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Using the Analytical Hierarchy Process (AHP) to Construct a Measure of the Magnitude of Consequences Component of Moral Intensity

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ABSTRACT. The purpose of this work is to elaborate an empirically grounded mathematical model of the magnitude of consequences component of "moral intensity" (Jones, *Academy of Management Review* **16**(2),366, 1991) that can be used to evaluate different ethical situations. The model is built using the analytical hierarchy process (AHP) (Saaty, *The Analytic Hierarchy Process*, 1980) and empirical data from the legal profession. One contribution of our work is that it illustrates how AHP can be applied in the field of ethics. Following a review of the literature, we discuss the development of the model. We then illustrate how the model can be used to rank-order three well-known ethical reasoning cases in terms of the magnitude of consequences. The work concludes with implications for theory, practice, and future research. Specifically we discuss how this work extends the previous work by Collins (*Journal of Business Ethics* **8**, 1, 1989) regarding the nature of harm variable. We also discuss the contribution this work makes in the development of ethical scenarios used to test hypotheses in the field of business ethics. Finally, we discuss how the model can be used for after-action review, contribute to organizational learning, train employees in ethical reasoning, and aid in the design and development of decision support systems that support ethical reasoning.

KEY WORDS: ethics, moral reasoning, moral intensity, magnitude of consequences, analytical hierarchy process, nature of harm, mathematical model, law, legal data, jury awards, decision making, decision support

Introduction

According to most ethical systems, making an ethical decision requires that the decision maker consider the magnitude of consequences of a set of courses of action. Magnitude of consequences is a key component of moral intensity, a rich construct that includes six factors as defined by Jones (1991). Magnitude of consequences captures the notion that actions that result in more severe consequences (e.g., death, dismemberment, etc.) are deemed to have higher moral intensity, all other things being equal. This is a question posed each day to juries, which assign monetary awards to cases brought before them. Several studies (e.g., Chia and Mee, 2000; Dukerich et al., 2000; McMahon and Harvey, 2007) have found the magnitude of consequences component of moral intensity to be a significant factor. Most recently, Tsalikis et al. (2008) found that of all the factors comprising moral intensity, magnitude of consequences and social consensus were ranked highest in terms of significance frequency. We thus began this work with a keen interest in the role that consequences have in decision making.

As decision theorists, we were concerned with how decision makers can compare two or more courses of action in terms of magnitude of consequences. We thought that one should not have to "go to trial" to assess the consequences of one's decision; tools and models should be available to organizational decision makers to assess pending courses of action.

We were therefore motivated to develop an empirically grounded model to help decision makers in organizational settings assess the magnitude of consequences of courses of action or situations. The model was built using the analytical hierarchy process (AHP) using empirical data from the legal field to establish the factor weights. This paper describes the process of constructing the model and how the model may be used in theory and practice.

Justification and literature review

Social context

We live in a world plagued by scandals and breaches of ethics. Within government, the ethical lapses of Abramoff, Delay, Ney, and Foley remind us of the persistent nature of the problem. Enron and Arthur Anderson typify the worst breaches in recent corporate history. A recent Google search of "corporate ethics" returns 37,400,000 hits. Over a hundred scholarly papers have been written on corporate ethics since 2000 based on a recent search in ABI/INFORM. Managers are responsible for creating an ethical workplace yet the problem persists. What can be done?

Thwarting intentional breaches of ethics is hard to do and can only be accomplished by demotions, firings, stiff fines and legal action as warranted. However, many breaches of ethics are the result of poor education in the faculties of moral reasoning. In these cases, structured decision making, software tools, and training can make a difference. For instance, Cheney (2006) proposes a simple decision making model for managers to aid in ethical decision making. Nash (1981) proposed a similar model several years ago. One of the key challenges is simply defining and measuring aspects of the moral act. How do ethical situations differ from other ones? What are the criteria for the evaluation of options? What other factors are important? What are the practical implications of these ideas? These were the questions that we began with.

Research on ethical decision making

Prior research has produced several models of ethical decision making by individuals in organizational settings (Jones, 1991). Loe et al. (2000) compiled a list of empirical studies of ethical decision making in business by category and found that 15 concerned ethical awareness, 107 pertained to individual factors, 64 to organizational factors, and 2 to moral intensity (p. 187). Assessments of the moral components of a situation have appeared in the business literature in the works of Trevino (1986); Dubinsky and Loken (1989); Ferrell and Gresham (1985); Rest (1979, 1986); Hunt and Vitell (1986); Jones (1991); Weber (1996), among others. These models identify a process whereby the individual *recognizes* a moral issue, makes a moral *judgment*, establishes his or her *intent*, and engages in moral *behavior* (Jones, 1991, p. 370). This process is contingent on the moral context under consideration (Jones, 1991).

Previous research breaks the moral context into three primary factors.

- Characteristics of the Decision Maker.
- Organizational factors.
- The moral act or issue itself.

The primary aspect of the decision maker is the person's level of Cognitive Moral Development or CMD. This construct is built on foundation works from developmental and applied psychology that assume that individuals develop their ethical reasoning skills as they mature. The view that an individual develops his or her moral reasoning is based largely on the work of Kohlberg (1981). Kohlberg's research identified six stages to individual moral development, which are grouped into three levels: Pre-Conventional, Conventional, and Post-Conventional. Based on this framework, Kohlberg and other researchers developed and tested instruments to measure cognitive moral development and ethical reasoning capabilities. The most widely used instruments include the Moral Judgment Inventory (MJI) (Colby and Kohlberg, 1987; Kohlberg, 1981) and the Defining Issues Test (DIT) (Rest, 1979, 1986; Rest et al. 1997a, b, 1999, 2000). These instruments have been tested extensively for reliability and validity, and are used widely in the field. Another popular instrument used in management settings is the MJI developed by Weber (1991, 1996).

