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REASON AND EMOTION IN ENGINEERING ETHICS EDUCATION

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Introduction

For decades, philosophers, sociologists, and psychologists have discussed morality, reason, and emotion, drawing on various concepts that have often been shared – albeit using different terms – across disciplines. These different fields and perspectives have affected engineering ethics and engineering ethics education. Today, many Western cultures conceptualize emotions as separated from reason and rationality (Ritzer, 2020; Roeser, 2012). This divide is particularly strong in engineering and the natural sciences (Roeser, 2020; Sinatra et al., 2014), and engineering is typically considered a highly rational and technocratic field (Roeser, 2020; Lönngren, Bellocchi et al., 2024). Consequently, students are often warned that their emotions will hinder their ability to make rational decisions (Sunderland et al., 2014). Similarly, engineering ethics education has historically emphasized the development of moral reasoning skills through opportunities to practice reasoning based on ethical principles. Conversely, emotions are typically overlooked (Hess & Fore, 2018; Kim, 2022; Morrison, 2020; Tormey, 2020). This has, however, begun to change with a growing focus on exploring the relationship between reason and emotion in engineering ethics education.

Our core argument in this chapter is that because engineering ethics education has historically been treated in primarily rationalist and individualistic terms, a fuller account of reason and emotion, therefore, needs to expand in two dimensions: (i) by seeing how reason and emotion are connected and (ii) by exploring how individual, interactional, and macro-social levels are connected. Since this work is still in its infancy in engineering, we aim in this chapter to provide a conceptual framework and some integrating concepts that will allow researchers and teachers to better conceptualize how reason and emotion are linked in engineering ethics education at a range of levels of social analysis. Our goal is not simply to summarize what has already been written about reason and emotion in this field but also to provide some directions on how to move forward.

This chapter is structured into four sections. After this introduction, the first section explores foundational frameworks for linking reason and emotion in moral judgments. Emotion is defined and the notion of *moral schema* is introduced, which we use as an integrating framework to connect reason and emotion while bridging the gap between micro-individual, meso-interactional, and macro-social levels of analysis. We then look at each level of analysis in turn. The following sec-

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tion, therefore, explores how reason and emotion interact on the micro-individual level by looking at how individual engineers learn to make moral judgments and how individualist approaches have traditionally reinforced rationalist ways of thinking that define emotions as irrelevant or detrimental to engineering ethics. The third section focuses on the *meso-interactional level* (what sociologists would call the micro-social level) and examines how social, cultural, and emotional factors impact engineering students' moral behavior as they interact with peers. Finally, the fourth section addresses the *macro-societal level* and examines societal and cultural factors influencing moral decision-making. At this level, social institutions, social systems, and cultures shape individuals' schemas related to thoughts, feelings, and moral actions.

The authors of this chapter are researchers in engineering education. One author completed an engineering degree before moving into engineering education research. The other authors are trained in psychological and sociological learning sciences, respectively. Geographically, one author comes from Western Asia and two from Western Europe. All three were primarily trained in Western intellectual traditions, where they have worked on questions of diversity, inequality, and emotions in engineering education. The authors' backgrounds are reflected in the ideas presented in this chapter, most notably in the combination of Western psychological, interactional, and sociological perspectives on engineering ethics education.

Foundational concepts for connecting reason and emotion across different levels of social analysis

Although there is no agreement on how to define emotions, Shuman and Scherer's (2014) 'Multi-Component Model' of the definition of emotion has gained broad acceptance. It specifies five primarily biological and psychological components: (1) a cognitive component involving the evaluation of a situation, (2) a neurophysiological component involving bodily changes such as heart rate and hormonal secretion, (3) a motivational component involving action tendencies like avoidance behavior, (4) a motor expression component including facial expressions, and (5) a subjective feeling component involving affective experiences, such as feeling nervous. Sociological viewpoints build on this and emphasize that social and cultural factors and organizations shape a significant portion of those components (Bericat, 2016). Similarly, emotional expressions are often described as influenced, validated, and understood in accordance with broader societal values and culturally constructed discourses (Harré et al., 2009). This alignment of psychological and sociological understandings indicates the potential for a more integrated and collectively shared interdisciplinary understanding of emotions. Yet, there is not yet an agreed interdisciplinary definition of emotion, and differences between perspectives need to be identified, alongside shared understandings.

