Differences in Ethical Decision making between experts and novices: A Comparative Study

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An Exploratory Study To Predict Ethical Awareness using Linguistics Inquiry and Word Count

Abstract

Linguistic Inquiry and Word Count (LIWC) is a computerized text analysis program, which quantifies the frequency of different categories of words used in texts, emails, social media, etc. Linguistic analysis is widely used to predict personality, health and deception. This motivated us to do an exploratory study to investigate if the linguistic cues are the predictors of ethical awareness. In this study we have employed the free online version of LIWC to analyze the answers to the ethical vignettes. Pearson correlation coefficient was calculated, to study the association between four LIWC categories (self-reference words, social words, positive emotion words, and negative emotion words) and ethical awareness. There was a negative association between positive emotion words and ethical awareness. This association was expected, as many positive emotion words are not used to write about ethical breach. In our future study we aim to validate the usefulness of LIWC in predicting ethical awareness, by employing all the 74 LIWC categories to identify the ideal predictors of ethical awareness of a larger sample.

Background

Ethics are a set of standards or codes of socially approved conduct, while morals are personal principles about what's right and wrong. Professional development, including the development of a professional identity, is important to engineering students as they will have a responsibility to protect public safety and welfare while practicing engineering. Professional identity in engineers includes embodying the highest code of ethical conduct. Engineers have an obligation to act in an ethical manner, so assessing their professional skills is as important as assessing their technical skills. Students learn their code of ethics informally from relatives and colleagues. However, this mode of education is inadequate. Ethics education strengthens students' desire to act ethically [1]. Scholars suggest that engineering faculty and deans should support this integration to create a prosperous engineering world. In 2008, Colby and Sullivan cite earlier research [2], concluding, "Practicing engineers 'in the field' apparently feel more strongly about the desirability of such integration than do most engineering faculty or engineering school deans." They strongly argue to strengthen the nationwide effort to improve engineering ethics education [3]. The Educating the Engineer of 2020 report also provides similar arguments to improve ethics education in engineering [4]. Research also shows that work experience is positively related to ethical decision-making [5, 6] and whereby more experienced students had better ethical decision making skills [6, 7]. Graduate students and professionals are trained by their universities and organizations to reinforce their ethical reasoning. Also a code of ethics within an organization guides their employees in complex decision-making. Thus experience in engineering should lead to better awareness of ethical breach.

Moral Awareness

Many scholars have recognized the process by which an individual makes an ethical decision. James Rest's four component model was first to explain the process of ethical decision-making [8]. Moral awareness, moral judgment, moral intention and moral character are the four components of Rest's model. In this study we focused on the first process of Rest's model: moral awareness. Moral awareness/ sensitivity is the first step in making an ethical decision. In this step, an individual has the ability to recognize that a situation has a moral issue. According to Rest,

recognizing a moral issue demands the individual's awareness that acting unethically is going to affect other people's welfare. Since engineers are responsible for public safety and welfare, assessing their moral awareness is critical. Reynolds defined moral awareness as "a person's determination that a situation contains moral content and legitimately can be considered from a moral point of view" [9]. Moral awareness triggers his/her cognition before he/she makes moral judgment [8] or effectively judges the moral values of others [10]. Most of the research on moral awareness has focused on the characteristics of moral issue [11], individual differences [12], and lack of sleep [13]. High moral awareness relates to the nature of identifying unethicality in a situation [13]. In this study we used the framework for moral awareness to examine the ethical awareness by analyzing the linguistic style while answering ethical dilemmas. Linguistic analysis is widely used to predict personality [14], health [15] and deception [16]. This motivated us to investigate if the linguistic cues would predict ethical awareness.

Individual Differences and Moral Motivation

Individual differences in moral motivation are given importance to understand how people deal with ethical dilemmas. In this study, we scored the individuals' two potential measures of moral motivation: Person orientation and sociopolitical control. Individuals differ by having strong or weak orientation to other people or things in their environment. Engineers and engineering students score high on thing orientation and often on person orientation as well [17]. An individual with a strong person orientation should be aware of breaches in ethics, because detecting ethical dilemmas involves an understanding of other peoples' motives and intentions. [18]. Sociopolitical control is the outermost layer of three distinct spheres or domains for control described by Paulhus [19]. An individual who scores high on sociopolitical control is more likely to oppose an organization which behaves unethically. Engineers with a high score on sociopolitical control feel that they have the power to act ethically [18]. Person orientation and sociopolitical control should work together to predict ethical decision making. Person orientation should be predictive of the detection of a breach in ethics, and sociopolitical control should be predictive of the willingness to act to address the situation. Thus an individual who scores high on person orientation and sociopolitical control is more likely to be sensitive to unethical behavior.

