Perspectives on Computational Research

Final Paper: A Perceptual Map of Decision Making

HyungJin Cho

The etymology of the English word *decision* has the root from the Latin word *decisio* which means to cut off, meaning making a decision is about selecting choices. To understand decision-making, the current study categorized numerous examples of decisions. We expected to find distinct types of decisions and harness this knowledge to achieve an appropriate approach for making the unique types of decisions. For example, in comparative perspective, deciding a product to purchase may be made more rationally whereas deciding a person to marry may be made more emotionally. Is a voting more like a shopping or a dating? Depending on the type of decisions voting is included with, the strategy for influencing the voter's decision could be different. If a voting is a relatively a rational decision, the strategy should be to stress the content of a candidate's policies. On the other hand, if a voting is an emotional decision, the strategy should be to manage the tone of voice. The major goal of the current study is to identify the categorization of decisions. This can then have implications for the proper strategy for impacting decisions.

Cadwallader (1975) described decision-making as "the cognitive process of selecting from among alternatives". Ariely & Zakay (2001) characterized decision-making as "one of the most important mechanisms for active fast adjustments". They defined decision-making as "the ability to react to information in the environment, and to take one of a few different

action alternatives in order ultimately to better the organism". Bazerman & Moore (2008) describes 'judgment' to "the cognitive aspects of the decision-making process". Hogarth (1987) defines 'choice' as the outcome from the combination of judgments. Considering the diverse definitions of decision-making, judgment, and choice, the current study mainly focused on the kinds of decisions people have made or are likely to make in their life.

Previous studies have highlighted the intricate process of arriving at the best possible outcome. Researchers presented eight key elements to achieve an effective decision-making: problem, objectives, alternatives, consequences, tradeoffs, uncertainty, risk tolerance, linked decisions (Hammond, Keeney, & Raiffa, 2015) and proposed a rational model of decision-making process: defining the problem, identifying the criteria, weighing the criteria, generating alternatives, rating each alternative on each criterion, and computing the optimal decision (Bazerman, & Moore, 2008). Other past work has applied analytic hierarchy process model to account for decision-making processes (Saaty, 2008).

Other types of studies have outlined decision-making in a specific domain or an issue. Researchers have shown context dependency in legal decision-making (Kelman, Rottenstreich, & Tversky, 1996), the role of expectations in business decision-making (Cyert, Dill, & March, 1958), and shared decision-making in the medical field (Moumjid et al, 2007). Other past work has focused on particular topics and found that making decisions impairs self-control (Vohs et al, 2014), manipulating sense of connectedness with future identity changes intertemporal choices (Bartels & Urminsky, 2011), having an experience leads an underestimation toward subsequent risky choices (Hertwig et al, 2004), and nudging the environment by having presumed consent as a default increases donation decisions (Johnson & Goldstein, 2004).

The other studies have researched the characteristics of decision-making that

differentiate decisions. Previous research by Milkman and colleagues (1756) has shown that changing the environment can improve decision-making in the realm of System 1 dominant choices. A dual process theory suggests two cognitive pathways consisted of a fast, autonomic, intuitive, and emotional process called System 1 and a slow, controlled, reasoning, and logical process called System 2. The researchers proposed a strategy to change the environment rather than to change decision maker's thinking from System 1 to System 2 for the decisions susceptible to implicit attitudes or stereotype such as gender and race. This research establishes that there is variability in the types of decisions and each has its optimal strategy based on the type of decision.

The current study attempts to expand the dimension from rational vs. emotional to other characteristics which are reviewed in past papers as a factors having an effect on decision-making. The characteristics we measured for each decisions includes four Ws and one H (what, when, where, who, how), motives (rational or emotional), valence (positive or negative), frequency (frequent or infrequent), period (weekly, monthly, or yearly), times (a few or many), duration (short-term or long-term), respond time (quick or delayed), procrastination (weak or strong), risk (low-risk or high-risk), impact (low-impact or high-impact), identity (reflecting self or not reflecting self), influence (individual or social), variety (limited options or multiple options), actuality (actual or virtual), finance (financial or non-financial), ethic (moral or amoral). We expected to find essential characteristics in decision-making that makes decisions perceived significantly different.

Past research by Russell (1979) has shown that emotions can be categorized using factor analysis. The researcher measured level of similarity between emotions by collecting surveys. With the similarity matrix of emotions, the researcher visualized it as a map that preserves the distances using a statistical method called multidimensional scaling.

