Do Ethical Views Differ in Different Situations? Using Pathfinder Associative Networks to Compare Views

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Abstract

This paper describes a study that compared how people viewed ethics within the context of different situations. Using Pathfinder associative network analysis, the researchers compared associative networks of three groups of subjects. Pathfinder provides a graphical representation and statistical measure of how people relate ethics terms. The results confirm past scenario-based research that found people's judgment of what is ethical or unethical is situation-dependent. In addition, the use of Pathfinder associative networks introduced statistical measures and graphical representation of people's view of ethical concepts which have not been used in IT and ethics research.

Keywords: ethics, IT and ethics, associative network, Pathfinder, semantic network, mental model

INTRODUCTION

The news headlines in the past couple of years have raised awareness of ethical issues and unethical behavior in business in general but there have also been many serious problems with misuse of IT (information technology). Businesses have suffered large financial losses (Marshall, 1999). The 2004 Computer Security Institute/FBI Computer Crime and Security Survey found $141 million in financial losses to 494 survey respondents. Given the ethics crisis reported in news headlines, ethics research is still of interest in practical and theoretical terms for researchers and managers in IT.

Theoretical ethics research has produced a few models of ethical behavior and decision-making. Empirical ethics research in the IT field has most often used a scenario-based approach and examined judgments of whether a particular action was ethical or unethical. The current study is also scenario-based but uses an analysis technique known as Pathfinder associative networks to examine people's conceptual view of ethics. By using Pathfinder, which has not been done in IT and ethics research, this study provides a different analytical approach to examine whether one's view of ethics concepts varies in different situations.

If differences are confirmed, this will support previous research findings but it will also add to the research by providing a perspective into how people view ethics in a given situation. Pathfinder associative networks provide both a graphical and statistical model that depicts the relatedness of concepts within a certain knowledge domain (Dearholt and Schvaneveldt, 1990; Rowe and Cooke, 1995; Chen and Paul, 2001) and it has been used in other fields of research. (Associative networks are also known in the research literature as *proximity networks, semantic networks, cognitive systems and mental models.*)

PATHFINDER

The associative network and analysis techniques used in this study are known as Pathfinder Networks (PFNets) and are based on work done by Schvaneveldt (1990) and Schvaneveldt, Durso and Dearholt (1985). PFNets have been used in several fields of study but have yet to be used in IT and ethics research. The visualization of knowledge with PFNets has been used in co-citation analysis (Chen and Paul, 2001) to identify knowledge groups within a research area, in medical research to examine cognitive differences between schizophrenics and healthy subjects (Vinogradov et al., 2003) and in human-computer interaction to assess how users visualize the computer systems they use (Chen, 1998; McDougall et al., 2001). PFNets have also been used in education and training research to predict student performance and to measure training effectiveness (Goldsmith and Johnson, 1990; Goldsmith and Davenport, 1990; Housner et al., 1993; Rowe and Cooke, 1995; Choo and Curtis, 2000; Curtis, et al., 2003; Curtis and Davis, 2003).

When used in training, PFNets have been shown to capture knowledge apart from declarative or procedural knowledge (Rowe and Cooke, 1995; Curtis and Davis, 2003). Further, Pathfinder is distinguished from statistical methods such as principal components analysis and structural equation modeling. Principal components analysis is a data reduction method that extracts a small number of components from a large set of variables and structural equation modeling is for causal models that theorizes directional relationships between variables (Pedhazur and Schmelkin, 1991). Pathfinder's output is a directionless network (Bonebright, 1998), not causal, and the conceptual model is not assumed to reflect unobserved, underlying concepts. As the discussion below indicates, the non-directed least-path networks Pathfinder produces allow for analysis and observation of interesting relationships between concepts in a particular domain.

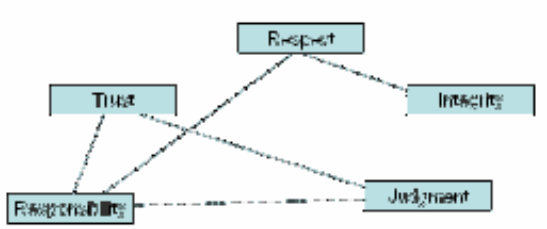
PFNet analysis provides both a statistical assessment and graphical representation of how a person relates terms or concepts within a knowledge domain. The relationship of the nodes in a PFNet is derived from pairwise ratings of terms (or concepts) in a subject domain, such as computer programming, risk management, managerial accounting, or for this study, ethics. The terms used in the ratings are identified by domain experts as representative concepts of the knowledge domain. For example, if the knowledge domain is relational database

design, terms such as entity, attribute, primary key and referential integrity would likely be part of this knowledge domain. If the knowledge domain is managerial accounting, terms such as break-even point, fixed cost, variable cost, and contribution margin ratio might be representative concepts (Curtis and Davis, 2003). To determine an individual's PFNet of managerial accounting concepts, the subject rates the similarity of all possible pairs of terms from the predetermined list of terms. Figure 1 shows an example of one pair of relational database terms and one pair of accounting terms and the range of relatedness is from 1 to 9 (a rating of 1 means the terms are highly related and 9 means the terms are unrelated).

