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## **Ethical Reasoning, Moral Intuitions, and Foreign Language in Global Engineering Education [Global Engineering Ethics Education]**

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# Foreign Language, Ethical Reasoning, and Moral Intuitions in Global Engineering Ethics Education [Global Engineering Ethics Education]

## 1 Introduction

Ethics has been widely recognized as essential to effective engineering, highlighting the importance of ethics education to engineering curricula [1], [2]. However, developing and delivering effective engineering ethics education is difficult, given the increasingly global environments of contemporary engineering.

In contemporary engineering, people from different places and backgrounds are studying and working together as never before [3]. National and cultural backgrounds can affect understandings of appropriate conduct within engineering [4]–[6], as well as conceptions of right and wrong in general [7], [8]. Further, while much of the research on engineering ethics education in the US has focused on ethical reasoning and knowledge as learning outcomes [9], it is unclear whether ethical reasoning or knowledge results in moral judgments or behaviors [10]–[12], or whether engineering ethical reasoning is the same across different national and cultural groups [13]. In addition to national and cultural backgrounds, research has found that foreign language affects ethical reasoning and moral intuitions [14].

Research has found that people are more likely to endorse ostensibly disgusting behaviors, such as drinking “recycled” water, in a foreign than a native language [15]. Studies have also found that participants are more likely to endorse sacrificial judgments in a foreign than a native language, specifically, judging that it is morally permissible to push a large person off a bridge to save others in footbridge dilemmas – although foreign language does not affect judgments about trolley-car dilemmas [16].<sup>1</sup> Although research on the ways foreign language affects moral intuitions is minimal, one study found that participants moralized behaviors to a great extent in a foreign than in their native language. (“Moralized” means participants gave higher scores to behaviors they considered important when deciding whether something was right or wrong, and agreed with statements involving moral contents, in a foreign than a native language [17].)

Researchers have given three main explanations for the foreign-language effect: (1) reflective cognitive processes play a larger role when thinking in a foreign language than a native language, overriding the intuitive – but perhaps irrational – disgust/repugnance one feels at drinking “recycled” water or killing one person to save others [18]; (2) intuitive processes play a smaller role in a foreign than a native language; (3) informational encoding is language sensitive, meaning that it is easier to retrieve information in the language in which it was learned, and ethical contents would be learned in a native language [16]. The foreign language effect disappears the more fluent one is in a language [19]. To date, it is unclear which of these paradigms best explains the findings. Nevertheless, these findings have implications for the ways ethics is conceived across cultures.

It appears some issues are more central to the ethical domain/conceptions of morality than others [20]. Some judgments are more robust than others, since they are less affected by superfluous

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<sup>1</sup> See [11] for a survey of the use of such dilemmas and their results in moral psychology.

factors [17], such as language. There is not a good *de jure* reason that the language in which one thinks about ethics should affect the judgments one makes. Hence, if judgments about some ethical issues are unaffected or less affected by language, then those contents would be more central to the ethical domain. Obviously, these considerations have implications for the ways ethics is taught across countries and cultures, where languages of instruction and work can be different.

To improve ethics instruction for global engineering education, a study is being conducted exploring the development of ethical reasoning and moral intuitions among engineering students in the US, Netherlands, and China [21]. This paper reports partial, preliminary results from that larger study, regarding the effects of foreign language on ethical reasoning and moral intuitions among engineering students at universities in the Netherlands and China. Given the prevalence of global education and work, more and more people study and work in foreign languages. Understanding how foreign language affects ethical reasoning and moral intuitions can help educational institutions and employers to develop more effective ethics education and training.

## 2 Research design and methods

Participants included 47 engineering students (female = 10; mean age = 18.7) at 2 universities in the Netherlands and China, 41 participants from the Netherlands and 6 participants from China. In the Netherlands, 20 participants completed study measures in English and 21 participants completed study measures in Dutch. In China, 5 participants completed study measures in English and 1 participant completed study measures in simplified Mandarin. Participants were randomly presented with study measures in either Dutch or English in the Netherlands, and Mandarin or English in China.<sup>2</sup> Participants were asked to rate their English-language abilities on a scale of 1 to 5, with 1 being almost none and 5 being very good. The mean rating was 4.1.