Researchers found that two dimensions appear from the map emotions are plotted on: valence (how positive or negative the emotional experience is) and arousal (how active or inactive the emotional experience is). This research illuminates how mapping the emotions can further our understanding of emotion. The current study also utilized factor analysis to extract underlying dimensions that classify decisions. By adopting this method, we expected to find the structure and relationship of decisions by generating a map of various decisions.

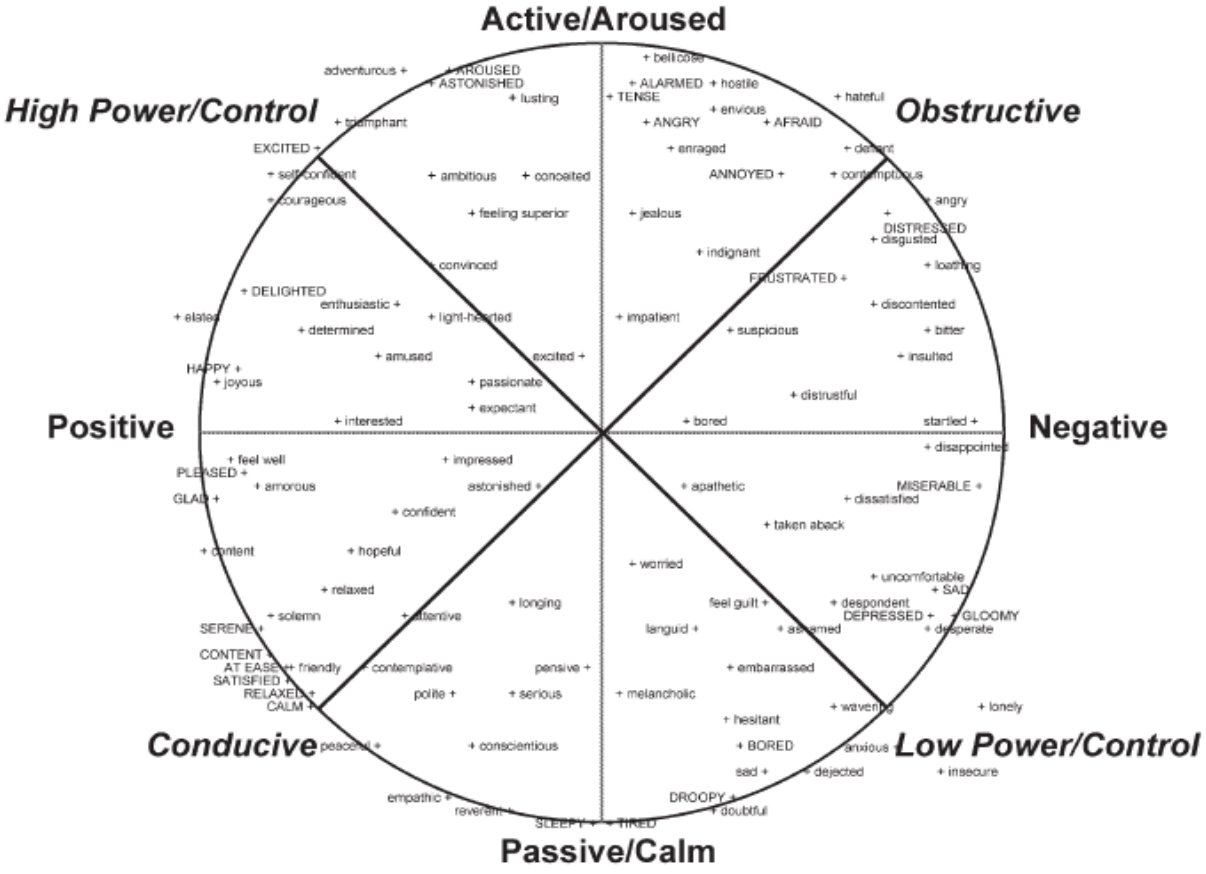

Figure 1. The map of emotions using multidimensional scaling (Scherer, 2005)

Past research suggests that there are different types of decisions retaining distinct characteristics and propose a way to analyze it by utilizing visualization. The present study seeks to establish a categorization of decisions using multiple approaches. In study 1, a qualitative analysis was conducted to explore the decisions that participants choose to list. In

study 2, regression analysis was used to identify which characteristics of a decision significantly predict whether two decisions are seen as similar or dissimilar. In study 3, multidimensional scaling was used to create a map of decisions. We expect the classification of decisions to not only further the understanding of the nature of decision-making, but to facilitate research that sheds light on the right approach to each category.

