Indeed, some companies even collaborate with professional ethicists. For instance, ethics researchers in the Netherlands have worked together with private companies in collaborative research projects funded by the Dutch Research Council (NWO, for example, in a large scale funding program devoted to socially responsible innovation), and EU projects sometimes bring together ethics researchers and industrial partners as well. These projects have resulted in academic publications, as well as in more responsible and value-sensitive innovations. Furthermore, to assess the impact of their products, some major high-tech companies have installed ethics boards. However, despite such laudable initiatives, there are still important ethical challenges concerning large-scale, systematic embedding of ethics in industry. One is the problem of "ethics-washing" (Bietti 2021), where ethics is mainly for show, and the company does not actually do anything to address ethical issues. Another issue in the collaboration between industry and ethicists is that ethicists who collaborate with industry are seen with suspicion. By becoming part of the system, these ethicists allegedly do not have the distance to the organization to critically assess it anymore (see recent media coverage of the Google ethics board, which was shut down one week after formation, Lichfield and Johnson 2019). This suspicion toward ethicists could undermine the public trust in their professionalism and threaten their credibility.

Another issue is that paying attention to ethics seems to be largely a voluntary initiative. It could be argued that it is a good thing that ethics is voluntary because it then draws on the intrinsic motivation of companies. However, if the intrinsic motivation is lacking, ethical issues will not be systematically addressed. While more and more engineering universities have institutional review boards assessing research projects in terms of human research ethics (cf. Koepsell et al. 2014), this kind of assessment is not widely used in high-tech companies, even though they engage in R&D and work on projects that can have a major impact on people's well-being. Here, policymakers and regulators could step in and make ethics reviews mandatory for certain companies (more on policy makers in the next section).

Future research is needed to investigate how ethics can be systematically embedded in companies. This involves studying how ethics committees and ethics advisors could be installed or involved in the high-tech

industry, without falling prey to (possibly justified) suspicion of bias. That is, how can ethics be embedded as a genuinely impactful voice rather than being overruled or absorbed by powerful forces in industry?

Furthermore, while attention to ethics already requires a big step for tech companies, paying attention to emotions will require an even more radical change of mindset, as tech companies usually pursue formal, quantitative, and supposedly rational approaches to problem-solving. This focus on quantification and rationality comes at the expense of attention to values and ethical concerns. More work is required to figure out how to integrate emotional-moral reflection in such companies as a key ingredient to decision-making. This requires novel approaches to decision-making and leadership in high-tech industries.

Not all management practices ignore values, however. Emotional-moral reflection could enhance management approaches that focus on values, such as shared value creation, which is a principle for corporate social responsibility. Proponents of the principle of shared value creation suggest that we should find ways of creating economic value that, at the same time, creates social value (Porter and Kramer 2019). Focusing on shared value creation requires that managers think of corporations as embedded in society and communities, and that they create strategies that enhance social conditions, answer societal challenges, and create value for all stakeholders. Focusing on shared value creation means moving beyond short-term economic and corporate gains and instead focusing on how to link societal and economic progress. Integrating emotions into strategies like shared value creation would bolster the success of these value-focused approaches and lead to the creation of economic value without sacrificing social and moral values.

One idea for a new way of decision-making that takes emotions and values more seriously is to give emotions more room at the workplace and in day-to-day practices. During the design and development phase of technology, designers and engineers (but also other employees involved in the process) experience emotions that can point toward neglected values. For instance, an engineer may feel uncomfortable making certain design choices to cut costs because the resulting design could be less safe for users. Giving designers and other employees an opportunity to voice their emotions and related concerns can contribute to more ethical design (cf. Roeser 2012c). This participatory process of "innovating with emotions," which takes advantage of employees' emotions that point toward values, will require some restructuring of the design process. Making these changes, however, will not only contribute to more ethical design but will also foster an open climate where employees are welcome to talk about emotions and to raise concerns, which could contribute to a more self-critical and supportive company climate.

9.3.3 Policy Makers

Policy makers play a vital role in responsible innovation of risky technologies because they develop policies to regulate these technologies and because they develop procedures for decision-making on the innovation and implementation of technologies. Addressing emotions and values in policy making in an appropriate way is challenging. Policy makers typically follow approaches that see emotions as a source of irrationality (also cf. Kahneman 2011). They either follow technocratic approaches that are based on purely quantitative information and models, thereby leaving out emotions and explicit attention to values, or they follow populist approaches that only pay attention to citizens' concerns for instrumental or populist reasons, but not as a source of substantive insight. The problem is that in those cases, there is no genuine, critical deliberation about emotions and underlying values (Roeser 2018). Alternatively, policy makers sometimes involve the public through approaches to participatory risk assessment that may also include deliberation on values. However, those approaches usually do not pay explicit attention to emotions and may thereby miss important values (Roeser and Pesch 2016). As mentioned above, in previous work, one of us has developed an emotional deliberation approach to risk to overcome this lack of attention to emotions. The emotional deliberation approach takes emotions as the starting point of moral deliberation (Roeser 2018; Roeser and Pesch 2016).

