Exploring the Relations between Ethical Reasoning and Moral Intuitions among First-Year Engineering Students across Cultures [Research Paper, Global Engineering Ethics Assessment]

Introduction

This paper describes some first-year results of a five-year project funded by the NSF's ER2 program. The project explores how culture and education affect the ethical reasoning and moral intuitions of engineering students. This paper describes the project and is divided in two parts. First, it begins by describing some background about this project. Second, the paper presents some first-year results.

Background: Motivation, Method, and Goals

This first section describes some of the project's background, including its motivation, method, and goals.

Motivation for this project: Ethics has long been recognized as crucial to engineering, although ethics curricula and research have tended to be developed in and by people from the US [1]–[4]. However, engineering is more cross-cultural and international than ever before, with peoples from different places studying and working together as never before [5]–[8]. As a result, and since culture affects ethics [9]–[14], it is unclear if curricula developed and research conducted in the US would be effective among non-US students and engineers. (Here the term "ethics" is used in a relatively broad sense, to refer to conceptions of right and wrong, what should and should not be done, in general, "normativity." This comes from the word "norms," referring to rules regarding what people are obliged to do or refrain from doing. This distinction is mentioned since there's increasing evidence that a concern with demarcating a specifically "ethical" or "moral" domain is a concern somewhat unique to Western, Educated, Industrialized, Rich, and Democratic (WEIRD) cultures, which are outliers on other psycho-social measures, including self-concepts, thought styles, and ethical reasoning [15]–[24].)

Method for this project: To address these issues, this project consists in assessing the effects of education and culture on the ethical perspectives of engineering students, tracking the effects of curricular and extra-curricular interventions on the ethical reasoning and moral intuitions of engineering students in the US, Netherlands, and China over a five-year period. Although ethical reasoning and moral knowledge are typically adopted as goals of professional ethics education, it is unclear that either of these result in more ethical judgments or behaviors [12], [25]–[32]. For that reason, in addition to ethical reasoning, this project assesses moral intuitions.

To assess ethical reasoning, this study uses the Engineering and Science Issues Test (ESIT), which is an engineering-and-science-specific version of the Defining Issues Test 2 (DIT2), a neo-Kohlbergian instrument to assess ethical reasoning [33]–[36].

With this instrument, participants read six ethical dilemmas related to engineering and the sciences. Then they decide on a course of action and rank twelve considerations of potential importance to their decision-making, as well as identifying the four most important considerations. Each of these corresponds to one of four categories, one nonsense category – to

ensure participants are paying attention and answering in earnest – and three "schema," ways of conceiving right and wrong, the preconventional, conventional, and postconventional [35], [37].

The preconventional consists in considerations that affect oneself, for example, being punished; the conventional consists in considerations affecting social order, such as laws and conventions; and the postconventional consists in considerations of universal concern, for instance, justice. According to this theory, postconventional reasoning is the highest, most developed form of reasoning, assessed by the P and N2 scores.

While the P score measures the prevalence of postconventional reasoning, the N2 score measures the prevalence of postconventional relative to preconventional reasoning – not only the presence of postconventional but also the absence of preconventional reasoning. Previous research using the ESIT and DIT2 has found that ethical reasoning is related to higher levels of education, US citizenship, and liberal political tendencies, raising questions about its potential biases [33], [34], [38]–[40]. As a result, we're also using a second measure to assess moral intuitions, the Moral Foundations Questionnaire (MFQ) [41].

According to Moral Foundations Theory (MFT), moral judgments are the result of intuitions, closer in nature to emotions than rational thought [11], [42]. These intuitions have evolved to address key challenges throughout our species' history, such that they are relatively universal while at the same time culturally variable. These include a concern with care, fairness, loyalty, authority, and sanctity, where caring for others would be good and harming them would be bad, behaving fairly would be good and cheating would be bad, and so on [43]. The first two are called the "individuating foundations," since they protect individuals, whereas the last three are called the "binding foundations," since they bind individuals into groups.

On the MFQ, participants read a series of statements corresponding to each moral foundation and a nonsense category – again, to ensure sufficient attention and earnest responses. For the first set of statements, participants must decide how relevant they would be when deciding whether something was right or wrong and, for the second set of statements, participants must decide how much they agree with them. The higher the average score participants give to statements corresponding to each foundation, the more intuitive and important are those types of considerations. Previous research using the MFQ has found that individuals who identify as politically liberal and those from the West tend to emphasize the individuating and deemphasize the binding foundations, whereas those who identify as politically conservative and individuals from the East tend to emphasize all the foundations [11], [41], [44]–[48]. Work using the MFQ with the DIT2 has found that an emphasis on the individuating foundations is positively related to conventional reasoning, and negatively related to both conventional and preconventional reasoning [49], [50]. (Full versions of both the MFQ and ESIT can be found in the appendix to this paper.)

Information was collected from the first cohort of first-year engineering students in the fall of 2021, from the US, Netherlands, and China. To ensure meaning, versions of the ESIT were translated and back translated into Dutch and Mandarin, and then corrected. Mandarin- and Dutch-language versions of the MFQ were taken from moralfoundations.org. Along with demographic items and open-ended questions, these were placed online. First-year engineering

students at [blinded], [blinded], [blinded], and [blinded] were recruited to complete them, through large, required courses. In total, 454 valid responses were collected – 300 male, 140 female, 7 non-binary/third gender, and 7 who preferred not to say. The mean age was 19.46 years old.

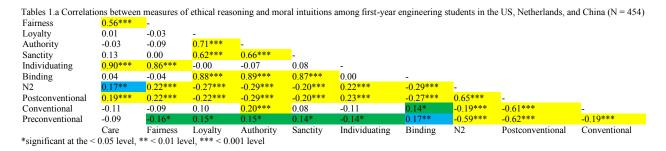
The hope is that by better understanding how moral intuitions and ethical reasoning interact, and how these are affected by education and culture, we can develop more effective, culturally responsive engineering ethics education and training [6], [51].

Ethical reasoning and moral intuitions among first-year engineering students across cultures

The second section of this paper describes some first-year results, the effects of culture on the relations between ethical reasoning and moral intuitions.

