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ORIGINAL RESEARCH/SCHOLARSHIP

Towards a Psychologically Realist, Culturally Responsive Approach to Engineering Ethics in Global Contexts

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Abstract
This paper describes the motivations and some directions for bringing insights and methods from moral and cultural psychology to bear on how engineering ethics is conceived, taught, and assessed. Therefore, the audience for this paper is not only engineering ethics educators and researchers but also administrators and organizations concerned with ethical behaviors. Engineering ethics has typically been conceived and taught as a branch of professional and applied ethics with pedagogical aims, where students and practitioners learn about professional codes and/or Western ethical theories and then apply these resources to address issues presented in case studies about engineering and/or technology. As a result, accreditation and professional bodies have generally adopted ethical reasoning skills and/or moral knowledge as learning outcomes. However, this paper argues that such frameworks are psychologically "irrealist" and culturally biased: it is not clear that ethical judgments or behaviors are primarily the result of applying principles, or that ethical concerns captured in professional codes or Western ethical theories do or should reflect the engineering ethical concerns of global populations. Individuals from Western educated industrialized rich democratic cultures are outliers on various psychological and social constructs, including self-concepts, thought styles, and ethical concerns. However, engineering is more cross cultural and international than ever before, with engineers and technologies spanning multiple cultures and countries. For instance, different national regulations and cultural values can come into conflict while performing engineering work. Additionally, ethical judgments may also result from intuitions, closer to emotions than reflective thought, and behaviors can be affected by unconscious, social, and environmental factors. To address these issues, this paper surveys work in engineering ethics education and assessment to date, shortcomings within these approaches, and how insights and methods from moral and cultural psychology could be used to improve engineering ethics education and assessment, making them more culturally responsive and psychologically realist at the same time.

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Keywords Global engineering ethics · Moral psychology · Culture · WEIRD · Ethical reasoning · Moral intuitions

Introduction

Engineering ethics has typically been conceived and taught as a branch of professional and applied ethics with pedagogical aims, where students and practitioners learn about professional codes and ethical theories, and then apply these to address issues presented in cases studies about engineering and/or technology (Hess & Fore, 2018; Van Grunsven et al., 2021; Zhu et al., 2022a, 2022b). As a result, accreditation and professional bodies have generally adopted ethical reasoning and moral knowledge as learning outcomes (ABET, 2016; "Washington Accord: 25 years 1989–2014," 2014). However, this paper argues that such frameworks have serious limitations, since they are based on psychologically "irrealist" and culturally biased assumptions. Specifically, it is not clear (1) that ethical judgments or behaviors result from applying principles, or (2) that ethical concerns captured in professional codes or ethical theories reflect the engineering ethical concerns of global populations. (For explanations and clarifications regarding the use of "ethics," "morality," and "global (engineering ethics)," and their variants throughout this paper, please see the section "Terminology Chosen" below.)

Efforts have recently been made to address both problems. These have consisted in making engineering ethics (1) more culturally responsive, including more geographically, culturally, and conceptually diverse cases studies, non-Western ethical theories and perspectives, and gameplay, for example (Clancy & Zhu, 2022; Harris et al., 2018; Luegenbiehl & Clancy, 2017; NASEM, 2016; Van Grunsven et al., 2021; Verharen et al., 2021; Wong, 2021; Zhu, 2020), and (2) more psychologically realist, building up research paradigms and educational approaches based on empirically informed, psychological insights and theories (Beever & Pinkert, 2019; Clancy, 2020; Frey, 2010; Gelfand, 2016; Han et al., 2018; Hess et al., 2019; Kim, 2022; Roeser, 2018; Walker, 2019).

To strengthen these efforts, these two lines of work should be brought together. Cultural responsiveness should go together with psychological realism. This would consist in integrating empirical insights and methods from the behavioral and social sciences—moral and cultural psychology, anthropology, and sociology—regarding how culture affects those working in and affected by engineering and technology. The claim here is not that a psychologically realist perspective should replace other theoretical frameworks. Rather, we hope that it can supplement and support other frameworks, perspectives, and work. As such, the audience for this paper is not only engineering ethics educators and researchers but also administrators and organizations. Researchers, educators, administrators, and organizations could all benefit from an empirically informed, culturally responsive approach to engineering ethics.