More work is needed to investigate how an approach like emotional deliberation can best be implemented in policy making. For example, some governments try to involve members of the public via citizen panels. It could be investigated how the emotional deliberation approach can be used and further developed in order to pay explicit attention to emotions as gateways to values.

Furthermore, policy makers typically use quantitative approaches to assess risks, such as CBA or QUALYs (quality-adjusted life years). However, such approaches leave out emotions and explicit consideration of values. Even though quantitative approaches to risk are intrinsically value-laden, this is typically not acknowledged and explicated, and important ethical considerations are left out of such models—for example, issues of justice and autonomy (cf. Roeser et al. 2012). One interesting avenue of exploration is how these formal (quantitative) approaches can be made more interactive, paying attention to values of different stakeholders and including ethical considerations such as capabilities, needs, justice, and fairness, not only regarding present but also future generations. For example, in the context of decision-making about the energy transition, an option could be an interactive dashboard to let members of the public deliberate about an optimal energy mix, trying out different options and seeing their

implications for different people, appealing to imagination and compassion. This can also provide motivation for climate justice by making impacts of climate change more visible to people.

9.3.4 The Public

In the current literature on risk and emotion, the public is typically portrayed as emotional and is, for that reason, seen as irrational in its responses to risky technologies (e.g., Loewenstein et al. 2001; Sunstein 2005). However, as argued above, emotional responses to risky technologies should not be dismissed out of hand as irrational. Rather, emotions can be important gateways to values and should therefore play an important role in democratic decision-making about risky technologies. Including emotions is not only important for democratic and instrumental reasons, but there are also substantive reasons to include emotions in decision-making about risky technologies, as they can play an important epistemic role by shedding light on values that may otherwise be overlooked (Roeser 2006, 2018). It needs to be investigated how the inclusion of emotions in public decision-making can be fostered. Our conventional democratic tools, such as incidental voting and binary referenda, do not do justice to ethical complexities. This is why deliberative approaches to democracy emphasize the importance of deliberation and genuine exchange of viewpoints. The emotional deliberation approach to risk emphasizes the importance of emotions for this. As mentioned before, this can be combined with approaches such as citizen panels and other participatory approaches (Roeser and Pesch 2016).

A challenge is that in the age of social media, emotional responses to technologies are themselves mediated by technologies. Social media can be democratizing by providing cheap and easy access to information and communication for everyone. However, social media also has features that make it easy to manipulate emotions. For example, "trolls" can abuse platforms and the emotional reactions of other users. Furthermore, social media platforms are often designed in such a way that they stimulate certain kinds of interactions above others and reward engagement with emotional content (Steinert and Dennis 2022). In addition, the AI in the background is designed to push emotional content. These designs tend to entice poorly reflected emotions with negative ethical implications above more reflective emotions such as compassion (Marin and Roeser 2020). Last but not least, there are regular users whose goal is to mobilize crowds rather than stimulate a respectful dialogue. Hence, while online deliberation could be a way to include citizens and their emotions and values, social media may lead to skewed emotions and values. One could argue that emotional deliberation may only work offline because of its embodied

nature and because social media can be too manipulative. Genuine democratic deliberation may require real encounters. However, it seems that there is nothing intrinsic to social media that would exclude it from serving as a tool for genuine deliberation. Social media could be redesigned in such a way that it fosters (emotional) deliberation. For example, social media could allow for feedback mechanisms while typing messages with possibly hurtful content (Marin and Roeser 2020). This could give users pause to think about whether they want to post something or engage in a certain discussion. Social media could be transformed into platforms for emotional-moral deliberation.

9.4 Addressing Diverging Values and Emotions in the Responsible Innovation of Risky Technologies

In the previous sections, we discussed how values and emotions could and should play an important role in responsible innovation of risky technologies in the context of different types of stakeholders—universities, industry, policy makers, and the public. However, different stakeholders (within or between generic types identified above) can hold different values and may, accordingly, have diverging emotional responses to innovations. People's values and emotions can conflict, which means that trade-offs and decisions need to be made. This also requires moral reflection on which value decisions and value trade-offs are morally justifiable. In what follows, we discuss existing approaches to how to deal with value conflicts. We will argue how such approaches can benefit from taking emotions more seriously and "emotional deliberation" in particular.