The influence of organization factors such as size, climate and other factors on the moral context appear in Trevino (1986), Kelley and Elm (2003), and others. However, these interesting issues lie outside the scope of this research.

Finally, the action or issue itself is a part of the moral context. This notion was first operationally defined by Jones (1991). The moral act itself is evaluated using the notion of moral intensity.

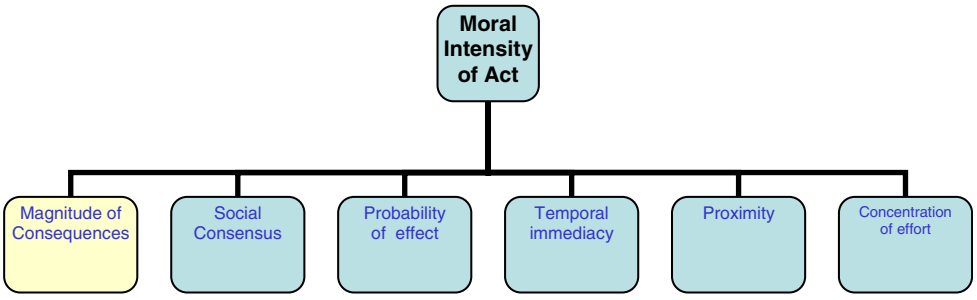

Figure 1. Moral intensity construct.

Moral intensity

Jones defines moral intensity to be a function of six (6) components (Figure 1)

- Magnitude of Consequences
- Social Consensus
- Probability of Effect
- Temporal Immediacy
- Proximity
- Concentration of Effort

These six components are defined as follows:

- *Magnitude of Consequences (MC)* is defined as "…the sum of the harms (or benefits) done to victims (or beneficiaries) of the moral act in question" (Jones, 1991, p. 374).
- *Social Consensus (SC)* is defined as the degree of social agreement that the act is good or evil (p. 375).
- *Probability of Effect (PE)* is the joint probability that the act will take place and produce the harm or benefit expected (p. 375).
- *Temporal Immediacy (TI)* is the length of time between the present and when the effects are likely to be experienced (p. 376). Shorter time implies greater temporal immediacy.
- *Proximity (PX)* is the feeling of social nearness (i.e., physical psychological, social, cultural) between the moral agent and the victim (or beneficiaries) of the moral act (p. 376).
- *Concentration of Effort (CE)* is an inverse function of the number of people impacted by an act of a certain magnitude (p. 377).

One indication of the value of a construct is its use in other works. A number of empirical studies have been conducted over the past 15 years using Jones' concept of moral intensity. These include: Morris and McDonald (1995); Weber (1996); Harrington (1997); Marshall and Dewe (1997); Franke et al. (1997 on gender differences); Davis et al. (1998); Singer et al. (1998 on whistle-blowers); Douglas et al. (2001); Shafter (2002 on financial reporting) and May and Pauli (2002).

Several works have tested the validity of Jones' moral intensity construct, and in general, support has been found. For instance, a study by Paolillo and Vitell (2002) found that "Moral intensity explained 37% and 53% of the variance in ethical decision making in two decision-making scenarios" (2002, p. 5).

Several studies have been conducted to verify the relative importance the six components of moral intensity first proposed by Jones. McMahon and Harvey's (2006) factor analysis supports, "…a three-factor structure, with the MC, PE, and TI items loading on the first factor, the PX items loading on the second factor, and the SC items loading on the third factor" (2006, p. 381). Dukerich et al. (2000) also found support for the magnitude of consequences component of moral intensity but not all of the other components. McMahon and Harvey (2007) note that social consensus and magnitude of consequences appear to be the most robust constructs of the six. Social consensus and magnitude of consequences were observed to be significant in nine out of 11 studies, and six out of 12 studies, respectively (p. 339); less support was found for the other factors. In one study, Chia and Mee (2000) examined the relationships between issue recognition and the components of moral intensity. Support was found for social consensus and magnitude of consequences but limited or no support for the rest. These results prompted the authors to observe:

''This raises the question of whether the moral intensity construct proposed by Jones (1991) should include all six components'' (Chia and Mee 2000, p. 266). A recent study by Tsalikis et al. (2008) calculated a ''significance to times studied'' ratio (STSR) for all components and found the STSR for social consensus to be 81% and for magnitude of consequences to be 73%, which were the highest. Concentration of effect was lowest at 33% (p. 615). The emerging conclusion is that social consensus and magnitude of consequences are most likely to be significant in moral decision-making contexts, with more limited support for the other components. For these and other pragmatic reasons described in the next section, we chose like others (e.g., Weber, 1996) to focus on the magnitude of consequences component of moral intensity in this study.

Magnitude of consequences and the nature of harm

Magnitude of consequences deals with the positive and negative impacts of a course of action on various stakeholders; i.e., ''…the sum of the harms (or benefits) done to victims (or beneficiaries)…'' (Jones, 1991, p. 374). This apparently simple definition bears closer examination, especially regarding the concepts of ''harm'' and ''victims.'' Harms can be characterized in a number of ways. Collins (1989) was one of the first to outline a typology of harm. He proposed that harmful transactions (p. 4) are a function of three variables: (1) the nature of the harm; (2) the nature of the harmed; and (3) the stage at which the harm occurs. In this study, we focus on the nature of the harm variable since we agree with Weber (1996) who writes, ''…consideration of all three of Collins' components…would result in an entangled data analysis'' (1989, p. 4).

Our pragmatic and theoretical understanding of the nature of harm is based on legal theory. Collins (1989) and Weber (1996) provide excellent summaries of the nature of the harm variable based on existing legal theory, specifically tort law (see Prosser and Keaton, 1984). Tort law provides a means to assess the severity of harm, its impact on victims, and to assign a cash value to such incidents to compensate victims. Harms are broken into three ''essential'' and distinct categories: physical, economic, and psychological harms (Collins, 1989). Physical harms include death, dismemberment, and all forms of physical injuries. Economic harms include tangible factors such as property damage as well as intangible or estimated factors such as diminished future earning power. Psychological harms include mental distress, anxiety, loss of sleep, depression, and a host of other mental conditions that may interrupt ''normal'' life. These categories are deemed to account for all categories of harm suffered by victims.

