From 'Empathic Design' to 'Empathic Engineering': Toward a Genealogy of Empathy in Engineering Education

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Abstract

In philosophy and psychology literature, empathy in general refers to 1) the ability to understand another person's ideas and feelings; and 2) the inclination to feel emotionally responsive to, and act to alleviate, another person's distressful experience. Until recently, however, discourses on "empathy" in engineering education are inspired primarily by "empathic design," a concept that originated from market research and first gained popularity in the business world. This paper argues that the discourse of "empathic design" inadvertently advances an instrumentalist interpretation of empathy, one that ignores the depth and breadth of philosophical and psychological insights into empathy. The adoption of this instrumentalist, product-oriented conception of empathy exacerbates some persistent problems confronting engineering education, including a tendency to objectify the users of engineering products.

Seeking to reconstruct empathy on the ground of philosophy and psychology literature, in this paper I begin to develop a genealogy of empathy in engineering education. The paper does this by tracing the discursive history of empathy in engineering education and in its discipline-based sub-communities (e.g., design and entrepreneurship). This genealogical survey also examines recent scholars' efforts toward redefining empathy as an engineering competency, which lays the groundwork for envisioning "empathic engineering." Champions of empathic engineering, taking advantage of knowledge developed in psychology and social work, link empathy to engineering students' moral development and communication skills. Ultimately, empathic engineering aims at advancing objectives related to community needs, sustainability, and social justice. I assess the implications of the discursive migration from "empathic design" to "empathic engineering" for the identity formation of the engineering profession. Furthermore, I argue that the movement toward "empathic engineering" suggests the potential for overcoming a narrowly-defined, instrumentalist, and product-oriented conception of empathy. As an example, I suggest two alternative conceptions of empathy in engineering: 1) empathy as a commitment to communicating and understanding across different cultural and epistemic communities; and 2) empathy as a professional excellence for engineers.

Introduction

Empathy, a word translated from "*Einfühlung*" in German, originally refers to an aesthetic experience in which a viewer "feels into" a work of art [1]. Since the 19th century, philosophers and psychologists have scrupulously examined the meanings of empathy and its role in numerous human actions and characters (e.g., helping). Although interpretations of empathy vary across time and disciplines, philosophers and psychologists in general think of empathy as 1) our ability to understand another person's ideas and feelings; and 2) our inclination to feel emotionally responsive to, and act to

alleviate, another person's distressful experience [2]. In addition, empathy in philosophy and psychology is commonly used to describe cognitive or affective responses of individual persons: we usually suggest a person, not some other thing, has empathy.

Over the last decade, engineering educators have become increasingly interested in empathy and its role in engineering. As of this writing, 439 papers published at the ASEE annual conference proceedings have included the word "empathy," and the number is surging in recent years (see Figure 1). Unlike its typical usage in philosophy and psychology, empathy in engineering education describes non-human items, such as empathic design or empathic engineering. What inspires engineering educators to adopt and adapt the concept of empathy? How does engineering educators' engagement with empathy enrich existing philosophical and psychological insights into this concept? How might we take a more imaginative approach to empathy in engineering? This paper begins to explore these questions through a genealogical study of empathy in engineering education.
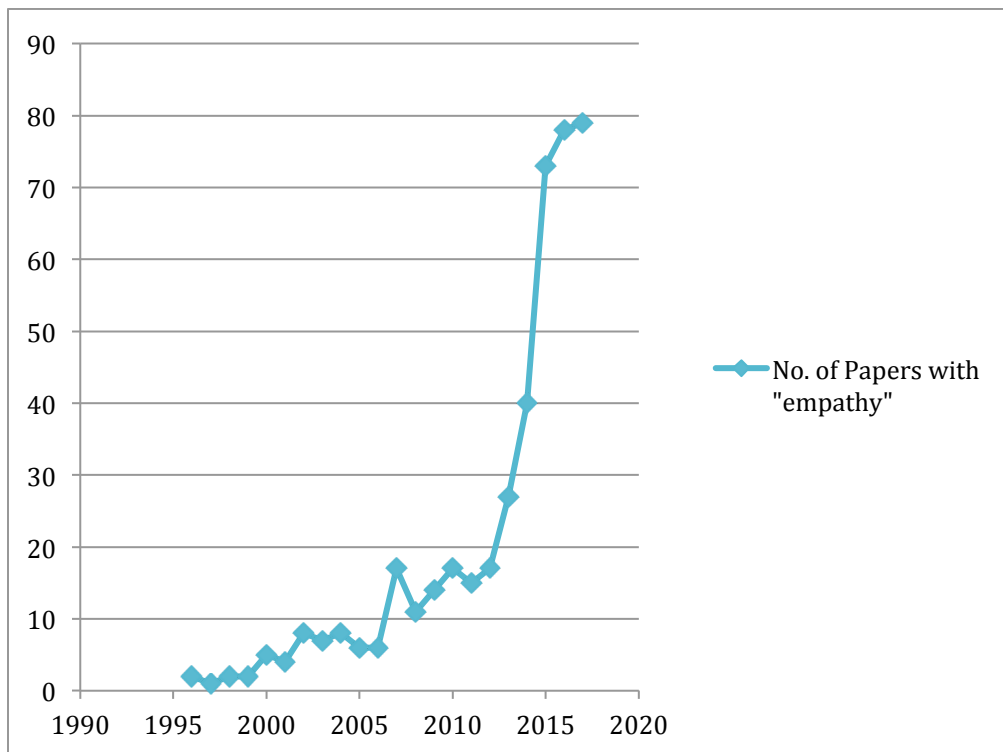

