An Investigation of the Use of Heuristics on Judgment

By

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Abstract: How and when are individuals more or less influenced by heuristics when making judgments? The first essay of my dissertation examines whether individuals can reduce their reliance on heuristics that cause them to form biased judgments. According to Kahneman and Frederick (2002, 2005), people have a tendency to commit judgmental biases by basing their judgments on accessible heuristic cues (heuristic attributes) rather than relevant cues (target attributes). This prevalent tendency to substitute an inaccessible (but relevant) attribute with an accessible (but irrelevant) attribute results in a biased judgment. To eliminate people’s tendency to rely on heuristics, the first essay of my dissertation examines whether it is possible to make the target attribute more readily accessible in individuals’ minds by merely exposing individuals to the relevant cue – the target attribute using a non-conscious prime. I demonstrate that brief exposure (20 milliseconds) of the target attribute can increase the accessibility of the target attribute and reduce judgmental biases. The second essay of my dissertation examines the ease-of-retrieval heuristic. Previous research has shown that the ease of retrieving information leads to more favorable judgments, whereas the difficulty of retrieving information leads to less favorable judgments (Menon & Raghubir, 2003; Schwarz et al., 1991; Tormala, Petty, & Briñol,
2002; Tversky & Kahneman, 1973). Contrary to previous research, I find that, when individuals have the opportunity to use a product (i.e., direct product experience), the influence of ease-of-retrieval on their judgments becomes reversed. In particular, after a gustatory product experience with a soft drink or a tactile product experience with a hand lotion, individuals evaluate the product more (less) favorably when listing many reasons why they like (dislike) the product compared to listing a few reasons. I demonstrate that this finding is not a result of alternative explanations such as motivation levels or the reliance of the content of reasons.
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INTRODUCTION

My dissertation consists of two essays which examine how and when individuals are more or less influenced by heuristics when making judgments. The first essay examines whether individuals can reduce their reliance on heuristic cues (heuristic attributes), that cause them to form biased judgments, by increasing the accessibility of relevant cues (target attributes), that should be used to make correct judgments. The second essay examines how and when individuals use or reverse the ease-of-retrieval heuristic by investigating product evaluation both in no direct product experience and direct product experience conditions.

Ever since the Tversky and Kahnman’s seminal articles on heuristics and biases (Kahneman & Tversky, 1972, 1973; Tversky & Kahnman, 1973, 1974), a considerable amount of research has been directed toward understanding why these heuristics and biases occur and under what conditions the biases increase or decrease. Individuals have a tendency to neglect important information which is required to make correct judgments and rather use heuristics, which lead them to make biased judgments (e.g., Kahneman & Tversky, 1972, 1973; Kirkpatrick & Epstein, 1992; Tversky & Kahnman, 1973, 1974, 1983). For example, when one needs to estimate the probability that a particular individual belongs to a category of individuals (e.g., lawyers), one should consider base rates (prior probabilities) or the proportion of the population that is a member of that category. However, the engineer-and-lawyer problem (Kahneman & Tversky, 1973) illustrates that individuals often use the representativeness heuristic, a rule of thumb in which they judge the probability that an individual is a member of a category of individuals by relying more on how much a person is representative of a given category, that is, how much this person resembles the stereotype of the category, without much considering the base-rate of a given sample (Tversky & Kahneman, 1974).
Kahneman and Frederick (2002, 2005) propose the Model of Heuristic Judgment as an underlying mechanism for why people make these judgmental biases. According to Kahneman and Frederick (2002, 2005), individuals tend to rely on a heuristic attribute, that comes more easily to mind, rather than a target attribute, which should be used to make a rational judgment. In other words, people unwittingly substitute the heuristic attribute which is more accessible for the target attribute which is less accessible. Substituting the heuristic attribute for the target attribute inevitably creates judgmental biases because these two attributes are different.

The Model of Heuristic Judgment also proposes a dual process model which explains the underlying mechanism for making judgmental biases through the interplay between two cognitive processes – System 1 and System 2. According to the Model of Heuristic Judgment, the processes of System 1 are automatic and effortless whereas the processes of System 2 are controlled and effortful. This Model posits that System 1 quickly proposes intuitive answers to judgmental problems, and System 2 monitors the quality of these answers by endorsing or correcting them.