A helpful framework for thinking about how conceptions of emotion are changing over time is provided by Barbalet (2001, pp. 45–54), who distinguishes three approaches to theorizing reason and emotion, which appear to be common across multiple disciplines. First is the traditional or *conventional* approach, drawing on a Cartesian and Kantian understanding, theorizing emotion as a bodily disturbance that undermines reason. This approach frames good moral judgment as driven primarily by reasoning (understood as logical thought in the absence of emotional disturbance) and as being opposed to decisions based on emotion or gut instinct. This approach was dominant in moral psychology (Kohlberg, 1969) and sociology (Weber, 1930/1992) in the twentieth century. It also often underpins 'folk' theories of emotion (i.e., those used by people in everyday life). Although this traditional/Kantian approach to understanding reason and emotion remains dominant in popular culture, it is less commonly used today by emotion researchers.

A second way of theorizing reason and emotion is what Barbalet (2001) calls a *critical* approach. It sees emotion as complementary to reason by providing rapid insights and guidance on the salience of information that reason itself cannot provide. This tradition is influenced by the work of the philosopher David Hume, among others. While Barbalet presents the critical approach as coherent, other writers tend to emphasize differences within this tradition, between those who focus on emotion as informing reasoned judgments ('emotion as *moral insight*', e.g., Roeser, 2012) and those who focus on a dual-process model which sees emotion as acting alongside and potentially bypassing reasoned judgment (*social intuitionist model*, e.g., Greene et al., 2004; Haidt, 2008). These critical approaches emphasize the co-operation between reason and emotion in coming to judgment (not their conflict, which tends to be emphasized by the traditional or conventional approach).

Barbalet also identifies a third approach, a *radical* approach, influenced by the work of the psychologist William James and the sociologist Georg Simmel. Rather than seeing reason and emotion as distinct but interrelated processes, this approach sees reason and emotion as "distinct names for aspects of a continuous process" (Barbalet 2001, p. 45). From this perspective, reason is not opposed to emotion (as for Kant) or informed by emotion (as in critical perspectives). Rather, reason is seen as a way of thinking associated with particular emotional states – including trust, security, and certainty. In this sense, reason is only possible when we give ourselves emotional permission to not engage with the consequences of our actions, which might disturb our sense of certainty and security (we will return to the moral implications of this argument in the section on macro-social frameworks below).

'Schema' as an integrating concept

This chapter aims at integrating many concepts: reason and emotion on one axis and micro-individual, meso-interactional, and macro-social levels of analysis on the other. These elements are closely connected: at the micro-individual level, we explore how emotions and reasoning operate within individuals. Moving to the meso-interactional level, we examine how these aspects manifest in personal interactions. Finally, at the macro-social level, we look at the broader societal contexts and influences on emotions and reasoning. A useful integrating concept across multiple levels of social interaction is provided by the work of Firat and McPherson (2010), who use the concept of *moral schema* to integrate across these levels of analysis within a common framework.

Schemas are often described as cognitive frameworks that guide people's perceptions, interpretations of their experiences, and actions (Boutyline & Soter, 2021; c.f. Piaget, 1932/1965). According to this schema-based model, a given experience activates mental schemas, which means that in that situation, a person will automatically and intuitively perceive certain things and think and feel in particular ways – and these elements influence their judgment (Thoma & Dong, 2014, p. 56). Schemas often operate implicitly and unconsciously, and people may not always be aware of their influence. *Moral schemas* are schemas that involve automatic and implicit cognitive processes important for moral behavior as they guide people's attention to moral issues and drive moral judgment (Narvaez & Bock, 2002). While schemas have historically been conceived as purely cognitive constructs, the concept of moral schemas highlights the importance of emotions, which operate as signals "activating schemas' salience, intensity, and content in people's everyday lives" (Firat & McPherson, 2010, p. 354).