To assess relations between ethical reasoning and moral intuitions, correlations and their significance levels were calculated between scores of care, fairness, loyalty, authority, sanctity, individuating, and binding foundations on the MFQ, and N2, P, conventional, and preconventional scores on the ESIT. Since multiple comparisons were made, to reduce the probability of type I errors, the significance levels reported are the result of applying Holm-Bonferroni corrections. To compare relations between ethical reasoning and moral intuitions across cultural groups, correlations and their significance levels were calculated for each of the samples collected in the US, Netherlands, and China. The results of all scores can be found in Table 1.a, and those from the US, Netherlands, and China in Tables 1.b to d, respectively.

The following discusses findings that jump out from each of the tables, first in terms of relations between ethical reasoning and moral intuitions, and next in terms of the coherence of each instrument in relation to the different samples.

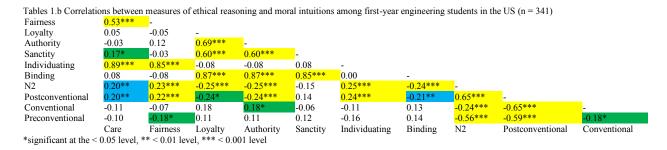


In terms of the pooled results, the individuating foundations (care and fairness) were positively related to ethical reasoning (N2 and P scores), but they were negatively related to preconventional reasoning (a concern with oneself). Similarly, the binding foundations (especially loyalty and authority) were negatively related to ethical reasoning, but they were positively related to conventional (social concerns) and preconventional reasoning. These findings are largely in lines with previous results of work using the MFQ in conjunction with the DIT2 [49], [50].

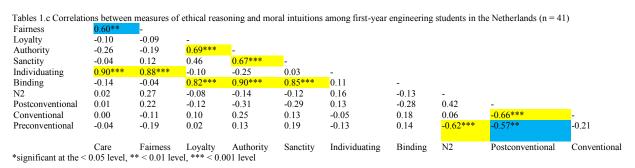
The preconventional, conventional, and postconventional schema are conceived as theoretically distinct/mutually exclusive, such that the more one relies on preconventional reasoning, for

instance, the less one relies on conventional or postconventional reasoning. Since scores of postconventional, conventional, and preconventional reasoning are all significantly negatively related to each other, with this sample, the ESIT can differentiate between these forms of reasoning, supporting the validity and use of this instrument. (If these scores were positively related, then they would not be mutually exclusive/distinct.) One could draw a similar conclusion regarding the MFQ, since scores of the individuating foundations are significantly related to each other, the binding foundations to each other, and the binding and individuating foundations are unrelated/negatively related to each other. Obviously, confirmatory factor analyses would have to be conducted, and alpha levels calculated, to further support the validity of these measures. This will be done once the sample sizes are larger.

It should also be mentioned that the sample sizes of each of the national groups are different, with 341 from the US, 41 from the Netherlands, and 72 from China. As a result, the significance levels of correlations reported across the different groups should be interpreted with care, since small differences in large samples are more likely to be flagged as significantly different from the null hypothesis – here, that there is no relation between scores of ethical reasoning and moral intuitions.

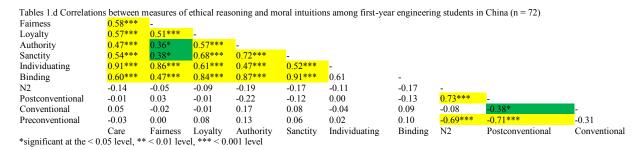


The US sample largely confirms trends in the larger sample, positive relations between ethical reasoning and the individuating foundations, and negative relations between ethical reasoning and the binding foundations. The ESIT does an equally adequate job differentiating between postconventional, conventional, and preconventional reasoning. Interesting here is a positive relation between the care and sanctity foundations. Since a concern with sanctity is typical of religious beliefs, this might be explained by the highly religious nature of the US, relative to its level economic of development [52].



Within the Dutch sample, ethical reasoning and moral intuitions were less clearly related among Dutch than US participants, especially between ethical reasoning and the individuating foundations. Negative correlations between N2 scores and the binding foundations were higher

among Dutch than US participants, although this relation was not identified as significant. Like the US sample, the ESIT could differentiate between postconventional, conventional, and preconventional reasoning. There were high correlations between both individuating foundations, but only between loyalty and authority among the binding foundations. Again, this difference might be explained with reference to high rates of religiosity in the US, relative to countries with similar levels of economic development throughout the world.



The Chinese sample is the most interesting, since there don't appear to be any relations between ethical reasoning and moral intuitions. This might be explained by the fact that ethical judgments among individuals from East-Asian cultures tend to involve lower degrees of emotion than those from Western cultures [53]. Nevertheless, the ESIT could differentiate postconventional, conventional, and preconventional reasoning. Differences between postconventional and conventional reasoning were less pronounced among the Chinese than the Dutch and US participants, perhaps supporting the claim that Confucian ethics tends towards conventional reasoning [54]. Unlike the ESIT, the MFQ seems to have done a poor job differentiating between moral intuitions among Chinese participants. All measures were highly correlated, although individuating foundations more so among individuating foundations, and the same with binding foundations.

Conclusion

This paper described a five-year study that will be carried out in the US, Netherlands, and China, exploring the effects of culture and education on the ethical reasoning and moral intuitions of engineering students. This paper was divided into two parts: It began by discussing the background of this project, including its motivation, method, and goals – its motivations concern the increasingly cross-cultural and international environments of contemporary engineering; its method consists in administering the ESIT and MFQ to engineering students in the US, Netherlands, and China over a five-year period; and its goals are to improve engineering ethics education and training. This paper moved on to talk about some first-year results, concerning the effects of culture on ethical reasoning and moral intuitions. Initial findings seem to indicate that culture affects if and how moral intuitions are related to ethical reasoning among first-year engineering students. They were most closely linked in the US, less so in the Netherlands, and not at all in China. The work reported here did not check for confounding variables – for example, the effects of professed religiosity or political orientation on the relations between reasoning and intuitions – although this is an important activity that will be undertaken in future work.