In Essay 1, I directly tested the Model of Heuristic Judgment by examining whether increasing the accessibility of a target attribute versus a heuristic attribute using nonconscious priming can reduce the judgmental biases (e.g., ratio-bias phenomenon, base-rate neglect). In the first experiment, I examined the effect of priming the target attribute on the ratio-bias phenomenon. I found that, participants who were subliminally primed with the target attribute were more likely to reduce the ratio-bias phenomenon, as compared to participants who were not primed or were primed with the heuristic attribute. In addition, I found that participants who were primed with the heuristic attribute showed a similar level of the ratio-bias phenomenon as participants who were not primed. This indicates that priming the heuristic attribute did not increase the ratio-bias phenomenon because the heuristic attribute was already readily accessible,
and therefore the effect of priming the heuristic attribute was redundant. In the second experiment, I examined the effect of priming the target attribute on the base-rate neglect. To determine whether cognitive resources are also required to correct the bias, I also used a cognitive load manipulation. Consistent with the finding of the first experiment, when participants had enough cognitive resources, they were able to reduce the base-rate neglect after being primed with the target attribute. However, when participants experienced cognitive load, they were not able to reduce the base-rate neglect even though the target attribute was made accessible. These findings are also consistent with the Model of Heuristic Judgment which posits that cognitive resources are required to correct biased judgments.

Another heuristic that has received a considerable amount of research attention is that of availability (Tversky & Kahneman, 1973). The availability heuristic is a phenomenon in which one predicts the frequency of an event, or the likelihood of its occurrence, “by the ease with which instances or associations come to mind” (Tversky & Kahneman, 1973, p 208). For instance, when individuals are asked whether more words begin with the letter “R” than words that have the letter “R” in the third position, most people would answer that words beginning with the letter “R” are more common although the reverse is true. This is because it is easy to think of words beginning with “R” (e.g., road, rabbit) compared to those having “R” in the third letter (e.g., care, borrow).

Since Tversky and Kahneman introduced the availability heuristic, it has instigated a vast amount of research in social cognition (see Sherman & Corty, 1984; Strack, 1985, for reviews). The research of Schwarz, Bless, Strack, Klumpp, Rittenauer-Schatka, and Simons (1991) is notable since it suggests another look at the availability heuristic by showing that ease-of-retrieval can be used as information. To show the underlying process of the availability heuristic, Schwarz et al. (1991) disentangled the impact of the content of recall and the
subjective experience of ease or difficulty that may accompany recall. They show that experienced ease of recall can qualify the implications of recalled content. Participants assessed themselves as less assertive (less unassertive) after recalling 12 assertive (unassertive) behaviors, which was more difficult, than after recalling 6 assertive (unassertive) behaviors, which was less difficult. In this case, participants relied more on their subjective feeling of difficulty in recalling than the content of their assertive (unassertive) behaviors, thereby leading to rating themselves less assertive (unassertive). This research finds that individuals frequently rely on the ease or difficulty with which the information comes to mind when making a judgment instead of relying on the content of the information they recall.

This ease-of-retrieval effect has been replicated in a persuasion context (Tormala, Falces, Brinõl, & Petty, 2007; Tormala, Petty, & Brinõl, 2002). For instance, participants who generated 2 thoughts in favor of the policy on comprehensive exams formed more favorable attitudes toward the comprehensive exams than participants who generated 8 thoughts. The effect was mediated by confidence in thoughts: Participants who generated 2 (vs. 8) thoughts had a greater confidence in their thoughts, which resulted in more favorable attitudes. In a marketing context, not only actually generating thoughts about brands after reading the comparative advertisements of the brands but also merely imagining about generating thoughts has been shown to elicit the same ease-of-retrieval effect (Wänke, Bohner, & Jurkowitsch, 1997).

In Essay 2, I examine whether ease-of-retrieval effects found in previous research can be extended to direct product experience situations (e.g., product testing or trials). Prior research has shown that ease of retrieving instances or generating thoughts results in more favorable judgments than the difficulty of retrieving instances or generating thoughts. Contrary to prior research which examines indirect experience situations (e.g., recalling instances, listing
thoughts about brands after reading advertisements), I suggest that ease-of-retrieval effects will reverse with direct product experience. In the first experiment, I directly compared a no direct product experience condition (e.g., read the features of a hand lotion) with a direct product experience condition (e.g., read the features of a hand lotion and use the hand lotion), and found the traditional ease-of-retrieval effect in the no direct experience condition and the reversed ease-of-retrieval effect in the direct product experience condition. In the no direct product experience condition, participants form more favorable attitudes toward a hand lotion when generating 2 positive thoughts about the hand lotion than 8 positive thoughts. However, in the direct product experience condition, participants form more favorable attitudes toward the hand lotion more when generating 8 positive thoughts than 2 positive thoughts. In the second experiment, I replicated the reversed ease-of-retrieval effect when generating negative thoughts. Individuals with direct product experience form more negative attitudes toward the hand lotion when generating 8 negative thoughts than 2 negative thoughts. Moreover, I ruled out the motivation account by demonstrating the reversed ease-of-retrieval effect under both a high motivation condition and a low motivation condition. In the third experiment, I demonstrate that the effect cannot be explained simply by the reliance of thought-content. In the final experiment, I replicate the reversed ease-of-retrieval effect using a different product – a soft drink.