While the language in the literature on schemas primarily derives from work at the individual/psychological level, the basic idea behind the concept – that internalized frameworks from our culture and our experiences shape our perceptions and responses – is also used to make

sense of patterns at interactional and macro-social levels. Yet, writers in disciplines other than psychology may use different terms to refer to this idea. In sociology, for example, the term *habitus* is often used to describe a pattern of perception, thinking, and action shaped by our past experiences (Bourdieu, 1990). As we will show in the section on the interactional level of social analysis, *discourse* is another related concept. Our goal here has been to use a single term (schema) to give clarity to the reader, not to prioritize psychological or individualistic perspectives.

Psychological perspectives and their impacts on engineering ethics education and research

Psychological perspectives on moral reasoning and emotion are explored in more detail in Chapter 10 of this handbook. Thus, we provide only a concise overview here.

Historically, rationalist (Kantian) cognitive-developmental models (what Barbalet would call conventional models) have dominated moral psychology. For example, Kohlberg's theory (1969) suggests that individuals progress through a series of stages of moral reasoning as they develop cognitively. The theory outlines six stages, divided into three levels: pre-conventional (judgment based on personal interest), conventional (judgment based on rule-following), and post-conventional (judgment based on the assessment of what is good for people in general). Moral judgment in this model is described as primarily based on reasoning and reflection. Some emotions, such as sympathy, are assumed to contribute to reasoning occasionally but are not seen as directly influencing moral judgments (Kohlberg, 1969).

However, this theory has been criticized for oversimplifying the complex nature of moral reasoning and underestimating the role of cultural (Tappan, 1997), social (Bandura, 2001), and emotional (Haidt, 2001) factors in shaping moral judgment. Within more critical approaches to understanding how reason and emotion interact, others have argued that emotions influence moral reasoning *and* crucial elements of cognitive abilities in moral judgments. For example, Hoffman (2000) emphasized emotional empathy – rather than cognition – as the primary driver of moral decision-making. However, Hoffman also connected emotion with cognition, proposing that empathy includes both cognitive and emotional processes. Haidt (2001) went even further, proposing a social intuitionist model of moral decision-making as an emotion-driven alternative to rationalist models. Haidt (2001) argued that moral judgments are guided by emotionally based intuitions that happen quickly, effortlessly, and automatically, while moral reasoning is formed slowly and with the effort exerted only after judgments have been made (*post-hoc* rationalization). Social neuroscientists have also brought a new perspective on moral judgment: the dual process theory of morality (Greene et al., 2004). According to this theory, a complex interaction between cognitive and affective psychological mechanisms influences moral judgments.

In response to the criticisms of Kohlberg's theory, Rest and his colleagues (1999) introduced the Neo-Kohlbergian approach, which retained Kohlberg's fundamental framework while integrating schema theory. This model conceptualizes moral development as a shift in the distribution of three primary 'schemas' – the *Personal Interest Schema*, the *Maintaining Norms Schema*, and the *Postconventional Schema* – rather than a linear progression through six discrete 'stages' (Thoma & Dong, 2014). Contrary to Kohlberg's assertion of the universality of moral stages, this approach recognizes that moral schemas are context-dependent and can be influenced by factors such as emotional information (Thoma & Dong, 2014). To assess individuals' levels of moral development, Neo-Kohlbergian researchers also developed the Defining Issues Test (DIT-1 and DIT-2) to detect shifts in these moral schemas (Rest et al., 1999).