Method

Participants

One hundred seventeen people were recruited through Amazon MTurk to participate in a survey constructed using Qualtrics. Participants who failed to complete the entire survey (n=19) were excluded from analysis. The final sample included 98 participants with 64 men and 34 women. The age of participants ranged from 21 to 68 years (M = 36.82, SD = 10.75). Age was non-normally distributed, with skewness of 0.94 (SE = 0.24) and kurtosis of 0.11 (SE = 0.48). The demographic characteristics of the participants are summarized in Table 1.

Table 1. Descriptive Statistics of Participants' Demographics

	Frequency (%)					Mean	SD
Age	20s	30s	40s	50s	60s	36.82	10.75
	27 (28%)	38 (39%)	18 (18%)	10 (10%)	5 (5%)		
Gender	Male	Female					
	64 (65%)	34 (35%)					
Ethnicity	European American	African American	Asian American	Two or more races	n/a		

	72 (73%)	11 (11%)	7 (7%)	3 (3%)	5 (5%)		
Education	High school graduate	Some college	Associate's degree	Bachelor's degree	Master's degree	Professional degree	Doctoral degree
	13 (13%)	20 (20%)	24 (24%)	31 (32%)	8 (8%)	1 (1%)	1 (1%)

Procedure

Ninety eight participants completed a survey that they agreed to spend around 45-60 minutes doing in exchange for a monetary reward of $9. Informed consent about the study's purpose, task, risks, and confidentiality was provided to all study participants. The survey was composed of five major sections.

In the first part of the survey, participants were asked to freely list ten decisions they have made in their life. Then, in the second part, participants rated how one decision is similar to another on a 5-point scale ranging from 1 (*very low*) to 5 (*very high*) for each pair of decisions. For example, if a participant listed '*deciding a product to purchase*', '*deciding a person to marry*', '*deciding a candidate to vote for*', … in the list, then the similarities between '*deciding a product to purchase*' and '*deciding a person to marry*', '*deciding a product to purchase'* and '*deciding a candidate to vote for*', '*deciding a person to marry'* and '*deciding a candidate to vote for*', … were measured. Since the similarity between '*deciding a product to purchase*' and '*deciding a person to marry*' and the similarity between '*deciding a person to marry*' and '*deciding a product to purchase*' may be rated differently, participants were randomly assigned to one of two conditions which presented the pairs in opposite order. Altogether, there are 45 unique similarity ratings for the pairs of 10 decisions.

After scoring perceived similarity between two decisions, for the third part,

participants answered to what extent they agreed with statements that described characteristics of decisions they have made on a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Twenty-two questions about characteristics of decision-makings are selected. For example, '*This decision is usually made emotionally*", "*This decision is a choice between positive options*", … were presented to measure the characteristics of decisions (see Appendix A for a full list).

In the fourth part of the survey, participants were asked to list two decisions each for the suggested characteristics. Twenty nine questions are used for making a list of decisions based on characteristics. These questions included questions such as '*Please list two decisions people make only a few times in a lifetime*', '*Please list two decisions that you have not yet made, but you expect to be making in the future*' (see Appendix B for a full list). After listing decisions in accordance with offered characteristics, participants had the chance to freely list extra decisions that are different from the decisions they listed above.

Finally, in the last part, a part of *Need for Closure Scale* (Webster & Kruglanski, 1994) measuring decisiveness was presented. Also, participants answered question which measured their preference for simplicity vs. complexity. Demographics which included age, gender, ethnicity, and education were collected.

Results

To assess the unique effects of difference in each decision characteristics on perceived distance between decisions, a multiple linear regression analysis was conducted to simultaneously regress the distance between decisions on the difference in twenty-two decision characteristics (i.e., '*This decision is usually made emotionally*", "*This decision is a*

choice between positive options"). Difference in decision characteristics was determined by calculating the absolute difference between reported characteristics ratings. Distance between decisions was scored by reversing reported similarity scores between decisions which was rated on a 5-point scale (1 becomes 5, 2=4, 3=3, 4=2 and 5=1).