Linguistic Inquiry and Word Count (LIWC)

Linguistic Inquiry and Word Count (LIWC) is a computer application based on text analysis [20]. This text analysis method has an ability "to detect meaning in a wide variety of experimental settings, including to show attentional focus, emotionality, social relationships, thinking styles, and individual differences" [21].

LIWC analyzes text word by word and categorizes each word using 74 linguistic categories. After processing all the words in a file, LIWC quantifies the percentage of each category. LIWC is a validated tool for psychometric analysis of linguistics [22] and is widely used in numerous domains. In 2003, LIWC was suggested by Pennebaker et al. to detect language differences between truthful and deceptive statements [23]. In another study in 2003, LIWC was used to quantify the frequency of linguistic markers in true versus deceptive statements [16]. A study in 2004 identified LIWC to be useful in detecting deception in their participants' discussion on music preference. Participants who were lying used more words related to negative emotion [24]. In 2005, a study analyzed if linguistic cues could detect deception when people wrote their

preferences for TV shows or movies. This study suggests that linguistic analysis may be used in detecting deception across various topics [25]. Krackow et al. in 2010 analyzed the participants' narratives of childhood events using the LIWC cognitive process category to distinguish between experienced and imagined childhood events [26]. In the current study we have expanded LIWC's application into predicting moral awareness. This study was an exploratory investigation to determine if the linguistic style in answering ethical vignettes are predictors of ethical awareness. We utilized the free online version of LIWC to investigate if the LIWC categories, like self-references (I, me), social words (e.g., she, us, talk), positive emotion words (e.g., happy, love) and negative emotion words (e.g., sad, afraid) are predictors of moral awareness. According to [21], the high rate of self-reference words indicates that an individual tends to be more honest. The high rate of social words links to a more social and outgoing personality. More positive emotion words are used by an individual who feels good about themselves and are more likely to see the world in a positive way. Thus people do not use more positive emotion words when they write about ethical breach, as they do not feel good about ethical breach.

Purpose of the Study

The purpose of the study was to investigate the differences in individuals' ethical awareness of the ethical breach/issue across three different groups: Undergraduate engineering students, graduate engineering students and professional engineers. In addition we employed LIWC to determine if LIWC categories are predictors of ethical awareness of the participants in dealing with ethical dilemmas. We tested four different hypotheses:

1. Professional engineers are more aware of ethical breach than graduate and undergraduate engineers.
2. Person orientation scores are positively related to ethical awareness scores.
3. Sociopolitical control scores are positively related to ethical awareness scores.
4. **LIWC categories such as self-awareness, social words, positive emotion words and negative emotion words are predictors of ethical awareness.**

Participant and Settings

This study was conducted at The University of Oklahoma in the United States in the Fall 2013 and Fall 2014 semesters. Our sample consisted of 60 participants: 20 undergraduate engineers, 20 graduate engineers and 20 professional engineers. 57% of the participants in this study were male, 58% were domestic participants and 53% indicated that they had no previous ethical training.

Task and Analysis

After providing informed consent, participants answered a survey that included demographic questions and whether they had ever taken an ethics training/ class. Participants then answered six ethical vignettes in their own words. One such ethical vignette was as follows:

"While working for your company, you invent a device that has a potential for making you wealthy. You used the company's lab and test facilities but did not work on your own time. What do you do with your invention?"

Participants then completed validated measures of person and thing orientations [17] and spheres of control [19]. We scored their answers to the vignettes on a scale from 0-2. 0 was marked

for missing answers, 1 for answers that indicated no ethical awareness and 2 for answers that indicated ethical awareness. In addition we analyzed their answers using LIWC. The output of the application is shown in Table 1. Formal text and personal text columns indicate the percentage of words that should be present in the formal text and personal text (e.g., personal texts should have 11.4 % of self-reference words, whereas formal texts should have 4.2% of self-reference words). We considered this to be a formal text as the participants answered the ethical vignettes. We generated a person orientation and sociopolitical control score for each participant by averaging responses to items on the respective scales.

Table 1 Sample output of LIWC application

LIWC Dimension	Your Data	Personal Texts	Formal Texts
Self-references (I, me, my)	4.55	11.4	4.2
Social words	9.09	9.5	8.0
Positive emotions	2.73	2.7	2.6
Negative emotions	0.00	2.6	1.6

In this study we scored the answers to the first five ethical vignettes, as many students skipped the last ethical vignette. We summed the scores across each of the five vignettes to create an ethical awareness score for each participant (range: 0-10). We ran a one-way analysis of variance (ANOVA) to test for mean differences between the three groups. Next we correlated each participant's person orientation (PO) and sociopolitical control (SPC) scores with their ethical awareness scores. Finally the participants' frequency of words in each of the LIWC categories was correlated to their ethical awareness score.

