A Study of Cognitive Effort of Decision Makers with Different NC under Framing

Chiung-Wen Hsu[1] and Chen-li Kuo[2]
[1]*Information Management Department, Cheng-Shiu University, 840 Chengcing Rd., Niaosong Dist., Kaohsiung City 83347, Taiwan*
[2]*Department of Information Management, Chang Gung University, 259 Wen-Hwa 1st Road, Kwei-Shan Tao-Yuan, Taiwan, 333, Taiwan*

Keywords: Framing Effect, Need for Cognition, Cognitive Effort, Eye-tracking.

Abstract: The purpose of this study is to examine cognitive effort of decision makers with different need for cognition (NC) while making decision under framing. Hundreds of empirical studies have demonstrated the framing effect moderating by NC in various contexts. However, these studies often treated cognition as a black box and focused on the outcomes rather than on the process by which decisions with different NC are made. In order to explore cognitive process of decision makers with different NC under framed problems, our research observes the cognitive effort of decision makers with different NC (High vs. Low NC) under different framing (Positive vs. Negative framing) from the perspective of their information process. A laboratory experiment of 65 subjects was conducted. Eye-tracking was applied to evaluate decision makers' cognitive effort. The results indicate that all subjects are susceptible to framing effect, and NC doesn't moderate framing effect. Decision makers with high NC will spend more cognitive effort to framed problems. In addition, decision makers with high NC, compared with those with low NC, will pay more cognitive effort in negative frame, but not for positive framing. Finally, there is no significant relationship between cognitive effort and framing effect. The results could compensate the shortage of past studies related to framing effect and NC, which only focused on final choices. In addition, by using eye tracking, we also unveil the track of information process before framing effect generated, which could benefit the richness of research on framing effect and NC.

1 INTRODUCTION

The formulation of a decision stimulus or an event influences how decision makers think and decide. Framing effect, proposed by Kahneman and Tversky (1979), refers to the phenomenon that by presenting the same problem in terms of gains (positive frame) or losses (negative frame) can systematically affect the choice one makes. The logically equivalent problems are framed in positive versus negative ways, so called valence-based framing, may systematically affect the decisions or actions decision makers take. People are prone to select the risk-averse option under positive frame and the risky option under negative frame.

These framing phenomena have been widely investigated in a variety of research fields (Kuhberger, 1998). A meta-analysis by Kuhberger (1998) concluded that framing was a reliable phenomenon and further suggested other variables such as risk characteristics, task characteristics, and personal personality might moderate the framing effects. Need for cognition (NC), a personal trait, is a significant factor moderating framing effect. Cohen et al., (1955) defined NC as "the tendency for an individual to engage in and enjoy thinking" (p. 116). Previous studies showed that people with higher NC are willing to conduct more cognitive processing, while those with lower NC are not motivated to do so when making decisions. Specifically, people with higher NC examine the information more completely and tend to ignore influences from other information (Verplanken, 1993). Because of the different thinking style derived from NC, previous studies suggested that NC is an important factor moderating framing effect. Many studies found that NC interferes with framing effect (Chatterjee et al., 2000); (Simon et al., 2004); (Smith and Levin, 1996); (Petty et al., 2008), suggesting that people with higher NC have more

Hsu C. and Kuo C..
A Study of Cognitive Effort of Decision Makers with Different NC under Framing.
DOI: 10.5220/0004437300750082
In *Proceedings of the 15th International Conference on Enterprise Information Systems* (ICEIS-2013), pages 75-82
ISBN: 978-989-8565-61-7

thinking on framing problems and are not susceptible to framing effect. On the other hand, recent research found that framing effect exists no matter decision makers with high or low NC (LeBoeuf and Shafir, 2003); (Levin et al., 2002); (Cárdaba et al., 2013); (Tonetto and Stein, 2010).

Those studies, whether in support of the notion that NC moderate framing effect, assume that level of cognitive effort increases as NC increases (Simon et al., 2004); (Petty et al., 2008). Cognitive effort refers to the total use of cognitive resources required to complete the task (Payne et al., 1990). However, little studies use physiological apparatuses to measure cognitive effort in order to provide objective evidence. In addition, scarce studies discuss which information is paid more attention in response to framed problems. Therefore, one purpose of this study is to measure and compare the difference of cognitive effort devoted to the framed problems between high and low NC decision makers. Based on previous studies which show that more cognitive effort paid to framing problems reduce framing effect, the relationship between cognitive effort and relationship is investigated further.