According to Collins, ''…physical harms are the most serious and receive the highest condemnation from the justice system, followed by economic harms and psychological harms'' (Collins, 1989, p. 4). Physical harms are the easiest to recognize and to assign compensation to victims. Implicit in the preceding is the assumption that more serious physical harms will be recognized by individuals (e.g., juries) and will evoke higher levels moral reasoning. Weber (1996) tested this assumption and found support for it, among others. Economic harms can be recognized and quantified with some degree of confidence as well, although compensation is generally less. Psychological harms are the most difficult to assess given their subjective nature and compensation tends to show the highest variance.

Although the three categories are broad, they are independent of each other and provide a means to operationally define the notion of consequences. We accepted these distinctions for the purposes of this study. We framed the magnitude of consequences variable in terms of the three nature of harm categories provided by Collins. These categories offer several benefits. First, they are grounded in extensive legal theory. Second, they are parsimonious and non-overlapping. Third, they are easy to understand from a common-sense perspective. Finally, they provide an avenue for measurement. These categories have been used for many, many years to assess consequences in court cases and records have been kept of these results. We can use these records to determine the relative weights of various courses of action in terms of their magnitude of consequences.

Research objectives

Our original research goal was to produce an empirically grounded model that would allow us to

numerically assess the moral intensity of a particular situation and compare that to other ethical situations. We could then use the model to rank-order the moral intensity of various decision options or to assess prior actions taken (see Implications section of the paper).

However, given the multi-dimensionality of the construct of moral intensity, the questions raised regarding the significance of each component of moral intensity in the literature, and the paucity of research and data in this area, we scaled back our efforts to produce a model of just the magnitude of consequences component of moral intensity; i.e., our current model calculates a partial score of the moral intensity of the proposed act using the magnitude of consequences component only. In the future research section of this paper, we discuss ways to incorporate the other factors into the model.

Measuring magnitude of consequences

Consistent with tort law and Collin's (1989) nature of harm definition, we broke the magnitude of consequences construct into three sub-components: physical, economic, and psychological impacts (harm or benefits). These are further broken into sub-categories as is illustrated in Figure 2.

Physical harms are broken into death and injury. Economic harms are broken into financial loss, loss of property, and damage to reputation. Psychological distress encompasses a host of emotional states including depression, anxiety, sleep disruption, etc. The harm classifications are consistent with how the justice system makes awards to plaintiffs in civil and criminal suits and keeps records of court cases.

Our goal was to establish the relative weights of each component and build a model that could produce a composite score of the Magnitude of Consequences for a particular course of action or situation. In this study, we made the choice to focus on harms instead of benefits. We chose the AHP as the means to assess the weights of the variables of the model using empirical data from the legal profession.

Assessment and decision making using the analytical hierarchy process

AHP is a powerful and flexible multi-criteria decision-making method that has been applied to solve unstructured problems in a variety of decision-making situations ranging from the simple personal decisions to the complex capital intensive decisions in fields as diverse as management science, economics, finance, politics, and sports (Saaty and Vargas, 1991). Surprisingly, there are very few published examples (e.g., Millet, 1998) of applying AHP in the domain of ethics. One contribution of this work is that it illustrates an in-depth application of this highly flexible and powerful method to the area of moral decision making.

AHP differs significantly from other decision making and ordering methods. AHP is best applied in situations where structuring, measurement, and/or synthesis are required (Ahmad et al., 2006; Saaty and Vargas, 1991). AHP allows a decision maker to

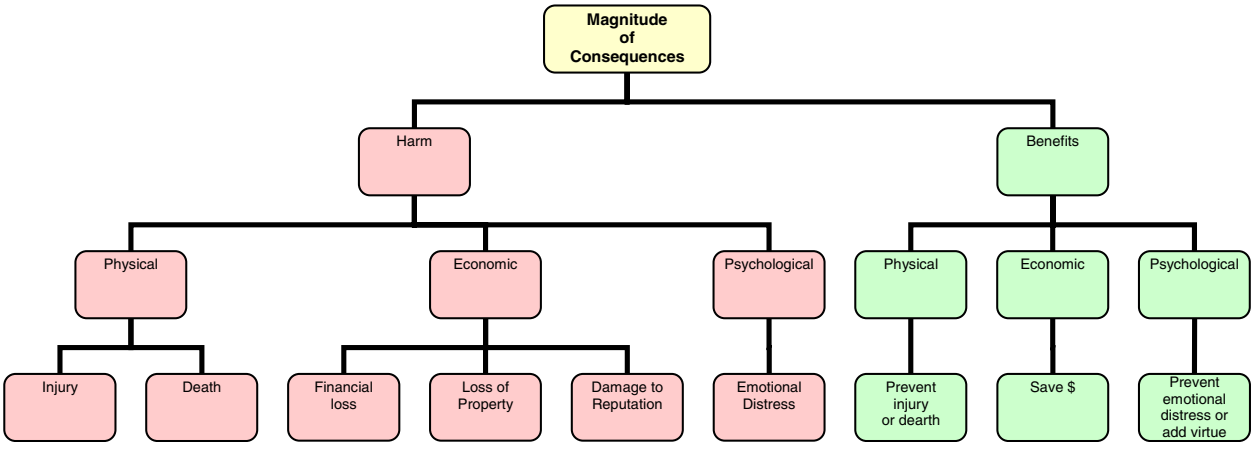

Figure 2. Components of magnitude of consequences.

make assessments, prioritize, and select from among a set of options. The AHP process is reliable and repeatable. It reduces a set of options (or situations) into pairwise comparisons and asks for a ratio assessment of each pair. For example, to assess preference for three features, A, B, and C, AHP would set up the three pairwise comparisons (AB, AC, and BC). The results of the comparisons are arrayed in a matrix and values are assigned to each option. Once values are assigned, the options can be compared or rank-ordered.