References

- [1] C. E. Harris, M. Pritchard, M. Rabins, R. James, and E. Englehardt, *Engineering Ethics: Concepts and Cases*, 6th ed. Cengage Learning, 2018.
- [2] M. Martin and R. Schinzinger, *Introduction to Engineering Ethics*, 2nd ed. New York: McGraw-Hill, 2009.
- [3] M. Davis, "An Historical Preface to Engineering Ethics," *Sci. Eng. Ethics*, vol. 1, pp. 33–48, 1995.
- [4] I. Van de Poel and L. Royakkers, *Ethics, Technology, and Engineering: An Introduction*. Malden: Wiley-Blackwell, 2011.
- [5] H. C. Luegenbiehl and R. F. Clancy, *Global engineering ethics*. New York: Elsevier, 2017.
- [6] Q. Zhu and B. Jesiek, "Engineering Ethics in Global Context: Four Fundamental Approaches," in *American Society for Engineering Education*, 2017, doi: 10.18260/1-2-28252.
- [7] R. F. Clancy and Q. Zhu, "Global Engineering Ethics: What? Why? How? and When?," in *ASEE Annual Conference and Exposition, Conference Proceedings*, 2021.
- [8] P.-H. Wong, "Global Engineering Ethics," in *Routledge Handbook of Philosophy of Engineering*, D. Michelfelder and N. Doorn, Eds. 2021.
- [9] J. Henrich, *The WEIRDest People in the World: How the West Became Psychologically Peculiar and Particularly Prosperous*. New York: Farrar, Straus and Giroux, 2020.
- [10] J. Henrich, *The Secret to Our Success: How Culture Is Driving Human Evolution, Domesticating Our Species, and Making Us Smarter*. Princeton: Princeton University Press, 2015.
- [11] J. Haidt, *The Righteous Mind*. New York: Vintage Press, 2012.
- [12] J. D. Greene, *Moral Tribes: Emotion, Reason, and the Gap between Us and Them.* New York: Penguin Books, 2014.
- [13] V. Dranseika, R. Berniūnas, and V. Silius, "Immorality and bu daode, unculturedness and bu wenning," *J. Cult. Cogn. Sci.*, vol. 2, no. 1–2, pp. 71–84, 2018, doi: 10.1007/s41809-018-0013-y.
- [14] R. Shweder, N. Much, M. Mahapatra, and L. Park, "The 'big three' of morality (autonomy, community, divinity), and the 'big three' explanations of suffering," in *Morality and health*, A. Brandt and P. Rozin, Eds. Routledge, 1997, pp. 119–169.
- [15] D. Kelly and S. Setman, "The Psychology of Normative Cognition," in *The Stanford Encyclopedia of Philosophy*, E. N. Zalta, Ed. 2020.
- [16] D. Kelly and T. Davis, "Social Norms and Human Normative Psychology," *Soc. Philos. Policy*, vol. 35, no. 1, pp. 54–76, 2018.
- [17] S. Stich, "The moral domain," in *The Atlas of Moral Psychology*, K. Gray and J. Graham, Eds. New York: Guilford Press, 2017.
- [18] S. Stich, "The quest for the boundaries of morality," in *The Routledge Handbook of Moral Epistemology*, K. Jones, M. Timmons, and A. Zimmerman, Eds. New York: Taylor and Francis Group, 2018.
- [19] E. MacHery and S. Stich, "You can't have it both ways: What is the relation between morality and fairness?," *Behavioral and Brain Sciences*. 2013, doi: 10.1017/S0140525X12000908.
- [20] M. Chudek and J. Henrich, "Culture-gene coevolution, norm-psychology and the emergence of human prosociality," *Trends Cogn. Sci.*, vol. 15, no. 5, pp. 218–226, 2011,

- doi: 10.1016/j.tics.2011.03.003.
- [21] C. S. Sripada and S. Stich, "A Framework for the Psychology of Norms," in *Innateness and the Structure of the Mind*, vol. II, P. Carruthers, S. Laurence, and S. Stich, Eds. New York: Oxford University Press, 2007, pp. 280–301.
- [22] C. Bicchieri, *Norms in the Wild*. Oxford: Oxford University Press, 2016.
- [23] R. E. Nisbett, *The Geography of Thought: How Asians and Westerners Think Differently and Why.* New York: Free Press, 2010.
- [24] E. Machery, *Philosophy Within Its Proper Bounds*. New York: Oxford University Press, 2017.
- [25] Infusing ethics into the development of engineers: Exemplary education activities and programs. Washington DC: National Academies Press, 2016.
- [26] M. J. Drake, P. M. Griffin, R. Kirkman, and J. L. Swann, "Engineering ethical curricula: Assessment and comparison of two approaches," *J. Eng. Educ.*, vol. 94, pp. 223–231, 2005, doi: 10.1002/j.2168-9830.2005.tb00843.x.
- [27] D. R. Haws, "Ethics Instruction in Engineering Education: A (Mini) Meta-Analysis," *J. Eng. Educ.*, vol. 90, no. 2, pp. 223–229, 2001, doi: 10.1002/j.2168-9830.2001.tb00596.x.
- [28] J. L. Hess and G. Fore, "A Systematic Literature Review of US Engineering Ethics Interventions," *Sci. Eng. Ethics*, vol. 24, no. 2, pp. 551–583, 2018, doi: 10.1007/s11948-017-9910-6.
- [29] M. H. Bazerman and A. Tenbrunsel, *Blind Spots: Why We Fail to Do What's Right and What to Do about It.* Princeton University Press, 2012.
- [30] J. M. Doris, *Lack of Character: Personality and Moral behavior*. New York: Cambridge University Press, 2005.
- [31] M. D. Mumford, L. Steele, and L. L. Watts, "Evaluating Ethics Education Programs: A Multilevel Approach," *Ethics Behav.*, vol. 25, no. 1, pp. 37–60, Jan. 2015, doi: 10.1080/10508422.2014.917417.
- [32] T. J. Mulhearn, L. M. Steele, L. L. Watts, K. E. Medeiros, M. D. Mumford, and S. Connelly, "Review of Instructional Approaches in Ethics Education," *Sci. Eng. Ethics*, vol. 23, no. 3, pp. 883–912, 2017, doi: 10.1007/s11948-016-9803-0.
- [33] J. Borenstein, M. J. Drake, R. Kirkman, and J. L. Swann, "The engineering and science Issues Test (ESIT): A discipline-specific approach to assessing moral judgment," *Sci. Eng. Ethics*, vol. 16, no. 2, pp. 387–407, 2010, doi: 10.1007/s11948-009-9148-z.
- [34] J. R. Rest, D. Narvaez, S. J. Thoma, and M. J. Bebeau, "DIT2: Devising and Testing a Revised Instrument of Moral Judgment," *J. Educ. Psychol.*, vol. 91, no. 4, pp. 644–659, 1999, doi: 10.1037/0022-0663.91.4.644.
- [35] J. R. Rest, D. Narvaez, M. J. Bebeau, and S. Thoma, "A Neo-Kohlbergian Approach: The DIT and Schema Theory," *Educ. Psychol. Rev.*, 1999, doi: 10.1023/A:1022053215271.
- [36] M. J. Bebeau, "The defining issues test and the four component model: Contributions to professional education," *J. Moral Educ.*, vol. 31, no. 3, pp. 271–295, 2002, doi: 10.1080/0305724022000008115.
- [37] D. Narvaez and T. Bock, "Moral schemas and tacit judgement or how the defining issues test is supported by cognitive science," *J. Moral Educ.*, vol. 31, no. 3, pp. 297–314, 2002, doi: 10.1080/0305724022000008124.
- [38] Y. Dong, "Norms for DIT2: From 2005-2009," *Center for the Study of Ethical Development*. 2011, [Online]. Available: https://ethicaldevelopment.ua.edu/uploads/8/4/9/8/84986096/norms-for-dit2 05-09.pdf.