The DIT has found extensive use in exploring moral reasoning development in higher education (King & Mayhew, 2002), including engineering ethics education (Hess & Fore, 2018; Hess et al., 2019). Furthermore, the DIT and DIT-like instruments, such as the Engineering and Science Issues Test (Borenstein et al., 2010), have also often been used to assess the effectiveness of engineering ethics education (Watts et al., 2017, p. 14). Thus, Kohlberg's theory (based on a conventional or Cartesian/Kantian model of the emotion–reason relationship) has played an essential role in engineering ethics education, whether implicitly or explicitly (for a comprehensive overview, see Hess, Beever, et al., [2019]). This influence significantly shapes the teaching approaches of engineering ethics educators, often placing a strong emphasis on reasoning as the primary driver of moral judgment while downplaying the role of emotions, which are often regarded as irrelevant or even harmful (Guntzburger et al., 2019; Kellam et al., 2018; Lönngren, Adawi et al., 2021; Ottemo et al., 2021; Roeser, 2020; Sunderland, 2014). For example, widely used engineering ethics textbooks such as those by van de Poel and Royakkers (2011), Fledderman (2011), and Harris et al. (2019) hardly even mention the term 'emotion' (Tormey, 2020). Similarly, engineering ethics case studies are typically designed and presented as moral dilemmas to be resolved through logical reasoning, neglecting the important emotional aspects of moral judgment (Bairaktarova & Woodcock, 2017; Martin et al., 2021; Miñano et al., 2017).

Fortunately, there is a rapidly growing interest in emotions in engineering education and engineering ethics education (Lönngren et al., 2023, preprint). For example, Roeser (2012, 2020) has emphasized the significance of emotions in technology ethics and design work. Others have shown that emotions play a crucial role in human-centered design practices (Bairaktarova & Plumlee, 2022), development of professional engineering identities (Huff et al., 2021), and engineers' ability to value moral decision-making (Hess et al., 2021). These researchers have argued that paying attention to emotions in professional engineering ethics is crucial. Others stress the importance of integrating emotions into engineering ethics education (e.g., Davis, 2015; Snieder & Zhu, 2020; Kim, 2022). Some even argue that emotions can bridge theoretical knowledge of engineering ethics and practical decision-making (Davis, 2015; Newberry, 2004). In this direction, Sunderland et al. (2014) and Sunderland (2014) examined how project-based learning may engage engineering students' emotions in engineering ethics education, finding that engagement with emotions can contribute to more meaningful ethics learning experiences for engineering students.

Another approach for introducing emotions into engineering ethics education can be using fictional films, as proposed by Hitt and Lennerfors (2022) (for more on this, see Chapter 36). According to the authors, fictional films can help engineering students relate to the ethical challenges engineers may face in their careers, empathize with the individuals affected by engineering decisions, and develop a more profound sense of moral awareness and sensitivity. Hess, Strobel, and Brightman (2017) and Hess et al. (2019) have also tested various models for incorporating emotions into teaching engineering ethics. For example, Hess et al. (2019) investigated how an emotionally engaging process can be applied to the practical examination of ethics cases. They employed a scaffolded, interactive, and reflective analysis (SIRA) approach and observed that it resulted in increased cognitive empathetic perspective-taking. Researchers have also begun to investigate the effects of including emotional information in ethics case studies on engineering students' ethics learning (Thiel et al., 2013; Watts et al., 2017), activated moral reasoning schemas (Kotluk & Tormey, 2023), and moral judgment (Higgs et al., 2020) (this is explored in more detail in Chapter 20, on 'teaching ethics using case studies').

Thus far, we have identified that there are now multiple theoretical frameworks aiming to connect reason and emotion in the ethical decision-making of individual engineers. So far, we have only explored connections between reason and emotion at the individual level. We next turn our

attention to the connection of reason and emotion at the next level of social analysis – the level of social interaction.