Critics of AHP argue that rank reversal can occur in AHP when alternatives are added or deleted (Belton and Gear, 1983; Belton and Stewart, 2002). However, several studies have shown that rank reversal can be avoided through a link between the normalization and weighting processes (Choo et al., 1999; Saaty, 2000; Schoner et al., 1997). Based on the results of numerous studies, we believed that AHP provided an excellent means to measure components of moral intensity. In the next section, we discuss the procedure in detail.

Fundamentals of the analytical hierarchy process

AHP addresses subjective issues by using ''fuzzy set'' theory based on the idea that decisions are usually not absolute but are often made up of concepts that are defined only in ''fuzzy'' or relative terms (Saaty, 1980). Developed by Saaty (1980), it has been used as a method for evaluating complex multi-criteria decision-making problems. The method allows users to analyze both qualitative and quantitative criteria for purposes of generating weights of importance of the decision criteria and measuring the relative performance of alternatives in terms of each individual decision criterion. AHP simplifies the decision-making process by breaking the problem into three basic steps: (1) problem decomposition, (2) comparative judgments, and (3) synthesizing the result (Ahmad, 2005).

Step 1: Decomposition of the problem

In this first step, a problem is decomposed into a hierarchical structure that consists of an objective (i.e., overall goal), criteria, sub-criteria, sub-sub-criteria, etc., and decision alternatives. The objective of the decision is represented at the top level of the hierarchy. The criteria and sub-criteria are represented at the intermediate levels. The decision alternatives or selection choices are laid down at the last level of the hierarchy.

Step 2: Comparative judgments

The second step involves the construction of simple pairwise comparisons of pairs of criteria, pairs of sub-criteria (pairs of sub-sub-criteria, if any), and pairs of alternatives. Comparisons are based either on field data (e.g., the buying preferences of consumers from bar code data) or from the judgments of content experts. If experts are used, the latter make pairwise comparisons using a nine-point scale as is shown in Table I and the results are tabulated in a set of matrices (Saaty, 1980). The number of matrices depends on the number of elements at each level and the order of the matrix at each level depends on the number of elements at the lower level to which it is linked. The pairwise comparisons are made in terms of how much element A is more important than element B. It uses a ratio scale driven from each level of criteria, sub-criteria, and alternatives, which allows the construction of relative weight matrixes.

For example, for a given criteria in the first row, if alternative A is ''Very Strongly Preferred'' over alternative B by a rater, then a weight of 7 is entered. If alternative A is ''Strongly Preferred'' over alternative C, then a weight of 5 is entered.

TABLE I

Saaty nine-point scale

Weight	Description
1	Equally preferred
2	Equally to moderately preferred
3	Moderately preferred
4	Moderately to strongly preferred
5	Strongly preferred
6	Strongly to very strongly preferred
7	Very strongly preferred
8	Very to extremely strongly preferred
9	Extremely preferred

TABLE II

Matrix illustration

Criteria 1	Alternative A	Alternative B	Alternative C
Alternative A	1	7	5
Alternative B	1/7	1	3
Alternative C	1/5	1/3	1

Consequently, the relative importance of alternative B and C to alternative A is the reverse value, which is 1/7, and 1/5, respectively, as shown in Table II. The remaining comparison is made between B and C, which in this case assumes that B is "Moderately Preferred" to C as shown in row 2.

Step 3: Synthesis

The third step involves manipulating the values entered in the second step to determine the best alternative for a particular goal. Once the pairwise comparison matrix is constructed, we next normalize the table by dividing each number in a column of the pairwise comparison matrix by its column sum. We then develop the priority vector, which is a set of eigenvalues of the matrix, by taking the row average of the normalized matrix. These row averages form the priority vector of alternative preferences with respect to a particular criterion. The values in this vector sum to 1. In this step, we also have the capability to measure the consistency of our judgment. The consistency of the subjective input in the pairwise comparison matrix (Step 2) can be determined by calculating a consistency ratio (CR). In general, a CR of <0.1 is good (Saaty, 1980).

In the next section, we show how this method was applied in the development of our model of the magnitude of consequences component of moral intensity.

Using AHP to calculate overall weights of the magnitude of consequences

Refining the structure

We decomposed magnitude of consequences into the three sub-factors as noted above: physical, economic, and psychological. We used the AHP technique as a means to set the relative weights of the physical, economic, and psychological components of Magnitude of Consequences. The hierarchical structure for this construct is shown in Figure 3.