My dissertation research contributes to previous research in several ways. Essay 1 contributes to the literature on heuristics and biases by providing strong support for the Model of Heuristic Judgment (Kahneman & Frederick, 2002, 2005). The findings of Essay 1 indicate that the heuristic attribute is more accessible in mind than the target attribute. Moreover, Essay 1 tests the implication of the Model of Heuristic Judgment (Kahneman & Frederick, 2002, 2005) by demonstrating that increasing the accessibility of the target attribute can reduce judgmental
biases. In addition, Essay 1 demonstrate the importance of having enough cognitive capacity to reduce the biases by finding that individuals experiencing cognitive load fail to reduce the biases even after the target attribute is made more accessible. Importantly, Essay 1 adds to the literature on reducing judgmental biases by suggesting that nonconscious priming can reduce the biases in addition to previously known explicit methods (e.g., training statistical concepts).

Essay 2 contributes to the ease-of-retrieval literature by expanding our understanding as to how individuals’ judgments will be affected by the ease-of-retrieval when they have direct product experience. The findings of Essay 2 indicate that the ease-of-retrieval effect actually reverses with direct product experience: Individuals form more (less) positive attitudes after generating many positive (negative) thoughts than a few positive (negative) thoughts. Essay 2 opens up new avenues for future research as to whether the reversed ease-of-retrieval effect can be extended to different product types. The products used in Essay 2 (e.g., a hand lotion, a soft drink) are products where attitudes are primarily based on the sensory attributes of the products. It would be interesting to test whether the effect will hold for different product types where attitudes are not based only on the sensory attributes of the products (e.g., a digital camera, a calculator).
ESSAY 1. WILL THE INCREASED ACCESSIBILITY OF THE TARGET ATTRIBUTE REDUCE JUDGMENTAL BIASES?

Understanding why individuals are subject to biases when making probability judgments and examining how these biases may be corrected has generated considerable research interest since the classic article by Tversky and Kahneman (1974). Previous research, for instance, has examined various explicit methods for correcting the biases such as training in statistics and the logic of sets (Agnoli, 1991; Agnoli & Krantz, 1989; Nisbett, Krantz, Jepson, & Kunda, 1983) and using frequency formats to define the problem (Cosmides & Tooby, 1996; Gigerenzer & Hoffrage, 1995; Tversky & Kahneman, 1983).

In this essay, I take a different approach by drawing on the Model of Heuristic Judgment which has been proposed by Kahneman and Frederick (2002, 2005) to explain why the biases occur. According to this model, systematic biases occur because individuals substitute the heuristic attribute, which is more readily accessible, for the target attribute, which should be used to make a correct judgment. The Model of Heuristic Judgment also include a dual process model where the processes of System 1 (intuition) are automatic, effortless, fast, parallel, and slow-learning whereas the processes of System 2 (reasoning) are controlled, effortful, slow, serial, and flexible. They assume that “System 1 quickly proposes intuitive answers to judgment problems as they arise, and System 2 monitors the quality of these proposals, which it may endorse, correct, or override” (p 51).

Kahneman and Frederick (2002) propose three conditions under which attribute substitution occurs: (1) the target attribute is relatively inaccessible; (2) the heuristic attribute is highly accessible; (3) System 2 (reasoning) fails to reject the substitution of the heuristic attribute. The implication of this model is that increasing the accessibility of the target attribute should reduce the bias. Since previous research has not examined whether or not it will, I
directly test this possibility by using nonconscious priming to increase the accessibility of the target attribute.

In addition, I am interested in whether individuals need cognitive resources to reduce the bias since according to the Model of Heuristic Judgment, System 2 identifies and corrects the bias. In other words, in order to make the correct judgment, is it sufficient to increase the accessibility of the target attribute in memory or does it also require cognitive resources as argued by Kahneman and Frederick (2002)?

While numerous dual process models have been proposed (e.g., Epstein, 1994; Sloman, 1996; Stanovich & West, 2000), the model of Kahneman and Frederick (2002) has been specifically applied to understanding heuristics and biases and the correction process. Kahneman and Frederick (2002) assume that, when the automatic and controlled cognitive operations of System 1 and System 2 compete for the control of overt responses, the corrective judgments tend to remain anchored on initial impressions. In other words, individuals only partially correct their judgments.

Why do errors still occur even though System 2 monitors the quality of both mental operations and overt behavior (e.g., Gilbert, 2002; Stanovich & West, 2000)? Kahneman and his colleagues explain that many intuitive erroneous judgments are expressed because the self-monitoring function is normally quite lax and effortful (Kahneman, 2003; Kahneman & Frederick, 2002).

