How Do People Resolve Dilemmas? Eliciting Subjective Decision Factors

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Abstract
The organization and operation of human societies involve many kinds of social rules which we all more or less obey. Such rules for proper behaviors in a society or a group are called normative or deontic. The deepest, most internalized forms of these rules govern our moral and ethical behaviors. A key concern in this type of situations is deontic conflicts: decisions where all the alternatives lead to the violation of some norms. People think critically about these kinds of decisions. But, what they think about may not be always clear. Our broad focus is on difficult kinds of forced decisions where people need to choose between alternative undesirable outcomes. Most specifically we focus on so-called deontic dilemmas, where each alternative results in some kinds of violation of a normative/ethical rule. An elicitation approach is proposed that helps to identify the subjective factors that people use to resolve these kinds of difficult choices. Our technique is a hybrid of two established research methodologies: repertory grid and conjoint analysis. We illustrate our technique using a well-known challenge problem from psychology, known as the Trolley Problem. The technique is implemented as a prototype web-based application. We refer to our technique as the Open Factor Conjoint Methodology. We identify areas that need further research in order to refine and fully validate the methodology.

1. Introduction
A long time ago, a Chinese king had a dilemma. His kingdom was surrounded by invaders, and he could not decide what to do. He gathered his ten generals and asked for their advice. Three of the generals agreed and recommended one plan. The other seven generals recommended a different plan. The king chose the first plan. Why? Because number three was considered as a lucky number for Chinese at the time,. The moral: sometimes people make decisions based on surprising factors.

We all make decisions every day based on a combination of objective factors (e.g., factors economists would consider rational), as well as subjective factors that may be personal in nature. We get up in the morning: coffee first vs. shower first? At breakfast: glazed sweet-roll vs. granola? In these cases, the scope of the decision consequences is limited to our personal well being, with little consequence to others. In the other cases, our decisions may be affected by social norms, laws or customs. In these cases, the outcomes have a broader, social effect. When one does not obey such a normative rule, the outcome is recognized as a violation, and negative consequences, such as a fine, criminal punishment, or merely social disapproval (a raised eyebrow).

Analysis of deontic dilemmas provides insights into moral and ethical reasonings, and has consequences for the design of legal and regulatory systems. However, while there is a great deal of philosophizing about ethics and morality, there is not a great deal about how people actually go about making choice between these kinds of trade-offs. An important
challenge in analyzing choice behaviors for these kinds of decisions is that morality and ethics tend to be highly internalized. Operationally, an internalized rule is one that we follow even when no one is watching. We learn these rules early on, and they become largely subconscious. The purpose of this research is to propose a methodology for empirically investigating such deontic dilemma decision problems, with an attempt to reveal these hidden factors.

In this paper, we discuss the nature of deontic conflicts and the lack of empirical research regarding how people actually make moral decisions. We then suggest a new methodology for eliciting these factors from individuals by combining two well known methodologies: repertory grid and conjoint analysis. We illustrate the methodology with examples from the Trolley problem and we describe a prototype web-based system which, once fully developed, could be used to apply the methodology in a cross-cultural context. Finally, we discuss limitations and identify areas for further research and methodology development.

1.1 Example: the trolley problem

Among the various moral/ethical conflicts that one might face, probably the most acute are those involving a personal moral violation. Greene & Haidt [7] define this as follows:

A moral violation is personal if it is: (i) likely to cause serious bodily harm, (ii) to a particular person, (iii) in such a way that the harm does not result from a deflection of an existing threat onto a different party. A moral violation is impersonal if it fails to meet these criteria.

Personal moral violations are more likely to involve emotional factors that one may not be consciously aware of. A classic example contrived to illustrate a personal moral dilemma is known in the literature as the trolley problem. The trolley problem was initially formulated by Philippa Foot [24] and elaborated by Judith Jarvis Thomson [14, 15]. The Trolley Problem has since become a favorite in philosophy and psychology for discussions related to ethical dilemmas [8, 27].