Reason and emotion in moral social interaction

We have described how moral philosophy and psychology research have begun attending to the multiple roles that reason and emotion can play in individual moral judgment and development. Engineering, however, is an inherently *social* profession characterized by complex social relationships, distributed knowledge and production systems, unclear power structures, and conflicting value systems (Rojter, 2007; Ross & Athanassoulis, 2010). Thus, decisions on moral issues are never made by individual engineers alone – they are always also influenced by the social contexts in which engineers work and live. Similarly, engineering students learn ethics in the social contexts of educational institutions.

In this part of the chapter, we thus focus on the meso-level of social interaction among individuals and smaller groups, drawing on research from social psychology and critical discourse studies. In this type of research, emotions are not understood as residing 'inside an individual's head,' but as co-constructed, negotiated, and used as rhetorical resources for influencing social norms or power relations (Ahmed, 2014; Lönngren, Adawi et al., 2021; Pepin, 2008). In other words, social interaction researchers are not interested in whether an individual 'has' or 'experiences' an emotion. Instead, they study how people express emotions in social contexts, how social norms influence who expresses which emotions, and how the expression of emotions influences how people interact with and position themselves relative to others.

Social psychological and discourse studies employ many terms and expressions that may be new to readers trained in philosophical or psychological traditions. The most important concept for the discussion in this section is *discourse*, which refers to societal norms, rules, and practices that guide individual and collective behavior. Discourse is closely linked to schemas: we can say that people enact their schemas through discourse when they use language and other forms of communication in interaction with others to make sense of their experiences and create meaning together (Kvasny, 2005). Thus, professional ethics schemas can shape engineering ethics discourses, including discourses constructing ethics as separate from the technical subject content and irrelevant to the engineering profession (Lönngren, 2021; Martin & Polmear, 2022; Nieusma & Cieminski, 2018; Polmear et al., 2019; Tormey et al., 2015). This is important since meaning created through such discourses, in turn, influences engineers' and students' professional schemas.

Besides discourse, *power* is an essential concept in social interaction research. There are many ways of conceptualizing power, but here, we use a definition from positioning theory, where power refers to peoples' rights and/or duties to perform specific actions in a given interactional context (Harré et al., 2009; Zembylas, 2016). Thus, like emotions, power is not something individuals 'have,' but something that is dynamically assigned to people in specific situations. So far, however, there is very little research on emotions in relation to discourses and power in engineering ethics education (Lönngren, Bellocchi et al., 2024). This is unfortunate, since such research could provide important knowledge on how engineering education could position students as morally responsible agents and thus support students in developing schemas with a strong commitment to ethics in engineering practice.

To begin developing such research, scholars can draw on a growing body of social interactionist research in other educational domains, which provides many valuable concepts and theories for studying emotion and power in social practices. Hochschild's (1979) notion of *feeling rules* is an

essential and highly influential concept in such research. Feeling rules are social norms about who is expected to feel and express which emotions, how to feel and express them, and in which situation. In Western cultures, feeling rules typically associate rationality with strength, authority, and power, while emotionality is associated with weakness, submission, and loss of power (Bericat, 2016). In engineering contexts, we can expect feelings rules to limit the range of emotions one can express without considerable social costs (e.g., loss of status and power; Lönngren, Adawi et al., 2021). This, in turn, may pose significant challenges for ethical decision-making since it becomes challenging to express emotions related to, for example, compassion, empathy, and care. Thus, to strengthen moral schemas, we must also challenge prohibitive feeling rules in engineering. Another critical issue is that emotionality is often associated with women, minoritized groups, and groups with lower socio-economic status. This association exacerbates inequality and unequal representation in engineering and engineering education, since groups with lower status are likely to face an even greater loss of power when they express or engage with emotions (Ahmed, 2014; Boler, 1999; Lutz, 1996). As a result, individual students and engineers have unequal opportunities to use emotions to support ethical decision-making (e.g., exploring emotions to identify and/or communicate concerns about ethical issues).