- [39] H. E. Canary, J. R. Herkert, K. Ellison, and J. M. Wetmore, "Microethics and macroethics in graduate education for scientists and engineers: Developing and assessing instructional models," *ASEE Annu. Conf. Expo. Conf. Proc.*, 2012.
- [40] C. D. Bailey, "Does the defining issues test measure ethical judgment ability or political position?," *J. Soc. Psychol.*, vol. 151, no. 3, pp. 314–330, 2011, doi: 10.1080/00224545.2010.481690.
- [41] J. Graham, B. A. Nosek, J. Haidt, R. Iyer, S. Koleva, and P. H. Ditto, "Mapping the Moral Domain," *J. Pers. Soc. Psychol.*, 2011, doi: 10.1037/a0021847.
- [42] J. Haidt, "The emotional dog and its rational tail: A social intuitionist approach to moral judgment.," *Psychol. Rev.*, vol. 108, no. 4, pp. 814–834, 2001, doi: 10.1037/0033-295X.108.4.814.
- [43] J. Haidt and C. Joseph, "The Moral Mind: How Five Sets of Innate Intuitions Guide the Development of Many Culture-Specific Virtues, and Perhaps Even Modules," in *The Innate Mind, Vol. 3*, P. Carruthers, S. Laurence, and S. Stich, Eds. New York: Oxford University Press, 2007, pp. 367–391.
- [44] T. Talhelm, J. Haidt, S. Oishi, X. Zhang, F. F. Miao, and S. Chen, "Liberals Think More Analytically (More 'WEIRD') Than Conservatives," *Personal. Soc. Psychol. Bull.*, vol. 41, no. 2, pp. 250–267, 2015, doi: 10.1177/0146167214563672.
- [45] J. Graham, J. Haidt, and B. A. Nosek, "Liberals and Conservatives Rely on Different Sets of Moral Foundations," *J. Pers. Soc. Psychol.*, vol. 96, no. 5, pp. 1029–1046, 2009, doi: 10.1037/a0015141.
- [46] Y. Zhang and S. Li, "Two Measures for Cross-Cultural Research on Morality: Comparison and Revision," *Psychol. Rep.*, vol. 117, no. 1, pp. 144–166, 2015, doi: 10.2466/08.07.PR0.117c15z5.
- [47] K. R. Kim, J.-S. Kang, and S. Yun, "Moral Intuitions and Political Orientation: Similarities and Differences between South Korea and the United States," *Psychol. Rep.*, vol. 111, no. 1, pp. 173–185, 2012, doi: 10.2466/17.09.21.pr0.111.4.173-185.
- [48] J. Graham *et al.*, "Moral Foundations Theory: The Pragmatic Validity of Moral Pluralism," in *Advances in Experimental Social Psychology*, vol. 47, P. Devine and A. Plant, Eds. Academic Press, 2013, pp. 55–130.
- [49] G. L. Baril and J. C. Wright, "Different types of moral cognition: Moral stages versus moral foundations," *Pers. Individ. Dif.*, vol. 53, no. 4, pp. 468–473, 2012, doi: 10.1016/j.paid.2012.04.018.
- [50] R. J. Glover *et al.*, "Moral rationality and intuition: An exploration of relationships between the Defining Issues Test and the Moral Foundations Questionnaire," *J. Moral Educ.*, vol. 43, no. 4, pp. 395–412, 2014, doi: 10.1080/03057240.2014.953043.
- [51] R. F. Clancy, "The Development of a Case-Based Course on Global Engineering Ethics in China," *Int. J. Ethics Educ.*, vol. 6, no. 1, pp. 51–73, 2021, doi: 10.1007/s40889-020-00103-1.
- [52] A. Norenzayan, *Big Gods: How Religion Transformed Human Cooperation and Conflict.* Princeton: Princeton University Press, 2015.
- [53] S. An and D. Trafimow, "Affect and Morality: A Cross-Cultural Examination of Moral Attribution," *J. Cross. Cult. Psychol.*, vol. 45, no. 3, pp. 417–430, 2014, doi: 10.1177/0022022113511298.
- [54] K.-K. Hwang, Foundations of Chinese Psychology: Confucian Social Relations. New York: Springer, 2012.

Appendix: ESIT and MFQ

ESIT

Engineering and Science Issues Test (ESIT) Georgia Institute of Technology Jason Borenstein, Robert Kirkman, and Julie Swann 2005, version 1.0p

This questionnaire is concerned with how you would make decisions about professional conduct in science and engineering. Each case includes a story about a problem faced by a scientist or engineer in professional practice, followed by a set of twelve questions representing different issues that might be raised by the problem. For each case, you will be asked to make a decision, then rate and rank the questions in terms of how important each of them seems. There are six cases in all.

Here is an example of the rating and ranking tasks called for in the questionnaire:

Investing in Real Estate

Suppose you are planning to buy some real estate for investment purposes. You have come across a parcel of land that is for sale, and need to decide whether it is a worthwhile investment. In this example, you are considering five questions about the parcel, and you **rate** each of them according to their importance in shaping your decision, on a scale of 1 to 5 (1=great importance, 2=much importance, 3=some importance, 4=little importance, 5=no importance).