Individual difference, NC, is a factor about one's ability to determine how cognitive effort paid to framed problems. However, other variables such as motivation to process may also moderate NC on cognitive effort. Motivation could be driven by complex tasks, relevant topics or untrusted messages (See, Petty, and Evans, 2009). Overall, the characteristics of task (i.e. level of complexity, blatancy of message) are important factors moderating NC on cognitive effort and effect of persuasion (Petty et al., 2008). NC is more salient depending on task conditions. For example, Levin et al., (2000) set laptop shopping environment, and asks respondents to choose the notebook they want to buy. Each respondent has to use inclusion and exclusion strategy to decide which product he/she wants. The results revealed that in the inclusion condition where subjects showed greater narrowing of options (i.e. cognitive effort required), high NC subjects processed information in a more focused manner with greater depth and breadth than did low NC subjects, and the quality of their selections tended to be higher. The characteristics of task may be important moderators for influence of NC on cognitive effort, and worthy to explore further.

Recent breakthroughs in physiological apparatuses such as functional magnetic resonance imaging (fMRI) have helped disclose the underlying cognitive activities during the process of decision making. Another physiological apparatuses, eye tracking, has been used to measure cognitive effort in the studies related to decision making (Kuo et al., 2009); (Huang and Kuo, 2012). Eye-tracking has been used in a variety of research fields, ranging from reading processing (Rayner,1998), marketing (Wang and Day, 2007), and decision making (Kuo et al., 2009); (Huang and Kuo, 2012). Studies which track eye movements have proven that eye movement is a sufficient and valid reflection of the decision process (Kuo et al., 2009); (Huang and Kuo, 2012). Researchers have confirmed the eye–mind assumption: eye movements are directly related to the underlying cognitive process (Rayner, 1998).

Thus, the present study utilized eye-tracking to measure high and low-NC decision makers' cognitive effort under framing. Further, the moderator of framing (i.e. positive and negative framing) on cognitive effect is investigated and the relationship between cognitive effort and framing effects is discussed. The result will explore the black box into which decision makers' cognitive effort could be observed further under different framing.

2 LITERATURE REVIEW AND HYPOTHESIS

2.1 NC and Cognitive Effort

Studies tackling the issue of whether NC interferes with framing effect (Chatterjee et al., 2000); (Simon et al., 2004); (Smith and Levin, 1996), suggested that people with high NC analyse framed problems more thoroughly. Most research hypothesizes that different kinds of NC lead to difference cognitive effort,. Scholars believed that people with low NC, compared with high NC, are less motivated to process information and have different information processing and interpretation. People with high NC are likely to process information in a careful, elaborate fashion, paying less attention to peripheral or superficial cues. They understand positive and negative frame with the same equivalent logic, and may not have cognitive bias by framing problems. Verplanken (1993) showed the relationship between individuals' NC and cognitive effort measured by variability of search across alternatives and pattern of search. It was found that people with lower NC applied less cognition effort to information processing, and vice versa. Fisk and Neuberg's (1990) theory of impression formation demonstrated

the same hypothesis that people with high NC are more motivated to analyse information, and the analysis process turns from category to piecemeal model. Thus, the present study hypothesized that people with higher NC are more willing to put cognition effort than people with low NC when they are faced with framed problems.

H1: People with high NC pay more cognitive effort than those with low NC under framing.

H1a: People with high NC pay more cognitive effort, measured by number of fixations, than those with low NC under framing.

H1b: People with high NC pay more cognitive effort, measured by fixations duration, than those with low NC under framing.

In addition to decision makers' cognitive ability influencing cognitive effort paid in the process of decision, contextual factor is an important factor motivating information process while making decision. Prior NC research showed that different tasks are of interest to those varying in NC. Specifically, high NC individuals are more motivated by complex tasks rather than simple (i.e. high cognitive resources required) (See, Petty, & Evans, 2009). Similarly, researchers claimed that NC is internal traits, and it will only salient when driven in ways such as instructing participants to enter the information processing or motivating them with complex tasks (Levin et al., 2000); (McElroy and Seta, 2003). Both individual and situational factors affecting the extent of thinking have been identified in the persuasion process (See, Petty and Evans, 2009).Levin et al., (2000) show that the NC does indeed predict differences in information search in decision making, and such differences are more pronounced in situations where more cognitive effort is needed. For example, Levin et al., (2000) show that high NC subjects exhibited more effort than low NC subjects only in the inclusion condition which requires the most effortful thought. Thus, task condition is an important factor for motivating decision makers' cognitive effort. Similarly, Simon et al., (2004) found that the framing effect was moderated by the combination of NC and the depth of processing. NC is more salient by asking decision makers to justify framed problems. Providing reasons for making choices of framed problems facilitates people with high NC, but not for those with low NC, to think deeply and eliminate framing effect.

