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.

Tables 1.a Correlations between measures of ethical reasoning and moral intuitions among first-year engineering students in the US, Netherlands, and China (N = 454)

Fairness	0.56***	-								
Loyalty	0.01	-0.03	-							
Authority	-0.03	-0.09	0.71***	-						
Sanctity	0.13	0.00	0.62***	0.66***	-					
Individuating	0.90***	0.86***	-0.00	-0.07	0.08	-				
Binding	0.04	-0.04	0.88***	0.89***	0.87***	0.00	-			
N2	0.17**	0.22***	-0.27***	-0.29***	-0.20***	0.22***	-0.29***	-		
Postconventional	0.19***	0.22***	-0.22***	-0.29***	-0.20***	0.23***	-0.27***	0.65***	-	
Conventional	-0.11	-0.09	0.10	0.20***	0.08	-0.11	0.14*	-0.19***	-0.61***	-
Preconventional	-0.09	-0.16*	0.15*	0.15*	0.14*	-0.14*	0.17**	-0.59***	-0.62***	-0.19***
	Care	Fairness	Loyalty	Authority	Sanctity	Individuating	Binding	N2	Postconventional	Conventional

*significant at the < 0.05 level, ** < 0.01 level, *** < 0.001 level

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.

Tables 1.b Correlations between measures of ethical reasoning and moral intuitions among first-year engineering students in the US (n = 341)

Fairness	0.53***	-								
Loyalty	0.05	-0.05	-							
Authority	-0.03	0.12	0.69***	-						
Sanctity	0.17*	-0.03	0.60***	0.60***	-					
Individuating	0.89***	0.85***	-0.08	-0.08	0.08	-				
Binding	0.08	-0.08	0.87***	0.87***	0.85***	0.00	-			
N2	0.20**	0.23***	-0.25***	-0.25***	-0.15	0.25***	-0.24***	-		
Postconventional	0.20**	0.22***	-0.24*	-0.24***	0.14	0.24***	-0.21**	0.65***	-	
Conventional	-0.11	-0.07	0.18	0.18*	-0.06	-0.11	0.13	-0.24***	-0.65***	-
Preconventional	-0.10	-0.18*	0.11	0.11	0.12	-0.16	0.14	-0.56***	-0.59***	-0.18*
	Care	Fairness	Loyalty	Authority	Sanctity	Individuating	Binding	N2	Postconventional	Conventional

*significant at the < 0.05 level, ** < 0.01 level, *** < 0.001 level

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].

Tables 1.c Correlations between measures of ethical reasoning and moral intuitions among first-year engineering students in the Netherlands (n = 41)

Fairness	0.60**	-								
Loyalty	-0.10	-0.09	-							
Authority	-0.26	-0.19	0.69***	-						
Sanctity	-0.04	0.12	0.46	0.67***	-					
Individuating	0.90***	0.88***	-0.10	-0.25	0.03	-				
Binding	-0.14	-0.04	0.82***	0.90***	0.85***	0.11	-			
N2	0.02	0.27	-0.08	-0.14	-0.12	0.16	-0.13	-		
Postconventional	0.01	0.22	-0.12	-0.31	-0.29	0.13	-0.28	0.42	-	
Conventional	0.00	-0.11	0.10	0.25	0.13	-0.05	0.18	0.06	-0.66***	-
Preconventional	-0.04	-0.19	0.02	0.13	0.19	-0.13	0.14	-0.62***	-0.57**	-0.21
	Care	Fairness	Loyalty	Authority	Sanctity	Individuating	Binding	N2	Postconventional	Conventional

*significant at the < 0.05 level, ** < 0.01 level, *** < 0.001 level

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.

Tables 1.d Correlations between measures of ethical reasoning and moral intuitions among first-year engineering students in China (n = 72)

Fairness	0.58***	-								
Loyalty	0.57***	0.51***	-							
Authority	0.47***	0.36*	0.57***	-						
Sanctity	0.54***	0.38*	0.68***	0.72***	-					
Individuating	0.91***	0.86***	0.61***	0.47***	0.52***	-				
Binding	0.60***	0.47***	0.84***	0.87***	0.91***	0.61	-			
N2	-0.14	-0.05	-0.09	-0.19	-0.17	-0.11	-0.17	-		
Postconventional	-0.01	0.03	-0.01	-0.22	-0.12	0.00	-0.13	0.73***	-	
Conventional	0.05	-0.02	-0.01	0.17	0.08	-0.04	0.09	-0.08	-0.38*	-
Preconventional	-0.03	0.00	0.08	0.13	0.06	0.02	0.10	-0.69***	-0.71***	-0.31
	Care	Fairness	Loyalty	Authority	Sanctity	Individuating	Binding	N2	Postconventional	Conventional

*significant at the < 0.05 level, ** < 0.01 level, *** < 0.001 level

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.