A multiple linear regression was based on cluster-robust standard errors by participants, since among the total of 4410 decisions, each participant made 45 similarity evaluations. The full model, which included all twenty two characteristics of decision, significantly predicted the perceived distance between decisions, R^2 = .13, F(22, 4387) = 31.28, p < .001. This indicates 13% of the variance of the perceived distance between decisions was explained by the twenty two characteristics of decision.

It was also discovered that five of the twenty-two characteristics had a statistically significant effect on the perceived distance, in the multiple regression controlling for the other characteristics. Specifically, the perceived distance between decisions was predicted by the level of difference between decisions in emotional characteristic, B = .085, t(4387) = 4.014, p < .001, long-term characteristic, B = .076, t(4387) = 3.537, p < .001, high-risk characteristic, B = .081, t(4387) = 3.702, p < .001, high-impact characteristic, B = .110, t(4387) = 4.037, p < .001, and financial characteristic, B = .106, t(4387) = 5.502, p < .001 (see Table 2 for a summary of the regression analysis).

Table 2. Summary of Linear Regression Analysis Assessing the Unique Effects of Each Decision Characteristic Predicting Distance between Decisions

	Distance between Decisions		
Characteristics	***B***	***SE B***	***p***
(Intercept)	3.068	0.095	< .001
"What"	0.045	0.020	0.023

“When”	0.025	0.021	0.217
“Where”	0.037	0.013	0.003
“Who”	0.041	0.018	0.025
“How”	-0.017	0.023	0.454
Rational	-0.004	0.030	0.886
Emotional	0.085	0.021	< .001
Positive	0.050	0.026	0.053
Negative	-0.023	0.029	0.431
Frequent	0.051	0.029	0.078
Per week	0.017	0.029	0.559
Per month	-0.052	0.033	0.118
Per year	0.042	0.019	0.024
Short-term	-0.029	0.020	0.155
Long-term	0.076	0.021	< .001
Time-consuming	0.014	0.024	0.573
Procrastination	0.013	0.028	0.650
High-risk	0.081	0.022	< .001
High-impact	0.110	0.027	< .001
Social	0.040	0.024	0.090
Variety	0.053	0.023	0.022
Financial	0.106	0.019	< .001

Another multiple linear regression analysis was performed using only the characteristics that were statistically significant in the first model. The five characteristics were measured by the ratings agreeing for the following statements: ‘*This decision is usually made emotionally*’, ‘*This is a long-term decision for the future*’, ‘*This decision involves high risk*’, ‘*This decision has a high impact on your life*’, and ‘*This is a financial decision*’. The second model significantly predicted the perceived distance between decisions, $R^2 = .11$, $F(5, 4404) = 107.5$, $p < .001$. Thus, the five characteristics accounted for 11% of the variance of the perceived distance between decisions. All five characteristics had unique effect on the

perceived distance. Particularly, the perceived distance was significantly predicted by the perceived the level of difference between decisions in emotional characteristic, $B = .106$, $t(4404) = 4.910$, $p < .001$, long-term characteristic, $B = .081$, $t(4404) = 3.868$, $p < .001$, high-risk characteristic, $B = .109$, $t(4404) = 4.897$, $p < .001$, high-impact characteristic, $B = .127$, $t(4404) = 5.126$, $p < .001$, and financial characteristic, $B = 0.123$, $t(4404) = 6.214$, $p < .001$ (see Table 3 for a summary of the regression analysis).

Table 2. Summary of Linear Regression Analysis Assessing the Unique Effects of Selected Characteristics of Decision Predicting Distance between Decisions

	Distance between Decisions		
Characteristics	***B***	***SE B***	***p***
(Intercept)	3.318	0.076	< .001
Emotional	0.106	0.022	< .001
Long-term	0.081	0.021	< .001
High-risk	0.109	0.022	< .001
High-impact	0.127	0.025	< .001
Financial	0.123	0.020	< .001

Discussion

An author wrote that “truly successful decision making relies on a balance between deliberate and instinctive thinking” (Gladwell, 2007). Are there kinds of decisions more prone to deliberate or instinctive thinking? What are the other factors that may categorizes decisions in people’s mind?

Our results revealed that participants perceived two decisions differently based on five characteristics of decision-making. Particularly, decisions are perceived different depending on whether the decisions are emotional, long-term, high-risk, high-impact, or financial. It was found that other characteristics of decisions such as frequency of decision-

making or the number of options did not have significant additional effects on differentiating decisions.