In line with the arguments above, we assumed that the influence of NC on cognitive effort will be moderated by task characteristics. More complex tasks will motivate decision makers' NC to process tasks. Studies have showed that negative framing is more complex than positive framing, and cost decision makers more cognitive effort to resolve problems (Gonzalez et al., 2005). Therefore, we hypothesize that valence of framing will moderate the influence of decision makers' NC on cognitive effort. Specifically, people with high NC will pay more cognitive effort under negative framing, but not for positive framing, than those with low NC. People with high NC will exert piecemeal-based information processing, showing that more number and duration of fixations are devoted to negative framing. Hypothesis 2 is provided.

H2: People with high NC will pay more cognitive effort under negative framing, but not for positive framing, than those with low NC.

H2a: People with high NC will have more number of fixations under negative framing, but not for positive framing, than those with low NC.

H2b: People with high NC will have more fixation duration under negative framing, but not for positive framing, than those with low NC.

2.2 Cognitive Effort and Framing Effect

Previous studies have shown that the framing effect would be eliminated when more effort expended to framed problems. Researchers claimed that the more cognitive effort paid to framed problems by decision makers, the more likely that framing effects can be attenuated (Smith and Levin, 1996); (Chatterjee et al., 2000); (Simon, 2004). For example, McElroy and Seta (2003) argued individuals engaging a decision task with an analytic processing style are especially insensitive to the influence of framing effect. Smith et al., (2004) also suggested that deep thought manipulated by asking participants justifying their choices would not be susceptible to framing effect. Decision makes with high NC and deep thought pay more attention on the relevant attributes of the options and therefore eliminate framing effect.

Cognitive effort paid to framed problems could be derived from decision makers' traits or be manipulated by external forces. For the decision makers' traits, some studies revealed that people with high NC can better reduce framing effect than those with low NC (Smith and Levin, 1996); (Chatterjee et al., 2000); (Simon, 2004). For the external force, numerous studies ask subjects to justify choices they made in order to increase

thoughts given to framed problems. The deep thoughts result more cognitive effort to process information, and the framing effect weakens (Takemura, 1994). In conclude, when decision makers pay more cognitive effort to framed problems, they may think more about the problem and pay more attention on the relevant aspects of the problems, consider the opposite information, such as thinking about the death rate when only the survival rate is presented. Thus, in line with previous studies, hypothesis 3 is proposed. When decision makers pay more cognitive effort on information processing under framed problems, they can enter piecemeal-based information processing, adopt more analytical way to deal with framed problems and attenuate the influence of framing.

H3: There is negative relationship between cognitive effort and framing effect. The greater cognitive effort is paid, measured by number of fixations, the more likely it is that the framing effect is reduced.

3 METHOD

3.1 Participants

A total of 65 college students with age ranging from 18-22 years were recruited as subjects from a university in Taiwan. 15 participants were excluded due to incorrect calibration and 50 participants are valid. Cash reward were given for participation.

3.2 Stimulus Materials

Four risky-choice problems were employed in the current research, including two in the life domain and two in the monetary domain. All problems are adopted from previous studies (Kahneman and Tversky, 1979); (Kuhberger, 1995), and some modifications are made in order to fit local contexts. The problem description was validated by several experts.

Each problem in this study had both a certain and a risky alternative. The order in which the two kinds of alternatives appeared in a problem was counter-balanced. For each problem, two versions were generated: the positively framed version and the negatively framed version.

3.3 Measurement

(1) Cognitive Effort. Cognitive effort was measured in the study by using EyeLink II with a sampling rate of 1000Hz for tracking and recording subjects' eye movements. Kahneman (1973) suggested that cognitive effort be measured in terms of intensity and time, both of which can be captured by means of eye-fixation and eye-movement time. Thus, two measurements of cognitive effort were employed in this study: the average fixation per word and the fixation duration per word.