Figure 1. ASEE Papers with "Empathy" by Year

The remainder of this paper begins with a short historical sketch of empathy, drawing from philosophy and psychology literature. The purpose is to set a "benchmark" for observing similar and different interpretations of empathy in engineering education. Given the rare presence of genealogical studies in engineering education literature, I also briefly discuss genealogy as a research method and the reasons for pursuing a genealogy of empathy in engineering. The following section traces the discursive presence of "empathy" in engineering education. This section focuses on the ways in which empathy

(or related terms like "empathic" or "empathize") is talked about in the engineering education community, and I do so by analyzing papers published with the ASEE annual conference proceedings. To assist the imagining of new possibilities, I then suggest two ways of reformulating empathy in the engineering context.

Literature Review

A prehistory of empathy in engineering

According to psychologist Lauren Wispé, empathy was studied in a variety of disciplines throughout the 20th century, and the fields in which empathy drew intense attention shifted from time to time. In the 19th century, Germans used the word "Einfühlung" in aesthetics theory to describe the process in which a viewer projects oneself into the object of beauty. At the turn of the century, "Einfühlung" migrated out of aesthetics and became a choice for psychologists to describe the ability to recognize other persons' psychological status [3]. Titchener first translated "Einfühlung" into the English word "empathy" in 1909, referring to the act of imitating another person's feelings [3]. From the 1930s on, personality theorists considered empathy, or the ability to imitate others' feeling, as the key for understanding personalities. In the 1950s and 1960s, psychotherapists, led by Carl Rogers, valued empathy for effective therapy. Psychotherapists at this time particularly recommended and practiced the technique of empathic listening, which emphasizes withholding one's own presumptions and judgments and trying to see the world through the lens of the patients. In the decades that followed, empathy became a popular object of study in social and developmental psychology. Psychologists in these fields did enormous work in creating scales for measuring empathy, particularly measuring the growth of empathy in children [3].

Contemporary studies in psychology still follow a wide range of definitions of empathy. However, according to Batson, these diverse interpretations of empathy converge in two domains: 1) knowing another person's thinking or feeling; 2) motivating someone to be sensitive and care for others' suffering [2]. The first domain stresses the cognitive aspect, the second the affective.

Genealogy

According to philosopher Bernard Williams, "a genealogy is a narrative that tries to explain a cultural phenomenon by describing a way in which it came about, or could have come about, or might be imagined to have come about" [4]. By probing both the widely-received and the potentially viable accounts of a cultural phenomenon, a genealogist sets in motion a process for questioning, evaluating, and renewing a taken-for-granted way of thinking, acting, or being. For example, in *The Genealogy of Morals*, Nietzsche demonstrates a genealogical scrutiny of moral values when he asks, "Under what conditions did man construct the value judgments good and evil? And what is their intrinsic worth? Have they thus far benefited or retarded mankind? Do they betoken misery, curtailment, degeneracy or, on the contrary, power, fullness of being, energy, courage in the face of life, and confidence in the future?" [5]. Foucault more explicitly

designated genealogy as a force to destabilize and disrupt any authoritative, monotonous, and linear account of history: "[genealogy] opposes itself to the search for 'origins'"[6].