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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	
○	○	○	○	○	1. How close is the parcel to the fringe of suburban development?
○	○	○	○	○	2. How is the land currently zoned?
○	○	○	○	○	3. Is the asking price of the parcel comparable to that of similar parcels in the area?
○	○	○	○	○	4. What is the composition of the topsoil of the parcel?
○	○	○	○	○	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	○	○	○	○	○	○	○	○	○	○	○	○
Second most important	○	○	○	○	○	○	○	○	○	○	○	○
Third most important	○	○	○	○	○	○	○	○	○	○	○	○
Fourth most important	○	○	○	○	○	○	○	○	○	○	○	○

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)

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.

Should Engineer Jameson participate in the vendor decision?

- ○ Should participate in the decision
- ○ Can't decide
- ○ Should not participate in the decision

RATE THE FOLLOWING 12 ISSUES IN TERMS OF IMPORTANCE (1 – 5):

Great	Much	Some	Little	No	
1	2	3	4	5	
○	○	○	○	○	1. Would the process be more or less fair if she discloses her financial interest?
○	○	○	○	○	2. Is it required by law that she report that she owns the stock?
○	○	○	○	○	3. Is the transfer from vendor to customer inherently efficient?
○	○	○	○	○	4. If she participates in the decision, would Jameson be undermining the credibility of the engineering profession?
○	○	○	○	○	5. What does the code of ethics of the National Society of Practicing Engineers (NSPE) have to say?
○	○	○	○	○	6. Would disclosing her financial interest help Jameson's career?
○	○	○	○	○	7. Would Jameson's coworkers be angry if they learned of her financial interests in the decision?
○	○	○	○	○	8. Is now a good time to buy Pandora stock?
○	○	○	○	○	9. Does Jameson have a professional duty to participate in the decision, no matter what?
○	○	○	○	○	10. How much would the value of Jameson's stock decrease if RJ Industries is cut?
○	○	○	○	○	11. If Jameson remains silent, will RJ Industries hire her in the future?
○	○	○	○	○	12. Will Jameson's decision potentially cause harm to the public?

Rank importance of items (Questions 1-12):

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

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 favor George telling someone about this problem?

- ○ Should tell someone
- ○ Can't decide
- ○ Should not tell anyone

RATE THE FOLLOWING 12 ISSUES IN TERMS OF IMPORTANCE (1 – 5):

Great	Much	Some	Little	No	
1	2	3	4	5	
○	○	○	○	○	1. Are there state or federal regulations that cover this particular lubricant?
○	○	○	○	○	2. How would George feel if someone died of cancer because he failed to act?
○	○	○	○	○	3. Will George lose his job if he doesn't follow the supervisor's orders?
○	○	○	○	○	4. Does the lubricant pose risks to plants and animals in the watershed?
○	○	○	○	○	5. As a student, is George covered by professional codes of ethics?
○	○	○	○	○	6. Is George obligated to do what his boss tells him to?
○	○	○	○	○	7. Do corporations have a responsibility to eliminate environmental waste whenever they can?
○	○	○	○	○	8. How much do leaky machines contribute to the high price of oil?
○	○	○	○	○	9. Does the public have a right to know about the potential pollution?
○	○	○	○	○	10. Does the company have the right to pollute the environment, given that they own the land?
○	○	○	○	○	11. Will a competitor find out about the lubricant and use the information against Burdell Company?
○	○	○	○	○	12. Would it cause harm to the company if George reports it and is wrong?

Rank importance of items (Questions 1-12):

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

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 you think Mary should try to convince Steve and Joe to delay the project?

- ○ Should try to convince them
- ○ Can't decide
- ○ Should not try to convince them

RATE THE FOLLOWING 12 ISSUES IN TERMS OF IMPORTANCE (1 – 5):

Great	Much	Some	Little	No	
1	2	3	4	5	
○	○	○	○	○	1. Are city officials usually part of the decision as to whether to delay a project?
○	○	○	○	○	2. Would future users of the bridge find the margin of safety acceptable?
○	○	○	○	○	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?
○	○	○	○	○	5. How common it is that projects for the city are delayed?
○	○	○	○	○	6. Will Mary feel guilty if someone dies later?
○	○	○	○	○	7. Is Steve right about the range of professional standards for safety?
○	○	○	○	○	8. Is the inversion of the safety factor an example of the *post hoc* fallacy?
○	○	○	○	○	9. Should the construction company have the right to make this decision on its own?
○	○	○	○	○	10. What does the contract with the city say about the firmness of the deadline?
○	○	○	○	○	11. How much money would Joe's company lose if the project is delayed?
○	○	○	○	○	12. What's more important: risk to employees of losing jobs or safety of the public?