(2) Need for Cognition. Need for cognition was measured with the short form of the Need for Cognition Scale (Cacioppo et al., 1984). The scale consists of 18 items such as “I prefer my life to be filled with puzzles that I must solve” that are rated using 5-point Likert scales.

3.4 Design and Procedure

An incomplete within-subject design was employed in our experiment. Subjects received both positive and negative framing, but not for the same problem. The 65 subjects were randomly divided into two groups. Two positively framed problems and two negatively framed ones were assigned to each group. As four problems were used in this study, Group 1 was assigned the positively framed version of P1 and P2 as well as the negatively framed version of P3 and P4. Conversely, Group 2 was assigned the negatively framed version of P1 and P2 as well as the positively framed version of P3 and P4. Four framing problems were randomly presented to each subject as stimuli.

Each participant was individually led to the experimental room and asked to sit in front of the experimental PC. The calibration and a subsequent validation were treated. An experimental program designed for the present study was then launched, and the subject was told to read the instructions on the screen and enter the choice via keyboard. Two sample problems before the formal experiment are presented in order to acquaint the subjects with the experimental system and the eye tracker. After that, four experimental problems were randomly presented. At the beginning of each trial, the problem and its two alternatives were displayed on the screen. At the same time, the eye tracker started to record subjects' eye movements. On average, subjects took 15-30 seconds to finish a question, and they were asked to enter their choice at any time during a 30s response period. After finishing four trials, participants are provided questionnaire about their background and NC scale.

4 RESULT

The eye movement data from each participant were inspected using a custom-made program to determine whether or not the data were invalid due to incorrect calibration (i.e., the fixation s were out of screen positions). 15 participants' fixations were invalid. The resulting data of 50 participants were available for analysis. 26 subjects remained in Group 1 and 24 in Group 2.

4.1 NC and Framing Effect

A SPSS-based $\chi 2$ test was conducted to examine whether or not individuals made different choices due to the difference in framing. Combing four experimental framed problems, the proportion of risk-seeking choices is 75% under negative framing and 40% under positive framing ($\chi 2$ (1)=12.303, $p<0.05$), respectively. The result indicates that subjects in this study were more likely to choose the risky alternative than the certain one in response to a negatively framed problem. Besides, In order to test the moderator of NC on framing effect, two-way ANOVA is conducted to test the interaction. The result shows that there was no significance of interaction between framing and NC on framing effect (F=1.70, p=0.21).

4.2 Hypothesis 1: NC and Cognitive Effort

The coefficient alpha for the NC scale in the study is 0.79, showing good reliability. In order to test the difference of cognitive effort paid by decision makers with different NC, we divided participants into high and low NC by using a median score, 3.45. Participants' NC scores higher than 3.45 are categorized into high need for cognition. On the other hand, scores lower than 3.45 are categorized into low need for cognition. The result of t test, shown as Table 1, indicates that there is difference of NC scores between high and low NC group. T test was used to analyse the differences between cognitive efforts paid by decision makers with high and low NC under framing and result are shown as table 2.

The results indicate that subjects with high NC also expended more frequency-based cognitive effort, average fixation, to process framed problem than those with low NC (M=1.62 per word vs. M=1.39 ; t=2.584; $p<.05$). Similarly, subjects with high NC in this study expended more cognitive effort, measured by fixation duration, to process the framed problem than those with low NC (M= 423.99 vs. M=374.82; t=2.143; $p<.05$). Therefore, both Hypotheses 1a and 1b are supported. Collectively, these results indicate that subjects with high NC in this study exerted more cognitive effort for processing information in framed problems than those with low NC. Decision makers' cognitive effort paid for framed problems depends on their NC.

Table 1: NC score between high and low NC group.

	High NC	Low NC	t value	P
NC Scores	3.84	3.22	6.109	<.05

Table 2: NC and Cognitive effort.

NC / Cognitive effort	High	Low	t value	P
Average fixation	1.62	1.39	2.584	<.05
fixation duration (ms)	423.99	374.82	2.143	<.05

4.3 Hypothesis 2: Moderator of Framing on Cognitive Effort

In order to test whether valence of framing interfere with relationship between NC and cognitive effort. Cognitive effort paid by decision makers with high and low NC in positive and negative frame was analysed separately. T test was conducted and results are shown in Table 3 and 4.

Table 3: Positive frame: NC and cognitive effort.