Below is a description of the essence of the trolley problem. You are a bystander seeing an oncoming trolley whose brakes have apparently failed but is unable to stop the fast runaway train. On the track ahead are four workmen. There is a fence on either side, so that the workmen cannot get out of the trolley’s way. Fortunately, there is a switch you can throw to divert the trolley to another track. Unfortunately, on the other track there is a single worker, who is also fenced in and unable to jump out of the way. What should you do? Most people agree that it is morally permissible throw the switch to de-track the train to the single worker’s direction. Indeed, some would even say that they are morally obligated to do this.

However, there is another version of the trolley problem. Again, the out-of-control trolley is approaching, and again there are four workmen ahead, with fences on both sides. However, in this case there is no switch to divert the trolley. The only option is to somehow stop the trolley, for instance by dropping some heavy weight in front of it. As it happens, you are observing this from an overhead bridge. Coincidentally, there is another person on the bridge, who happens to be quite fat. So fat, in fact, that he could stop the trolley, or at least slow it down enough for the workmen to escape. However, the fat man is of the type that enjoys life and is not about to throw his life away by a suicidal jump. Thus, to stop the trolley, you would have to give the fat man a push, so that he would fall off the bridge and stop the trolley. Would you do this? Most people find the latter version of the trolley problem to be more troubling. But, usually they are not able to explain why. In the later part of the paper, we will use the trolley problem to illustrate our method.

2. Social norms and deontic reasoning

Vranes [32] wrote, “Norms have the fundamental functions of obligating, prohibiting and permitting according to deontic (legal) logic” (p.398). Deontic logic, also called logic of norm or logic of obligation, refers to a study of the normative use of language and formalizes such concepts as obligation, permission, and prohibition.

There is a sizable literature devoted to deontic logic and the formalization of deontic reasoning. The early works in this area are summarized in Hilpinen [12]. For a more recent survey of the field, see McNamara [18]. Also, Nguyen [21] provides a detailed summary of deontic aspects as applied to business processes. Since our focus in this paper is more on the empirical aspects of deontic (ethical, moral) reasoning and due to page limit, we will not attempt to summarize this formal literature.
More relevant to our concerns is an emerging literature about deontics in cognitive psychology. For instance, Buccarelli and Johnson-Laird [2] describe “deontic principles concern[ing] what is obligatory, permissible, and impermissible. They lie at the heart of human social relations, and underlie all ethical, legal, and religious systems” (p.159). Beller [1] describes deontic reasoning as “thinking about which action a person may or must perform with respect to a social rule”.

When confronted with a novel situation, people appraise the situation and consider whether or not to respond, and if to response, what actions to take. As Mikhail [20] notes, “a central problem moral cognition must solve is to recognize (i.e., compute representations of) the deontic status of human acts and omissions” (p.81). People evaluate deontic situations in a mixture of circumstances, with a variety of considerations for making their decision. For example, consider the following situation. Your girl-friend would like to meet with you tonight, but your mother also wants to see you. Decisions involving global considerations often become more complicated. For example, does the USA have the right to prosecute Somali pirates without Somalia’s jurisdiction? We appraise others’ actions as being permissible. For example, imported designer clothes are often all the rave. People do not pay attention to the facts that producing these clothes often involve child labors. “There are many frameworks in which deontic states are central – systems of morality, religion, laws, kinship, social conventions, games, and so on. In all these systems, some states are permissible and some are impermissible” [2].

From the cognitive psychology perspective, what is of interest is the mental models people use in making deontic inferences [2]. Three predictions follow. First, reasoners should tend to draw those conclusions according to their mental models. Second, inferences based on one mental model should be easier to make than those based on multiple mental models. Third, premises yielding more than one mental model with an explicit content should elicit a greater variety of responses than premises yielding only one mental model with an explicit content (p.179).

3. Deontic conflict

There are many sources of norms in a civilized society: government, religion, public health, local institutions, and so forth. In a given location or situation, several sets of norms may co-exist. However, sometimes conflicts may arise between deontic rules and/or between multiple overlapping jurisdictions. For instance, nearly every religion has a prohibition against killing another human being. However, when the government decides to go to war, it may draft young people into the military and demand that they go kill the enemy. For those with strong religious convictions, this is a serious deontic conflict [23].

