Assessing Deontic Trade-offs: A Conjoint Analysis Approach

Chen-Kuo Pai
Faculty of Hospitality and Tourism Management, Macau University of Science and Technology,
Avenida Wai Long, Taipa, Macau, P R China.
Email: ckpai@must.edu.mo

Ronald Lee
Department of Decision Sciences and Information Systems, Florida International University,
11200 SW 8th Street Miami, Florida 33199 USA
Email: r.lee@fiu.edu

Bruce Seaton
Department of Marketing, Florida International University,
11200 SW 8th Street Miami, Florida 33199 USA
Email: seatonb@fiu.edu

David Hinds
Department of Decision Sciences, Nova Southeastern University,
3301 College Avenue, Fort Lauderdale-Davie, Florida 33314 USA
Email: dhh123@bellsouth.net

Weidong Xia
Department of Decision Sciences and Information Systems, Florida International University,
11200 SW 8th Street Miami, Florida 33199 USA
Email: xiaw@fiu.edu

Abstract— **Deontic conflicts are situations where you are "damned if you do and damned if you don't" – where each of the available options will lead to an undesirable outcome or violation. How do people reason about deontic conflicts? In this paper we use the experimental technique of conjoint analysis to uncover the relevant decision factors that people use in such situations. Applications are to programming of robots that interact with humans in social situations and which may face deontic conflicts.**

Index Terms— **deontology; deontic conflict; conjoint analysis; robotics; robot vehicles; machine ethics**

I. INTRODUCTION

A striking feature that sets humans apart from animals is their use of language. While it is true that for instance some of the most intelligent animals like chimps and dolphins can demonstrate some rudimentary language skills -- even combining several words -- these are skills are trivial as compared to what a human child can do after a few years of age.

But there is another human capacity, equally remarkable, though perhaps less obvious for its ubiquity: social norms. For instance, our remarkable language skills would be of little value if we did not agree on syntax and semantics and pronunciation. Within the language community for a given dialect, there is remarkable agreement. These are the norms of language usage. But the pervasiveness of norms extends far beyond the use of language. Norms include the simple conventions of how we dress (e.g. in Scotland, men may wear skirts or kilts), the kinds of foods we eat and don't eat (locusts are nourishing), the way we rear our children (e.g. spanking your own kids is now illegal in Europe).

We all belong to a variety of different organizations, each of which has its own set of norms. These include the company where we work, our church, school, social organizations. For these organizations, norms provide the rules to achieve the organization's goals such the production of good and services or the shared entertainment of a sports club.

The purpose of government institutions, on the other hand, is about managing and enforcing societal norms. Thus we have governmental institutions for policing the streets, for regulating corporations, for tax collection, for military defense, etc. All of these organizations and institutions impose norms that control human behavior.

II. DEONTOLOGY

Manuscript received July 10, 2012; revised September 15, 2012; accepted September 20, 2012.

doi:10.4304/jcp.8.7.1771-1776

Deontology is the technical term for the analysis of norms, normative reasoning, and normative systems. There is a branch of logic known as deontic logic, which proposes formalisms to model normative rules and normative reasoning. In the philosophy of law, deontology is also of interest, though with less formal rigor, and more breadth of scope than deontic logic. The interests of deontic logic and philosophy of law converge in topics of AI and law, which develops expert systems for legal reasoning. Within experimental psychology, there is also interest in deontic cognition, in particular, based on the experimental work of Wason (1966) [13].

In this paper we are ultimately concerned with the development of expert systems for deontic reasoning. However, for practical systems, we need more than the general principles provided by deontic logic. We also need to embed the heuristics that people use to make judgment calls about deontic situations. This is especially needed in so-called deontic conflict situations, where a violation is unavoidable, where you are "damned if you do and damned if you don't". These kinds of dilemmas are also called Catch-22 situations, based on a book by that name by Heller (1961)[5].

III. APPLICATION DOMAIN: DEONTICS FOR ROBOTS

To better visualize applications for deontic reasoning, we envision applications where robot devices need to interact in human social situations. For instance, one could imagine a robot nurse in a hospital, for instance for patients with highly contagious disease. A patient might give orders to the robot that are in conflict with the patient's treatment protocol. Perhaps the patient is delirious, or, on the other hand, perhaps the patient realizes that the treatment is causing an allergic reaction. The robot needs to be able resolve conflicting duties of this kind.