In order to test whether cognitive resources are required to reduce judgmental biases, when the target attribute is made more accessible by the nonconscious priming, I used a cognitive load manipulation. If the process of making the correct judgments requires cognitive resources, a high cognitive load will impair this process as opposed to a low cognitive load. Consequently, the likelihood of correcting judgments may decrease with a high cognitive load.
The following section provides a theoretical background concerning the mechanisms for making and reducing judgmental biases (i.e., ratio-bias phenomenon, base-rate neglect) and the effect of cognitive load on the process of reducing the biases. In subsequent sections, I discuss two experiments which investigate the effect of nonconscious priming on judgmental tasks – the jelly beans task and an analogue of the engineer-and-lawyer problem. Finally, I conclude with a summary and discussion of my findings.

**CONCEPTUAL FRAMEWORK**

**Attribute Substitution**

One of the mechanisms which explain why people err is *attribute substitution* (Kahneman & Frederick, 2002, 2005). Kahneman and Frederick (2002) explicitly defined a generic heuristic process of *attribute substitution* when an individual makes a judgment by substituting a related heuristic attribute, that comes more readily to mind, for the target attribute, which should be used to make a correct judgment. Attribute substitution occurs with many heuristic judgments. Direct evidence for attribute substitution was reported by Kahneman and Tversky (1973) in a task of categorical prediction about a fictitious graduate student, Tom W.

Tom W. is of high intelligence, although lacking in true creativity. He has a need for order and clarity, and for neat and tidy systems in which every detail finds its appropriate place. His writing is rather dull and mechanical, occasionally enlivened by somewhat corny puns and by flashes of imagination of the sci-fi type. He has a strong drive for competence. He seems to have little feel and little sympathy for other people
and does not enjoy interacting with others. Self-centered, he nonetheless has a deep moral sense.

In one condition, the similarity condition, participants were asked to rank the degree to which Tom W. “resembles a typical graduate student” in nine different departments of a university (e.g., business administration, computer science, engineering, humanities and education, etc.). Participants in another condition, the probability condition, were asked to rank the probability that Tom W. was a graduate student in the nine different departments. While the similarity of Tom W. to various stereotypes is highly accessible, judgments of probability are difficult and not directly accessible. Therefore, if participants in the probability group substitute a judgment of similarity (representativeness) for the required judgment of probability, their responses will elicit similar judgments to those of participants in the similarity group (Kahneman, 2003). The results of these judgments provide evidence for attribute substitution. As shown in Figure 1, the correlation between judgments of similarity and probability is very high (r = .98).

This example illustrates that substituting the target attribute with the heuristic attribute (e.g., representative heuristic) inevitably introduces systematic errors because these two attributes are different. Under what conditions do people substitute the target attribute with the heuristic attribute? Previous studies have shown that insufficient information (e.g., judging the relative frequency of words beginning with K or R) or unfamiliarity (e.g., comparing the population of a familiar foreign city with unfamiliar one) leads people to commit judgmental biases (Gigerenzer & Goldstein, 1996; Tversky & Kahneman, 1973). Since heuristic attributes (e.g., instances of words beginning with K or R, the amount of media coverage of two cities) are more accessible than target attributes (e.g., real frequencies of words, real populations of cities), attribute substitution occurs.
Dual Process Models

Dual process models propose that people are liable to make errors, due to a tendency to base their judgments on heuristics and intuition rather than on a logical reasoning process (e.g., Epstein, 1994; Kahneman, 2002; Kahneman & Frederick, 2002, 2005; Sloman, 1996; Stanovich & West, 2000). According to dual process models, the interplay between the two cognitive processes—System 1 (intuition) and System 2 (reasoning)—is used to explain why we use heuristics and under what circumstances we make judgmental errors or biases. Although other researchers who have proposed dual process models used different labeling for the two systems such as experiential system vs. rational system (Epstein, 1994), associative system vs. rule-based system (Sloman, 1996), and type 1 rationality vs. type 2 rationality (Evans & Over, 1996), they commonly assume that, System 1 operates quickly and requires little effort and few cognitive resources, whereas System 2 operates slowly and requires effort and cognitive resources. The present research adopts Kahneman (2002)’s dual process model to explain the underlying mechanism for making judgmental errors.

According to Kahneman and Frederick (2002, 2005), the processes of System 1 are automatic, effortless, associative, rapid, parallel, and slow-learning whereas the processes of System 2 are controlled, effortful, deductive, slow, serial, and flexible. These researchers assume that System 1 quickly proposes intuitive answers to judgment problems as they arise, and System 2 monitors the quality of these answers by endorsing, correcting, or overriding them. Furthermore, they assume that, when automatic and controlled cognitive operations of System 1 and System 2 compete for the control of overt responses, deliberate judgments are likely to remain anchored on initial impressions.

Why do errors still occur even though System 2 monitors the quality of both mental operations and overt behavior (e.g., Gilbert, 2002; Stanovich & West, 2000)? Kahneman and
his colleagues explain that many intuitive judgments are expressed, including some erroneous judgments, because the self-monitoring function is susceptible to dual-task interference and is normally quite lax (Kahneman, 2003; Kahneman & Frederick, 2002, 2005).