NC / Cognitive effort	High	Low	t value	P
Average fixation	1.55	1.50	0.241	>0.1
fixation duration (ms)	410.42	407.60	0.004	>0.1

Table 4: Negative frame: NC and cognitive effort.

NC / Cognitive effort	High	Low	t value	P
Average fixation	1.69	1.28	2.363	<.05
fixation duration (ms)	437.56	342.04	4.283	<.05

Test result shows in positive frame, the average fixation of high NC and that of low NC do not have

distinct difference (M=1.55 vs. M=1.50; t=0.241, p=0.812). Their fixation duration does not have distinct difference either (M=410.42 vs. M=407.60; t=0.004, p=0.951). However, in negative frame high NC respondents' and low NC respondents' average fixation have distinguished difference (t=2.363, p<.05). High NC responds' average fixation are higher than that of low need for cognition respondents (M=1.69 vs. M=1.28). Fixation duration also has distinct difference (t=4.283, p<.05). High need for cognition responds' fixation duration is longer than that of low need for cognition respondents (M=437.56 vs. M=342.04). The H2a and H2b are supported evidence by the test. Respondents with high NC and low NC do not have obvious difference of cognitive effort devoted to positive frame, only in negative frame. Overall, the information processing was more pronounced for high-NC participants when they are faced with negative framing.

4.4 Hypothesis 3: Cognitive Effort and Framing Effect

$\chi 2$ was used to test the relationship between cognitive effort and framing effect. First we split cognitive effort into high and low cognitive effort by a median of fixations for each framed problem. Next, we count numbers of framing effect for each problems framed as positive or negative. Framing effect will be counted 1, if participants choose certain option in positive frame or risky option in negative frame, otherwise, they will be counted 0. Then, two factors, cognitive effort and framing effect, are tested by $\chi 2$. Cognitive effort and the framing effect in the four problems were analysed separately to test H3. Cognitive effort allocated to positive and negative frame and framing effect are not evident correlation. For the disease problem in positive frame, the results of chi-square test is not significant ($\chi 2(1)= 0.11$, p=0.74), neither in negative frame($\chi 2(1)= 0.01$, p=0.91). The second question related to cancer in positive frame, the results of chi-square test is not significant ($\chi 2(1)= 0.12$, p=0.72); in negative frame they are also not significant ($\chi 2(1)=0.24$, p=0.62). Third question related to investment in positive frame, the results of chi-square test is not significant ($\chi 2(1)=2.40$, p=0.12); in negative frame they are also not significant ($\chi 2(1)=0.24$, p=0.62). Fourth question related to factory in positive frame, the results of chi-square test is not significant ($\chi 2(1)=0.26$, p=0.61); in negative frame they are also not significant ($\chi 2(1)=0.02$, p=0.89). The above results show that no matter which framed problem they are facing, respondents' cognitive effort and the reduction of framing effect do not have distinguished correlation. H3 is not supported.

5 DISCUSSION

Different from past studies, the main contribution of this study is to trace cognitive effort allocated to framing by decision makers with high or low NC. From the observation of eye movement, the depth and breadth of information process under framing could be described specially and black box of cognition could be explored further. In the present study, H1 and H2 are supported and H3 not, producing two important topics to be discussed.

1. NC and Cognitive effort. According to H1, we found that decision makers with high NC will spend more cognitive effort to process framed problems, which is consistent with previous studies (Chatterjee et al., 2000); (Simon et al., 2004); (Smith and Levin, 1996). From the distributions of fixations for framed problems (see Figure 1), we found that participants have more fixations on the two options than the question. In addition, fixations on numerical information such as probability and outcomes for each option are more than other information no matter decision makers with high or low NC.

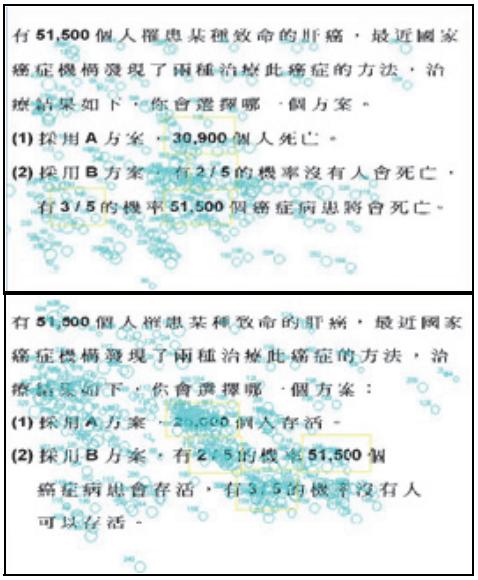

Figure 1: Distributions of fixations for one framed problem. Top panel: positive frame; bottom: negative.