Robots might also be used in emergency situations, where the situation might be too dangerous for rescue workers. (For instance, a nuclear breakdown; a chemical leak.) Such a robot may need to make difficult choices, for instance between saving one group or another group. This is similar to the trolley problems described below.

A more conventional application is to imagine robot vehicles to deliver packages. The robot vehicle needs to navigate on the public roadways along with human drivers. For instance, suppose the traffic is going faster than the speed limit. Should the robot keep pace or keep to the posted speed limit? Suppose the robot is late in delivering the package – should the robot speed?

IV. BASIC DEONTICS

Deontic logic has its origin in the classical philosophy of ethics. The modern development of deontic logic was initiated in the early 1950's by von Wright [1951][11] who coined the term, based on the Greek *δεοντωζ* meaning "as it should be" or "duly." Deontic logic is a logic of normative concepts. Its major application, outside of ethics, has been to the philosophy of law. The practical relevance of deontic logic in administrative contexts is to provide automatic inference in, say, contract arbitration or the interpretation of bureaucratic regulations. Such applications are useful in complex cases where the chain of connections would otherwise be difficult to follow. Thus, the axioms and inference rules of deontic logic take on practical importance for normative systems that are complex yet explicit, amenable to formalization. The first axiomatization for deontic logic was proposed by von Wright [11; 12]. A basic concept is captured by the operator:

$$\mathbf{O}\,\Phi$$

read that "*f* is obliged." Based on this, a notion of permission can be defined as its logical dual:

$$\mathbf{P}\,\Phi =_{\text{def}} {\sim}\mathbf{O}{\sim}\,\Phi$$

that is, "Φ is permitted" if and only if "it is not obliged not to do Φ." A related concept of prohibition was defined as:

$$\mathbf{F}\,\Phi =_{\text{def}} \mathbf{O}{\sim}\,\Phi$$

that is, "*f* is forbidden" if and only if "it is obliged not to do Φ." For completeness, we also add a notation for waiver (of an obligation):

$$\mathbf{W}\,\Phi =_{\text{def}} {\sim}\mathbf{O}\,\Phi$$

that is, "Φ is waived" if and only if "it is not obliged to do Φ."

Various axiomatic systems of deontic logic have been proposed. In an introductory survey, Føllesdal and Hilpinen [1971][2] present what they call the standard system of deontic logic. Based on propositional logic, this serves as a more or less consensually accepted core on which to base further discussion. The standard system assumes elementary generic actions (in the sense of von Wright [1968][12]). Assuming Φ and Ψ to be actions of this type, the standard system has the following axioms:

[DA1] $\mathbf{O}\,\Phi \leftrightarrow {\sim}\mathbf{O}{\sim}\,\Phi$ (or equivalently $\mathbf{O}\,\Phi \rightarrow \mathbf{P}\,\Phi$)
If Φ is obliged, then Φ is permitted.

[DA2] $\mathbf{O}(\Phi \,\&\, \Psi) \leftrightarrow \mathbf{O}\,\Phi \,\&\, \mathbf{O}\,\Psi$
Φ and Ψ are together obliged if and only if they are obliged separately.

[DA3] $\mathbf{O}(\Phi \vee {\sim}\Phi)$
It is obliged to either do or not do Φ.

V. DEONTIC CONFLICT

Imagine a spotlight on a darkened stage. The light creates a yellow circle on the floor. A man steps into this light. This spotlight represents the man's basic physical needs: eating, sleeping, etc. Now another spotlight appears, creating a larger circle of green light. This green spotlight, which overleaps the first one, contains the man's family. Another spotlight appears an orange one that is much larger and contains many other people. This orange spotlight represents the company where the man works. It overlaps the yellow spotlight where the man is standing, but does not overlap with his family. Then there is another spotlight, a purple one, which is much larger still. This represents the church where the man and his family belong. There are other spotlights of many other colors, representing social organizations, etc. Finally, there is a very big spotlight, perhaps a red one that represents the government of the country where the man lives. At the location where the man is standing, there are many overlapping circles. These represent all the different normative systems that prescribe the man's behavior, including the man's personal needs, as a special case.