Figure 1: Examples of Pairwise Terms

Two readily observable and important characteristics of Pathfinder associate networks are *distance* and *neighborhood*. Figure 2 shows an example of a small PFNet of some ethics terms. The *distance* between any two nodes represents the minimum path between those two nodes. Distances of one means two nodes have no intermediate node and we view these two nodes as more closely related than other nodes in the area. In the example shown in Figure 2, judgment has a closer relationship to trust than to respect or integrity because it is directly linked to trust with a distance of one. The *neighborhood* characteristic is represented by the set of nodes with a distance of one from a specified node. In the example network, integrity, judgment and responsibility are in trust's neighborhood. Responsibility and integrity are in respect's neighborhood.

Figure 2: Example of a pathfinder Associative Network



As described earlier, two PFNets can be compared as to their *similarity*. Continuing our managerial accounting example, the similarity between the PFNet of a student and instructor or between a trainee and manager can be measured; we would expect the PFNet to be substantively different (or dissimilar) to the trainee's PFNet. To compare two associative networks, PFNet analysis measures the *closeness* or similarity of the two networks as a ratio of the links in common divided by the number of links in either network. The closeness ratio can range from 0 (no shared links) to 1 (identical networks). A statistical test of similarity is the Tail Probability which is the probability that two networks would share a given number of links or more by chance. Another measure used in graph comparison is correlation. We examine the raw proximity data files, which have a rating for each concept pair. Since Pathfinder produces a 'shortest-path' network, examination of correlations in raw proximity data is also useful in observing relationships among datasets that the network similarity measure does not capture.

ETHICS AND IT

Though the use of Pathfinder networks has not been reported in research of ethics and IT, a preliminary study done by the authors using Pathfinder confirmed findings from published research that students studying IT differ from IT professionals in their ethical views (Athey, 1993; Benham and Wanger, 1995; Cappel and Windsor, 1998). Other ethics and IT research has examined ethical decision-making and possible influential factors (Jones, 1991; Banerjee, Cronan, and Jones, 1998; Leonard, Cronan, and Kreie, 2004). One factor that has been found to be significant is *attitude*—often measured as whether a person judges an action as ethical or unethical (Leonard et al, 2004). Another factor, as proposed by Jones (1991), is the

situation or ethical issue involved. The current study may add to an understanding of one's attitude by examining a person's associative network of ethics concepts and examine whether one's associative network is issue-contingent.

THE STUDY

The objectives of the current study were to gather and assess subject's view s of some ethical concepts within the context of a specific situation (scenario) and to compare associative networks for three different scenarios to determine if the networks vary according to the scenario. In a preliminary study, a list of 17 terms was gathered from several articles in journals that discuss business ethics (see the Appendix). We reduced the list of terms 12 by having a small group of professionals read the scenarios (later used in the experiment) and rank the ethics terms as to their relevance (or centrality) to each scenario. The top 12 terms across the three scenarios were used in this study.

Students in an introductory course in management information systems volunteered to participate in this study. Participants were given a URL to access. At this Web site, the subjects answered a few demographic questions then read one of three ethics scenario and completed the relatedness rating for all possible pairs of the ethics terms. Each subject read *only one* scenario. Scenario 1 described a programmer who works at a bank and modified some code to avoid paying late fees, Scenario 2 described a programmer that used company computer equipment after work hours to write programs for friends, and Scenario 3 described an analyst who copied a data set that was being analyzed on a government contract (The scenarios are given in their entirety in the Appendix). Also, past research using these scenarios and measuring attitude have found that the majority of subjects judge the behavior in scenarios 1 and 3 as unacceptable. The majority of subjects judge the behavior in scenario 2 as acceptable (Kreie and Cronan, 2000).

After reading the scenarios, all possible pairs of the 12 terms of interest were presented to each subject as described in Figure 1. The subjects were asked to make a similarity judgment *in the context of the scenario just read* and assign a rating as to the relatedness of the two concepts. Our web application then saved the ratings of each subject for processing and analysis using the Pathfinder algorithms.