The question then becomes, is this genealogical method, at the first glance elusive and even antithetical to the common logic of engineering, an appropriate way to study empathy in engineering? Whereas reasonable doubts might exist, there are a few reasons for taking this intellectual risk. First, in its opposition to a singular "origin story," a genealogical inquiry reveals the heterogeneous pathways through which empathy enters and interplays with engineering, thus it enables multiple conceptions of empathy as it pertains to diverse engineering identities. Second, asking what "could have come about" frees us to imagine possibilities aside from the current dominant narrative about empathy, inherited from market research, which retains few of the rich insights into empathy resulting from a century of philosophical and psychological investigations. Third, similar to engineering design, a genealogical study is iterative. This iterative nature thus allows reconstruction of empathy with insights learned from its interaction with engineering.

A Brief Discursive History of Empathy in Engineering Education

The word "empathy" first appeared in two papers published with the ASEE annual conference proceedings in 1996. However, "empathy" only appeared once in each paper, and in both cases the authors used "empathy" to describe a personal character without clearly defining the concept [7] [8].

More systematic discussion of "empathy" did not appear until 2001. Welker and Carlson's report of engineering ethics education considers empathy as a precursor to moral imagination [9]. While not explicitly defining empathy, Welker and Carlson reported using different media and genres to help students develop empathy with engineers who make difficult ethical choices and with people who are impacted by corresponding engineering decisions. Crowley et al. developed a course that cultivates engineering students' emotional intelligence [10]. The authors define emotional intelligence as "bring[ing] awareness of their own emotions to their life experiences, and to develop the skills to recognize and work with the emotions of others"[10]. The latter half of this definition aligns well with the cognitive and affective dimensions of empathy in psychology literature. Crowley et al. also explicitly addressed empathy, recognizing it as a "foundational component of emotional intelligence." Notably, while Welker and Carlson's and Crowley et al.'s papers treat empathy respectively as a framework for engineering students' moral and emotional development, neither one cites sources that explain the theoretical underpinnings of empathy.

The lack of reference to academic sources on empathy lasted for a few more years, during which time a number of papers appeared in ASEE that explore the role of empathy in communication, teamwork, and design, and yet authors of these papers treated empathy as if it were a well-known and self-explanatory concept that needed no definition. This absence of "empathy reference" lasted until 2006, when Mawasha and colleagues cited Carl Rogers's definition of empathy to describe student attitude [11]. The following year—2007—arguably marked the beginning of the "blossom of empathy" in ASEE. The number of papers containing "empathy" reached double digits (17) for the first time in the 2007 ASEE annual conference proceedings, almost tripling from the

previous year. While the majority of this year's papers still use empathy tangentially without clear definition or references to academic sources, three exceptions existed.

Ellis et al. developed a survey instrument to assess high school girls' perceptions of artificial intelligence [12]. Drawing from Wiggins and McTighe's framework of understanding by design, Ellis et al. included survey questions to assess respondents' level of empathy [13]. It is worth noting that Ellis et al. operationalized a concept of empathy that had been laid out in the design literature. In comparison, Mann et al. followed a different theoretical tradition. Attempting to achieve deep understanding of sustainable design, the authors utilized a relatively new technique, phenomenography, to interview practitioners who had close experience with sustainable design [14]. This paper recommends empathy as a critical means for engaging the subjects' "life-world," citing Ashworth and Lucas's introduction of the phenomenographic method [15]. Mann et al.'s interpretation of empathy echoes earlier psychotherapists' recommendation of "empathic listening." Finally, in a follow-up study to their previous work [10], Cordova-Wentling and Price cited psychologist Daniel Goleman's theory to discuss the role of empathy in engineering emotional intelligence [16].

Beyond the initial introduction of empathy to engineering educators, what motivates a sustained conversation about empathy in engineering education? How do different sub-communities of engineering education talk about "empathy?" Reading the papers published in discipline-based ASEE divisions can shed some light on these questions.