**How to Reduce Judgmental Biases**

How could people avoid judgmental errors resulted from using heuristics (e.g., the availability heuristic)? Knowing and developing various ways to reduce the systematic errors is crucial since it enables us to make better judgments, thereby producing better outcomes from these judgments in broad domains. Previous research has indicated various ways to enhance the likelihood of making correct judgments such as intensifying the vigilance of monitoring activities and furnishing stronger cues to the relevant rules (Kahneman, 2003), training in statistics and the logic of sets (Agnoli, 1991; Agnoli & Krantz, 1989; Nisbett, Krantz, Jepson, & Kunda, 1983), making respondents think as statisticians (Zukier & Pepitone, 1984), and suggesting problems in frequency format (Cosmides & Tooby, 1996; Gigerenzer & Hoffrage, 1995; Tversky & Kahneman, 1983).

In addition to these methods, the present research examines whether the nonconscious priming of the target attribute would also reduce judgmental errors by making the target attribute more accessible. According to the Model of Heuristic Judgment (Kahneman & Frederick, 2002, 2005), people make systematic errors because they substitute the heuristic attribute for the target attribute. What would happen if the target attribute is made more accessible by nonconsciously priming words related to the target attribute? I expect that priming the target attribute nonconsciously/subliminally may enhance the likelihood of making correct judgments. I chose the subliminal priming rather than the supraliminal priming for two reasons. First, the use of the subliminal priming is a more conservative test than that of the
supraliminal priming. Second, it is possible that the supraliminal priming (e.g., a scrambled sentence task) can elicit demand characteristics to participants after being consciously exposed to words related to the target attribute.

Despite the extensive research on judgmental biases, there is little research which investigates the effect of priming on judgmental biases. In a rare exception, Gabrielcik and Fazio (1984) employed a subliminal priming procedure (priming condition: presenting words containing the letter $t$ vs. control condition: presenting strings of asterisks) in order to provide direct evidence for whether increasing the accessibility mediated the effect of the availability heuristic. After the priming manipulation, subjects were asked to answer five items which compare the frequency of words containing $t$ with that of other letters ($d$, $m$, $p$, $r$, $s$) on a 9-point scale with one end labeled, “More words contain T” and the other “More words contain S.” The data provides strong support for the availability heuristic by showing that the subjects who had been primed with words containing $t$ judged $t$ to occur more frequently than did the control subjects. Thus, the mediating effect of increasing the accessibility of the critical words was confirmed: subliminal activation of words containing the letter $t$ enhanced the accessibility of the words, thereby facilitating the likelihood of retrieving words containing $t$ from memory which in turn affected subjects’ frequency estimates.

Gabrielcik and Fazio (1984)’s study, however, used priming to facilitate the availability heuristic, not to inhibit its use. This study differs from Gabrielcik and Fazio (1984)’s study in the way priming is used. This study uses priming to mitigate judgmental biases by making the target attribute more accessible. Although it is nonconscious, seeing words related to the target attribute results in a transient increase in accessibility of the representation of this target attribute, which in turn affects subsequent memory access (i.e., greater likelihood of retrieval). According to the Model of Heuristic Judgment, increasing the accessibility of the target attribute
should increase the likelihood of using the target attribute instead of the heuristic attribute, thereby reducing the judgmental biases. Therefore, individuals can reduce the biases without being aware of it.

**The Involvement of System 2 in Reducing Judgmental Biases**

Although the subliminal priming of the target attribute is a nonconscious process, I am interested in whether individuals need cognitive resources to reduce judgmental biases. In other words, in order to reduce the biases, is it sufficient to increase the transient accessibility of the target attribute in memory or does it also require cognitive resources? According to the Model of Heuristic Judgment, when System 1 quickly proposes intuitive answers to judgmental problems, System 2 monitors the quality of these answers. So, if System 1 produces judgmental biases, System 2 is required to identify and correct the biases. Since the operation of System 2 is controlled, slow, and effortful, reducing cognitive resources impedes the correction of System 2. To test this idea, I manipulated cognitive load by using a number rehearsal task (e.g., memorizing 2- vs. 9-digit numbers). If the process of reducing judgmental biases requires cognitive resources, a high cognitive load will impair this process as opposed to a low cognitive load. Consequently, the likelihood of reducing the biases may decrease with a high cognitive load.