To support this claim, address these problems, and develop an alternative, this paper is divided into three parts. First, it explains how the mainstream of engineering ethics education and assessment to date have been psychologically irrealist: Neither ethical judgments nor moral behaviors are simply the result of reflectively applying principles. Rather, judgments also involve intuitions, closer in nature to emotional than rational thought (Greene, 2014; Haidt, 2001, 2012), and behaviors are affected by myriad, unconscious, social, and environmental factors (Bazerman & Tenbrunsel, 2012; Doris, 2005). Next, this paper explains how engineering ethics education and assessment have been culturally biased: they have originated from and been developed in mostly WEIRD (Western educated industrialized rich democratic) cultures (Clancy & Zhu, 2022; Davis, 1995; Luegenbiehl & Clancy, 2017; Van de Poel & Royakkers, 2011) but, relative to global populations, individuals from WEIRD cultures are psychological and social outliers, concerning self-concepts, thought styles, and ethical reasoning (Cohn et al., 2019; Feinberg et al., 2019; Henrich et al., 2010; Nisbett, 2010). Finally, it goes on to describe what it would take to make global engineering ethics education more psychologically realist and culturally responsive: the field must engage with insights from and methods associated with a growing body of interdisciplinary work associated with empirical moral and cultural psychology.

Terminology Chosen

Throughout this paper, we use the terms **"ethics"** and **"morality"** (and their variants) interchangeably, referring to conceptions of right and wrong—what should and should not be done and why—in the broadest possible sense. This is somewhat idiosyncratic, since **"normative"** and **"normativity"** are typically used to refer to such considerations. These terms come from **"norms"**—rules about what people are required to do or refrain from doing—and have a broader denotation than "ethics" or "morality." "Normative" and its variants can refer to matters of **"convention," "laws,"** and **"legality,"** in addition to ethics and morality (Kelly & Setman, 2020). This broadened understanding of ethics and morality in the context of global engineering is important for two reasons: (1) technical standards in engineering without any obvious ethical import could, in fact, have wide-ranging ethical implications, since the behaviors of engineers and work of engineering is involved in all facets of the modern-day world, with tremendous potential ramifications (Davis, 2021a, 2021b; Stappenbelt, 2013); (2) although all cultures have norms and recognize a normative domain, not all of them have distinctly ethical or moral norms, or recognize a distinctly ethical or moral domain within that of the normative domain more broadly (Machery, 2012). As a result, on might wonder about the reason to continue using the terms "ethics" and "morality" in these contexts. A full consideration of this point would lead beyond the scope of the present paper, but, at present, one of the best reasons to continue using these terms is convention.

We use the expression **"global engineering ethics"** throughout this paper, although the expression is ambiguous and potentially confusing. Breaking it down, we use **"engineering"** to refer to the employment of technology to address concrete human concerns, such that **"global engineering"** would refer to the ways that people do this differently, in different parts of the world, depending on their environments, cultures, and the interplay between the two. Regarding this understanding, we feel it is important to highlight two main points. The first is the fact that we understand "engineering" as consisting in the application of technology, rather than as the application of science. Whereas the development and use of technology among people is relatively ancient and cross-cultural, the development of science is a more recent phenomenon, and its development has been largely confined to a few cultures (Richerson & Christiansen, 2013). Additionally, technology need not and has not always depended on science. For instance, there are examples of technology providing the impetus for scientific insights (Dusek, 2006). We feel that this understanding and distinction is important because of the cross-cultural nature of engineering. Specifically, an understanding of engineering as applied science only makes sense in limited cultural and historical contexts, while people throughout the world do and always have engaged in what we term "engineering." Obviously, this raises the question of what constitutes "technology," or charges that we use "engineering" too broadly, but a full consideration of this point would lead beyond the scope of the current article. The interested reader is encouraged to consult (Dusek, 2006; Martin et al., 2023). The second main point we wish to highlight is the intrinsically ethical nature of engineering on this understanding. Insofar as engineering is about the application of technologies to address concrete human concerns, it always involves—if only implicitly—normative judgments and behaviors regarding what constitutes a concern, which concerns should be addressed, and how these concerns should be addressed.

How Has Engineering Ethics Been Psychologically Irrealist?