Now suppose that you thought question 1 was of great importance, question 2 was of some importance, question 3 also was of great importance, question 4 was of little importance, and question 5 was of no importance. You would fill out the form as follows:

Great	Much	Some	Little	No		
1	2	3	4	5		
0	0	0	0	0	1.	How close is the parcel to the fringe of suburban development?
0	0	0	0	0	2.	How is the land currently zoned?
0	0	0	0	0	3.	Is the asking price of the parcel comparable to that of similar parcels in the area?
0	0	0	0	0	4.	What is the composition of the topsoil of the parcel?
0	0	0	0	0	5.	Is the current owner of the land a nice person?

Once you have rated the questions you need also to rank them, selecting the four questions you consider to be most important. In this part of the questionnaire, the numbers across the top represent question numbers; you should click one circle in each row to indicate which question was most important, second most important, and so on.

In the real estate example, suppose you thought question 1 was more important than question 3, even though you rated them both as being of great importance. You also thought that question 2 was third in importance, and question 4 was fourth. You would fill out the form as follows:

	1	2	3	4	5	6	7	8	9	10	11	12
Most important	0	\odot	0	0	\odot	\odot	0	0	\odot	0	\odot	0
Second most important	0	\odot	0									
Third most important	\odot	0	\odot	0	\odot	0	\odot	\odot	0	\odot	0	0
Fourth most important	\odot	\odot	\odot	0	\odot	0	0	\odot	0	0	\odot	0

Note: If a question strikes you as irrelevant, or if it does not make sense to you, rate it as being of no importance and do not rank it.

Also note: Each case in the questionnaire is followed by twelve questions rather than five; please be sure to rate all twelve questions and to select the top four from the full set of twelve questions when you rank them. Your ratings and rankings of questions should agree.

Please take your time answering this survey. Your help is greatly appreciated.

Case 1 (Stock)

Should Engineer Jameson participate in the vendor decision?

Engineer Jameson owns stock in RJ Industries, which is a vendor for Jameson's employer, Modernity, Inc., a large manufacturing company. Jameson's division has been requested by management to cut one vendor: either RJ Industries or Pandora Products, Inc. Pandora Products makes a component that is slightly higher in quality and slightly more expensive than that made by RJ Industries. Management and the other engineers in her division do not know that Jameson has a financial interest in one of the two vendors.

○ C	hould part an't decide hould not p	e			n												
RATE	THE FO	LLOWI	NG 12 I	SSUES	IN T	ERMS	OF IM	PORT	ANCE	(1 – 5)	:						
Great	Much	Some	Little	No													
1	2	3	4	5													
\odot	\odot	\odot	0	\odot	1.	Would the process be more or less fair if she discloses her financial interest?											
0	0	\odot	\odot	0	2.	Is it required by law that she report that she owns the stock?											
0	0	\odot	\odot	0	3.	Is the	transfe	from v	endor t	o custo	mer inl	nerently	efficie	ent?			
0	0	\odot	\odot	\odot	4.						vould J	ameson	be und	lerminin	g the cre	dibility	
\odot	\odot	\odot	0	\odot	5.	What	f the engineering profession? What does the code of ethics of the National Society of Practicing Engineers NSPE) have to say?										
0	\odot	\odot	\odot	\odot	6.		Vould disclosing her financial interest help Jameson's career?										
0	\odot	\odot	\odot	0	7.		Would Jameson's coworkers be angry if they learned of her financial interests in the decision?										
0	\odot	\odot	0	0	8.			l time t	o buy P	andora	stock?						
0	\odot	\odot	\odot	0	9.	Does :	Jameso	n have	a profes	ssional	duty to	particip	oate in	the decis	sion, no 1	natter	
0	\odot	\odot	0	\odot	10.	How r	nuch w	ould th	e value	of Jam	eson's	stock de	ecrease	if RJ In	dustries	is cut?	
0	\odot	\odot	0	0	11.	If Jam	eson re	mains s	silent, w	vill RJ l	Industri	es hire	her in t	he futur	e?		
\odot	0	\odot	\odot	0	12.	Will J	ameson	's decis	sion pot	tentially	y cause	harm to	the pu	ıblic?			
D1-		C'4	(0	1	12).												
Kank	importan	ce of iter	ns (Ques	stions 1	-12):												
Second Third i	mportant I most impo most impo most imp	rtant	1 •• •• ••	2 	3 ○ ○ ○	4 	5 	6 ○ ○ ○	7 ○ ○ ○	8 O O O	9 0 0 0	10 ○ ○ ○	11 ○ ○ ○	12 ○ ○ ○			

Case 2 (Leak)

George is studying for an engineering degree, working as a co-op in a manufacturing plant operated by Burdell Corporation. A few weeks into his employment, he discovers that one piece of equipment is leaking industrial lubricants that are making their way into the ground under the plant. He checks maintenance records and discovers that the equipment has been consuming excess lubricant for the past six months. He brings this to the attention of his supervisor and expresses his concern that the oil would probably find its way into the groundwater under the plant. His supervisor tells him to mind his own business: "You're just a student; you don't understand how things work in the real world. The process is working fine, even if it does take a little extra lubricant now and again. Besides, we've been working with that lubricant for years, and it's never killed anyone." Not satisfied with this, George does some more research and discovers that the groundwater under the plant makes its way to a nearby river, just upstream from a metropolitan area. George needs to figure out whether to tell anyone else about this problem.