9.4.1 Value Conflicts

The design, development, and use of technology can affect a variety of different values, and people may respond to this in different ways. A value conflict within a person, an intrapersonal value conflict, occurs, for instance, when an innovation has a positive impact for one value type a person holds and a negative impact on another value type a person holds. Take electric cars as an example where an innovation can affect various values. If you strongly care about the environment, then electric cars, with their low greenhouse gas emissions, are an innovation that you will evaluate positively. In contrast, when you strongly care about your own personal resources, then the steep price of electric vehicles may bother you. In addition, the problematic social, political, and labor conditions in regions where companies harvest the rare minerals needed for electric vehicles may not sit well with you when you strongly care about the well-being of others.

An innovation can also have positive and negative implications for one and the same value type. For instance, new products for a vegetarian diet may reduce meat consumption and thus have a positive effect on the climate. At the same time, the harvest and production of the ingredients of said products may not be sustainable and negatively impact the local environment. In a situation like this, there are both negative and positive implications for values related to the environment.

Furthermore, there can be interpersonal value conflicts. Complex technologies usually affect multiple stakeholders with a variety of considerations and values. For example, an innovation can have positive impact on a value that one person endorses but negative impact on the value of another person. An interpersonal value conflict often takes the form of a value conflict between groups or communities. For instance, engineers and managers of a wind park may endorse different values than people who will live near the turbines.

Addressing and managing public value conflicts can lead to more responsible innovations and make them more legitimate because it takes stakeholder values seriously. In what follows, we will first discuss existing methods to address value conflicts. We will then explore how attention to emotions can improve these methods. We focus on value conflicts between persons, but we think our suggestions are also partly applicable to intrapersonal value conflict. In particular, our focus is on value conflicts between stakeholders of an innovation.

9.4.2 Existing Methods to Address Value Conflicts

Authors have proposed several approaches to deal with value conflicts. It is important to note that these approaches do not discuss the role of emotions. We will briefly present some existing approaches and argue that they can be improved by considering emotions.

One way to deal with a value conflict is simply to ignore it (Meijer and De Jong 2020). However, that can be morally and pragmatically problematic. People's emotions and values are then simply disregarded, thereby foregoing important ethical considerations as well as explanations for the lack of acceptance. A more constructive and morally defensible way to solve a value conflict is to change the design of the innovation and implementation strategies to include important values of stakeholders. This may also include finding novel ways of designing and implementing an innovation.

However, oftentimes it is not possible to include all values in the design and implementation of a technology. In such a case, one has to compare, rank, and trade off values and decide which values to include. Alas, making such a trade-off is not a straightforward endeavor and involves

decisions about which values supersede others and which stakeholder opinions should have weight in the decision process[2]. One major problem here is how values can be compared and ranked. There are several systematic approaches for dealing with value conflicts in the design of technologies. These approaches include the well-known, but limited (see above), cost benefit analysis and so-called satisficing. In satisficing, one trades off the loss of a value with the gain in another value, but trade-offs cannot be done below a certain threshold for each value. Another way to make a value trade-off and to solve a value conflict is to re-conceptualize the values that are at stake and what design requirements are entailed to satisfy the value (van de Poel 2014). One could also deal with value conflicts with the so-called best-worst method, which assigns weights to values, thereby ranking their relative importance (van de Kaa et al. 2020).

All these approaches to addressing value conflict can benefit from paying attention to emotions, as we will discuss in the following subsection.

9.4.3 Value Conflicts and Emotions

We suggest that taking emotions into account can provide crucial access to people's values. It is our contention that emotions can play a helpful role in alleviating and potentially resolving value conflicts, in the following ways:

1. Emotions can provide crucial information as to the relative importance that people assign to values, and this information can help to make a ranking and comparison of conflicting values.
2. Taking emotions as reflections of personal values can help to focus on easily overlooked values that are implicated by the design or implementation of an innovation. By paying attention to the emotions of stakeholders, including emotions that may seem unusual, we can gain insights into underlying values that would have been overlooked otherwise. This could help to prevent interpersonal value conflicts because the underlying values can be incorporated in the design and implementation.
3. Because emotions are linked to values, an emotion conflict may be symptomatic of a deeper conflict between values. That is, when people endorse different values, they will probably have diverging emotions about an innovation. Furthermore, paying attention to emotions in the innovation process can enable people to appreciate the emotions of others and could thus help to gain insights into their values. Emotions can play a role in various ways: not only as indicators of people's personal values, but also as a "tool" to better understand the emotional responses of others. Drawing on people's compassion and sympathy can lead to a better understanding of their perspective. This can help to

prevent disagreements related to value conflicts from hitting a dead end because people talk past one another.