In sum, the main objective of the present research is to answer the following questions: 1) Will the subliminal priming of a target attribute, which increases its accessibility, reduce judgmental biases? 2) Does the process of reducing the judgmental biases require cognitive resources, which implies the involvement of System 2?
EXPERIMENT 1. RATIO-BIAS PHENOMENON

The purpose of Experiment 1 is to test 1) whether priming the target attribute reduces judgmental biases and 2) whether priming the heuristic attribute increases the judgmental biases. I use subliminal priming to increase the accessibility of the target attribute, which should result in less bias because there will be less substitution of the heuristic attribute for the target attribute. In addition, I subliminally primed the heuristic attribute to examine whether it increases the biases. Since the Model of Heuristic Judgment predicts that the heuristic attribute is highly accessible when making the judgment, subliminally priming the heuristic attribute should not increase its accessibility, so this should not increase the biases.

To test the proposed ideas, this experiment adopted the jelly beans task used by Kirkpatrick and Epstein (1992). The jelly beans task implies a ratio-bias (RB) phenomenon where “the perception of the likelihood of a low-probability event is greater when it is presented in the form of larger (e.g., 10-in-100) rather than smaller (e.g., 1-in-10) numbers” (Pacini & Epstein, 1999, p303). For instance, when rewarded for drawing a red jelly bean, individuals prefer to draw from a tray with a “larger” number of beans (e.g., 10 red out of 100 jelly beans) over a tray with a “smaller” number of beans (e.g., 1 red out of 10 jelly beans) despite the identical ratios of winning between the two trays. The RB phenomenon is known to be robust in various domains such as self-reported gambling in real life (Denes-Raj & Epstein, 1994), heuristic responses to vignettes (Denes-Raj & Epstein, 1994), depression (Pacini, Muir, & Epstein, 1998), and even health (Yamagishi, 1997). This phenomenon is attributed to a tendency to focus on the frequency of the numerator (i.e., heuristic attribute) instead of the overall probability (i.e., target attribute). Selecting one of two trays that offer equal probabilities
is, in itself, not a judgmental error. However, the preference for a tray with 9 out of 100 jelly beans versus a tray with 1 out of 10 jelly beans is (Denes-Raj & Epstein, 1994).

In Experiment 1, participants were asked to choose one of two trays from which they could participate in a lottery where they could win $50 if they drew a red jelly bean: where one tray, tray A (10% tray) contained 1 red and 9 white beans and the other tray, tray B (9% tray) contained 9 red and 91 white beans. In my modified jelly beans task, since the target attribute is the ‘objective probability’ of drawing a red bean, if participants choose a tray based on the target attribute instead of the number of red jelly beans, they should be more likely to choose the tray A (10% tray).

**Design and Procedure**

A total of 92 participants in a North American university were randomly assigned to one of three conditions – a no priming condition, a target attribute priming condition, and a heuristic attribute priming condition.

Upon arrival, participants were informed that they would participate in two ostensibly unrelated studies. The first study was a priming task which was disguised as a perception task. Participants were told that they would participate in the perception task and their task was to identify whether each string of letters presented on a computer screen contained two vowels (press “Z” key) or not (press “M” key). They were told that the researchers were interested in how quickly university students responded to visual stimuli. Participants first completed three practice trials where they saw three strings of letters (e.g., mecedjz). Next, they started the main word perception task. In this task, unbeknownst to participant, they were first subliminally primed (20 ms) before they saw a string of letters. In the target attribute priming condition, five words related to the target attribute (i.e., probability, proportion, ratio, likelihood, and odds)
were shown twice in a random order. In the heuristic attribute priming condition, five words related to the heuristic attribute (i.e., frequency, number, many, more, and numerous) were shown twice in a random order. In the no priming condition, a string of Xs (i.e., xxxxxxxx) was shown 10 times. In all three conditions, when participants saw the string of letters, they indicated whether it contained two vowels or not.

After all participants finished the first study, they were asked to move to a desk which was located on the opposite side of the cubicles in the lab. Two trays for the jelly beans task were arranged on this desk. Before they participated in the second study, they were asked to look at these two trays when they answered each item in the questionnaire. First, participants were given a brief paragraph to read. The vignette for the jelly beans task was as follows:

As you can see, there are two trays on the table. One tray (Tray A) contains 10 jelly beans (1 red bean and 9 white beans) while the other tray (Tray B) contains 100 jelly beans (9 red beans and 91 white beans). If you draw a red jelly bean, you can participate in a lottery in which the winner will receive $50. However, if you draw a white jelly bean, you will win nothing.

Given this information, participants were told that they had a real opportunity to draw one jelly bean from one of the two trays for a real lottery. Before the actual drawing, they were asked to choose which tray they wanted to draw from. Those who draw a red bean were given a lottery ticket in which they wrote their name and contact information for the drawing.

After participants finished the second study, they completed a short funnel debriefing questionnaire (Chartrand & Bargh, 1996). This debriefing questionnaire included a series of questions such as whether participants noticed any primed words or a particular pattern in the
perception task, whether they guessed the hypothesis of the study, whether they thought that two studies were related in any way, and so on. None of them were suspicious of the priming task or aware of the real relationship between the priming task and the jelly beans task.