What concerns us here is situations where two or more deontic rules are in conflict: that is they obligate or forbid behaviors that a mutually exclusive, so that a violation of one or the other of the rules cannot be avoided. For instance, most societies have a norm against urinating in public. Yet our bodies may create the urgent need. This creates a conflict that many of us have felt at certain times.Or consider that the overlapping circles of the man's family and the company where he works. From the family perspective, he feels obliged to spend more quality time with his children. From the work perspective, he feels obliged to put in extra hours on a special project. This is a deontic conflict.

Deontic conflicts, large and small, abound. These are the 'shoulds' in our lives which cannot be met, and which give rise to many of our anxieties. An obvious example: you are late for an important meeting. Should you speed? There is the chance of getting a speeding ticket. Is it worth it? Will the speeding cause danger to other drivers or pedestrians? Will the boss notice if you are just a little late? excessively late? Finally … you get to the office just in time, but the parking lot is full! Should you park illegally? (And so on…)

VI. DX – SYSTEM FOR DEONTIC REASONING

In order to illustrate the issues of reasoning about deontic conflicts from the mechanical perspective a robot, we introduce a simple deontic expert system called DX [9]. The basic syntax of DX is based on the **IF/THEN** structure common to expert systems. The rule structure[3] for DX is

<condition> **IF** <conditions> **.**

or equivalently,

IF <conditions> **THEN** <condition> **.**

Rules may also be unconditional, in which case they are expressed as the predicate <condition> by itself without the **IF/THEN**. The <conditions> may include the connectives **AND** and **OR**, where **AND** has the more immediate binding. When a rule includes **OR**, it may be decomposed to rules that do not include **OR**. That is, a rule:

<condition> **IF** <condition1> **OR** <condition2> .

is equivalent to rules:

<condition> **IF** <condition1> .
<condition> **IF** <condition2> .

A <condition> may be a simple predicate expression, e.g. **STAFF(X)**, **DEPT-OF(X,Y)**. In DX, these predicate names are regarded as part of the open vocabulary, introduced as appropriate for the problem domain. Also, there are five primitive deontic conditions that have special interpretations in the system:

OBLIG(<action> **)**
PERMIT(<action> **)**
FORBID(<action> **)**
WAIVE(<action> **)**
COMMIT(<action>**,** <action> **)**

Additionally, a condition may be negated, using the symbol '~'. In the DX rule interpreter, since negation is treated as explicit negation, if a condition cannot be proven, the interpreter will ask the user whether it is true or false. The <action> is represented as:

<agent> **:** <condition>

read that <agent> brings about <condition>. An <agent> is an expression of term, which is either a constant, variable, or a function. These terms are regarded as part of the open vocabulary as predicates for conditions are. The combined syntax for the DX rules is shown in Figure 1. Another type of assertion is sometimes included in the rule-base, to specify that certain conditions are mutually exclusive. This enables the system to infer the truth values of certain predicates without having to ask. The format is

EXCLUSIVE([<list-of-conditions> **]**),

where

<list-of-conditions> ::= <condition>
<list-of-conditions> ::= <condition>**,** <list-of-conditions>

For instance,

EXCLUSIVE([STUDENT(X),STAFF(X),FACULTY(X)]).

states that "**X** is exclusively either a student, a staff member, or a faculty member."

```
<rule>::= <condition> .
<rule>::=IF <conditions> THEN <condition> .
<rule>::=  <condition> IF <conditions> .
<rule>::=FROM <conditions>
IF <action>
TO <conditions> .
<conditions>::=<condition>
<conditions>::=<condition> AND <conditions>
<conditions>::=<condition> OR <conditions>
<condition>::=<predicate>
<condition>::=OBLIG( <action> )
<condition>::=PERMIT( <action> )
<condition>::=FORBID( <action> )
<condition>::=WAIVE( <action> )
<condition>::=COMMIT( <action> , <action> )
<condition>::=~ <condition>
<action>::=<agent> : <condition>
<agent>::=<term>
```

Figure 1. DX Rule Syntax

For readability, both predicate constants and variables are written in upper case, variables being just a single letter while predicate constants are longer words. Individual constants begin with a capital letter followed by lower case letters or digits. For example,

FACULTY(X), CONTRACT(Smith, Jones)

VII. DX MODELING FOR CONFLICT REASONING

Deontic dilemmas, or deontic conflicts, are often observed in normative systems and their resolution is important from a practical standpoint [Hilpinen, 1971: p. vii][6]:

> It has often been argued that unlike "natural" necessities, obligations can conflict with one another, and the resolution of such normative conflicts is an important part of moral discourse.