RESULTS

Forty-three subjects completed the study successfully, all undergraduates in a college of business in a Southwestern university. The utility algorithms contained in the set of Pathfinder tools (http://interlinkinc.net/) allow us to examine and analyze the ratings data in a number of ways. For example, some observations (not counted above) were removed either because Pathfinder's data coherence tool indicated that the subjects had either encountered technical difficulties during the online ratings presentation or was in some way was unable or unwilling to take the ratings task seriously. The coherence threshold is generally .20. The remaining observations showed data coherence (> .20)., and those were used for PFNet derivation, comparison, and analysis across the three scenarios.

The analysis found negligible similarity between PFNets averaged by scenario. It is expected that there would be some commonality between the networks since they all deal with the ethics domain. The expected similarity ratio is .104 and the observed similarity ratio is only .263—a similarity greater than chance but not strongly similar. There is no precise similarity threshold, only a subjective judgment based on how much more similar two networks are than chance. One useful metric is the measure of observed (2.63) minus expected (1.04) closeness. Since the difference between the expected and actual similarity is only .159, we can readily judge that the networks are in fact not similar. The fact that all three networks have 5 links in common is coincidence, and not unusual in networks of this size.

Table 1: Correlation of PFNets for the Three Scenarios

Scenario	1	2
2	0.113	
3	0.435	0.183

Another Pathfinder tool is the correlation measure, which examines the relatedness of

the raw ratings data between 2 or more data files. The associative networks for the three scenarios are not highly correlated, as shown in Table 1, but the lowest correlation is between scenario 2 and the other two scenarios. As noted earlier, the action depicted in scenario is most often judged by subjects as acceptable, and this is reflected in the low correlation between scenario 2 and the other scenarios.

We averaged the subjects' networks for each of the three scenarios using additional tools in the Pathfinder suite. Averaging is especially useful in observing different features of the conceptual networks. The average associative network for the three scenarios is shown in Figures 3, 4, and 5, respectively.

Figure 3: Average PFNet for Scenario 1 (Programmer at Bank Modified Code)

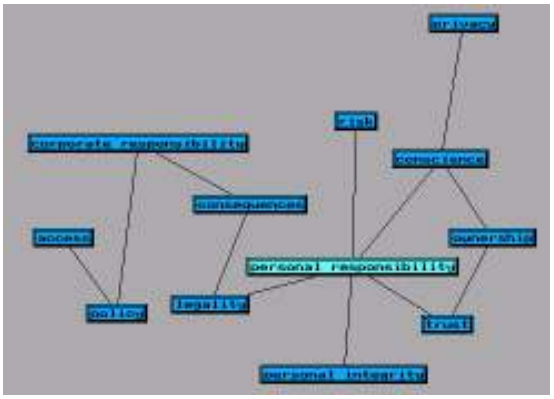
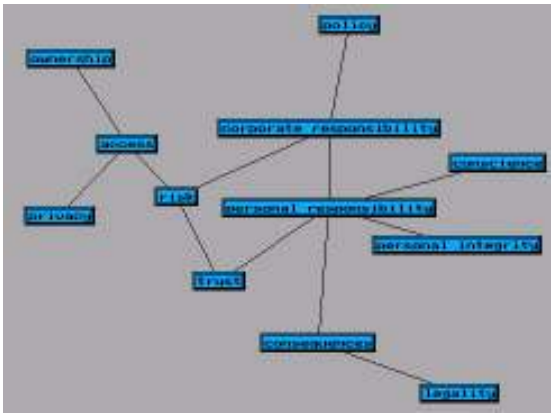
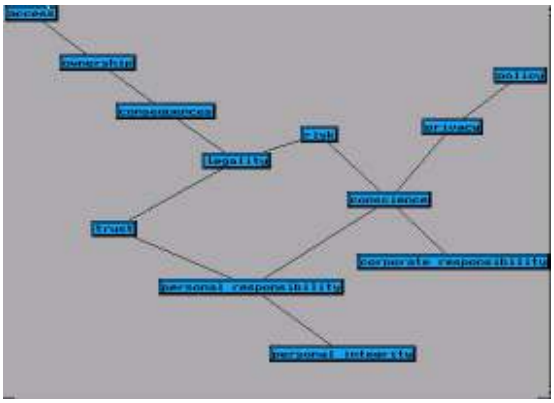


Figure 4: Average PFNet for Scenario 2 (Programmer Used Equipment after Work Hours for Personal Use)



With respect to the few commonalities indicated by the common links identified in Table 1, all three networks directly link personal responsibility (highlighted for visibility) to trust, conscience, and personal integrity; all three directly link legality to consequence. For scenarios 1 and 2, personal responsibility has the most complex neighborhood with direct links to five other concepts. The distinction between these two scenarios for personal responsibility is that Scenario 1 directly links personal responsibility to legality and risk, while scenario 2 directly links personal responsibility to corporate responsibility and consequences. Since scenario 1 depicts the surreptitious modification of code, intuitively, the link to legality and to risk seems apropos. The link from personal responsibility to corporate responsibility and consequences in scenario 2 (use of company equipment after work hours for personal use) may reflect the perception that companies should make it clear to employees whether personal use of company equipment is acceptable or unacceptable. Though only anecdotal, subjects in past research have made comments to the authors regarding this scenario stating that a company should make clear whether employees can do personal work outside of work hours.