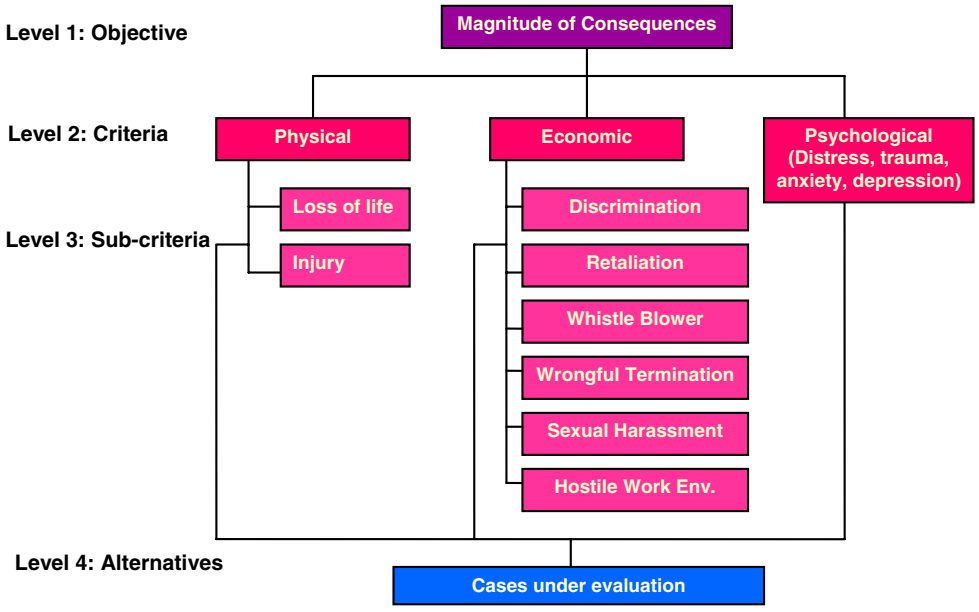

Figure 3. Hierarchy for magnitude of consequences construct.

The sub-structure is based on the way court cases are grouped by the legal profession (e.g., see for example Jury Verdict Research). It should be noted that this decomposition while not perfect, is the best available. Cases that are relatively straight-forward fit nicely into one of the categories, e.g., loss of life would fit into the physical harm category. On the other hand, more complex cases assigned to one category may include elements of the other harm categories. For example, a case that involves discrimination (e.g., economic harm) may also include depression in the victim (e.g., psychological harm). We assumed that cases are classified according to the "primary" harm that dominates and that jury awards reflect the value associated with the most severe category of harm, i.e., we assumed that juries are able to discriminate between the various harms and weight their compensation judgments accordingly. We also assumed that the legal profession knows how to file such records in terms of the three major categories.

Once the hierarchy has been constructed, the next step is to perform a comparative analysis (Step 2). An analysis using AHP hinges on the type of the data fed into the model. These data can come from two sources: content experts and/or empirical data from the field. In the first case, we would ask a group of experts to judge the relative importance of each outcome and, from a set of pairwise comparisons, compute the weights of the factors. In the second case, we would use empirical measurements of the severity of various outcomes to establish the weights. Fortunately for us, the legal profession (as well as other groups such as the insurance industry) assigns numerical values to the magnitude of consequences of various outcomes every day. We saw an opportunity to use compensation awards in instances of physical, economic, and psychological harm to victims. Our rationale was that court cases codify legal expertise in the form of monetary awards; more severe consequences to victims merit higher awards. This assumption is partially supported by Weber's (1996) study that found support for the hypothesis that the acts that result in more severe consequences evoke higher levels of moral recognition and reasoning. Compensation verdicts in legal cases can therefore be used to estimate the relative weights of various harms. We chose the latter for the purposes of this study.

Sources of data

We used legal data compiled on a state-by-state and national basis by Jury Verdict Research (www.juryverdictresearch.com. Horsham, PA). This organization collects and disseminates jury verdict awards based on physical, economic, and psychological harms. These data are shown in Table III.

TABLE III

Verdict compensation $ awards by category

Category	Harm	Median verdict average ($)	Ratios (hi/lo)
Physical[a] (1998–2004)	All types	639,834	8.5
	Death	1,248,500	
	Injury	31,168	
Economic[b] (1999–2005)	All types	176,892	2.4
	Discrimination	195,000	
	Retaliation	150,452	
	Whistle-blower	218,067	
	Wrongful termination	125,880	
	Sexual harassment	186,250	
	Hostile work environment	185,700	
Psychological[a] (1998–2004)	All types	75,000	1.0
	Emotional distress	75,000	

Sources: [a] *Current Award Trends in Personal Injury* (LRP Publications, Horsham, PA), 2006; [b] *Employment Practice Liability: Jury Award Trends and Statistics 2006 Edition* (Jury Verdict Research, Horsham, PA), 2006.

TABLE IV

Normalized matrix using legal data

Factors	Legal awards ($)	Normalized weights for physical harm	Normalized weights for economic harm	Normalized weights for psychological harm
Physical harm	639,834	1	3.62	8.53
Economic harm	176,891	0.28	1	2.36
Psychological harm	75,000	0.12	0.42	1

The median award values are based on hundreds, if not thousands, of annual court cases. We assumed that the filings by courts discriminate between the major categories and that the large sample size provides a fair approximation of the dominant classification of harm.

The normalization matrix

Further, we performed a pairwise comparison of the values in Table III and constructed a normalized matrix for the three evaluation criteria. The normalized matrix appears below in Table IV.

The next step using AHP is to calculate the priority vector for the criteria in Table IV. We sum each column, and then divide each entry in the table by its column sum; this gives us a new matrix. The last step is to take the average of each row in our new matrix.

Each individual value in any priority vector will range between 0.0 and 1.0. The values in any priority vector will sum to 1 (subject to rounding error). The priority vector for the criteria is shown in Table V. The CR for this study was also calculated and a score of 0.0 was obtained, indicating a high level of consistency. Therefore, we get

TABLE V

Priority vector for harm categories

Component	Weight
Physical harm	0.737
Economic harm	0.177
Psychological harm	0.085

$$\begin{aligned}\text{Magnitude of Consequences Score} &= 0.737(\text{Physical Harm})l \\ &+ 0.177(\text{Economic Harm}) \\ &+ 0.085(\text{Psychological Harm})\end{aligned}$$

Discussion

According to the model, physical harm is 4–5 times as significant as economic harm in the eyes of juries and 8–9 times as important as psychological harm. We viewed this result as a good approximation of the overall model weights (in future research, we will determine the overall weights using legal expert raters and modify the results obtained here as necessary; see last section of paper). The model allows us to now evaluate any situation as a weighted sum of each of the three types of harms, thus adding to our understanding of Collin's (1989) nature of harm variable. For example, in Table III in Collins paper (p. 7), the nature of harm is listed for 15 different ethical issues ranging from pollution to bribery. For instance, 'plant closing' is simply listed as producing 'economic/psycho harm,' to which we might ask, ''in what proportion?'' Our method provides a potential answer. Furthermore, Collin's Tables III and IV (p. 10) are meant to be used by managers as part of an organizational harm analysis prior to making a decision about a situation that has ethical dimensions. He argues, and we agree, that ethical decisions force a decision maker to evaluate subtle degrees of harm, not just simple trade-offs between harms and benefits (p. 8). Our model yields a composite score of harm for each situation that allows the decision maker to compare it directly to all others. We believe this is an important extension of the earlier work.