"Psychological irrealism" is used here to refer to assumptions about how individuals and groups understand and enact conceptions of right and wrong, which are suspect or incorrect.[1] These assumptions are often foundational to normative ethical theories—in other words, claims about how people *should* think about or behave are based on (often implicit) assumptions about how they *do* think and behave—such that were these assumptions incorrect or suspect, it could call into question the theories on which they are based (Doris, 2005; Kumar & Campbell, 2012; Tiberius, 2015). For example, views about the ways that virtues affect behaviors are based on assumptions about the nature of character traits and their influences on behaviors, even if only implicitly. In the Chinese philosophical tradition, different ethical systems and normative claims in the work of Mengzi and Xunzi are explicitly based on descriptive claims and assumptions about the goodness and badness of human nature (Ivanhoe et al., 2005).

Although engineering ethics has made strides in adopting novel research paradigms and developing innovative pedagogies, the field began, has evolved, and remains primarily a branch of professional and applied ethics. This results in two distinct yet related sets of problems, stemming from (1) psychologically irrealist

[1] The use of this terms is somewhat idiomatic to the nature of the discussion here. It should not be mistaken with the use of this term in the work of Nelson Goodman or similar notions, such "anti-realism" (Goodman, 1978).

assumptions in general and (2) the nature of engineering ethics specifically—each of which are further discussed, in turn, below. Instead of designing interventions based on how people actually think and behave, mainstream approaches to engineering ethics tend to assume people are rational, autonomous moral agents and, therefore, automatically know how to and do behave ethically if taught moral knowledge and ethical reasoning skills (Zhu & Jesiek, 2017).

Motivating Engineering Ethics Assessment

Since engineering affects billions of lives and involves trillions of dollars, ethics has been recognized as increasingly central to engineering, evident in licensing and accreditation guidelines (ABET, 2016; Shuman et al., 2005; "Washington Accord: 25 years 1989–2014," 2014). Therefore, organizations must demonstrate that students and practitioners have acquired certain knowledge and are proficient in given skills, necessitating forms of assessment. Identifying and administering forms of assessment have generally fallen to engineering educators. Although engineering ethics educators increasingly come from fields such as philosophy, psychology, and elsewhere, at least in the US, most of those responsible for teaching and assessing engineering ethics are engineering faculty.[2] Although proficient in engineering disciplines, such educators often lack the training necessary to effectively develop, deliver, and assess ethics training. As a result, assessment efforts have sometimes taken the form of one-off, ad hoc exercises, the results of which are difficult to interpret, providing marginal insights into the effects of educational interventions, either largescale or long-term trends.[3] In other instances, educators have used instruments developed by the educational and social sciences, or altered these instruments, critically addressing the contexts in which they were developed to make them suitable to engineering ethics education assessment specifically (Borenstein et al., 2010; Drake et al., 2005; Hamad et al., 2013; Haws, 2001; Hess et al., 2019; Loui, 2005; Self & Ellison, 1998; Troesch, 2015; Zhu et al., 2014b). These include the ESIT (engineering and science issues test) and EERI (engineering ethical reasoning instrument),

[2] The situation is somewhat different in continental Europe, where engineering/technology ethics education tends to be developed and delivered by philosophers in conjunction with engineering faculty. See (Taebi & Kastenberg, 2019; Van de Poel et al., 2001; Van Grunsven et al., 2021) for discussions of paradigmatic examples at the Delft University of Technology, the Netherlands. Variants of this approach have been adopted and adapted by other technical universities.

[3] The authors prefer not to alienate individuals/teams with specific citations. The interested reader is encouraged to attend any session of the Ethics Division of the American Society for Engineering Education or peruse its proceedings over the last ten years. To support the claim ethics interventions were successful, student and instructor reflections abound, along the lines of "Students seemed to get a lot out of the course!" and "I liked the teacher and think I understand ethics now." One has a difficult time imagining statements of this type being marshalled to support purported progress in reading or mathematics proficiency, that students' claims they now understand math better at the end of a semester would count towards the success of this course. (Mulhearn et al., 2017; Mumford, Steele, & Watts, 2015; Steele et al., 2016; Watts, Medeiros, et al., 2017a, 2017b; Watts, Todd, et al., 2017a, 2017b) provide excellent, recent reviews of work in assessment, although much of this work and these materials fall under the purview of responsible conduct in research and science ethics education more broadly, rather than engineering ethics specifically.

which are based on the DIT2 (defining issues test version 2) (Borenstein et al., 2010; Zhu et al., 2014b). The DIT2 and DIT have been the most widely used standardized instruments for assessing applied and professional ethics education to date.