Deontic conflict is an occurrence where there are two rules a person must obey but fulfillment with one of the rules will violate the other. For example, in the human world, people need to get to work on time, but one cannot speed over the limit on the highway. Mandatory evacuations are in place for human safety during natural disasters, but a relative is bedridden at home. Under these circumstances, the decision to stay violates the mandatory evacuation policy. Some religions oppose life saving blood transfusions; a doctor needs to decide to violate the religious beliefs and save the patient or decide to honor the religious belief and lose the patient?

The classifications of deontic conflicts include two groups: resource conflicts and procedural conflicts. Resource conflicts are situations with particular time constraints. An agent is incapable of fulfilling two obligations at the same time. For example, a man is incapable of participating in a relative’s funeral and at the same time being in a hospital with his wife who is in labor. Procedural conflicts represent events where one needs to perform two or more obligations in a specific order. For instance, people cannot cook or prepare a meal without first purchasing groceries [23].

4. Implementation of the methodology

This paper presents our methodology as an online system called the Open Factor Conjoint System. This system provides an automatic1 functionality for data collection and result analysis. The (theoretical) method is based on a synthesis of two established research techniques: repertory grid and conjoint analysis. In addition, factor analysis was employed to identify the underlying attributes derived from repertory grid as a basis for conjoint analysis. Compared with both

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1 The server is run by Microsoft Windows Server 2003 R2. In addition, Microsoft Access 2003 and Microsoft Excel 2003 are used as backends. And, VB.Net, ASP.Net are used as front-ends. SPSS 15 with conjoint analysis was embedded within this system for both Factor Analysis and Conjoint Analysis.
original methods, this system does not require the interviewer to be face to face with the interviewees. As such, the administrator can administer the survey anywhere/anytime in the world. This is an especially efficient feature when the system is used for performing cross-cultural research. Furthermore, the technique is designed to reduce the experimental bias and extend the effectiveness of both methodologies. In particular, the methodology was used to discover the empirical results for deontic-issue research.

4.1 Role requirements

There are 4 positions or “roles” that will participate in this system: Experimenter, Domain Experts and two groups of Respondents (which may be the same group). The responsibilities of each role are as follows:

(1) Experimenter: The major responsibilities of an Experimenter are to select elements, set up the survey system and execute the analysis processes.

(2) Domain Experts: These individuals participate in a “Construct Elicitation” survey. They also provide specific expert domain knowledge in their field(s).

(3) Respondents Group 1: These individuals participate in a ‘Grid Rating’ survey.

(4) Respondents Group 2: These individuals participate in a ‘Conjoint Analysis’ survey.

4.2 Steps in the Open Factor Conjoint Methodology

4.2.1 Select Elements

The experimenter will select elements which are focused in the field being studied. With regard to deontic decisions, these elements represent situations or scenarios in which a deontic dilemma may be encountered. After the elements are selected, the Open Factor Conjoint Methodology provides a simple interface for the Experimenter to input those elements into the database.

For example, there are five elements used in the survey which was developed to investigate the Trolley Problem [14, 15]. All of these elements involve the same structure as the Trolley Problem, whereby the decision-maker must choose between “kill one to save four” and “take no action and let four die”. These elements include:

1: The bystander at switch.
2: The fat man.
3: Transplant.
4: The man in the yard.
5: The track that loops back.

Examples of the full descriptions for Element 1 and Element 2 are shown below:

**Element 1:** A trolley is running out of control down a track. In its path are 4 people who have been tied to the track. Fortunately, you can flip a switch, which will lead the trolley down a different track to safety. Unfortunately, there is a single person tied to that track. Should you flip the switch?

**Element 2:** As before, a trolley is hurtling down a track towards four people. You are on a bridge under which it will pass, and you can stop it by dropping a heavy weight in front of it. As it happens, there is a very fat man next to you - your only way to stop the trolley is to push him over the bridge and onto the track, killing him to save four. Should you proceed?