A deontic dilemma arises when two or more deontic rules imply conflicting conclusions for a give situation. A classical example is Kierkegaard's analysis of Abraham's dilemma whether or not to kill his son, Isaac. God had commanded Abraham to kill his son, yet ethical principles said he should not. We distinguish two categories of dilemmas, 'mild' and 'deadlock.' A *mild dilemma* occurs when deontic rules conflict, but there is still a course of action available that avoids violating either rule. There are two main cases:

FORBID(X:A) & **PERMIT(X:A)**
OBLIG(X:A) & **WAIVE(X:A)**

In the first case, where the same action is both forbidden and permitted, the party **X** may abstain from the forbidden action to avoid violation. In the second case, where the same action, **A**, is both obliged and waived, the party **X** may do the obliged action to avoid violation. *Deadlock dilemmas* are more difficult. In these cases, the individual has no course of action that avoids a violation. The principal pattern of a deadlock dilemma is the following:

OBLIG(X:A) & **FORBID(X:A)**.

That is, an action **A** is both obliged and forbidden. Or more generally:

OBLIG(X:A) & **OBLIG(X:B)**.

where **A** and **B** are mutually exclusive actions, represented in DX with the assertion:

EXCLUSIVE([A,B]).

Example (Mild Dilemma). The university library has a policy that students with outstanding fines may not use copiers on campus.

assess: Chen:USE-COPIER
rule : PERMIT(X:USE-COPIER) IF
STUDENT(X).
rule : FORBID(X:USE-COPIER) IF
STUDENT(X) AND
OUTSTANDING-FINE(X).
fact: STUDENT(Chen).
fact: OUTSTANDING-FINE(Chen).
response: PERMIT(Chen:USE-COPIER)
FORBID(Chen:USE-COPIER)

Example (Deadlock Dilemma). Teaching assistants must make use of the copier to prepare exam materials for class.

assess: **Chen:USE-COPIER**
rule: **OBLIG(X:USE-COPIER) IF**
TEACHING-ASSISTANT(X) AND
REQUESTED-COPYING-EXAM(X).
rule: FORBID(X:USE-COPIER) IF
STUDENT(X) AND
OUTSTANDING-FINE(X).
fact: **TEACHING-ASSISTANT(Chen).**
fact: **REQUESTED-COPYING-EXAM(Chen).**
response: **OBLIG(Chen:USE-COPIER)**
FORBID(Chen:USE-COPIER)

One of the ways to systematically avoid deontic dilemmas is hierarchical reasoning of rules by default or defeasible reasoning (e.g. Nute, 1989)[10]. Often we indicate that certain deontic rules apply as defaults; when a more specific situation occurs, defaults are defeated. However, this kind of strategy is merely a heuristic, in the absence of further information. An alternative strategy would be to elicit domain specific instructions from human informants about what factors they employ to resolve such deontic conflicts.

VIII. PSYCHOLOGY OF DEONTIC CONFLICT – TROLLEY PROBLEMS

Deontic conflicts are an important source of stress in our ordinary lives. It is thus useful to examine how people actually reason about deontic conflicts – and whether some deontic reasoning approaches might be better than others. As mentioned earlier, there is mounting psychological evidence that people have specialized reasoning apparatus for reasoning about deontic situations. Thus far, this has focused on human estimations of fairness, and cheater detection. This type of reasoning relates to the effectiveness of group cooperation, and the detection and punishment of free-riders.

A related but somewhat distinct literature relates to ethical decision making – choices about deontic conflicts. One set of experiments, so-called trolley problems, suggest an anomaly: that for logically equivalent problems, people will give different answers, depending on the interpretation that is given to the problem. However, others claim that this apparent anomaly is due to an over-simplification of the problem. The different interpretations of the trolley problem introduce additional factors that are not recognized in the test itself. It is these additional factors that can expain the different outcomes. Yet there is no agreement about what these 'additional factors' are. Different people provide different explications.