Zarnoth & Sniezek (1997) have shown that decision making can be influenced by social factors. A previous study suggests that different cultures have different levels of individualism and collectivism (Oyserman et al, 2002). The cultural difference may lead to a result that showing different cultures make a distinction between decisions using different characteristics of decisions. For example, a social characteristic of decision making is not important in an individualistic culture, while it is important in a collectivist culture.

One limitation of this model is that it only explains around 13% of the variance, while does not suggest any accounts for most of the remaining unexplained variance. It raises a possibility that there are other factors that actually differentiate decisions but people do not aware of. This study is based on the classification of decisions built upon self-reported ratings of people's perception. Nisbett & Wilson (1977) showed that there may be differences that people are not conscious of and cannot express. It may be possible that the neurological system that draws a distinction is different from our findings at the perceptual level.

The present findings demonstrate how different characteristics of decision may lead to different perceptions of these decisions. From this understanding, instead of applying for a general strategy of decision-making, developing a different strategy for different types of decisions may lead to a better outcome since each decision owns distinct characteristics of decision-making.

Further research might investigate if the perceptions people form about decision-making competencies are similar to the perceptions they form about the perceived classifications of decisions. For example, if people think choosing which computer to buy is

different from choosing which person to marry, do people consider if there are different competencies for making different decisions? Future study may find if the perceptual classification of competencies for making decisions is identical to the perceptual categorization of decisions.

Appendix A

Characteristics of decision	Questions used for decision's characteristics ratings
Four Ws and one H (what, when, where, who, how)	This decision is about deciding "what" or "which one" This decision is about deciding "when" or "which time" This decision is about deciding "where" or "which place" This decision is about deciding "who" or "which person" This decision is about deciding "how" or "which way"
Motives (rational or emotional)	This decision is usually made rationally This decision is usually made emotionally
Valence (positive or negative)	This decision is a choice between positive options This decision is a choice between negative options
Frequency (frequent or infrequent)	This decision occurs very frequently
Period (weekly, monthly, or yearly)	This is a decision you make every week or so This is a decision you make every month or so This is a decision you make every year or so
Duration (short-term or long-term)	This is a short-term decision for the present This is a long-term decision for the future
Respond time (quick or delayed)	This decision requires a great amount of time to make
Procrastination (weak or strong)	This is a decision you put off making until the last possible moment
Risk (low-risk or high-risk)	This decision involves high risk
Impact (low-impact or high-impact)	This decision has a high impact on your life
Influence (individual or social)	This is a decision that affects not only the person deciding, but also other people
Variety (limited options or multiple options)	This decision involves choosing between a variety of options

Finance (financial or non-financial)	This is a financial decision

Appendix B

Characteristics of decision	Questions used for decision list based on characteristics
Four Ws and one H (what, when, where, who, how)	Please list two decisions about deciding "what" or "which one" Please list two decisions about deciding "when" or "which time" Please list two decisions about deciding "where" or "which place" Please list two decisions about deciding "who" or "which person" Please list two decisions about deciding "how" or "which way"
Motives (rational or emotional)	Please list two decisions that are usually made rationally Please list two decisions that are usually made emotionally
Valence (positive or negative)	Please list two decisions that are a choice between positive options Please list two decisions that are a choice between negative options
Frequency (frequent or infrequent)	Please list two decisions people make very frequently Please list two decisions people make very infrequently
Period (weekly, monthly, or yearly)	Please list two decisions people make every week or so Please list two decisions people make every month or so Please list two decisions people make every year or so
Times (a few or many)	Please list two decisions people make only a few times in a lifetime.
Duration (short-term or long-term)	Please list two short-term decisions people make for the present

	Please list two long-term decisions people make for the future
Respond time (quick or delayed)	Please list two decisions that require a great amount of time to make
Risk (low-risk or high-risk)	Please list two decisions that involve high risk Please list two decisions that involve low risk
Impact (low-impact or high-impact)	Please list two decisions that have high impacts on people's lives Please list two decisions that have low impacts on people's lives
Influence (individual or social)	Please list two private decisions that only affect you Please list two social decisions that affect other people
Variety (limited options or multiple options)	Please list two decisions that have only two options (binary choices) Please list two decisions that have more than two options (multiple choices)
Actuality (actual or virtual)	Please list two decisions that you have not yet made, but you expect to be making in the future.
Finance (financial or non-financial)	Please list two financial decisions Please list two non-financial decisions
	Please freely list any two decisions that are different from the decisions you listed above

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