Emotional labor (Hochschild, 1983) is another crucial concept, referring to the effort professionals perform when they express emotions that are socially expected but not aligned with how they feel or when they try to change their emotions to better align with social norms and expectations. Emotional labor is pervasive in educational settings and has been studied in, for example, higher education (Lawless, 2018), science education (Zembylas, 2004), social justice education (Rivera Maulucci, 2013), and engineering education (Adams & Turns, 2020; Kotluk et al., 2023). Due to the strong rationality discourses in engineering, engineering students and professionals are often required to perform emotional labor to control and repress their emotions and to reconcile rationality discourses with demands to show empathy and care (Buzzanell et al., 2023; Lönngren, Adawi et al., 2021). Education research has also shown that members of some minoritized groups may be expected to be more empathic and caring than others (Maddamsetti, 2021; cf. Nair & Bulleit, 2020 for an introduction to care ethics in engineering education) while also having to deal with emotions related to discrimination, prejudice, and a lack of power (DeCuir-Guby et al., 2009).

Finally, *emotional capital* provides a helpful lens for exploring engineering students' and professionals' access to tools for moral decision-making. The concept is associated with Bourdieu's work and describes how organizations and cultures tend to value the *habitus* (schemas) of powerful social groups over those of others. Emotional capital has been defined as "one's trans-situational, emotion-based knowledge, emotion management skills, and feeling capacities, which are both socially emergent and critical to the maintenance of power" (Cottingham, 2016, p. 454). In educational contexts, emotional capital is unequally distributed, meaning that particular emotional schemas are valued more than others (Zembylas, 2007). This can further exasperate unequal access to emotional resources for ethical decision-making.

Much of the early work on emotions in social interaction developed as a critical response to conventional theories that saw emotion and rationality as distinct and thus sought to explain social interaction through purely rational processes (Wetherell, 2013). More recent research, however, has begun to explore more critical and radical approaches that position reason and emotion relative to each other. For example, a study of engineering students' reflections on addressing a complex sustainability issue has illustrated how students can use discourses of reason and emotion side by side (Lönngren, Adawi et al., 2021). Engineering education researchers and practitioners have much to learn from those students!

Rationality and emotion in moral action at the institutional and societal level

Previous sections in this chapter have explored how reason and emotion interact in moral judgments made at individual and meso-interactional levels. Each has highlighted an intellectual shift from more conventional understandings of the reason–emotion relationship to more critical or radical conceptions. The text has shown that these intellectual shifts are not yet well reflected in work on engineering ethics education. In this section, we focus on the macro-social level – involving social institutions and broader cultural contexts – from the perspective of sociology. This topic requires making yet another shift regarding the language used to describe phenomena related to reason and emotion.

The terms 'rationality' and 'reason' come from the same root and effectively mean the same thing (one could play a semantic game to disentangle them, but in practical terms, people use the terms interchangeably). In sociology, the term 'rationalization' is more commonly used, so it is used in this section. The key argument in this section is that rationality and emotion are important not only in understanding the ethical action of engineers at the level of the internal mental processes of individual engineers, or in terms of the discourses of reason and emotion that shape their interactions, but also because the product of engineering rationality becomes embedded in technologies and social systems that, in themselves, have an impact on the moral action of the people who live and work within them. One key sociological concept in this regard is that modern societies are characterized by a process of *rationalization* (Weber, 1930/1992).

Weber's account has been very influential and controversial in sociological analysis, particularly in Western societies (see Chapter 9 for a range of more contemporary accounts). For Weber, Western cultures that increasingly valued rational action created bureaucratic, accounting, legal, and managerial rules based on rational evaluation according to clear rules and metrics, thus removing emotion from decision-making. These rationality-based social systems and the technologies that support them are often the work of engineers. The process of division of labor, for example, in which work tasks are studied, quantified, and then subdivided and distributed across multiple workers, is based upon principles of scientific management first articulated by mechanical engineer F. W. Taylor. The principles of scientific management remain a key organizing principle in workplaces today (see Ritzer, 2020).