Do you	ı favor Ge	eorge tell	ing some	one abo	out this	s proble	m?									
⊙ Sł	nould tell	someone														
⊙ Ca	an't decid	e														
⊙ Si	nould not	tell anyo	ne													
RATE	THE FO	LLOW	ING 12 I	SSUES	IN T	ERMS	OF IM	PORT	ANCE	(1-5)	:					
		~	* 1. 1													
Great	Much	Some	Little	No												
1	2	3	4	5	1	A ma th	omo stat	o on for	domal ma	an lation	a that	aarran th	ia manti	oulan lu	haissat?	
0	0	0	0	0	1.					77 (1)			10.00		bricant?	
0	0	0	\odot	\odot	2.			1750							iled to a	ict?
\odot	\odot	0	0	0	3.				5				•	sor's or		
\odot	\odot	\odot	\odot	\odot	4. Does the lubricant pose risks to plants and animals in the watershed?											
0	\odot	\odot	\odot	\odot	5.											
\odot	\odot	0	\odot	\odot	6.	Is Geo	orge ob	ligated	to do w	hat his	boss te	lls him	to?			
\odot	\odot	\odot	\odot	\odot	7.	Do co		ons hav	e a resp	onsibil	ity to e	liminate	e enviro	onmenta	l waste	whenever
\odot	\odot	\odot	\odot	0	8.	How 1	nuch d	o leaky	machir	ies conf	ribute t	to the h	igh pric	e of oil	?	
\odot	\odot	\odot	\odot	\odot	9.	Does	the pub	lic have	e a righ	t to kno	w abou	it the po	otential	pollutio	n?	
\odot	\odot	\odot	\odot	\odot	10.	Does t		npany h	ave the	right to	pollut	e the er	vironm	nent, giv	en that t	hey own
\odot	\odot	\odot	\odot	\odot	11.		compe ll Com		nd out a	bout th	e lubric	ant and	l use the	e inforn	nation ag	gainst
\odot	\odot	\odot	\odot	0	12.				to the	compar	ny if Ge	orge re	ports it	and is	wrong?	
Dank i	mportan	as of its	ms (Oue	stions 1	12).											
Kank i	шрогсан	ce of ite	ns (Ques	5110115 1	-12).											
	nportant I most im	nortant	1 ⊙ ⊙	2 ⊙ ⊙	3 ⊙ ⊙	4 • •	5 ①	6 ⊙ ⊙	7 ⊙ ⊙	8 ①	9 ① ①	10 ○	11 ①	12 ⊙ ⊙		
	nost impo		0	0	0	0	0	0	0	0	0	0	0	0		
	most imp		\odot	\odot	0	\odot	\odot	\odot	\odot	\odot	\odot	0	\odot	\odot		

Case 3 (Contract)

A construction company has begun to lay the cement foundation for an overpass that will cross over a local highway. Mary is the designer who drew up the blueprints for the project. She overhears Joe, the project manager, talking with Steve, an engineer working on the project. Steve informs Joe that taking into account the amount and quality of materials they have available to complete the overpass, it is estimated that the overpass will fall somewhat short of the initial factor of safety recommended for the project. The typical factor of safety recommended by professional engineering organizations is six times as strong as what would be required for normal daily use. Steve tells Joe that he has already discussed the matter with other engineers hired to work on the project. Steve suggests that the project's engineers estimate that the safety factor for the overpass will be between three to four times stronger than what is required for daily use when the overpass is completed. Steve believes that the safety factor will be within the range of what many experts would find acceptable. Joe listens to the information Steve provides to him and acknowledges that the overpass project is already over budget and that waiting for any additional materials would push the project's completion date beyond the deadline that the company promised to the city. Shortly thereafter, Mary asks Joe whether he thinks that there is reason to be concerned that the overpass project might not live up to its original expectations. Joe suggests that there is a greater likelihood that the company will lose future contracts with the city if it fails to meet its current deadline than risk that the overpass will not be safe. Mary has to decide whether to convince Steve and Joe to delay the project.

Do yo	u think Ma	ary shoul	d try to c	onvince	e Steve	e and Jo	e to de	lay the	project	?							
⊙ s:	hould try t	o convin	ce them														
⊙ c	an't decid	e															
	hould not	try to cor	vince the	em													
		-,															
RATE	THE FO	LLOW	NG 12 I	SSUES	IN T	ERMS	OF IM	PORT	ANCE	(1 – 5)	:						
Great	Much	Some	Little	No						, ,							
1	2	3	4	5													
O	<u>.</u>	O	→	O	1.	Are ci	tv offic	ials usu	ially pa	rt of the	e decisi	on as to	wheth	er to de	lay a pr	oiect?	
0	O	0	0	0	2.				_			nargin o				- J	
0	0	0	<u>.</u>	0	3.					1200		500000		T-10		e bridge?	
0	0	0	0	0		3. As the designer, would Mary be blamed for any future problems with the bridge?4. Will Mary lose her job if she reports problems?											
0	0	0	O	0	5.												
0	O	\odot	0	0	6.				y if som		200703-0		ayea.				
	0	0	0	0	7.							nal stan	dards f	or safet	v?		
0			0	0	8.		10.75		100			mple of			5		
0	0	0		0	9.								-			n its own?	
0	0	0	0		10.					ā 5		-			e deadl		
0	0	0	0	0	11.					(6)	50 050	ose if th				me.	
0	0	0	0	○○	12.						C7100					e public?	
0	\odot	\odot	\odot	\odot	12.	What	3 more	mport	ant. His	to em	proyecs	01 10311	ng joos	or sare	ty of the	puone.	
Rank	importan	ce of iter	ns (Ques	tions 1	-12):												
			1	2	3	4	5	6	7	8	9	10	11	12			
Most i	mportant		\odot	\odot	0	\odot	\odot	\odot	\odot	\odot	\odot	0	0	\odot			
	d most im	ortant	0	0	0	0	0	0	0	0	0	0	0	0			
	most impo		0	\odot	0	0	0	0	0	0	0	\odot	0	\odot			
Fourth	most imp	ortant	\odot	\odot	0	\odot	\odot	\odot	0	\odot	\odot	\odot	\odot	0			

Case 4 (Testing)

Engineer Luke is conducting reliability tests on a component for a prosthetic arm. Luke's supervisor called this morning to say that she needs the final data by mid-afternoon. Unfortunately, the testing process has gotten bogged down, and Luke has only completed half of the planned iterations of the test. Luke's assistant, Ben, also an engineer, has suggested extrapolating the results from the earlier tests, introducing minor variations to make them look like new data. Luke has to decide whether to go along with this plan.