Figure 5: Average PFNet for Scenario 3 (Analyst Copied Data Set for Employer)



For scenario 3 (copied a dataset), the most interrelated neighborhood in the PFNet links conscience to four other concepts: privacy, personal responsibility, corporate responsibility, and risk. Again, past research has shown increasing concerns about privacy and whether companies act responsibly. Though the action taken in the scenario is not described as illegal, the direct links of conscience to responsibility (corporate and personal), privacy and risk reflects subjects'

perception that these ethical concepts are closely related in such a situation.

The purpose in observing the various relationships between nodes and groups of nodes is that the clusters reflect how a person directly relates certain concepts and, in the case of this study, how the clusters can vary in different situations. Though further research is needed, we may find that a well-defined network cluster containing personal responsibility, trust, personal integrity, and conscience reflects a person's view that personal ethics is most pertinent in a given situation while, in another situation, legality, corporate responsibility, policy, and trust reflect the company's central role.

CONCLUSIONS AND DISCUSSION

The purpose of this study was to compare associative networks to see if people's view of the ethics domain varies across different situations. We created 3 situational contexts by presenting the subjects with 3 different scenarios followed immediately by the pairwise ratings task. Our analysis of the similarity ratios of various networks (averaged by scenario) indicated that the results for each scenario were in fact different. The slight similarity above chance was not unexpected (even though the context scenarios were different) since the terms were all from the ethics domain, and the subjects were in effect 'primed' by the scenarios.

The purpose of introducing the use of Pathfinder to the research of ethics and IT goes toward the whole problem of teaching ethics. As mentioned in the Introduction, educators now are directly tasked to teach ethics and ethics concepts. We believe the production and use of conceptual networks can significantly help in the area of assessment of learning in this complex and highly subjective domain.

The current work and analysis has confirmed findings from past research that *context matters* when trying to assess the ethical views of an individual or a whole class, and adds another dimension to the examination of ethics and IT. In order to accurately assess ethical views, the Pathfinder networks help to identify the subtleties in views produced by different situations. We feel this type of analysis and assessment will lead to a better understanding of what techniques are working (or not) in teaching ethics. Further study is warranted to discover whether the PFNets are correlated with attitude (people's judgment of what is ethical or unethical) and behavioral intention. Planned future experiments will assess ethical mental models (using scenarios) both before and after ethics instruction. The similarity measures in particular seem to be an ideal way to assess if the student mental model is moving toward an expert or target model after a treatment. Additionally, visual cluster analysis may indicate the direction to follow in developing course modules to reinforce relationships between concepts.

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APPENDIX

Scenario 1: A programmer at a bank realized that he had accidentally overdrawn his checking account. He made a small adjustment in the bank's accounting system so that his account would not have an additional service charge assessed. As soon as he made a deposit that made his balance positive again, he corrected the bank's accounting system.

Scenario 2: A computer programmer enjoyed building small computer applications to give his friends. He would frequently go to his office on Saturday when no one was working and use his employer's computer to develop computer applications. He did not hide the fact that he was going into the building; he had to sign a register at a security desk each time he entered.

Scenario 3: A company employee was doing piecework production data runs on company computers after hours under contract for a state government. Her moonlighting activity was performed with the knowledge and approval of her manager. The data were questionnaire answers of 14,000 public school children. The questionnaire contained highly specific questions on domestic life of the children and their parents. The government's purpose was to develop statistics for behavioral profiles, for use in public assistance programs. The data included the respondents' names, addresses, and so forth.

The employee's contract contained no divulgement restrictions, except a provision that statistical compilations and analyzes were the property of the government. The manager discovered the exact nature of the information in the tapes and its value in business services his company supplied. He requested that the data be copied for subsequent use in the business. The employee decided the request did not violate the terms of the contract, and she complied.

ETHICS TERMS: LIST OF THE ORIGINAL SEVENTEEN

Accountability	Conscience
Fairness	Consequences
Access	Piracy
Privacy	Accuracy
Corporate responsibility	Policy
Legality	Personal integrity
Personal responsibility	Ownership
Respect	Risk
Trust	

ETHICS TERMS: LIST OF TWELVE USED IN STUDY

Access	Personal integrity
Conscience	Personal responsibility
Consequences	Policy
Corporate responsibility	Privacy
Legality	Risk
Ownership	Trust