Applied and Professional Ethics, and Moral Psychology

The DIT is a neo-Kohlbergian instrument, based on the work of developmental psychologist Laurence Kohlberg (Rest et al., 1999a, b, 2000). According to Kohlberg, humans develop through different levels of moral reasoning, the preconventional, conventional, and postconventional (Kohlberg, 1981). To assess this development, participants are presented with ethical dilemmas and asked about their reasons for choosing different courses of action (Kohlberg, 1984). The kinds of answers participants give indicate their levels of ethical development. Reasons based on self-interest are associated with preconventional reasoning. Those related to social order belong to conventional reasoning. Reasons based on principles of justice are associated with postconventional reasoning. However, few participants reach the highest stages of postconventional reasoning and the theory is biased against women (Gilligan, 1982; Muuss, 1988). Additionally, the dilemmas are administered and assessed in interviews, making the assessment and administration difficult.

As a result, James Rest and colleagues developed the DIT and corresponding four-component model/schema theory of ethical behaviors (Bebeau, 2002; Rest et al., 1999a, 1999b; Rest et al., 1999a, 1999b). On this view, rather than levels into and out of which individuals pass throughout their development, the preconventional, conventional, and postconventional are different contemporaneous "schema," ways of thinking about and resolving normative dilemmas (Narvaez & Bock, 2002; Rest et al., 1999a, b, 2000). The contemporaneous nature of schema are influenced by the work of developmental psychologist Eliot Turiel (Turiel, 1977, 1983).

The DIT and DIT2 include five dilemmas followed by considerations representative of different schema, as well as a nonsense category, to ensure participants are paying attention and answering in earnest. Based on how participants score these considerations, researchers can determine the ethical development of participants, the extent to which they reason in a postconventional manner, relative to conventional and preconventional reasoning. Versus Kohlberg's initial work, results of research using the DIT and DIT2 found no evidence of a bias against women. Nevertheless, this instrument and framework are based on problematic moral psychological assumptions. Although the DIT should not be understood as a proxy for moral development, on this view, ethical behaviors result from moral motivations, reasoning, and sensitivity, where judgments (resulting from the application of principles) in reasoning are the most important part (Bazerman & Tenbrunsel, 2012; Bebeau, 2002). These contribute to moral character. However, as was mentioned above, there are good reasons for thinking these assumptions are false.

A growing body of work has found that ethical judgments are also the result of intuitions, closer in nature to emotions than reflective, rational thought, and behaviors are affected by unconscious, environmental factors (Bazerman & Tenbrunsel, 2012; Doris, 2005; Greene, 2014; Haidt, 2012; Levy, 2009). If the ability to reason ethically resulted in more ethical behaviors, then professional ethicists—arguably the most skilled in ethical reasoning—would behave the most ethically, but previous research has consistently failed to find evidence to support this assumption (Schönegger & Wagner, 2019; Schwitzgebel & Rust, 2014). Although research has found evidence of a positive relation between ethical reasoning and behaviors, the nature of this relation is unclear, since previous work has also found evidence of a positive relation between ethical reasoning and unethical behaviors.

For example, to explore the relation between ethical reasoning and behaviors, Lawrence Ponemon had participants complete the DIT and play a cooperation game (Ponemon, 1993). He found that participants with relatively low *and* high levels of ethical reasoning were the least likely to cooperate. This study was later replicated and its results reproduced (Bay & Greenberg, 2001). Unfortunately, little work has explored the relation between ethical cognition and behaviors. More work has explored ethical cognition than behaviors, likely because ethical reasoning and moral judgments are easier to study in controlled settings than ethical behaviors (Clancy & Zhu, 2023; Ellemers et al., 2019; Villegas de Posada & Vargas-Trujillo, 2015). Just as work in moral psychology calls into question the assumptions on which ethics in general is based, so too does it undermine those of engineering ethics specifically.

Engineering Ethics and Moral Psychology

Given the prestige of the medical profession and maturity of medical ethics education, aspects of engineering ethics have been modelled on medical ethics (Barry & Ohland, 2009; Luegenbiehl & Clancy, 2017; Newberry et al., 2011). This includes the centrality of "informed consent" and the individualist, cognitivist assumptions about decision-making and ethics on which this centrality is based (Zhu & Jesiek, 2017). However, these assumptions are ill suited to the field of engineering.