One of Weber's concerns was that the increasing rationalization of societies had implications for moral or ethical action (in what follows, we will apply these to engineering situations, but Weber was not, himself, particularly concerned with engineering). He saw rational social systems as characterized by rule-based and quantified behavior in which decisions are based on rules, laws, and calculations rather than on consideration of 'right' and 'wrong.' Hence, the space for moral decision-making was progressively reduced; in the language of the neo-Kohlbergian model introduced above, one could say that social organizations such as companies or other bureaucratic institutions created the conditions in which post-conventional moral reasoning was progressively replaced by decisions that were required to be taken based on conventional moral reasoning. One way this happens is through the division of labor, which implies that engineers are often charged with decisions about 'how' rather than 'what' or 'why.'

In engineering ethics education, the effects of this division of labor can be seen in the foregrounding of discussions as to what is (and is not) the ethical responsibility of the engineer. The engineering ethics textbook of van de Poel and Royakkers (2011), for example, begins with a discussion of whether the engineer who had identified potential problems with the Challenger Space Shuttle before take-off was responsible, as a salaried employee who was hierarchically below a manager, for doing more than reporting the problem to managers. From a sociological perspective, the question here is not simply whether the individual engineer has a responsibility to do more, but

rather how the social system that separates the 'how' and 'what' questions had emerged in the first place, as a result of a series of rational organizational decisions.

The Challenger case is a spectacular one but, in the Weberian account, not the only one. This issue (what is the responsibility of the engineer *vis a vis* the manager) has been framed by engineering ethics educators in different ways (see, e.g., Bucciarelli, 2008; Johnson, 1992). One way of thinking about this is the distinction between the teaching of micro-ethics, which is concerned with the responsibility of the individual engineer as an employee, and macro-ethics, which is concerned with the broader responsibility of the profession as a collective (Bielefeldt et al., 2016; Dyrud, 2014; Herkert, 2001). A possible takeaway from a macro-social analysis for engineering instruction on macro-ethics is the need to problematize and analyze (rather than accept as taken for granted) the social process through which laws, rules, bureaucracy, and the division of labor in organizations reduce or expand the space for engineers to make ethical decisions.

Weber's original account of rationalization saw rationalization as implying a progressive removal of emotion as an organizing principle in social life (see, e.g., 1930/1992, p. 73). However, as Barbalet noted (2001), this conception only holds as long as a traditional, Kantian understanding of 'emotion as disturbance' is used. While rationalization could be described as aiming for the removal of disturbance from social life, the radical view of the relationship between reason and emotion recognizes that rationally working to find the optimal means towards a given end requires a calmness that comes from not feeling threatened and from trusting that a given action will result in a given outcome (Barbalet, 2001, p. 49).

Indeed, since the 1990s, there has been an increasing recognition of the importance of 'trust' in the organization of social life (Möllering, 2001). Trust has been described as a mental process involving a sense of suspension that enables favorable expectations regarding other people's actions and intentions (Möllering, 2001). In a sociological sense, trust is important because one of the features of the modern social system is that it connects people across cultures, space, and time. If we take, for example, a piece of technology like a mobile phone, the technology itself is based on using materials extracted from the earth in Central Africa (Fitzpatrick et al., 2015); built in factories in China, in which workers' rights and working conditions have been questioned (Josephs, 2013); and disposed of in countries such as China, India, Nigeria, Ghana, and Pakistan in circumstances that can lead to ground and water pollution (Awasthi et al., 2016).

In this complex sociotechnical system, a person is 'disembedded' (Giddens, 1991) from the other people they indirectly interact with across space and social distance (in the case of those from other cultures and countries who are affected by mineral extraction or electronic waste) and across time (in the case of a future generation affected by toxic waste). At a societal level, 'trust' allows us to suspend questions about the operation of social systems. Trust, therefore, reduces the impact of social complexity on individual persons (Luhmann, 1979) as it allows us to place a bracket around a whole set of relationships and to accept that these relationships will give rise to expected outcomes. Thus, while trust is generally regarded as a positive emotion, at a social level, its effects are more morally ambiguous.