Empathic in DEED

Eggert's 2008 paper, "Achieving Teamwork in Design Projects: Development and Preliminary Results of a Spreadsheet Tool," is the first recorded use of "empathy" in the Design in Engineering Education Division (DEED) of ASEE [17]. Like many of its predecessors, Eggert's paper only mentions "empathy" once when describing professionals' interpersonal style, which includes "empathy, tolerance, honesty, trust, and personal integrity" [17]. As part of a person's "style," empathy is considered a psychological trait, one that reflects an engineering designer's personality.

The concept "empathic design," coined by Leonard and Rayport, had gained prominence prior to its presence in engineering education [18]. The first reference to "empathic design" in DEED appeared in 2011. Titus and colleagues called empathic design "the ideal form" of human-centered design, "where the engineer is able to empathize with the user or take on the user's feelings on the broad range of issues defining both the problem and the solution space" [19]. The authors linked the emergence of empathic and human-centered design to the demographic changes that were taking place in the US and the world, "a significant change that means engineering as a profession will have to remain socially sensitive and be aware of the ways in which it must adapt if it is to properly address the needs of its stakeholders" [19]. In other words, the urge for engineers to empathize was magnified by the recognition that the targeted users are becoming increasingly different from, and unfamiliar to, the engineers themselves. This analysis seems to assume that the composition of the engineering community will not alter swiftly enough to reflect the increasingly diverse demographics of the users.

If Titus et al. identified the external drive for empathic design, Hess et al. emphasized empathy as a key in the internal reconstruction of the engineering identity: "Traditionally, engineering as a profession has focused primarily on a set of technical skills, such as problem solving, design, and modeling. It is undeniable that these skills are core and important. However, the target attributes for future engineering graduates, such as featured in the National Academy of Engineering's (NAE) 'Engineer of 2020', include specific character qualities and affective dispositions as well, wherein promoting traits such as empathy and care is sometimes referenced as holistic engineering education" [20]. Here empathy is included in a list of features that describe a new breed of engineers endorsed by the National Academy of Engineering, one that replaces the traditional image of engineers as narrowly technical-oriented problem solvers. This identity shift is explicitly recognized in the paper, when the authors suggested the new features described by the National Academy "would shift perceptions of engineers from individuals who are solely object-oriented workers to individuals who have a strong work ethic (in collaborations and communications), are ethically responsible (globally, socially, intellectually, and technologically), are able to adapt to new trends, are innovative, and are entrepreneurial." According to Hess et al., this identity shift will make the engineering profession more diverse and fluid, in part by reconfiguring the engineering toolbox to make space for communication, ethics, and empathic thinking. However, discussions about empathic design in many cases ignore engineers' internal cognitive and affective processes and instead focus solely on empathy as a tool for extracting data from the users.

Citing Leonard and Rayport [18], Seshadri et al. defined empathic design as "a set of techniques that helps to identify customer-needs," which "has its foundation in observation of the customer in her/ his environment, that is, in the context of use" [21]. The paper introduces detailed empathic design techniques, including observation, data capture, reflection, and brainstorm, yet the paper says nothing about designers' own psychological status or how designers register the user's feelings internally. Instead, the paper shows an interest in transforming users into data sources. Empathic design is valued for "empower[ing] designers by observation"[21].

Schmitt et al. reported pedagogical strategies in two capstone design courses that were said to enhance student designers' empathy [22]. The paper starts by grounding the need of empathy in the gap between the engineering designers and their users, noting that empathy "is particularly important in engineering education where students may be of different demographics than those they will ultimately design for." In a review of empathy in philosophical and psychological literature, the authors recognize the empathizer's cognition and identity formation. However, this focus on the empathizer's (designer's) inner life did not translate into pedagogical practice in the capstone projects, where empathy was once again operationalized as an instrument for data collection. Speaking of the projects—designing for users with disability, the authors concluded, "[r]egular exposure to handicapped users, their limitations, and how these impact their ability to perform daily tasks, can provide useful data"[22].

When empathic design is translated into a method for user observation, the focus is often placed on an exclusive, two-entity relationship: the designer and the user. That is, the focus on gathering user data in a way downplays the roles of other stakeholders (e.g.,

social workers in the case of designing for people with disabilities) in the communication between the designers and the users.