Application of the model to three test cases

To test the efficacy of the model, we illustrate the application of the model to the three well-known cases included in the Moral Judgment Interview (Weber, 1990, 1996), which has been used to assess the level of moral reasoning of adults in management settings. These cases represent varying degrees of moral intensity. We evaluated each case using the AHP procedure and the weights from the general model above. See Exhibit 1 for a summary of each case.

In order to apply our model to the three cases, we performed a comparison of each case (i.e., alternative) in terms of physical, economic, and psychological harm. The case comparison process is exactly the same as the attribute criteria process described earlier. Table VI shows a pairwise comparison matrix for Physical Harm.

TABLE VI

Pairwise comparison matrix for physical harm

	Heinz case	Evelyn case	Roger case
Heinz case	1	5	9
Evelyn case	1/5	1	3
Roger case	1/9	1/3	1

Using the same algorithm as previously described (i.e., compute column totals, divide each cell by its column total, compute each row average), we get the Physical Harm priority vector (Table VII).

We computed the CR for physical harm by multiplying each column of the pairwise comparison matrix (Table VI) by its priority vector (Table VII).

EXHIBIT 1

Three moral reasoning test cases (Weber, 1990, 1996)

C1: Heinz case

A woman was near death from a special kind of cancer. There was one drug that the doctors' thought might save her. It was a form of radium that a druggist in the same town had recently discovered. The drug was expensive to make, but the druggist was charging ten times what drug cost him to make. He paid $400 for the radium and charged $4000 for a single dose of the drug. The sick woman's husband, Heinz, went to everyone he knew to borrow the money tried every legal means, but he could only get together about $2000, which was half of what it cost.

He told the druggist that his wife was dying, and asked him to sell it or let him pay later. But the druggist said, ''No, I discovered the drug and going to make money from it.'' So having tried every legal means, Heinz gets desperate and considers breaking into the man's store to steal the drug for his wife.

C2: Evelyn case

Evelyn worked for an automotive steel casting company. She was part of a small group asked to investigate the cause of an operating problem that had developed in the wheel castings of a new luxury automobile and to make recommendations for its improvement. The problem did not directly create an unsafe condition, but it did lead to irritating sounds. Evelyn's boss, the Vice President of Engineering, told the group that he was certain that the problem was due to tensile stress in the castings. Evelyn and a lab technician conducted tests and found conclusive evidence that the problem was not tensile stress. As Evelyn began work on other possible explanations of the problem, she was told that the problem had been solved. A report prepared by Evelyn's boss strongly supported the tensile stress hypothesis. All of the data points from Evelyn's experiments had been changed to fit the curves, and some of the points, which were far from where the theory would predict, had been omitted. The report ''proved'' that tensile stress was responsible for the problem. Evelyn wonders if she should contradict her boss's report.

C3: Roger case

Roger worked for a small accounting firm and was conducting an annual audit of a machinery manufacturer when he found that the firm had received a large loan from the local savings and loan association. It is illegal for savings and loan associations to lend money to a manufacturing firm; they are restricted by law to mortgages based upon residential real estate.

Roger took his working papers and a copy of the ledger showing the loan to his boss, the partner in charge of the office. His boss listened to Roger, and then told Roger: ''I will take care of this privately. We simply cannot afford to lose a client of this status. You put the papers you have through the shredder.'' Roger wonders what he should do.

TABLE VII

Physical harm priority vector

	Weight
Heinz case	0.748
Evelyn case	0.180
Roger case	0.071

$$0.748\begin{bmatrix}1\\1/5\\1/9\end{bmatrix}+0.180\begin{bmatrix}5\\1\\1/3\end{bmatrix}+0.071\begin{bmatrix}9\\3\\1\end{bmatrix}=\begin{bmatrix}2.293\\0.544\\0.215\end{bmatrix}$$

We then divided these numbers by their priorities to get:

$$2.293/0.748 = 3.065$$
$$0.544/0.180 = 3.017$$
$$0.215/0.071 = 3.001$$

The average of the above results gives us λ_{max}, which is the maximum eigenvalue of the matrix. The λ_{max} value is an important validating parameter in AHP. It is used as a reference index to screen information by calculating the CR of the estimated vector in order to validate whether the pairwise comparison matrix provides a completely consistent evaluation (Saaty, 1980).

$$\lambda_{max} = (3.065 + 3.017 + 3.001)/3 = 3.029$$

We then computed the consistence index (CI):

$$CI = (\lambda_{max} - n)/(n-1) = (3.029 - 3)/2 = 0.015$$

where n is the number of factors used in the study.

Once the CI value is calculated, we can compute the CR. The CR = CI/RI, where RI is a known random consistency index obtained from a large number of simulation runs and varies depending upon the order of matrix (Saaty, 1980).

In this study, we have three factors so the value of RI is 0.58 (Saaty, 1980). Therefore,

TABLE VIII

Priority vectors for each case

	Physical harm	Economic harm	Psychological harm
Heinz case	0.748	0.548	0.681
Evelyn case	0.180	0.241	0.201
Roger case	0.071	0.211	0.118

$$CR = CI/RI = 0.0015/0.58 = 0.025$$

Since the CR, is less than 0.10, this is well within the acceptable range for consistency. We then repeated the entire AHP calculation process above for Economic Harm and Psychological Harm, which yields priority vectors for each case (Table VIII).