Engineers typically work as small parts of large projects and are influenced more by corporate/community norms than professional codes (Smith et al., 2021), and they rarely deal with stakeholders in a one-on-one fashion, as is the case with doctors and medical professionals. As a result, it is more difficult to discern the effects of engineering work on different stakeholders, as well as attribute the social and ethical responsibilities of engineering work to individual engineers. This is increasingly true, given the global nature of engineering and technology, where the consequences of engineering are diffuse in space and time (Clancy & Zhu, 2022; Zhu, Martin, et al., 2022a, 2022b). Since engineering and technology span different cultures and countries, they involve different, potentially competing technical regulations and cultural values. It becomes more and more difficult—and sometimes impossible—to assign responsibility in situations such as these, a problem known as one of "many hands" or "responsibility gaps" (Santoni de Sio & Mecacci, n.d.; Van de Poel et al., 2015).

Additionally, notions of responsibility vary by cultural groups (Feinberg et al., 2019). Matters of "right" and "wrong" within engineering can be much different from commonsense understandings of the terms. For instance, lifelong learning and performing within one's area of expertise are of paramount importance to "ethical engineering" specifically although not "ethics" in general (Stappenbelt, 2013). Thinking or talking about "ethical engineering" in general can be difficult.

In the first place, this results from myriad differences in the responsibilities of and practices in engineering disciplines. For example, civil and computer engineering share little in the way of professional practices or technical competences. Aside from their applied ambitions and placement within colleges of engineering or universities of science and technology, there is little that unites them as disciplines. Consequently, what it would mean to be "ethical" within civil engineering is very different from what this would mean in computer engineering, from the kinds of issues one would expect to face to the ways one should deal with these issues. Unlike "health," which is a relatively unified notion—although it differs by culture (Leeman et al., 2011)—identifying an ultimate goal that all branches of engineering share, which could be used to unite them—and on which an ethics could be based—is contentious. This approach has been termed the "functionalist" method, but there are reasons for thinking it is problematic (Clancy & Zhu, 2022).

To address this concern, some programs have specialized their engineering ethics curricula, developing ethics education adapted to different areas of and foci within engineering, for example, data science, research integrity, mechanical and electrical engineering (Cao, 2015; Fan et al., 2015; Taebi & Kastenberg, 2019; Van de Poel et al., 2001; Van Grunsven et al., 2021; Zhu, 2010). However, as students in general and engineering majors in particular tend not to work in their specific fields of studies, this raises the question of how specialized engineering ethics should be.

A second reason that conceiving of ethical engineering can be difficult is the intrinsically novel natures of engineering and technology. Technology and engineering change the material worlds and social environments in which they occur, making it difficult to identify and address the kinds of ethical challenges engineers will encounter and need to address (Latour, 1988). Technologies often have unintended consequences and have been used in ways different from those intended. Issues associated with this problem have been explored in terms of the "engineering as experimentation" paradigm (Van de Poel, 2017; Zhu, Martin, et al., 2022a, 2022b). Finally, from the perspective of ethics, there are reasons for thinking the ways engineering has been conceived, taught, and practiced are problematic.

Even when controlling for nationality and religious orientation, engineering students are more likely to become terrorists (Gambetta & Hertog, 2016). Students majoring in engineering report higher rates of dishonesty than those majoring in the humanities or social sciences (Harding et al., 2007; McCabe & Trevino, 1997). In that work, to control for the effects of self-selection—that students who tend towards dishonesty are not more likely to become engineering rather than the humanities or social sciences majors—students were also asked to report rates of cheating in high school. Although rates of reported cheating in high school were not different among majors, those in college and university were. Similarly, after four years of engineering education, Erin Cech found that students are less socially engaged (Cech, 2014).

In the last twenty years, considerable efforts have been made to improve engineering ethics education in the US (Hess & Fore, 2018; NASEM, 2016). The results of these efforts are mixed. On the one hand, a meta-study assessing the effects of ethics education for researchers and scientists—although not engineers specifically—pre- versus post-2000 provides evidence supporting gains, that efforts have been successful (Watts et al., 2017a, 2017b). On the other hand, initial results of a study reproducing Cech's work found that engineering students today are no more engaged socially than they were when she first carried out that work, questioning the success of these efforts (Zhu et al., 2022a). Scholars have offered different related explanations for what Cech terms a "culture of disengagement."