IX. TECHNIQUE: CONJOINT ANALYSIS

Conjoint analysis is a technique that was originally developed for marketing applications. When a consumer is presented with a choice among a variety of products, how do they trade-off the various product attributes? For instance, in the grocery store there is typically an aisle with a broad array of breakfast cereals. There are some price differences between the cereals, but the differences are not so much that people simply buy the cheapest. There are other attributes that affect the decision. In the marketing context, the attributes are typically well known, since they are part of the product design. For instance, the nutritional content of the cereal is a design choice. Some consumers may be wheat-intolerant – thus the factor or gluten-free might be important. Kids like cereal that is sweetened, has bright colors and fun shapes. These are other factors.

So, in the marketing case, it is useful to identify which factors are the most salient. It is also of interest whether certain factors group together, suggesting distinct market sub-groups. For instance, there may be distinct groups interested in high-nutrition and low calories, versus the kiddie crowd who wants fun colors and shapes. In the case of deontic dilemmas, we are interested in the salience of factors not between kinds of products, but between kinds of situations. As in the case with marketing, it may also turn out that there instead of a general consensus; there are sub-groups that have differing opinions.

X. Technique: Repertory Grid

Unlike the situation with marketing, deontic conflict situations may include factors that are not foreseen by the experimenter. This, we contend, is exactly what is happening in the case of trolley problems. An experimental approach for eliciting relevant attributes is the repertory grid technique.

The repertory grid technique recognizes that people perceive or 'construe' reality differently. This technique, originally developed by George Kelly [3; 8; 4], is a method for eliciting the 'constructs' that a person uses in their internal representation of a phenomenon. According to [Enquire Within, 2008][14]

> "We feel, think, and behave according to our construct system; we adapt our constructs, immunize them, or have them confirmed. Some of our constructs - those which represent our core values and concern our key relationships - are complex, quite firmly fixed, wide-ranging, and difficult to change; others, about things which don't matter so much, or about which we haven't much experience, are simpler, narrower, and carry less personal commitment. … A person's construct system represents the truth *as they understand it.* Construct systems cannot be judged in terms of their objective truth - whatever 'objective' means in the world of personal feelings and choices. … You do not have to have the same construct system as another person in order to understand them; but you do have to be able to infer the other person's construct system."

Key steps in using the repertory grid technique are as follows [Wikipedia, 2008][4]. The phenomena to be considered are called 'elements'. These may be presented on separate cards as verbal descriptions or photos or video clips – whatever media style is more appropriate. The interviewer selects three elements at random and presents them to the interviewee. The interviewee is asked to compare the three elements (for instance three emergency situations), and indicate which two of them have some characteristic in common while being different from the third. The interviewee might respond that tornados and hurricanes are alike because they involve wind whereas flooding does not. So windiness is one of the constructs for evaluating an emergency situation for this subject. The elements are then characterized in terms of the constructs. Typically, this is done by means of a 5-point rating system, a 1 indicating that the left pole of the construct applies (low windiness) and a 5 indicating that the right pole of the construct applies (high windiness). On being asked to rate all of the elements, our interviewee might reply that Hurricane Andrew merits a 4 (high windiness), Hurricane Barney (low windiness), and Hurricane Ivan a 5 (extremely windy). The remaining elements are then rated on this construct. A different triad is chosen, a further construct elicited, and all elements rated on this new construct. And so on, until the interviewee indicates that s/he can think of no other constructs. Typically, (and of course depending on the topic) people have a limited number of genuinely different constructs for any one topic: 6 to 16 are common when they talk about their job or their occupation, for example. The richness of our meaning structures comes from the many different ways in which a limited number of constructs can be applied to individual elements.

XI. Proposed Two-stage Technique

We propose a combination of the repertory grid and the conjoint analysis techniques for the analysis of deontic conflict situations.