In selecting elements, the Experimenter should consider the guidelines associated with selecting repertory grid elements. For example, according to Oppenheim et al. [22], “elements selected are most often people, objects, events and activities, in other words nouns and verbs. Element should also be homogenous, that is, classes of elements should be
mixed and should not be sub-sets of other elements” (p.422). In addition, Fransella et al. [4] mentioned two main keys to selecting elements: First, “elements should be within the range of convenience of the constructs used”. Second, “they should be representative of the area being investigated” (p.18).

4.2.2 Elicit Constructs

With regard to the repertory grid method, the purpose of eliciting constructs is to “invite the interviewee to tell you the constructs he uses about a particular part of his world” [31]. In this system, Domain Experts are the main interviewees. In the methodology, a Domain Expert is randomly shown two elements and is requested to answer a question: Which of these two elements presents the more difficult ethical choice? The Domain Expert will choose his/her answer. After he/she answers, the system will request the Domain Expert to enter a word/phrase to identify the distinguishing characteristic that most influenced his/her choice, resulting in the identification of a construct. This procedure is repeated until no new constructs are identified.

Generally, traditional repertory grid surveys will continue to show the subjects randomly selected elements until no new constructs are provided. In this Open Factor Conjoint Methodology, a Domain Expert will be closed out of the session if he/she cannot provide any new constructs three times; i.e. if he/she uses the same answer from previous subjects for three times in total. In addition, the survey will be terminated if the system counts five people entering the system who provide no new constructs.

4.2.3 Elaborate

After the elicitation construct step is complete, the Domain Experts will evaluate all constructs and provide a description for each construct. For example, a Domain Expert provided the following description for one of the constructs, “type of action”: “Whether or not you have physical contact with victim(s)”. The purpose is to assist respondents in understanding these constructs for the next step in the Grid Rating surveys.

4.2.4 Grid Rating

The purpose of Grid Rating is to provide data for use in factor analysis for the identification of independent and non-overlapping (orthogonal) variables. Louviere [17] addressed “constructs are derived from a content analysis of individuals’ responses. In some applications the constructs are rated by individual(s) and then subjected to a factor analysis” (p.50-51). This system will show all scenarios (elements) one at a time and it requests the subjects to rate the relevance of each scenario (element) based on the constructs (factors) using a ten-point scale. The answer will fall between one (lowest relevance) and ten (highest relevance). These constructs are obtained from a previous step, each with a short clear description provided by the Domain Experts.

4.2.5 Factor Analysis

In this system, factor analysis is applied for the analysis of the results of repertory grid. “Factor analysis is a technique used to identify factors that explain common variance among variables. This statistical method is often used to reduce data by grouping variables that are deemed to measure a common construct [19]. The data collected from the Grid Rating step will ultimately be analyzed by using SPSS v15 [30] which is embedded in the system. The default criterion of factor analysis in this system is based on a ‘Rotated Component Matrix’. According to this analysis, all factors are separated or loaded onto a set of components. The system will default to select the highest-valued factor to represent each component. However, the Experimenter is allowed to use his/her judgment for selection purposes. Furthermore, there are two methods - ‘KMO’ and ‘Bartlett’s Test’ - that are also provided to determine “the appropriateness of factor analysis examines the entire correlation matrix” [9]. According to Hair et al. [9], the Bartlett’s Test is:

A statistical test for the presence of correlations among the variables is one such measure. It provides the statistical significance that the correlation matrix has significant correlations among at least some of the variables. [And also], ‘measure of sampling adequacy’ (MSA), [also called ‘KMO’, is used] to quantify the degree of inter-correlations among the variables and the appropriateness of factor analysis. This index ranges from 0 to 1, reaching 1 when each variable is perfectly predicted without error by the other variables. The measure can be interpreted with the following guidelines: .80 or above, meritorious; .70 or above, middling; .60 or above, mediocre; .50 or above, miserable; and below .50, unacceptable (p.99).

4.2.6 Identify Dependences

Simmons and Esser [26] indicated that “One of the core requirements of traditional conjoint design is that the attributes and levels are independent. This means that the value or ‘worth’ of one level must not depend on its co-existence with another level” (p.76).
For instance, there is a tradeoff occurring in diverse features when people purchase a new vehicle (e.g. price, horsepower, color, brand etc.). In this case, the price has a dependence on both horsepower and brand. Therefore, it is suggested that these factors need to be revised or the wording of the questioning must be modified (p.76). In this step, the Experimenter needs to identify each attribute that is found in the previous step to confirm independence.