Students were recruited via email by faculty members at these universities who serve as consultants on the research project. The email included a link to the survey, with a brief description of the research, confirmation of participant age, and consent to have their responses used for research purposes. This research project and its associated materials were reviewed and approved by the Colorado School of Mine's IRB. The survey consisted of four parts, the Engineering and Science Issues Test (ESIT) to measure ethical reasoning [22], Moral Foundations Questionnaire (MFQ) to measure moral intuitions [23], questions about the nature of values and ethical behaviors in engineering and technology [24], and demographic items.

The ESIT is a neo-Kohlbergian measure that asks participants to decide on considerations relevant to resolving ethical questions, as well as the most important such considerations [22]. Ethical reasoning is measured by the extent to which these considerations concern "post-conventional" reasoning, whether they concern universal principles of justice. The measure can also be used to calculate "pre-conventional" reasoning, the extent to which reasons for judgments concern oneself alone, and "conventional" reasoning, the extent to which they concern social

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<sup>2</sup> The difference in the number of participants who completed the measure in English and Mandarin results from the fact that relatively stringent criteria were used for the ultimate inclusion of participant data. See [22], [23] for criteria related to the ESIT and MFQ.

conventions and laws. A final metric, the N2 score, concerns the prevalence of post-conventional relative to the absence of pre-conventional reasoning, not only that participants make decisions based on universal principles of justice, but also that they do not make decisions based on a concern for themselves alone.

The MFQ is a measure of moral intuitions that asks participants to decide on not only considerations relevant to resolving ethical questions, but also the extent to which they agree with statements with moral content [23]. These considerations belong to one of five “moral foundations,” understandings of right and wrong driven by intuitions, closer in nature to emotions than reflective thought [25]. These include care-harm, fairness-cheating, loyalty-betrayal, authority-subversion, and sanctity-denigration, where caring for others is good and harming them is bad, behaving fairly is good and cheating is bad, and so on. Care and fairness belong to the “individuating” foundations, since they support virtues aimed at protecting the individual, and loyalty, authority, and sanctity belong to the “binding” foundations, since they support virtues aimed at binding individuals into groups [10].

To ensure fidelity in meaning between the languages, all measures were first translated from English into the target languages (Dutch and Mandarin). Those translations were then translated back into English, and then those English translations were checked against the originals. Revisions were then made to the Dutch and Mandarin translations.

It was hypothesized that participants completing study measures in English would score higher on ESIT and MFQ variables than participants completing study measures in their native language. This hypothesis was based on two sets of previous research findings. First, research has found that reflective cognitive processes play a larger role – and intuitive processes play a smaller role – when thinking in a foreign than a native language [18]. Since ethical reasoning is associated with reflective processes, one would expect higher rates of ethical reasoning when responding in a foreign language. Second, a previous research study found that participants scored higher on all MFQ variables – “moralized” more – in a foreign than a native language [17].

### **3 Results**

To test the study hypotheses, independent sample t-tests were performed to compare mean scores on ESIT and MFQ study variables in English versus Dutch and Mandarin (Table 1). Welch t-tests were used, since this test does not assume equal sample sizes or homogeneity of variance. It assumes the normal distribution of population data, but the distribution of data was not tested for normality, because of the central limit theorem and the fact that the sample size used in this study is large by convention ( $n \geq 30$ ) [26].

These results provide partial support for the study hypotheses.