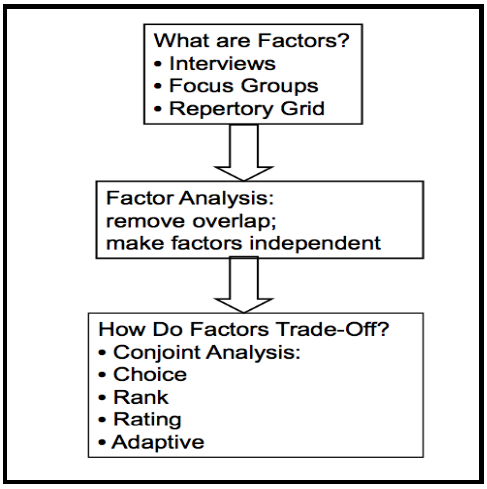


Figure 2. Main Steps of the Approach

XII. Results from Trolley Problem Experiments

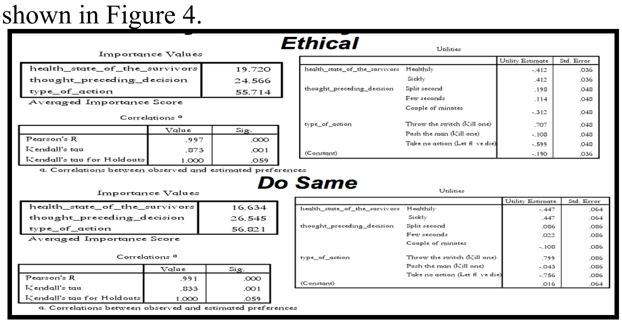
The mystery of the trolley problem is what are the factors that cause people to change their decision between case #1 (bystander at the switch) vs. case #2 (push the fat man).

The constructs we elicited from domain experts were as shown in Figure 3.

Attributes	Description
Type of action	Whether or not you have physical contact with victim (s)
Numbers of victim (s)	The net loss of life as a result of my decision
Physical proximity to victim	The physical distance between you and the victim (s)
All survive healthy	All who survive are healthy
All to die are healthy	All who die are healthy
Direct action	The degree to which your action directly caused the death of the victim (s)
Violates explicit rules?	The degree to which your professional ethic influence your decision
Deliberation time?	Extent to which you have to respond immediately
Relationship to victim	Personal acquaintance/relationship to victim (s)

Figure 3. Constructs Elicited about Trolley Problem

The results of the subsequent conjoint analysis are shown in Figure 4.



Ethical

Importance Values

health_state_of_the_survivors	19.720
thought_preceding_decision	24.566
type_of_action	55.714

Averaged Importance Score

Correlations a

	Value	Sig.
Pearson's R	.997	.000
Kendall's tau	.873	.001
Kendall's tau for Holdouts	1.000	.059

a. Correlations between observed and estimated preferences

Utilities

		Utility Estimate	Std. Error
health_state_of_the_survivors	Healthily	-.412	.036
	Sickly	.412	.036
thought_preceding_decision	Split second	.198	.048
	Few seconds	.114	.048
	Couple of minutes	-.312	.048
type_of_action	Throw the switch (Kill one)	.707	.048
	Push the man (Kill one)	-.108	.048
	Take no action (Let fi ve die)	-.599	.048
(Constant)		-.190	.036

Do Same

Importance Values

health_state_of_the_survivors	16.634
thought_preceding_decision	26.545
type_of_action	56.821

Averaged Importance Score

Correlations a

	Value	Sig.
Pearson's R	.991	.000
Kendall's tau	.833	.001
Kendall's tau for Holdouts	1.000	.059

a. Correlations between observed and estimated preferences

Utilities

		Utility Estimate	Std. Error
health_state_of_the_survivors	Healthily	-.447	.064
	Sickly	.447	.064
thought_preceding_decision	Split second	.086	.086
	Few seconds	.022	.086
	Couple of minutes	-.108	.086
type_of_action	Throw the switch (Kill one)	.799	.086
	Push the man (Kill one)	-.043	.086
	Take no action (Let fi ve die)	-.756	.086
(Constant)		.016	.064

Figure 4. Conjoint Results for the Trolley Problem

XIII. DISCUSSION AND CONCLUDING REMARKS

The weakness of this approach is revealed in the factor analysis. While the repertory grid is an effective technique when used to elicit constructs on an individual level, difficulties arise when aggregating the individuals' constructs across a group. One aspect of these difficulties involves the semantics of the constructs. One needs to be able to reconcile whether there is semantic overlap. At present, we do this manually, by having the domain experts review the reported constructs, and attempt to consolidate them on an intuitive basis. A more formal method would involve some basic ontology, from which each of the constructs could be given a formal explication. Based on this ontology, a more rigorous delineation of the constructs could be made.