4.2.7 Identify Levels
Except for ‘Independence’, Simmons and Esser [59] described that ‘focused’, ‘realistic’ and ‘balanced’ are also the criteria that must be satisfied to create the levels in a conjoint process. For example, one of the factors, ‘health status of victim(s)’ was assigned 3 levels: (1) healthy, (2) sick, and (3) very sick. The following are the definitions mentioned by Simmons and Esser [26]:

Focused: Conjoint levels must also be clearly defined along one dimension.
Realistic: The overall span or range defined by the levels of a conjoint attribute has a direct impact on the ‘importance’ of that attribute.
Balanced: An attributes will become more ‘important’ if it is given more levels. This effect, referred to as the number of levels effect (NOL), is well documented in conjoint literature. The only solution to the problem is to ensure that all attributes have a similar number or levels, ideally between three and five levels each. If this is not possible caution should be applied to the interpretation of the data (p.76-77).

4.2.8 Orthogonal Process
Based on attributes and levels as defined in the previous steps, the set of possible profiles (situations) can be created, but the total number of possible profiles may be too large for subjects to rate or rank. “When there are for instance 3 attributes with 4 levels and 2 with 3 levels 576 \((4^3 \times 3^2)\) different profiles can be constructed, which is clearly too large a number for respondents to rank or rate” [6]. Therefore, the orthogonal process is used “to reduce the number of stimulus descriptions to a small fraction of the total number of combinations” [5].

In this system, the Orthogonal Process generates a sufficiently large subset of the possible profiles (situations) based on the number of attributes and levels defined in the previous step. Furthermore, there are several (e.g. 3) default holdouts generated and they are included in the group of profiles (situations) and rated by subjects, but they are excluded in the conjoint analysis. The purpose of the holdouts is “to investigate the reliability of the within subjects conjoint analysis method” [25]. In addition, they are “generated from another random plan, not the experimental orthogonal plan” [29].

4.2.9 Conjoint Survey
The purpose of the conjoint survey is to evaluate an individual’s value system in some specific area [3]. Conjoint analysis has become widely used to analyze consumer product preferences in marketing research. For these applications, products or services of a certain kind are defined on a limited number of relevant attributes or characteristics each with a limited number of levels The resulting structured profiles are then evaluated by Respondents, who rank or rate them or choose their most preferred ones from smaller choice sets [6].

In some conjoint analysis surveys, certain situations are provided that depict the scenario of the major topic. Each of these situations incorporates a particular combination of levels of attributes. Each situation profile is defined by an explicit combination of levels of the attributes. The idea is that the Respondent’s overall assessment of profile is represented by the sum of the utilities associated with the specific levels of the attributes which represent the specific profile. The assessment of untested profile can then be determined by the summation of utilities. Hence, a group of Respondents will participate in the survey and provide their judgments on those profiles (situations) which are generated on the last step. The Respondents were requested to review carefully all of the situations, one by one, by noticing the combination of the above variables and to evaluate each situation using the scale provided. For instance, the following questions were asked:

How ethical do you think the above action is?
Unethical -4 -3 -2 -1 0 +1 +2 +3 +4 Ethical

Would you take the same action as the above?
Strong No -4 -3 -2 -1 0 +1 +2 +3 +4 Strong Yes

Finally, Respondents are requested to provide some general demographic information such as age, gender, years of work experience, ethnic group, and so forth.

4.2.10 Conjoint Analysis
Haaijer and Wedel [6] state:
The conjoint methodology is a decompositional approach to analyze consumer preferences.
Product profiles are constructed from the product
attributes, each defined at a certain number of levels, using factorial or fractional factorial design. Respondents give an overall ‘score’ to each product profile and the analyst has to find out what the preference contributions are for each separate attribute and level (p.321).