Once the priority vector for each case was obtained, we calculated the overall priorities for each case using the weights determined for the general model; i.e., we multiplied the priority vectors (Table V) by the priorities for each case (Table VIII).

$$\begin{aligned}&\text{Magnitude of Consequences Score}\\&= 0.737(\text{ Physical Harm})\\&\quad + 0.177(\text{ Economic Harm})\\&\quad + 0.085(\text{ Psychological Harm})\end{aligned}$$

Thus, the overall priority vector is for each case is:

$$\text{Case 1}: (0.737)(0.748) + (0.177)(0.548) + (0.085)(0.681) = 0.706$$

$$\text{Case 2}: (0.737)(0.180) + (0.177)(0.241) + (0.085)(0.201) = 0.193$$

$$\text{Case 3}: (0.737)(0.071) + (0.177)(0.211) + (0.085)(0.118) = 0.099$$

These results are summarized in Table IX.

Discussion

These results indicate that the magnitude of consequences of the Heinz case (C1) is 3.7 times as great

TABLE IX
MC harm scores by case

	Overall score
Heinz case	0.706
Evelyn case	0.193
Roger case	0.099

as the Evelyn case (C2) and about seven times as great as the Roger case (C3). This is what we would have expected and is consistent with case descriptions found in earlier research (e.g., Monga, 2007; Weber, 1996). The Heinz case is heavily weighted to life and death issues, while the others are not. Monga (2007) writes: ''…the moral intensity of the issue and the magnitude of consequences in Vignette 1 (Heinz) is much greater as compared to Vignettes 2 and 3, which is life/death in Vignette 1 (Heinz) versus corporate loyalty/obedience and personal/professional integrity in Vignettes 2 (Evelyn) and 3 (Roger)'' (Monga, 2007, p. 184). Monga (2007) and Weber (1996) both found support for the proposition that the Heinz case (Vignette 1) would invoke higher levels of moral reasoning than the other cases (Vignettes 2 and 3) because it contained more severe consequences, a result that was consistent across cultures (Monga studied Indian managers, while Weber studied American managers). Our model's results complement narrative explanations of the differences between moral dilemmas in terms of consequences, and help us to more precisely detect, and measure, such differences.

Perhaps more significantly, the ability to construct ethical scenarios that are finely graded in terms of consequences (or other components of moral intensity) using AHP is an important contribution to method. We note that most studies utilize ethical scenarios (e.g., ''The Used Car'') that are nominally defined as *low* or *high* in moral intensity (in addition to a control or neutral case). This poses certain problems identified by McMahon and Harvey (2007) and prompts several questions: What is the difference between low intensity and high intensity? How much greater in intensity is one scenario than another? Put another way as a threshold issue, ''At what point does an issue shift from low intensity to high intensity?'' (McMahon and Harvey, 2007, p. 354). Quoting Jones (1991) they write: ''measurement of moral intensity and its components is probably only possible in terms of relatively large distinctions (p. 378)'' (McMahon and Harvey, 2007, p. 351). What are *relatively large distinctions*? We do not know nor do we know the transition from one state to another. The problem has implications for research design, i.e., the choice of between-subject versus within-subject study design (McMahon and Harvey, 2007). Within-subject design tends to diminish the differences between high and low intensity scenarios making significance harder to detect, a problem that surfaced in the discussion of findings of Study 2 (McMahon and Harvey, 2007, p. 351). Perhaps some progress can be made on all of these questions given the ability to construct a number of scenarios that can be rank-ordered from low to high on a numerical scale. Our work thus provides a means to address several issues regarding the measurement of moral intensity, and in particular, the magnitude of consequences component.

Future research and applications of the model

There are many opportunities to apply this model to both research and real-world situations. In the previous section, we illustrated how the model can be used to rank-order three test cases. Here, we discuss how this model can be applied in both theory and practice. We also discuss avenues for further research.

Future research

To corroborate the results obtained here, we would perform a similar study using expert raters in lieu of using legal data. Experts would be asked to compare various harms using Saaty's nine-point scale (see Table I). For example, given a list of physical (A), economic (B), and psychological (C) harms, experts would make pairwise comparisons using the nine-point scale. The results would be compiled into a table like Table II and then normalized in a table like Table IV. We would then calculate a priority vector as before (e.g., see Table V) to obtain the weights of the three components of harm. Such a study would serve to cross-check the weights obtained for the general model.

Another study could be designed using AHP to measure other components of moral intensity. One of the chief limitations of this study is that it only addresses the magnitude of consequences component of moral intensity. For example, to measure degrees of social consensus, experts could be given various scenarios and they would be asked to rate them in terms of how ''good'' or ''evil'' they are. The scenarios could be anchored with cases that represent maximum evil or good courses of action. Using the results of several pairwise comparisons, a normalized matrix and the priority matrix would be constructed. New cases could then be evaluated using the weights obtained during the first step. Similar analyses could be conducted for the other components of moral intensity that are considered to be valid (see for example Tsalikis et al., 2008). A composite score could then be assigned to any new case under evaluation in terms of its moral intensity. Such a scoring model would be applicable to wide range of cases, moral situations, and ethical systems of reasoning.

After-action reviews and organizational learning

One of the aspects of a learning organization (Argyris and Schon, 1978; Senge, 1990) is the ability to learn from past actions. To accomplish that end, organizations need to engage in after-action reviews (e.g., Baird et al., 1999). Organizations that want to improve in their ability to make ethically sound decisions need to review past actions and practices along ethical lines. The model can provide a means to evaluate the ethical dimensions of past actions and practices. The results can provide a benchmark for improvement. For instance, a recent study by Giacobbe and Segal (2006) presented a framework for the evaluation of unethical marketing research practices. Evaluation of the seriousness of lapses in ethics in the marketing field was made according to the perceptions of a sample of marketing professionals. These marketing practices could also be evaluated using AHP and the model developed here. We expect the AHP process, which is structured, to increase the consistency and reliability of the results.