REFERENCES

[1] Enquire Within. "Kelly's Theory Summarized" [http://www.enquirewithin.co.nz/theoryof.htm#predictable] accessed 27 June 2008.

[2] Føllesdal, D., and Hilpinen, R. Deontic logic: An introduction. In Hilpinen, H., ed. *Deontic Logic: Introductory and Systematic Readings*, Dordrecht: D. Reidel, 1971, 1—35.

[3] Fransella, F., and Bannister, D. *A Manual for Repertory Grid Technique*. New York, New York: Academic Press, (1977).

[4] Fransella, F., Bannister, D., and Bell, R. *A Manual for Repertory Grid Technique*. 2nd ed.

[5] Heller, Joseph. (1961). *Catch-22*. Simon & Schuster.

[6] Hilpinen, R., ed. (1971). *Deontic Logic: Introductory and Systematic Readings*.

[7] Hilpinen, R., ed. (1981). *New Studies in Deontic Logic*. Dordrecht: D. Reidel

[8] Jankowicz, D. (2004). *The easy guide to repertory grids*. West Sussex: John Wiley & Sons Ltd.

[9] Lee and Ryu, 1995. Ronald M. Lee and Young Ryu. "DX: A Deontic Expert System", *Journal of Management Information Systems*, Vol. 12, No. 1, pp. 145—169, 1995)

[10] Nute, D. (1989). General and special defeasible logic. In *Proceedings of Tübingen Workshop on Semantic Nets and Nonmonotonic Reasoning*, 1989, 114—122.

[11] Von Wright, G.H. Deontic logic. *Mind*, 60, 237, (1951), 1—15.

[12] Von Wright, G.H. An essay in deontic logic and the general theory of action. *Acta Philosophica Fennica*, 21, (1968), 1—55.

[13] Wason, P. C. (1966). "Reasoning." New horizons in psychology 1: 135-151.

[14] Wikipedia. Repertory Grid [http://en.wikipedia.org/wiki/Repertory_grid], accessed 27 June 2008.

Chen-Kuo Pai received his Ph.D. in Business Administration from Florida International University in 2009. He is currently an Assistant Professor at the Faculty of Hospitality and Tourism Management, Macau University of Science and Technology, Macau. His research interests include the customer relationship management, information management, and electronic commerce, etc.

Ronald M. Lee holds a BA in Mathematics, an MBA, and a PhD in Decision Sciences from the University of Pennsylvania (Wharton, 1980). He is presently Professor of Decision Sciences and Information Systems at Florida International University. Prof. Lee's current research interests include: modeling of emotion contagion using virtual world bots; analysis of insult speech acts; emotional aspects of normative systems; deontic process modeling; and applications of process mining to healthcare logistics.

David Hinds holds a BS in Engineering Science, an MS in Operations Research, an MBA, and a PhD in Business Administration from Florida International University (Miami, 2008). He is presently Assistant Professor of Decision Sciences at Nova Southeastern University. Dr. Hinds current research interests include the features and effectiveness of process improvement programs with special emphasis on applications to service processes and the identification of facilitating or inhibiting conditions.

Bruce Seaton earned an M. Sc. In Chemistry (Honours) and a B. Sc. In Accounting and Economics at The University of Auckland (New Zealand). His PhD in Business Administration with a concentration in Marketing was awarded by Washington University in St. Louis. His is presently Associate Professor of Marketing at Florida International University. His research interests include the role of national stereotyping in consumer choice and the application of experimental methods to investigating models of business ethics.

Weidong Xia has published in a number of refereed journals and conference proceedings, including the MIS Quarterly, Decision Sciences, Communications of the ACM, Journal of Management Information Systems, Information and Management, European Journal of Information Systems, Journal of Information Technology Management, International Journal of Career Development, Journal of Statistics and Management Systems, Journal of End-User Computing, and International Conference on Information Systems. He is an Associate Editor of Information Systems Research and on the editorial board of Journal of Database Management.