Results

Table 2 shows the average ethical awareness scores for the three different groups. We found no statistically significant differences between the ethical awareness of the undergraduates, graduate students and the professional engineers, $F_{(2, 57)} = 2.42$, $p=0.10$. This doesn't support our hypothesis that professional engineers and graduate engineering students are more aware of ethical breach than undergraduate engineering students.

Table 2 Average Ethical Awareness Scores

	Mean	Std.deviation
Undergraduate	7.15	1.14
Graduate	6.00	1.56
Engineers	6.25	2.31

Person orientation scores were correlated with the ethical awareness scores and the Pearson correlation coefficient (r) was calculated to be r= -0.13, p= 0.32 indicating no significant relationship between person orientation and ethical awareness. In the same way sociopolitical control was correlated with the ethical awareness scores with r= 0.08, p=0.55. Again we found no evidence of a significant relationship.

Finally we correlated the participants' frequency of words in self-references, social words, positive emotion words and negative emotion words categories individually with their ethical awareness scores. Table 3 shows the r and p-values. This analysis reveals a significant negative

relationship between ethical awareness and words that convey positive emotion. This would make sense because people tend to use less positive emotion words when they write about an ethical breach. Following is a participant's answer for all the five ethical vignettes, which had low percentage of positive emotion words, but had a high score (8 out of 10) in ethical awareness.

"Write the best that you can without being untruthful. We don't have the contract yet, can you work with us anyway? I should not take the position. Alter an already made prototype. Inform management."

Following is another participant's answer for all the five ethical vignettes, which had higher percentage of positive emotion words, but had a lower score (5 out of 10) in ethical awareness.

"I will suggest to follow hard work. I will try to cover up the story and still make them to participate. I will try to help as well as I will manage without affecting my work. Advertisement. I will make the program to reach people aware of necessity water by arranging flash mob, videos, and interesting advertisement. I will give it to company and it should be useful everyone."

When comparing the language use between the two above statements, it is clear that the first response reflects greater ethical awareness than the second one. This indicates that text analysis technique may be useful in detecting ethical awareness.

Table 3 Correlation Between Ethical Awareness Scores and LIWC Categories

	r score	p-value
SELF-REFERENCE	-0.21	0.11
SOCIAL WORDS	0.16	0.22
POSITIVE EMOTION	-0.28	0.03
NEGATIVE EMOTION	-0.03	0.83

Discussion

Every day, engineers are exposed to life challenging situations, as engineering problems are very complex and dynamic. Engineers strive for the safety and welfare of the public and hence their decision-making demands adherence to the highest code of ethical conduct. We replicated the extant findings and hypothesized that professional engineers are more aware of ethical breach than graduate engineering and undergraduate engineering students. Contrary to our expectations, our data doesn't support this hypothesis, as the undergraduate students' mean score is higher than the graduate students' and professional engineers' mean scores, while ANOVA shows that there are no statistically significant differences between the ethical awareness of the three groups.

Person orientation scores are not related to ethical awareness scores. Research indicates that specific engineering disciplines such as biomedical, civil and environmental engineering are considered to be socially sensitive [27]. The majority of our participants are from mechanical and industrial engineering and therefore the relation might not hold true. In our current study we found no correlation between sociopolitical control and ethical awareness. One explanation could be due to the higher number of male participants than female participants. This supports our previous study's findings where there was no relation between sociopolitical control and ethical awareness for male students and the relation was negatively correlated for female students [18]. These analyses should be replicated in a larger sample.

Finally our study shows only one out of four LIWC categories, positive emotion words, is related to ethical awareness. The findings show a negative association between positive emotion words and ethical awareness. People who use a high frequency of positive emotion words feel good about themselves and so are more likely to see the world in a positive way [21]. This would make sense; usually people don't feel good if they are encountered with an ethical issue and hence they tend to use less positive emotion words to write about ethical breach. Since this was an exploratory study to investigate the use of LIWC categories in predicting ethical awareness, we do not have sufficient evidence to validate our findings. Instead we would like to further our studies and explore more on the other LIWC categories to identify the best predictors of ethical awareness.

A potential limitation of the study is the small number of words used by many of the participants in response to ethical vignettes. Ten or more words of each response is optimal for analysis. Many of the responses failed to reach the threshold. In future studies we will increase the number of ethical vignettes and direct participants to give fuller accounts of their responses to each vignette. This will provide us with more reliable measures of individuals' levels of awareness, motivations and understandings of engineering ethics.

We believe that LIWC has a potential to detect ethical awareness, provided if we can identify the ideal LIWC categories that are the predictors of ethical awareness. In our future study we aim to employ all the 74 LIWC categories to investigate the linguistic cues in answering ethical vignettes for a larger sample.

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