Further, referred to H2, the valence of framing will interact with need for cognition to determine the

extent of information processing. People who were relatively high in their NC were more motivated to process a message labelled as complex rather than simple. Specially, people with high NC, compared with those with low NC, will pay move cognitive effort in negative frame. McElroy and Seta (2003) suggest that some of the variability in decision makers' style of information process can be accounted for by considering individual difference and contextual factors. Specially, cognitive effort only occurs when individuals are both willing (have sufficient motivation) and able (have sufficient motivation) to perform the task at hand. Therefore, in situation where cognitive ability is not constrained, motivational factors, such as the complexity for task, emerge as the determining cause for effort allocation. That is, as the complexity of task increases, so too does the amount of effort that an individual is willing to expend on the decision task. The results in the study are also consistent with findings provided by Smith et al., (2004) and Levin et al., (2000), which demonstrated that task characteristics affect decision makers' NC more salient or not. The study by Levin et al. (2000) show that decision makers with high NC will use broader and deeper ways to find information than those with low NC for inclusion strategy, not for exclusion strategy. Accordingly, if task is easy, decision makers' NC may not motivated and decision makers with different NC may not express different thinking style. However, decision makers with high NC may pay more cognitive effort to process information when task is more complicated. From the result, we know that NC may be salient or not by the task conditions.

2. Cognitive Effort and Framing Effect. From H3, we found that there is not definitely relationship between cognitive effort and framing effect, which is inconsistent with previous studies. A lot of literature have explored that deep thought can reduce framing effect. Deep thought will influence decision makers' cognitive styles, and will make them turn their thinking style from holistic thinking style to analytic thinking (McElroy and Seta, 2003); (Smith et al., 2004). Hence, we infer that higher cognitive effort can reflect stronger deep thought, and eliminate framing effect.

Nevertheless, from our empirical data can notice that high or low cognitive effort may not influence framing effect. Petty and DeMarree, et al. (2008) found that whether analytic thought derived from high NC eliminate framing effect depending on framing blatancy. As NC increases, the magnitude of framing effects increases with a subtle prime but decreases with a blatant prime. Besides, Smith et al., (2004) provide an explanation for not moderator of NC on framing effect. They claim that except for NC, math skill is an important factor influencing framing effect. A decision maker with analytic thinking style but not with math ability may not find relevant attributes for attenuating framing effect. Based on the argument by Smith et al., (2004), we infer that the reason for not supporting H3 is that when decision maker is dealing with framing problem, even though they are searching information more thoroughly, and have much information attention, they don't find relevant attributes to eliminate framing effect if they don't have enough math skill.

6 CONCLUSIONS

Hundreds of empirical studies have demonstrated the framing effect moderating by NC in many different contexts (Chatterjee et al., 2000); (Simon et al., 2004); (Smith and Levin, 1996); (LeBoeuf and Shafir, 2003); (Levin et al., 2002), and explain framing effect moderating by decision makers' NC by using cognitive information-processing principles. However, no empirical evidence is presented as the cognitive effort. Researchers performing these studies often have treated cognition as a black box by focusing on the outcomes rather than on the process in which decisions are made by decision makers with different NC. As a result, the process of how people with different NC pay cognitive effort to problems framed with gain and loss has gone largely unaddressed. Our findings offer an evidence for cognitive effort paid by decision makers with different NC in response to positively and negatively framed problems. The results could compensate the shortage of past studies related to framing effect and NC, which only focused on final choices rather than cognitive effort of decision makers under framing. In addition, by using eye tracking, we also unveil the track of information process before framing effect generated, which could benefit the richness of research on framing effect and NC.

REFERENCES

Cacioppo, J. T.; Petty, R. E.; Feinstein, J. A.; Jarvis, W. B. G., (1996). Dispositional differences in cognitive motivation: The life and times of individuals varying in need for cognition. *Psychological Bulletin*, 119(2),

197-253.

Cacioppo, J. T., Petty, R. E., & Kao, C. F., (1984). The efficient assessment of need for cognition. J*ournal of Personality and Assessment*, 48, 306-307.