Empathy and entrepreneurship

Empathic design has also made an influential presence in the Division of Entrepreneurship & Engineering Innovation (EEI). Steffensen recommended "empathic design" as an important supplement to questionnaire-based market research, because "a user is not always able to verbalize and talk about his or her specific needs"[23]. Believing that the theoretical underpinnings of empathy will perplex engineering students and "be rated by the students as a very soft skill," Steffensen chose to omit its psychological connotations and instead defined empathy as a "strategic action and [to] an instrumental understanding of the empathee which helps to guide and to fine-tune the strategic innovation plans of firms"[23]. Thus Steffensen, perhaps going further than many authors of empathic design would prefer to, moved empathy out of the terrain of individual traits and relocated it in the domain of corporate resources. Following this approach, Steffensen considered empathic thinking "a means to decrease failure rates in innovation processes and hence a strategy for risk reduction"[23].

Not all authors in EEI agree with depersonalizing empathy and treating it as a pure technique. In fact, some authors see empathic design not only as a technique; they also value the role of empathy in building productive and open-minded entrepreneurial teams. Karanian et al. reported a design team that experimented with an "open process"[24]. Empathy, defined as "understanding the emotional make-up of other people, stepping into the shoes of another on the team and feel 'with' vs. for another," played a vital role not only among the designers but also between the designers and the users—participants of a virtue community [24]. The authors also suggested that the predominantly female composition of the design team facilitated empathy and care for the user population, which shared a similar gender composition.

From empathic design to empathic engineering

While terms like "user needs" have become a regular part of the engineering vocabulary, Hess et al. noted that empathy is rarely used as an independent concept in engineering. They expressed surprise at "the lack of research on the connection between engineering (along with other technical/scientific fields) and empathy/care," in particular because "empathetic design is considered the most comprehensive form of human-centered design and empathic communication skills are postulated to lead to more personal connection to stakeholders"[20]. Indeed, despite the amount of attention paid to harnessing empathy as an engineering tool, few engineering educators have explicitly explored the relation between empathy and engineering. Lately, however, breakthroughs in this direction seem to be on the horizon.

Walther et al. reported a collaborative effort between engineering and social work educators that led to course modules on empathic communication for engineering students [25]. The authors grounded empathic communication in the complex social-technical systems in which engineers conduct professional practice. These social-

technical systems, wrote Walther et al., frequently include multiple and conflicting values and perspectives. The social-technical systems thus require engineers to go beyond "dualist" approaches of communication or engagement, which separate engineers from the context of engineering work, and to develop "genuine, personal engagement with others"[25]. As Walther et al. suggested, the development of empathic communication "in a cognitive as well as affective sense would transform stakeholders into partners in a not only participatory but truly dialogical process of addressing the challenges of the future"[25]. Walther et al.'s paper traces in detail the trajectory of empathy in psychology literature throughout the 20th century, highlighting three aspects of empathy in particular: knowing others' feelings, feeling as others do, and responding to others' experience. Inspired by social work education, the authors introduced empathic communication into engineering classrooms. What distinguishes Walther et al.'s work is a sincere attempt to synthesize the psychological insights on empathy and the pedagogical and professional necessities of engineering.

Beyond the ASEE annual conference proceedings, other works are assessing empathy as a core engineering competency [26] [27]. Inspired by these works that try to develop a new paradigm of "empathic engineering," the next section discusses two possible ways of reformulating empathy in the context of engineering.

Re-envisioning Empathy in Engineering

The act of empathizing has two components: First, one makes an effort to understand or feel with others, and second, through this effort, one achieves the cognitive or emotional status of sharing others' thoughts and feelings. Accordingly, empathy includes two aspects: the commitment of empathizing (being willing to share understanding and feeling) and the outcome of empathy (shared understanding and feeling). Psychology literature, in particular psychological studies of empathy as a capacity, has emphasized the outcome aspect of empathy; i.e., much of psychological research on empathy focuses on ascertaining when and how shared understanding and feeling take place. The engineering education community, paying acute attention to data collection, stresses the outcome of empathy even further. As engineering educators overwhelmingly focus on achieving common understanding between engineers and their users, few pause to ask questions about the other aspect—the commitment to empathizing. For example, am I empathic when I am committed to sharing others' thoughts and feelings, knowing, however, I may not be able to truly understand them? This is not just a rhetorical question, for there are myriads of occasions in which engineers may not truly share their non-engineering partners' thoughts and feelings, especially when they work in cross-cultural settings. In this case, shifting emphasis from the outcome to the commitment of empathizing is very relevant and necessary for engineers to remain empathic when interacting with stakeholders who come from drastically different background. Instead of assuming empathy as a result of following given recipes for listening or observation, perhaps engineers will benefit from recognizing the "incommensurability" across different epistemic and cultural communities [28]. That is, engineers might develop more realistic expectations when they pay attention to the inherent differences in values and ways of knowing between themselves and other stakeholders. Given the incommensurability, empathic engineers would still commit themselves and make their