As a profession, engineering is unrepresentative of national and global populations (Slaton, 2015). Since engineering is evermore global in nature—a point to which we return below—stakeholder concerns are underrepresented within the profession. Meritocratic ideologies characterize engineering, and these ideologies negatively affect the wellbeing of marginalized groups (Cech, 2013). In turn, this likely affects "depoliticization" within the profession, the illusion that engineering is about technical knowhow alone (Leydens & Lucena, 2021).

All these problems, we would argue, are related to psychological irrealism—suspect or incorrect assumptions about how individuals and groups understand and enact conceptions of right and wrong. Culture is central to these tendencies, the ways that cultural biases effect ethical assumptions and conceptions.

How Has Engineering Ethics Been Culturally Biased?

"Culturally biased" refers to unjustified (sometimes unconscious) assumptions about how individuals and groups conceive of themselves and the world, which are affected by social information transmitted in and through behaviors, that make long-term differences to behaviors.[4] Checking these assumptions is important since, as was mentioned above, (1) individuals and groups belonging to WEIRD cultures are rarely representative of global populations, and (2) engineering and technology are more global, cross-cultural and international, than ever before.

First, whereas individuals from WEIRD cultures, and those who identify as politically liberal, conceive of ethics primarily in terms of care and fairness/autonomy, those from non-WEIRD populations, and individuals who identify as politically conservative, conceive of ethics in broader terms, including concerns about loyalty, adherence to authority, and sanctity/divinity (Graham et al., 2009; Graham et al., 2011; Haidt, 2012; Kim et al., 2012; Shweder et al., 1997; Zhang & Li, 2015). These likely result from more basic differences in thought styles and self-concepts: whereas individuals from WEIRD cultures tend to conceive of themselves in *independent* terms, as self-standing entities that incidentally enter into relationships with others, individuals from

[4] This is based on an account of culture outlined in (Ramsey, 2013), which is one of the most comprehensive and systematic to date, taking into account anthropological, sociological, biological, psychological, and philosophical perspectives/positions. What it would mean for assumptions to be "justified" is, of course, vague. As the following attempts to make clear, many very natural, seemingly intuitive assumptions about oneself and the world are, in fact, cultural in nature. For fuller, enlightening accounts, see (Henrich, 2015b) and (Richerson & Boyd, 2005). Here we hope to convey the importance of checking one's assumptions, especially if one comes from and/or has been raised in a WEIRD culture.

non-WEIRD cultures tend to conceive of themselves in *interdependent* terms, comprised fundamentally by their social relations (Markus & Kitayama, 1991). This distinction mirrors that between the thought styles of analytic versus wholistic, where wholistic thought tends to view the world in terms of fluid relations, while analytic thought tends to conceive the world in terms of rigid categories (Nisbett, 2010). These roughly correspond to—but are nevertheless distinct from—the better-known individualistic-collectivist distinction, which refers to different kinds of values (Triandis, 1995). Despite their peculiarity, individuals from WEIRD cultures are overly represented in psychological and behavioral scientific research and exercise undue influence in the development of global policies, including those related to engineering, technology, and education.

Despite the fact engineering is increasingly global—evident in the rise of multinational corporations, international supply chains, and educational and technology exchanges (Luegenbiehl & Clancy, 2017)—engineering ethics began in the US and has evolved in the Western world (M. Davis, 1995; Van de Poel & Royakkers, 2011). Therefore, engineering ethics includes characteristics that make it potentially ill-suited to the non-Western world, including its applied and professional natures (Didier & Derouet, 2013; Iseda, 2008; Luegenbiehl & Clancy, 2017; Van de Poel & Royakkers, 2011). Non-Western countries have different material circumstances, cultural values, and technological regulations, reflected in professional codes and accreditation guidelines (Ahmed et al., 2017; AlZahir & Kombo, 2014; Luegenbiehl, 2004; Zhu et al., 2014a). In recent years, work has attempted to address some of these issues.