Cárdaba, M. A. M., Briñol, P., Horcajo, J., & Petty, R. E., (2013). The effect of Need for Cognition on the stability of prejudiced attitudes toward South American immigrants. *Psicothema*, 25(1), 73-78.

Chatterjee, S., Heath, T. B., Milberg, S. J., & France, K. R., (2000). The differential processing of price in gains and losses: the effects of frame and need for cognition. *Journal of Behavioral Decision Making*, 13(1), 61-75.

Gonzalez, C., Dana, J., Koshino, H., and Just. M., (2005) The framing effect and risky decisions: examining cognitive functions with fMRI, *Journal of Economic Psychology*, 26(1), 1–20.

Huang, Y.F., Kuo, F. Y., (2012). How impulsivity affects consumer decision-making in e-commerce. *Electronic Commerce Research and Applications*,11(6), 582-590.

Kahneman, D. (1973). Attention and Effort. *New Jersey:Prentice-Hall*.

Kahneman, D., & Tversky, A., (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, 47(2), 263–291.

Kuhberger, A., (1995) The framing of decisions: a new look at old problems, *Organizational Behavior and Human Decision Processes*, 62 (2), 230–240.

Kuhberger, A., (1998) The influence of framing on risky decisions: a meta-analysis, *Organizational Behavior and Human Decision Processe*s, 75 (1) 23–55.

Kuo, F. Y., Hsu, C. W., & Day, R. F. (2009). An exploratory study of cognitive effort involved in decision under Framing - an application of the eye-tracking technology. *Decision Support Systems*, 48(1), 81-91.

LeBoeuf, R. A., & Shafir, E. (2003). Deep thoughts and shallow frames: on the susceptibility to framing effects. *Journal of Behavioral Decision Making*, 16, 77-92.

Levin, I. P., Gaeth, G. J., Schreiber, J., & Lauriola, M. (2002). A new look at framing effects: distribution of effect sizes, individual differences, and independence of types of effects. *Organizational Behavior and Human Decision Processes*, 88, 411-429.

Levin, I. P., Huneke, M. E., & Jasper, J. D., (2000). Information processing at successive stages of decision making: need for cognition and inclusion-exclusion effects. *Organizational Behavior and Human Decision Processes*, 82(2), 171-193.

McElroy, T., & Seta, J. J., (2003). Framing effect :a analytic-holistic perspective. *Journal of Experimental Social Psychology*, 39, 610-617.

Payne, J. W., Johnson, E. J., Bettman, J. R., and Coupey E., (1990) Understanding contingent choice: a computer simulation approach, systems, man and cybernetics, *IEEE transactions on systems, Man and Cybernetics*, 20(2), 296–309.

Petty, R. E., DeMarree, K. G., Briñol, P., Horcajo, J., & Strathman, A. J. (2008). Need for cognition can magnify or attenuate priming effects in social judgment. *Personality and Social Psychology Bulletin*, 34(7), 900-912.

Rayner, K., (1998). Eye movements in reading and information processing: 20 years of research. *Psychological Bulletin*, 124(3), 372-422.

See, Y. H. M., Petty, R. E., & Evans, L. M. (2009). The impact of perceived message complexity and need for cognition on information processing and attitudes. *Journal of Research in Personality*, 43(5), 880-889.

Simon, A. F., Fagley, N. S., & Halleran, J. G. (2004). Decision framing: moderating effects of individual differences and cognitive processing. *Journal of Behavioral Decision Making*, 17, 77-93.

Smith, S. M., & Levin, I. P. (1996). Need for cognition and choice framing effect. *Journal of Behavioral Decision Making*, 9, 283-290.

Takemura, K., (1994). Influence of elaboration on the framing of decision. *The Journal of Psychology*, 128(1), 33-39.

Tonetto, L. M., & Stein, L. M., (2010). Moderating Effects of Consumer Involvement and the Need for Cognition on Goal Framing. Revista Interamericana de Psicologia/Interamerican *Journal of Psychology*, 44(2), 256-262..

Verplanken, B., (1993). Need for cognition and external information search response to time pressure during decision making. *Journal of Research in Personality*, 27, 238-252.

Wang, J.-C., & Day, R.-F., (2007). The Effects of Attention Inertia on Advertisements on the WWW. *Computers in Human Behavior*, 23(3), 1390-1407.