best effort to understand other stakeholders. Thus, one reconstruction of empathy in engineering might describe a commitment to understanding, respecting, and communicating in spite of inherent and sometimes insurmountable differences. Besides being a personal trait of individual engineers, empathy as a commitment also declares a profession's ethical stance.

The commitment to empathic communication is particularly important when engineers work to meet the needs of underserved communities. Scholars working on the intersection of engineering and community engagement have pointed out the critical importance of listening and forming genuine partnership with community members in order to define engineering problems and solutions that are meaningful to the local communities [29]. In particular, literature in community engagement points out, engineering work that aims to facilitate sustainable community development and social justice goals necessitates "contextual listening," a framework that enables engineers to grasp the needs of community members in relation to the local historical and cultural contexts and to identity the structural (political, economic, etc.) barriers that prevent the fulfillment of these needs [30] [31]. As "contextual listening" also stresses patient, respectful, and non-judgmental communication, it provides an alternative formulation of "empathy" for engineers working toward community engagement and social justice. While appreciating the value and necessity of contextual listening for truly empathic engineering work, in this paper I choose to acknowledge the conceptual differences between empathy as a commitment to communicating, which highlights an internal, personal inclination, and contextual listening, which entails a broad set of conceptual tools for probing and analyzing the contextual and structural factors characteristic of a community.

In *Technology and the Virtues*, Philosopher Shannon Vallor discusses empathy as a virtue, drawing from Confucian and Buddhist traditions [32]. Vallor recognizes that contemporary technocultural systems, such as the digital culture, have enormous power to reshape—positively or negatively—community relationship and responses to moral indifference. Hence Vallor calls for the cultivation of empathy as a technomoral virtue. Defining empathy as a virtue is inspiring for thinking about engineering excellence. According to classical ethical theory, virtue means a form of excellence—cultivated wisdom that empowers one to make choices consistent with the good life [33]. Therefore, another way of reconstructing empathy in engineering is to define empathy as a form of professional excellence in engineering. This construct is compatible with recent scholars' work in developing a systematic language for empathy in engineering. Walther et al. proposed a comprehensive framework that articulates empathy in engineering as "a teachable and learnable skill, a practice orientation, and a professional way of being" [27]. According to this proposal, empathy describes both the skillset and the outlook of an excellent engineer, and like other virtues, it can be cultivated through education. Furthermore, Walther et al. argued that comprehensive integration of empathy in engineering would help enhance social justice, peace, and sustainability, goals that are connected with the good life in virtue theory.

Conclusion

This paper begins with the following motivating question: given the rich insights into empathy in philosophy and psychology literature, why do discussions of empathy in engineering education seem to focus narrowly on the marketing-based concept of "empathic design?" Taking a genealogical approach, I trace the discursive presence of "empathy" in engineering education. A preliminary survey of the ASEE annual conference proceedings indicates that engineering educators adopted the concept empathy primarily as a data collecting technique, and empathy was recommended as a solution to a widening gap of understanding between engineering designers and their users. A genealogical reading of empathy in engineering also reveals engineers' attempt to shift their professional identity from pure technical problem solvers to more holistic experts who can play leading roles in meeting complex sociotechnical challenges. In contrast to the objective of broadening engineers' professional identity, the discourse of empathy in engineering has subscribed to a predominantly instrumentalist paradigm, one that accentuates empathy as a depersonalized data collecting tool in engineering design activities. This instrumentalist paradigm, drawing heavily from market research, disregards much of the past century's research about empathy in philosophy and psychology. Countering the instrumentalist paradigm, recent works on "empathic engineering" suggest possibilities of reworking empathy as a more comprehensive and relevant framework to engineering competence, which encompasses engineers' moral and communicative development. In line with the proposal of empathic engineering, this paper suggests two possible ways of reframing empathy in the engineering context: empathy as a commitment to understanding and communicating, and empathy as an engineering excellence.

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