According to Camerer and Hogarth (1999), having knowledge or “cognitive capital” about a correct judgment is important in improving performance. So, in the jelly beans task, it is important whether participants have knowledge of probability to make a correct judgment. To check whether participants have correct knowledge of probability, participants were asked to calculate the probability for a sample question (e.g., At Kennedy Middle School, 3 out of 5 students make the honor roll. What is the probability that a student makes honor roll?).

**Results**

In my initial analyses, only 83 participants were included after excluding 9 participants who did not correctly answer the sample probability question.

**Tray choice.** Since choosing the 9% tray indicated the ratio-bias, I report the percentage choosing the 9% tray. An overall chi-square test revealed a significant effect of priming ($\chi^2(2) = 8.39, p = .01$). Participants in the target attribute priming condition (11%) chose the 9% tray significantly less often than participants in the no priming condition (44%; $\chi^2(1) = 7.60, p = .006$) and the heuristic attribute priming condition (42%; $\chi^2(1) = 6.24, p = .01$). The percentage of participants selecting the 9% tray were virtually identical in the no priming and the heuristic attribute priming condition ($\chi^2(1) = .02, p = .87$), which indicates that priming the heuristic attribute does not increase the ratio-bias. I conducted the same analysis by including 9 participants who failed to correctly answer the sample probability question, and I again found a main effect of priming: An overall chi-square test revealed a significant main effect of priming on the tray choice ($\chi^2(2) = 7.22, p = .03$). Specifically, there was no significant difference
between the heuristic attribute priming condition (42%) and the no priming condition (44%; \(\chi^2(1) = .04, p = .83\)) in terms of choosing the 9% tray. However, the percentage of choosing the 9% tray in the target attribute priming condition (16%) was significantly lower than that in the no priming condition (44%; \(\chi^2(1) = 6.59, P = .01\)) and that in the heuristic attribute priming condition (42%; \(\chi^2(1) = 4.74, p = .03\)).

**Discussion**

The findings of Experiment 1 provide supporting evidence for the Model of Heuristic Judgment by showing that the heuristic attribute is readily accessible when making a judgment. Importantly, I demonstrate that subliminally priming the target attribute can reduce the ratio-bias. The dependent variable – tray choice indicated that participants subliminally primed with the target attribute were more likely to reduce the bias even though they were not aware of why this occurred.

**EXPERIMENT 2. BASE-RATE NEGLECT WITH COGNITIVE LOAD**

The purpose of Experiment 2 is to generalize the findings of Experiment 1 by using a different judgmental bias (i.e., base-rate neglect) and to test whether the process of reducing judgmental biases requires cognitive resources. In Experiment 2, the problem-solving task used an analogue of the engineer-and-lawyer problem (Kahneman & Tversky, 1973), the professor-and-non-professor problem (Betsch, Biel, Eddelbüttel, & Mock, 1998). The engineer-and-lawyer problem illustrates a fallacy which reflects the use of the representativeness heuristic. For example, in the engineer-and-lawyer problem (Kahneman & Tversky, 1973), participants are told that the percentage of engineers in a given sample is very low (e.g., 30 %). They are
then given a description of an individual which is similar to the stereotype of engineers (e.g., having no interest in political and social issue and spending most of his time in home carpentry, sailing, and mathematical puzzles) The participants’ estimation of the probability that a person is an engineer is much higher (e.g., 80 %) than the base rate (e.g., 30%) because people tend to rely on the description of the person rather than the base rate. Base-rate neglect in probability judgments is problematic because people violate the fundamental Bayesian rule of statistical prediction. Although some find that providing the problem in frequency format (Cosmides & Tooby, 1996; Gigerenzer & Hoffrage, 1995; Tversky & Kahneman, 1983) or showing natural sampling (Betsch et al., 1998) can help to reduce base-rate neglect, no one has examined whether subliminally priming the target attribute will reduce base-rate neglect. I believe that the present research is the first which investigates the effect of nonconscious processes on the base-rate neglect.

To test whether cognitive resources are also required to reduce the bias with the increased accessibility of the target attribute, I manipulated cognitive load. In Experiment 1, increasing the accessibility of the target attribute reduced the bias when participants could use all their cognitive resources to make the judgment. However, the findings of Experiment 1 do not explain whether individuals need cognitive resources to reduce the bias. If individuals are still able to reduce the bias under a high cognitive load, it would indicate that increased accessibility of the target attribute is sufficient to reduce the bias. However, if individuals are less able to reduce the bias under a high cognitive, it suggests that cognitive busyness impairs the process of reducing the bias.
**Design and Procedure**

A total of 115 participants at a North American university were randomly assigned to a 2 (priming: no priming vs. target attribute priming) x 2 (cognitive load: low vs. high load) between-subjects design. To manipulate cognitive load, I used a number rehearsal dual task which has been successfully used as a cognitive load manipulation (e.g., Gilbert & Hixon, 1991; Krull, 1993; Pontari & Schlenker, 2000; Wegner, Erber, & Zanakos, 1993).