This has included attempts to make engineering ethics less biased and more inclusive by (1) identifying and focusing on common denominators across national and cultural groups—for example, developing "global" codes and identifying common professional expectations (the "functionalist" approach, mentioned above, belongs to these efforts) (Davis & Zhang, 2017; Luegenbiehl, 2010)—and (2) including more contents specific to national and cultural groups—for instance, geographically and culturally diverse case studies and ethical theories (Luegenbiehl & Clancy, 2017; Van de Poel & Royakkers, 2011). The former represent "universalist" approaches, where engineering ethics would be the same regardless of national or cultural contexts, whereas the latter represent "particularist" approaches, where engineering ethics is "particularized" for different national and cultural contexts (Clancy & Zhu, 2022). However, as Charles Ess has rightly noted, each approach has its risks: universalist approaches risk "homogenization," excluding relevant differences, and particularist approaches risk "balkanization," overlooking relevant similarities (Ess, 2006). Steering a course between these two risks requires cultural responsivity, based on psychological realism.

How Can Engineering Ethics Become Psychologically Realist and Culturally Responsive?

As was mentioned above, engineering ethics must develop a more culturally responsive perspective, and it can only do so by becoming psychologically realist. This is because culture affects assumptions about and conceptions of ethics, and a culturally responsive approach to ethics needs to build on empirical evidence regarding *how people in particular communities actually think, behave, and interact*. For instance, it is unclear whether engineering ethics educators should adopt particularist or universalist perspectives mentioned above, whether developing educational curricula and materials based on common cultural denominators (universalist) or culturally tailored materials (particularist) materials would be more effective. Answering such questions cannot be done through theoretical reflection and philosophical speculation alone.

Attempts at cultural responsivity without psychological realism easily result in odious forms of orientalism, where cultural caricatures are used in attempts at cultural responsivity (Slingerland, 2018). For example, to understand and respond to stakeholder perspectives in China, one cannot rely on hackneyed appeals to "Confucian values." It is necessary to understand what Chinese people think and how they behave regarding engineering, technology, and ethics. Addressing this problem requires that research in and education on engineering ethics becoming more theoretically nuanced and empirically informed. This necessity applies to all fields of engineering ethics education, not only assessment. It requires empirically informed engineering ethics research and education.

Empirically informed engineering ethics research and education are especially important, since interdisciplinary research in the social and behavioral sciences has resulted in the relatively counterintuitive findings about moral judgments and ethical behaviors discussed above. Philosophical speculation is not always a reliable guide to truths regarding human behaviors (Machery, 2017; Schwitzgebel & Cushman, 2015), but could become more reliable if supported by empirical research.

Engineers tend to receive extensive training in mathematics, the "hard," and engineering sciences, leaving less room in curricula for integrative subjects related to the critical and cultural aspects of technology and engineering, on which US higher education and a morally and politically engaged citizenry are supposed to be based (Mcavoy et al., 2019; Sant, 2019). Ideologies central to engineering—such as meritocracy, technocracy, and socio-technical dualism—could result in engineers considering the technical dimensions of engineering as *separate from* and *superior to* their social dimensions, including ethics (Cech, 2013; Slaton, 2015). Those trained in technical matters alone are ill-suited to addressing human-centered problems, as a result of which work on engineering ethics education must further engage with insights and methods from the empirically informed humanities and social sciences, especially including more culturally diverse theoretical frameworks.

Such frameworks have begun to make their way into engineering ethics, moving away from an exclusive use of and focus on neo-Kohlbergian paradigms and Western ethical theories, some of which are mentioned above. However, these tendencies must expand and deepen, taking place in tandem with empirical investigation. This would include studying and attempting to understand the relative contributions of different virtues, judgments, values, attitudes, and even environmental and political contexts to engineering-related behaviors. For instance, simply because insights from positive psychology ostensibly support virtue-ethical, moral psychological assumptions (Frey, 2010; Han, 2014) does not mean that including virtue ethics in curricula will improve engineering ethics. It might be the case that classes on engineering ethics are minimally impactful, that they do little to change minds or behaviors. As a result, it might make more sense to fulfill engineering ethics-related learning outcomes through community engagement and service-learning projects, for example, developing skills in stakeholder engagement to learn from the communities with which engineers are working to identify, develop, and implement solutions appropriate to those groups (Leydens et al., 2022).