The model could also be used proactively to help decision makers evaluate potential courses of action. As decision alternatives are generated and screened, the ethical dimensions of those actions can be evaluated using the model. Decisions that favor higher positive (or lower negative) magnitude of consequences scores will be preferred. The same approach could be used to rank-order projects designed to mitigate risk based on the magnitude of consequences and the probability of occurrence. This would be especially useful to organizations (e.g., pharmaceutical companies) that carry extensive product lines that pose potential risks to consumers.

Training employees in ethical reasoning

Another application of the model can be to help design and develop scenarios for training employees in the ethical dimensions of various problems. Jones' (1991) general model of ethical reasoning (see also Trevino, 1986 and others) and instruments that measure cognitive moral development evaluate the degree to which individuals can recognize moral situations; i.e., a person must first recognize the situation as ethical or moral prior to making any judgments. The model could be used to construct scenarios with a range of scores in terms of magnitude of consequences. Retrospectively, the model could be used to rank-order existing scenarios used in training and research. Instruments that measure cognitive moral development could benefit from scenarios that are rank-ordered.

Designing decision support systems that support moral reasoning

The model could be useful in the development of decision support systems (DSS) that support ethical reasoning. Decision support systems have been designed for a variety of tasks, mostly technical in nature. However, in the past few years there has been interest in designing DSS to support ethical reasoning capabilities.

For instance, Mancherjee and Sodan (2004) found some utility for a system called Ethos (Searing, 1998), which guides the user through the ethical decision-making process. Goldin et al. (2001) developed a web-based system that they argue helps students reason through ethical dilemmas in profes-

sional settings. Chae et al. (2005) discuss the consequences of incorporating an ethical perspective in problem formulation for DSS design. Stein (1999, 2004, 2005) designed an ethical decision support system (EDSS) that is accessible via the web at myethicscheck.com. The system engages the user in a Q&A session like one would have with a human advisor. At the end of the session, an on-screen report assesses the strength of the DM's ethical position and provides an explanation of the variables and their values. The system was piloted with two groups of working professionals enrolled in MBA classes (Stein, 2005) and the results were favorable.

Stein (2005) classifies EDSS designs in terms of the number of ethical viewpoints provided by the system (e.g., utilitarianism, Kantian, etc.) and the level of complexity of the ethical reasoning model(s) used. The model developed here would be useful in increasing the sophistication of the reasoning employed by the system.

For instance, Stein's EDSS first generation prototype (2005) used a structured decision-making model captured in twelve questions proposed by Nash (1981), a very simple model. The next version of the system uses a more complex model that takes into account the characteristics of the decision maker (DM) and the moral act itself, which is consistent with Jones' notion of moral intensity. Specifically, the system provides feedback to the user regarding the following:

- Internal Conflict and Stress of the DM;
- DM Stakeholder Conflict and Likelihood of Acceptance of the decision;
- Action-Outcome Probability; and
- Strength of DM's Ethical Position based on the magnitude of consequences and other factors.

The model component of the system calculates an overall score of the +/− magnitude of consequences of the act being considered using a point system. Negative points are accumulated if the alternative being considered involves injury, loss of life, financial damage, or damage to reputation. Positive points are accumulated if someone is helped, the solution can stand the test of time, or the world will be made a better place (i.e., Kant's test). Negative or low positive scores suggest a weaker ethical position; higher positive scores suggest a stronger ethical position.

An EDSS such as this one could be made considerably more powerful if it utilized the AHP model we developed. The model could be used to assess the magnitude of consequences component of various alternatives considered by the decision maker with greater consistency and reliability.

Conclusions

In this work we developed a measure of the Magnitude of Consequences component of Moral Intensity, a construct developed by Jones (1991) and used in several studies on ethics. We broke the magnitude of consequences component into three dimensions: physical, economic, and psychological consequences. To assess the relative strengths of the three sub-components, we used money awarded by juries to victims compiled between 1999 and 2005 by Jury Verdict Research. The results of this analysis produced a general model of the Magnitude of Consequences component of moral intensity:

$$\begin{aligned}\text{Magnitude of Consequences Score} &= 0.737(\text{Physical Harm}) \\ &+ 0.177(\text{Economic Harm}) \\ &+ 0.085(\text{Psychological Harm})\end{aligned}$$

In a subsequent study, we will use legal experts to independently evaluate the weights of the three subcomponents and compare those results to ones obtained using legal data. In the future, we hope to expand the model to include the other components of moral intensity in addition to magnitude of consequences.

We then illustrated the use of the model in the evaluation of three test cases used in instruments that measure cognitive moral development. Using the AHP process, we successfully rank-ordered the three cases in terms of magnitude of consequences.

In the last section, we discussed ways this model might be used to enhance theory and practice. In terms of theory, we view this study as a much needed extension of the earlier work by Collins (1989). Although several studies cite Collins, little has been done since on the nature of harm typology

he proposed, but there appears to be a need for it (McMahon and Harvey, 2007, p. 354). We also point to the value of the AHP method and the model we derived in the development of ethical test scenarios (rank-ordered or scored numerically from low to high) that can be used to test hypotheses in the field of ethics.

Practically, we would like to see the model used to help organizations learn from prior actions by evaluating the moral intensity of various actions taken in the past. It could also be used to evaluate various courses of action under consideration to address current and future needs. The model also holds promise for constructing scenarios that can help sensitize employees to the ethical dimensions of their actions and to measure cognitive moral development. Finally, because we have been able to assign a numerical score to the magnitude of consequences component of moral intensity, the model may aid in the design and development of Ethical Decision Support Systems that help people reason through the ethical dimensions of their decisions.

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