4. Paying close attention to emotions could also help to address and resolve value conflicts. This can be achieved by, for example, giving people the opportunity to reflect on their emotions and to assess whether their emotions genuinely reflect their values or whether the emotions are caused by some other consideration. For instance, it could be the case that the bad feeling about an innovation is caused by the management style of the company and not so much by the features of the technology.

Besides the characteristics of a technology as such (e.g., CO_2 emissions or design features like color), the way decisions are made and the way technologies are implemented (e.g., perceived procedural fairness, distribution of costs and benefits) can have implications for people's values, driving emotions, and acceptability judgments (Contzen et al. 2021). In this way, negative emotions may be caused by the proposed implementation of a technology, and these negative emotions may then spill over to what the person thinks about characteristics of the technology itself. A proper process of emotional deliberation can let people reassess their emotional responses as well as their values and let them gain understanding of different perspectives. By reflecting on and reconsidering their emotions, people may also reconsider or reinterpret the value implications of a technology and adjust their values.

Overall, incorporating emotions and paying attention to their underlying values in the design process will contribute to a socially and morally acceptable innovation because value conflicts may be prevented and resolved. Furthermore, people want to be heard and seen, and they want their values recognized. When people are given the opportunity to express their emotions and the values that underlie their emotions are taken seriously, social acceptance of technology can be facilitated.

To be clear here, uncovering the personal values and emotions that are implicated in innovations and their implementation is not sufficient. Simply put, not all considerations of values and emotions are morally justifiable; people's emotions and values can also be morally problematic. One reason is that sometimes people uphold stereotypical perceptions of others or stick to prejudices concerning technologies or the (public or private) organization that implements the innovation. This can lead people to close themselves off from new factual information or different perspectives on values. For example, grounded in some anti-government sentiment, someone may have a biased view about the administrative body tasked with implementing a technology. This could translate into an aversion regarding the technology itself. Cases like this, however, are no reason to dismiss emotions. On the contrary, by open-mindedly engaging with emotions and

underlying values and incorporating them into deliberation about innovation, the influence of biased views can be revealed and may then ultimately be reduced by inviting people to also open themselves to other perspectives. This can help to avoid potential and resolve already existing value conflicts.

9.5 Conclusion

In this chapter, we have provided an overview of why and how to include emotions in the responsible innovation of risky technologies. However, it is acknowledged that emotions can be biased and problematic. Specifically, risks and challenges related to emotions can arise in the context of forecasting one's own emotions, mixed emotions, emotional recalcitrance, and collective emotions (Steinert and Roeser 2020). In other words, emotions can be appropriate but also inappropriate, and it is important to develop insights in order to evaluate and distinguish these in the context of responsible innovation of risky technologies. This requires research to identify potential pitfalls of including emotional considerations and values of important stakeholders in the responsible innovation of risky technologies. Major ethical challenges include how to take citizen's concerns into account; how to handle the powerful interests of industry and government versus those of citizens; how to embed emotions and values in democratic decision-making about the responsible innovation of risky technologies in times of social media; how to respect and maintain individual rights and genuine moral perspectives in a context of big data, sentiment analysis, and manipulation of opinions via troll farms; how to do justice to the concerns of different stakeholders concerning well-being versus sustainability in a context of climate change; how to evaluate possible diverging emotions and values of different actors and stakeholders; and how to address possibly biased emotions. These and other related challenges require further research.

Explicitly including emotions can contribute to ethical deliberation about and responsible innovation of risky technologies by highlighting important values. As discussed in this chapter, this requires further research, developing approaches for including emotions, as well as addressing potential challenges. This future research requires an iterative process between profound theoretical analysis and real-life applications and impacts. It is a promising new avenue for bringing research on risk and responsibility further.

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Notes

1 Although there is no agreed-upon definition, by responsible innovation we mean approaches in research and innovation that aim to avoid negative societal impact and tackle crucial societal problems. Approaches of responsible innovation systematically consider moral and social values by paying attention to, and interacting with, stakeholders that are affected by the development and embedding of technology. For more on responsible innovation, see von Schomberg (2013) and Stilgoe, Owen, and Macnaghten (2013).
2 Because of the difficulties involved in the prioritization of values and how to make value-trade-offs, approaches seeking to address value conflicts should be supplemented with ethical theory and normative reflection (Manders-Huits 2011).

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