Table 1 Comparison of study variables in a foreign (English) versus native language (Dutch/Mandarin)

	<u>Mean</u>		<u>Difference</u>	<u>Independent t-tests</u>	
	English	Native		<i>t</i>	<i>p</i>
<b><u>MFQ variables</u></b>					
Caring	3.15	3.03	0.12	0.51	0.61
Fairness	3.56	3.38	0.18	0.93	0.35
Loyalty	2.34	2.36	-0.02	-0.10	0.91
Authority	2.26	2.57	-0.29	-1.55	0.12
Sanctity	1.96	2.53	-0.57	-2.26	0.02**
<b><u>ESIT variables</u></b>					
Preconventional	0.12	0.16	-0.04	-0.97	0.33
Conventional	0.33	0.34	-0.01	-0.26	0.79
Postconventional	0.51	0.47	0.04	0.85	0.39
N2	3.04	2.13	0.91	1.91	0.06*

\*significant at the  $\leq 0.10$  level or \*\*  $\leq 0.05$  level

These results indicate that language affects ethical reasoning and moral intuitions, although not uniformly or in the manner hypothesized.

Scores on intuitions regarding sanctity were significantly lower at the  $\leq 0.05$  level in English than in the native languages, and N2 scores were significantly higher at the  $\leq 0.10$  level in English than in the native languages. Scores on intuitions regarding authority were lower in English than in the native languages at a level that approached  $\leq 0.10$  significance.

#### 4 Discussion and shortcomings

The results of this study indicate that foreign language affects ethical reasoning and moral intuitions in different ways. It affects ethical reasoning in the manner hypothesized, but not moral intuitions. To an extent, previous research can help to make sense of these findings.

As was mentioned, research has found that people are more likely to endorse ostensibly disgusting [15] and sacrificial behaviors in a foreign than a native language [16]. Since disgust judgements concern issues of sanctity and denigration [10], it would make sense that participants would score higher on measures of sanctity in a native than a foreign language. Similarly, since ethical reasoning – understood as the application of ethical principles to resolve issues – depends more on reflective than intuitive processes, it makes sense that people would receive higher N2 scores in a foreign than a native language.

As a result, educators must be cognizant of the fact that ethics is multifaceted. Ethics is not about any one thing. Rather, ethics is about many different things – at least care and harm, fairness and cheating, loyalty and betrayal, and so on – and people think about these differently [10], [27].

Further, as was mentioned above, some of these matters are more central to the ethical domain, the extent to which they are unaffected by superfluous factors – in this case, language [17], [20].

In this study, language affected judgments regarding loyalty, care, and fairness less than those regarding authority and sanctity. These results seem to support the conclusion that judgments about loyalty, care, and fairness are more central to the ethical domain, whereas those about authority and sanctity are more peripheral.

Educators should consider such findings when making decisions about the contents and form of global engineering ethics curricula. For example, because of this study, educators might expect that students have more robust intuitions about issues of loyalty and care, and less robust intuitions about issues of authority and sanctity.<sup>3</sup> Depending on what instructors hope to convey, they might spend more or less time discussing such issues and their relevance to ethical engineering.

The present study suffers from several shortcomings that will be addressed in future work. First, the analyses reported here are rudimentary in their sophistication. For instance, no attempt was made to explore the effects of foreign language or its potential interactions with other study variables. Next, this study included only two native languages, Dutch and Chinese. To further explore and better establish the results reported here, it would be necessary to include more languages. Third, the sample size of this study was relatively small. Larger sample sizes will be used in future studies, as the research associated with this study progresses. Finally, the results reported here did not control for foreign-language proficiency. As was mentioned, research has found that proficiency affects the foreign-language effect [28].

## 5 Conclusion

Ethics has been recognized as central to engineering. However, the increasingly global nature of engineering presents difficulties to developing and delivering effective ethics education, since professional engineering norms and understandings of ethics can be affected by countries and cultures, include language. Language affects how people conceive of ethics. Although scholarship in engineering education has focused on ethical reasoning, moral intuitions are as important if not more so. Accordingly, this study explored how foreign language affects ethical reasoning and moral intuitions. While foreign language resulted in significantly lower scores of intuitions involving sanctity, it resulted in significantly higher scores of measures of ethical reasoning. These results seem to lend support to previous findings that intuitive versus reflective processes play a greater role in a foreign than a native language. To better support these findings, future work will address deficiencies in the current study, including further analyses, additional languages, larger samples, and more controls.

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<sup>3</sup> See [17] for more on this.

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