In this system, SPSS v15 Conjoint [30] is embedded for the analysis of the results of the conjoint survey. There are two major outputs that are generated: utility value for each factor level and relative importance of each variable. Also, there are two statistical measures which can be used for the purpose of validation: Pearson's R and Kendall's tau. Their characteristics are described below:

1. **Relative Importance**
   - The range of the utility value (highest to lowest) for each factor provides a measure of how important the factor was to overall preference. Factors with greater utility ranges play a more significant role than those with smaller ranges [29].

2. **Utility Scores**
   - The utility (part-worth) scores and standard error will be displayed for each factor level. “High utility values indicate greater preference” [29] depending on the nature of the rating scales in the ranking, the opposite is true.

3. **Validate**
   - The association value of Pearson's R and Kendall's tau will be used to evaluate the validity of the conjoint model [28]. These two statistical values (Pearson's R and Kendall's tau) “provide measure of the correlation between the observed and estimated preferences” [29].

   Furthermore, Kendall's tau for holdout situations was also shown. These holdouts “were rated by the subjects but not used by the Conjoint procedure for estimating utilities. Instead, the Conjoint procedure computes correlations between the observed and predicted rank orders for these profiles as a check on the validity utilities” [29]. This value is “used to determine how consistently the conjoint model could predict [subjects’] preference” [28]. “In many conjoint analyses, the number of parameters is close to the number of profiles rated, which will artificially inflate the correlation between observed and estimated scores” [64]. This is acceptable for a model test, but less for holdouts.

4.2.11 **Model Creating**

   The equation of Jain et al. [13] is using to create the decision model in this research. The “$U(X)$ is the overall utility derived from an alternative [subject]” (p.316).

   \[
   U(X) = \sum_{x=1}^{n} \sum_{y=1}^{l_x} \beta_{xy} v_{xy}
   \]

   **Decision Model (Ethical Score) =** $C + \sum_{x=1}^{n} \sum_{y=1}^{l_x} \beta_{xy} v_{xy}$

   - $n = \text{number of attributes}$
   - $l_x = \text{each attribute defined at } l_x \text{ levels}$
   - $\beta_{xy} = \text{part-worth contribution associated with the } y^{th}$ level of $X^{th}$ attribute
   - $v_{xy} = \text{represents the existence } (=1) \text{ or nonexistence } (=0)$
   - $C = \text{Constant}$

4.2.12 **Success Test**

   Two major success tests are used to validate the created model on the previous section (4.1.11):

   (1) A decision model is created to predict how people will resolve the deontic conflict situation which is based on two major outputs of Conjoint Analysis: utility value and relative importance.

   (2) In addition, the *Pearson's R* and the *Kendall's tau* statistics serve to evaluate whether current conjoint model has a ‘goodness-of-fit’ that means a high level of internal validity [25].

5. **Discussion**

   The proposed Open Factor Conjoint Methodology offers a technique for eliciting critical factors that people use to make deontic decisions with minimal experimenter bias. The methodology can also discover empirical constructs that people use in making decisions that resolve certain types of deontic dilemma situations. We have also noted that the methodology can be used online for cross-country or cross-cultural research without time/space limitations.

   That said, the methodology is presently in a prototype stage, and there are several areas where we have noted the need for further improvements, as described below.

(1) **Elements Selection**

   The selection of elements (Step 1.0 in Figure 1) is the critical first step in any kind of repertory grid
study. While the importance of this step is often emphasized, there are actually very few useful guidelines for going about it. Furthermore, in our methodology, each element is a choice (a deontic dilemma). This makes the selection of elements even more challenging. Ideally, one would like to adopt a collection of elements from some independent source, to avoid experimenter bias. Where this is not possible, some variation of a Delphi technique [16] might be useful.

(2) Constructs Elicitation
During the process of constructs elicitation (Step 2.0 in Figure 1), Domain Experts may provide some constructs that can be misunderstood by others or provide a construct with long confusing wording. Besides, Domain Experts may misinterpret the original meaning when they do the elaboration for each construct. Hence, Respondents may misunderstand the meaning of the construct and provide an incorrect response. Therefore, it will cause an inconsistent and unstable result in the factor analysis. The solution to overcome this problem may require the Domain Experts to not only provide the constructs, but also to provide a short sentence to describe the meaning of this construct.