Shou	ld Luke go	along wi	th Ben's	plan to	please	the sup	pervisor	?								
0	Should go a Can't decid Should not	e														
RAT	E THE FO	LLOW	NG 12 I	SSUES	SINT	ERMS	OF IM	PORT	ANCE	(1 – 5)	:					
Grea	t Much	Some	Little	No												
1	2	3	4	5												
\odot	\odot	\odot	\odot	0	1.	Will a	nyone l	know to	blame	Luke i	f the co	mpone	nt malfi	unctions	?	
\odot	\odot	\odot	\odot	0	2.	Do reg	gulating	g agenc	ies have	policie	es cove	ring sit	uations	like this	?	
\odot	\odot	\odot	\odot	\odot	3.	What	risks m	ight ext	trapolat	ion of o	lata pos	se for fu	iture re	search?		
0		\odot	\odot	0	4.	Will I	.uke ge	t to go	home ea	arlier if	he liste	ns to B	en?			
\odot	\odot	\odot	\odot	0	5.	Should says?	dn't Lu	ke do v	vhat he	believe	s is rigl	nt regar	dless of	f what hi	s superv	visor
\odot	\odot	\odot	\odot	0	6.	_ *										
0	\odot	\odot	\odot	0	7.	Does t	the firm	have a	policy	govern	ing the	conduc	t of res	search?		
0	\odot	\odot	\odot	<u>.</u>	8.	Is the	data go	od eno	ugh that	the co	mpany	could a	void fu	ture liab	ility?	
0	\odot	\odot	\odot	\odot	9.	If this	is foun	d out, v	vould it	cause	the pub	lic to lo	se conf	fidence i	n scienc	e?
0	\odot	\odot	\odot	0	10.	Is the	data Lu	ıke alre	ady has	adequa	ate acco	ording t	o norm	s of scien	ntific res	search?
0	\odot	\odot	\odot	<u>.</u>	11.	Will for		sers of	the pros	thetic l	ave be	tter or v	vorse li	ves depe	ending o	n what
\odot	\odot	\odot	\odot	0	12.			get in t	rouble i	f he adı	mits to	his sup	ervisor	that he is	s only h	alf done?
Rank	k importan	ce of ite	ns (Ques	tions 1	-12):											
			1	2	3	4	5	6	7	8	9	10	11	12		
	important		\odot	\odot	\odot	\odot	\odot	\odot	0	\odot	\odot	\odot	\odot	\odot		
	nd most imp		0	0	0	0	0	0	0	0	0	0	0	0		
	l most impo		0	0	0	0	0	<u>O</u>	0	0	0	0	0	0		
Fourt	h most imp	ortant	\odot	\odot	0	\odot	0	0	0	0	\odot	\odot	\odot	\odot		

Case 5 (Technology)

While working as an engineer for ABC Electrical and Lighting Company, Phil develops an innovative idea for a plastic light bulb that he believes will be more energy efficient and durable than a standard light bulb. Phil informs his boss, Bob, that he has a new project that he intends to pursue, but he does not fully disclose the details to Bob concerning what the project will be. Before he finishes a design sketch for a prototype of the light bulb, Phil is hired away by another company to work as an electrical engineer. During his last day of work at his old job, Bob wishes him luck and reminds Phil that he is obligated not to divulge proprietary information to ABC's competitors, which includes information that Phil discovered while working on his former projects. Phil's initial project at his new company is unrelated to lighting. Yet, later on during his employment, Phil attends a staff meeting where his project manager, Nancy, suggests that the focus shift toward discussing innovations in lighting. Nancy asks whether anyone at the staff meeting has an idea for a new innovation that the company should consider pursuing. Being rather new to the company, Phil wants to make a good impression with his employer. He struggles to determine whether it is appropriate to disclose the idea for the plastic light bulb that he started to develop while employed at his former company.

former	company																	
Should	Phil disc	lose his li	ight bulb	idea?														
○ Ca○ Sh	nould disc	e disclose	NG 14 I			EDMC	or na	TO DATE	ANGE	a 5								
KAIL	THE FO		NG 12 I	SSUES) IN I	EKNIS	OF IM	PORT	ANCE	(1 – 5)	:							
Great	Much	Some	Little	No														
1	2	3	4	5						777 5252 201			70.11 - 21	10 12	0200202			
0	\odot	\odot	\odot	\odot	1.			expecta	ation th	at Phil	will use	his kn	owledg	e to ben	efit his new			
0	\odot	0	0	0	2.	company? Would Phil's company be better able to assist customers if it creates the new product?												
0	\odot	\odot	\odot	0	3.													
0	\odot	\odot	\odot	0	4.	. Are Phil's actions going to harm his former company?												
0	\odot	\odot	\odot	\odot	5.	5. Should Phil consult with Nancy about what the appropriate course of action is?												
0	\odot	\odot	\odot	0	6.	Were	Phil an	d Bob f	riends v	while th	ey wor	ked tog	ether a	t ABC?				
\odot	0	\odot	\odot	\odot	7.			oduct be		the pub	lic, isn'	t that m	ore im	portant t	han which			
0	\odot	\odot	\odot	\odot	8.	Will P	hil get	sued if	he reve	als the	informa	ition ab	out the	light bu	ılb?			
0	\odot	\odot	\odot	\odot	9.	If Phil	shares	the des	ign, wi	ll it ero	de trust	betwee	en empl	loyers ar	nd employees	?		
0	\odot	\odot	\odot	\odot	10.	Does	Phil's c	ontract	with hi	s forme	er comp	any cov	er this	kind of	situation?			
0	\odot	\odot	\odot	\odot	11.	Would	l sharin	g the de	esign h	elp Phil	's reput	ation a	t his ne	w comp	any?			
0	\odot	\odot	0	0	12.	What	does th	e IEEE	code of	f ethics	say abo	out copy	yrights	and owr	nership?			
Rank i	mportan	ce of iter	ns (Ques	stions 1	-12):													
			1	2	3	4	5	6	7	8	9	10	11	12				
Most in	nportant		\odot	\odot	0	\odot	\odot	\odot	\odot	\odot	\odot	\odot	\odot	\odot				
Second	l most imp	portant	\odot	\odot	\odot	\odot	\odot	\odot	\odot	\odot	\odot	\odot	\odot	\odot				
Third n	nost impo	rtant	0	\odot	\odot	\odot	0	\odot	\odot	0	\odot	\odot	\odot	\odot				
Fourth	most imp	ortant	\odot	\odot	\odot	\odot	\odot	\odot	\odot	\odot	\odot	\odot	\odot	\odot				

Case 6 (Product)