There is limited empirical evidence regarding how particular ethical theories within educational curricula affect students from diverse national and cultural backgrounds, with different professional identities (Borenstein et al., 2010; Canary et al., 2012), as well as how these effects might differ based on these backgrounds and identities. One of the benefits of a psychologically realist perspective is the recognition that WEIRD individuals, societies, and cultures are psychological and social outliers, based on large-scale, long-term, cross- and multi-cultural research. Ultimately, this recognition and these findings could help to serve the decolonization of engineering education and practice. An example of this approach—applying a psychologically realist, culturally responsive approach to engineering ethics education and assessment—is "Global Engineering Ethics" (GEE), a course on engineering ethics taught at the University of Michigan-Shanghai Jiao Tong University Joint Institute (UM-SJTU JI).

The UM-SJTU JI is a US-Chinese educational institution based in the Minhang campus of Shanghai Jiao Tong University (SJTU), a premiere Chinese Engineering and Science University. Although the UM-SJTU JI is based in China and the result of a US-Chinese partnership, students and faculty who study and teach there come from and go on to study and work all over the world. As a result, GEE cannot be based on the specific technical standards, national laws, or cultural values of any one country or cultural group. Instead, it must be based on the characteristics of engineering in general and "normative standards"[5] common to many countries. These include (1) the nature of engineering and role responsibilities of engineers, (2) the use of reason to perform engineering work, and (3) a pluralistic versus monistic conception of ethics, where ethics is about many things rather than only one. To do so, the course supplements the rationalist Kohlbergian framework described above with social intuitionist work from Moral Foundations Theory (MFT).[6]

Further research should explore different, more specific forms of technology-ethical reasoning—for instance, regarding AI or robotics (Ghotbi & Ho, 2021)—and use more culturally representative, empirically supported paradigms of decision-making. Morality as Cooperation and paradigms assessing meta-ethical judgments are especially apt, since they are empirically supported and culturally diverse (Curry et al., 2019; T. Davis, 2021a, 2021b; Levine et al., 2021). Finally, research and education must move beyond ethical knowledge and judgments alone.

As was mentioned above, ethical knowledge and judgments have been the focus of research within moral psychology, since they are easier to study than behaviors.

[5] For an explanation of why the use of "normative standards" is more appropriate than "ethics" or "morality," see the section "Terminology Chosen" above.

[6] See (Clancy, 2021, 2022; Clancy & Zhu, 2024; Luegenbiehl & Clancy, 2017) for more on this work.

However, there are good reasons for thinking ethical behaviors should be the ultimate goal of engineering ethics education and focus of research (Clancy & Zhu, 2023). In recent years, work in evolutionary anthropology, social psychology, and behavioral economics has resulted in systemic, empirically supported theories of norms, explaining how and why people behave the ways they do (Bicchieri, 2016; Gelfand, 2018; Henrich, 2015b). This is important, since individual knowledge, judgments, preferences, beliefs, and values say very little about how and why people behave the ways that they do, especially outside WEIRD populations (Kanovsky et al., 2016; Knafo et al., 2009). Rather, behaviors are based on "norms," implicit and explicit rules about which kinds of behaviors are obligatory or prohibited, enforced through social dynamics (Henrich, 2015a; Sripada & Stich, 2007). Using these theoretical paradigms and (quasi-)experimental protocols in work on engineering ethics could begin to bridge the gap between behaviors and other, more studied factors, such as knowledge, judgments, and so on.

This would include using insights and methodologies from the behavioral and social sciences more broadly—including anthropology, sociology, and economics—not only (moral) psychology. Indeed, as a field psychology has been slow to acknowledge and study the importance of culture (Heine, 2016; Henrich, 2020). More ethnographic and qualitative research in engineering ethics education would be welcome, due in part to the complexity of studying ethical engineering. Findings are better supported when using mixed methods research, especially in cross-cultural contexts (Hwang, 2012; Nisbett, 2010).

Conclusion

Engineering ethics began in the US and has evolved as a branch of professional and applied ethics. As a result, engineering ethics education, assessment, and research are poorly suited to the increasingly global, cross-cultural and international, nature of contemporary engineering and technology. To address these challenges, engineering ethics must become more psychologically realist and culturally responsive, and these two tendencies must go together. Insofar as engineering ethics has focused on the moral knowledge and judgments of an exceedingly small percentage of the global population, it has been both culturally biased and psychologically irrealist. To correct for these tendencies, engineering ethics must employ more diverse theoretical paradigms and research protocols.

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