Trust in disembedding social systems has another emotional impact: those affected by our decisions across cultures, space, and time are rendered psychologically invisible and emotionally distanced. In other words, if we had to interact directly with factory workers in China, they would have a face and a name and would be hard to ignore emotionally – social systems of trade disembed us from them and so enable emotional distance and make them psychologically invisible. Thus, the engineer working on an application for a mobile phone can feel no emotional connection to the Central African miner; the Chinese laborer; the Indian, Nigerian, Ghanaian, and Pakistani e-recycling worker; or those affected by the carbon footprint of their application. In this sense,

rationalization produces the emotional experience of impersonality (Weber 1930/1992, p. 259) or a lack of compassion and empathy. This reinforces the lacking sense of responsibility for the socially distributed effects of engineers' actions in a rationalized world.

Conclusions and ways forward

In this chapter, first, we have presented a historical paradigm shift across multiple disciplines toward exploring the relationships between reason and emotion in moral judgment, in the moral nature of interactions and power dynamics, and in the moral problems that result from the ways in which trade, law, accounting systems, and organizations shape the effects of engineering decisions.

Considering the current evidence from moral psychology, we should focus on the role emotions play in moral decision-making and ethics learning in engineering ethics education, moving beyond the traditional focus on reason alone. For example, emotions linked to ethical issues can play a critical role in the decision-making and learning processes. Although some research has been done on the impacts of moral emotions on engineering students' moral judgment (Higgs et al., 2020; Kotluk & Tormey, 2022), more research is still needed. There is also a need to focus more on the emotional dimensions of teaching and learning ethics to ensure that future engineers have knowledge about what is ethical and the capabilities and dispositions needed to assume moral responsibility. However, engineering ethics education or research has not yet adequately investigated the impacts of moral emotions on ethics learning.

Second, we have discussed how engineering as a profession involves complex social relationships and power structures. We have shown that moral decision-making in engineering is not an individual act but is influenced by the social and cultural environments in which engineers work and live. Thus, attending to emotions in moral decision-making can have different social costs for diverse groups of engineers and engineering students. Yet, there is currently a lack of research exploring the connection between power dynamics and emotions in engineering ethics education. We suggest that a growing body of sociological and social interactionist research in other educational fields could be a foundation for such research.

Finally, taking a sociological perspective, we have examined how the institutional, emotional, and rational aspects of society (macro-level) impact engineering ethics education. Analyzing rationalization and emotion at a macro-social level has several implications for engineering ethics and engineering ethics education. First, it asks us to question conventional engineering ethics – with its focus on micro-ethical judgments, which are made within a highly constrained setting in which the engineer can only be 'responsible' for a limited number of decisions. It suggests that we should also focus more on macro-ethical questions, which take seriously the ways in which rationalized financial, legal, and organizational factors affect what gets to be 'defined in' and 'defined out' of engineer's ethical judgments. Second, it asks us to bring emotion back into ethics questions and ethics education. It highlights that we should perhaps be clearer about the role of 'trust' in bracketing off ethical components of engineering decisions and that we may need to work on building better capacities in engineers to imagine and feel emotions like compassion, empathy, or pity for those affected by the effects of engineering actions.

To sum up, this chapter has presented the arguments for why reason has historically been prioritized and why emotions have not been fully integrated into engineering ethics education on various levels – individual, interpersonal, and societal. It is crucial to note that research on the roles of reason and emotion in moral decision-making in engineering ethics education has mainly derived from moral psychology and is based on psychological processes. However, the evidence from social psychology and the perspectives presented by sociology have thus far been given little

consideration. Ultimately, we suggest that engineering ethics education must engage more with social and cultural psychology and sociology to better understand how reason and emotion interact in engineering ethics education.

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