(3) Factor Analysis
In the factor analysis step (Step 5.0 in Figure 1), even though Domain Experts provided a very detailed elaboration, the result of the factor analysis showed a stability problem and an inconsistent result. For instance, the value of KMO was not convincing or reliable. There were several possible reasons that caused this problem: (1) the number of Respondents was not sufficient (2) the demeanor of the Respondent’s attitude to participate in this survey (3) the Respondents may have misunderstood the meaning of the constructs. The solutions to overcome these problems could be to use a larger sample size and provide more detailed elaboration for each construct.

(4) Level Setup
In the Level Setup step (Step 7.0 in Figure 1), the number of levels for each factor is decided by the Domain Experts. Due to this step involving human responses, it was subjected to individual judgment (bias). Therefore, this step loses the automatic functionality purpose. In the Conjoint setup step, Domain Experts have decided the number of levels for each factor. However, the system cannot automatically decide the number of levels for those factors. It needs Domain Experts to make their subjective judgments. Therefore, the bias may occur and also the content of each level may have different opinions. The solution may be to use an Expert System to accumulate those records and as a reference for future use.

(5) Scenario Creating
In the Scenario Creating step (Step 8.0 in Figure 1), after the factors were identified and the orthogonal process was carried out, a scenario was created to cover all of the factors for a conjoint survey. However, it was sometimes not easy to have a scenario that could deal with all factors. In addition, this step cannot be systematic. For example, consider the following scenario in the Trolley Problem case which contains 3 factors: (1) thought preceding decision, (2) type of action / number(s) of victim, and (3) health status of victim(s). It was necessary to create a scenario that could connect all these factors. However, the system was incapable of providing a scenario that could be meaningful to connect all these factors received. This step needs the Experimenter to be involved.

6. Concluding remarks
A society is defined by its norms. These are the rules of collective cooperation that allow us to negotiate our individual interests with the common good. But as societies have become complex, so too are the related norms, rules, regulations, and laws. These are imposed on us from various levels and directions – by the government, by the organization where we work, by church, by social organizations, by political party, etc. Thus, it is not uncommon that we find ourselves in situations where more than one rule applies, and each of the applicable rules pulls us in a different direction. This is the Catch-22 situation: there is no choice that will not cause a violation of some kind.

Faced with such dilemmas, there is often no rational, analytical solution available. We must make up our mind based on some other, more subjective criteria. The purpose of the proposed Open Factor Conjoint Methodology is to uncover these hidden factors, with a minimum level of experimenter bias. The value of this methodology lies in provide a tool to uncover how people actually make ethical trade-offs. This kind of tool can potentially be of use for social policy analysis – for instance, in polling how a populace is willing to trade off scarce resources for
health care, or possibly how to trade off between privacy and security (with surveillance).

In summary, the Open Factor Conjoint Methodology proposed in this paper is a novel combination of two well-established research methods: repertory grid and conjoint analysis. Furthermore, it has been implemented as a web based online survey-system, so that all steps in the method can be executed via a web interface, including a survey page setup, subject survey and result analysis.

Further, this methodology provides a solution to discover the hidden factors that people use in making decisions to resolve deontic dilemma situations. Utility value and relative importance are generated as system outputs. According to the results, the decision model will be created to predict how people will resolve deontic conflict situations. Also, the Pearson's R and the Kendall's tau statistics are generated which are evaluations of whether the current conjoint model has a "goodness-of-fit between the observed data and those computed by the conjoint model" [25]. A high value of ‘goodness-of-fit' indicates a high level of internal validity.

In summary, our paper makes the following contributions to research:
1. We have addressed a gap in the empirical research regarding the decision rules used by individuals in resolving deontic conflicts.
2. We have shown how it is possible to combine the repertory grid and conjoint analysis methodologies in creating a new methodology for eliciting factors used by individuals in making deontic conflict decisions.
3. We have created a working prototype system which can be used to apply the suggested methodology cross-culturally and can also be used as a mechanism for further developing and validating the methodology itself.

8. References