A start-up company has recently installed a new model of air conditioning unit in the homes of hundreds of customers. The air conditioning unit, which is a hybrid model that draws power from solar and electrical sources, is advertised as being the most energy efficient model on the market. Sue, an engineer who worked on the prototype of the air conditioning unit, recognizes that the unit might have been marketed and sold to the public prematurely because a device within the unit that alternates between solar and electrical power sources sometimes fails. John, Sue's boss, assures her that the particular device in question is already in the process of being fixed and that the problem will be corrected in the already sold units before the general public becomes aware of it. Ann, an employee who works in customer service, has already received several phone calls about the new units because customers are complaining that they are paying more for their electric bills than was expected. Ann informs John about the customers' complaints. John responds by telling Ann about the problem with the alternating device and informs her that the problem will be corrected shortly. He claims that there is no reason to cause customers to worry needlessly. John suggests that informing customers will only cause the public to lose confidence in the company, which would be disastrous for the new company's future. John instructs Ann to remain silent about the problem and to tell customers that a service representative from the company will check their units in the near future. Ann wonders whether to follow John's instructions.

repre	esentative fr	om the co	ompany v	will che	ck the	ir units	in the n	ear futi	ıre. Anı	n wond	ers whe	ether to	follow	John's i	instructi	ions.	
Shou	ıld Ann tell	the custo	mers abo	out the p	problei	n?											
0	Should tell																
0	Can't decid	e															
0	Should not	tell															
RAT	TE THE FO	LLOW	NG 12 I	SSUES	SINT	ERMS	OF IM	PORT	ANCE	(1-5)	:						
Grea	at Much	Some	Little	No													
1	2	3	4	5													
0	\odot	0	0	0	1.	Should	d the pu	ıblic alv	ways ha	ve the	right to	know i	nforma	tion?			
0	\odot	0	\odot	\odot	2.	Would	the pu	blic fin	d out al	bout the	broke:	n devic	e if no o	one says	anythi	ng?	
0	\odot	\odot	\odot	\odot	3.	Is the	essence	of bein	ng a goo	od emp	loyee fo	ollowin	g your	ooss's i	nstructio	ons?	
0	\odot	\odot	\odot	0	4.	Shoule	d Ann t	rust Jol	ın's jud	gment	since h	e is her	boss?				
0	\odot	\odot	\odot	0	5.	Will waiting cause significant harm (e.g., death) to unknowing customers whose devices fail?											
0	<u>.</u>	\odot	\odot	\odot	6.	Will A	nn be	able to	avoid b	lame if	she me	rely fol	lows he	er boss'	s instruc	ctions?	
0	\odot	\odot	\odot	\odot	7.		200	to rep	_	problen	now n	nake th	e comp	any moi	re likely	to break	
\odot	\odot	\odot	\odot	\odot	8.	Do co	mpanie	s have	a respoi	nsibility	to be l	honest v	with the	public'	?		
0	\odot	\odot	\odot	0	9.	Is the	sublimi	ty of th	e circu	mstance	es prop	ortional	to the	underly	ing anal	lysis?	
0	\odot	\odot	\odot	\odot	10.				customenanner?		it the p	roblem	as long	as they	are all	being	
0	\odot	\odot	\odot	0	11.	Will J	ohn los	e confi	dence ir	n Ann i	f she do	es not	follow l	nis instr	uctions	?	
0	0	\odot	0	\odot	12.	Aren't		mpany'	s effort	s to fix	the dev	ice end	ough to	fulfill it	s obliga	ation to its	
Ran	k importan	ce of iter	ns (Ques	stions 1	-12):												
			1	2	3	4	5	6	7	8	9	10	11	12			
Mos	t important		\odot	\odot	\odot	\odot	\odot	\odot	\odot	\odot	\odot	\odot	\odot	\odot			
Seco	ond most im	portant	\odot	\odot	\odot	\odot	0	0	\odot	0	0	0	0	0			
Thire	d most impo	ortant	\odot	\odot	\odot	\odot	\odot	\odot	\odot	\odot	0	\odot	\odot	\odot			
Four	th most imp	ortant	\odot	\odot	0	\odot	.	\odot	\odot	\odot	0	0	\odot	0			

<u>MFQ</u>

Moral Foundations Questionnaire

Part 1. When you decide whether something is right or wrong, to what extent are the following considerations relevant to your thinking? Please rate each statement using this scale:

 [0] = not at all relevant (This consideration has nothing to do with my judgments of right and wrong) [1] = not very relevant [2] = slightly relevant [3] = somewhat relevant
[4] = very relevant[5] = extremely relevant (This is one of the most important factors when I judge right and wrong)
Whether or not someone suffered emotionally
Whether or not some people were treated differently than others
Whether or not someone's action showed love for his or her country
Whether or not someone showed a lack of respect for authority
Whether or not someone violated standards of purity and decency
Whether or not someone was good at math
Whether or not someone cared for someone weak or vulnerable
Whether or not someone acted unfairly
Whether or not someone did something to betray his or her group
Whether or not someone conformed to the traditions of society
Whether or not someone did something disgusting
Whether or not someone was cruel
Whether or not someone was denied his or her rights
Whether or not someone showed a lack of loyalty
Whether or not an action caused chaos or disorder
Whether or not someone acted in a way that God would approve of

Part 2. Please read the following sentences and indicate your agreement or disagreement:
[0] = Strongly disagree [1] = Moderately disagree [2] = Slightly disagree [3] = Slightly agree [4] = Moderately agree [5] = Strongly agree
Compassion for those who are suffering is the most crucial virtue.
When the government makes laws, the number one principle should be ensuring that everyone is treated fairly.
I am proud of my country's history.
Respect for authority is something all children need to learn.
People should not do things that are disgusting, even if no one is harmed.
It is better to do good than to do bad.
One of the worst things a person could do is hurt a defenseless animal.
Justice is the most important requirement for a society.
People should be loyal to their family members, even when they have done something wrong.
Men and women each have different roles to play in society.
I would call some acts wrong on the grounds that they are unnatural.
It can never be right to kill a human being.
I think it's morally wrong that rich children inherit a lot of money while poor children inherit nothing.
It is more important to be a team player than to express oneself.
If I were a soldier and disagreed with my commanding officer's orders, I would obey anyway because that is my duty.
Chastity is an important and valuable virtue.