Rank importance of items (Questions 1-12):

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

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.

Should Luke go along with Ben's plan to please the supervisor?

- ○ Should go along
- ○ Can't decide
- ○ Should not go along

RATE THE FOLLOWING 12 ISSUES IN TERMS OF IMPORTANCE (1 – 5):

Great	Much	Some	Little	No	
1	2	3	4	5	
○	○	○	○	○	1. Will anyone know to blame Luke if the component malfunctions?
○	○	○	○	○	2. Do regulating agencies have policies covering situations like this?
○	○	○	○	○	3. What risks might extrapolation of data pose for future research?
○	○	○	○	○	4. Will Luke get to go home earlier if he listens to Ben?
○	○	○	○	○	5. Shouldn't Luke do what he believes is right regardless of what his supervisor says?
○	○	○	○	○	6. Does Luke know anyone who would use this prosthetic?
○	○	○	○	○	7. Does the firm have a policy governing the conduct of research?
○	○	○	○	○	8. Is the data good enough that the company could avoid future liability?
○	○	○	○	○	9. If this is found out, would it cause the public to lose confidence in science?
○	○	○	○	○	10. Is the data Luke already has adequate according to norms of scientific research?
○	○	○	○	○	11. Will future users of the prosthetic have better or worse lives depending on what Luke does?
○	○	○	○	○	12. Would Luke get in trouble if he admits to his supervisor that he is only half done?

Rank importance of items (Questions 1-12):

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

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.

Should Phil disclose his light bulb idea?

- ○ Should disclose
- ○ Can't decide
- ○ Should not disclose

RATE THE FOLLOWING 12 ISSUES IN TERMS OF IMPORTANCE (1 – 5):

Great	Much	Some	Little	No	
1	2	3	4	5	
○	○	○	○	○	1. Isn't there an expectation that Phil will use his knowledge to benefit his new company?
○	○	○	○	○	2. Would Phil's company be better able to assist customers if it creates the new product?
○	○	○	○	○	3. Will someone else suggest the design if Phil does not?
○	○	○	○	○	4. Are Phil's actions going to harm his former company?
○	○	○	○	○	5. Should Phil consult with Nancy about what the appropriate course of action is?
○	○	○	○	○	6. Were Phil and Bob friends while they worked together at ABC?
○	○	○	○	○	7. If the new product benefits the public, isn't that more important than which company develops it?
○	○	○	○	○	8. Will Phil get sued if he reveals the information about the light bulb?
○	○	○	○	○	9. If Phil shares the design, will it erode trust between employers and employees?
○	○	○	○	○	10. Does Phil's contract with his former company cover this kind of situation?
○	○	○	○	○	11. Would sharing the design help Phil's reputation at his new company?
○	○	○	○	○	12. What does the IEEE code of ethics say about copyrights and ownership?

Rank importance of items (Questions 1-12):

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

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.

Should Ann tell the customers about the problem?

- ◯ Should tell
- ◯ Can't decide
- ◯ Should not tell

RATE THE FOLLOWING 12 ISSUES IN TERMS OF IMPORTANCE (1 – 5):

Great	Much	Some	Little	No	
1	2	3	4	5	
◯	◯	◯	◯	◯	1. Should the public always have the right to know information?
◯	◯	◯	◯	◯	2. Would the public find out about the broken device if no one says anything?
◯	◯	◯	◯	◯	3. Is the essence of being a good employee following your boss's instructions?
◯	◯	◯	◯	◯	4. Should Ann trust John's judgment since he is her boss?
◯	◯	◯	◯	◯	5. Will waiting cause significant harm (e.g., death) to unknowing customers whose devices fail?
◯	◯	◯	◯	◯	6. Will Ann be able to avoid blame if she merely follows her boss's instructions?
◯	◯	◯	◯	◯	7. Would failing to report the problem now make the company more likely to break the law in the future?
◯	◯	◯	◯	◯	8. Do companies have a responsibility to be honest with the public?
◯	◯	◯	◯	◯	9. Is the sublimity of the circumstances proportional to the underlying analysis?
◯	◯	◯	◯	◯	10. Is it okay not to tell customers about the problem as long as they are all being treated in the same manner?
◯	◯	◯	◯	◯	11. Will John lose confidence in Ann if she does not follow his instructions?
◯	◯	◯	◯	◯	12. Aren't the company's efforts to fix the device enough to fulfill its obligation to its customers?

Rank importance of items (Questions 1-12):

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

MFQ

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.