Participants were informed that they would participate in two unrelated studies. In the first study, I used the same perception task as in Experiment 1 to disguise the priming task. After finishing the first study, participants were provided a questionnaire which included the professor-and-non-professor problem (Betsch et al., 1998) with a modification of the base rate. They were told that the purpose of the study was to understand how university students answered various types of questions. Before being exposed to the professor-and-non-professor problem, participants were asked to memorize either a random 2- or 9-digit number. They then were asked to read the professor-and-non-professor problem in which they were first told that they would be provided with a description of an individual which was randomly selected from a sample which contained 17.6% professors and 82.4% non-professors, and they were then given a description of a person (e.g., typical characteristics of a professor such as attending international conventions and wearing a suit and a tie). Their task was to rate the probability that the person is a professor given the description of the person and the base rate. After rating the probability, participants were asked to write down the number that they memorized. Next, they answered several unrelated filler questions (e.g., judge a girl’s personality given the descriptions of her behaviors). And then, they were asked to rate the difficulty of memorizing the number on a 9-point scale (1 = extremely easy vs. 9 = extremely difficult). Prior to
debriefing, I also measured their mood using PANAS scale (Watson, Clark, & Tellegen, 1988) to rule out the account of mood effect.

To check whether participants were suspicious of the priming task or the relationship between the priming task and the professor-and-non-professor problem, they were asked to complete the same funnel debriefing questionnaire (Chartrand & Bargh, 1996). The debriefing revealed that none of them were suspicious of the priming task or aware of the real relationship between the two tasks.

**Results**

**Manipulation check.** A total of 102 participants were included in my analysis after excluding 13 participants who failed to report more than 5 out of 9 digits correctly in the high load conditions based on the a priori cutoff from previous literature (Gilbert & Hixon, 1991). All of the participants in the low cognitive load conditions successfully reported the 2-digit number. In support of my cognitive resource manipulation, individuals who were asked to memorize the 9-digit number reported more difficulty memorizing the test number than those who were given the 2-digit number $(M_{9\text{-digit}} = 3.56, M_{2\text{-digit}} = 1.22; F(1, 100) = 62.37, p < .001)$.

**Probability.** To analyze the probability estimates, I conducted a 2 x 2 ANOVA. The analysis revealed a significant main effect of target attribute priming $(F(1, 98) = 10.51, p < .01)$ and cognitive load $(F(1, 98) = 4.69, p < .05)$ which is qualified by a significant interaction $(F(1, 98) = 10.57, p < .01)$ (see Figure 2). In the low cognitive load conditions, participants primed with the target attribute $(M_{TA/low\ load} = 51)$ were more likely to estimate the probability to be closer to the base rate than those who were not primed $(M_{NO/low\ load} = 80)$, however, this difference was eliminated in the high cognitive load conditions $(M_{TA/high\ load} = 75 \text{ vs. } M_{NO/high\ load} = 75)$. Participants’ probability estimates were equally far from the base rate, which implies that
a reduction in cognitive resources impairs the correction of the base-rate neglect. I also conducted an analysis of the relationship between the number of digits correctly recalled and the probability estimate in the high load condition to examine whether the base-rate neglect increases as the number of digits correctly recalled increases. The regression analysis revealed that the number of digits correctly recalled had a significant positive effect on the probability estimate ($b = 2.78, t(59) = 2.43, p < .02$). This indicates that increasing cognitive load increases the base-rate neglect, because correctly recalling more digits should require more cognitive resources.

**Base-rate.** I also analyzed the percentage of participants who reported the exact base-rate of professors –17.6%. In the low load conditions, 25% of the participants who were primed with the target attribute reported the exact base-rate (i.e., 17.6%), significantly more often than those who were not primed (0%; $\chi^2(1) = 7.47, p < .01$). However, in the high load conditions, very few participants reported 17.6% regardless of whether they were primed with the target attribute (4%) or not (0%; $\chi^2(1) = 1.10, p = .29$). Among the participants who were primed with the target attribute, only 4% of the participants who experienced a cognitive load were able to report the exact base-rate as compared to 25% of the participants who did not experience a cognitive load ($\chi^2(1) = 4.07, p < .05$).

**PANAS scale.** In this analysis, only one hundred and one participants were included since one participant did not complete the PANAS scale. The analysis of the PANAS indicated no differences in positive affect ($M_{9-digit} = 3.89$ vs. $M_{2-digit} = 3.75$; $F(1,99) = .17, p = .68$) nor any differences in negative affect ($M_{9-digit} = 3.66$ vs. $M_{2-digit} = 3.52$; $F(1,99) = .08, p = .77$) as a function of cognitive load, which rules out the alternative mood account.

To determine whether using the total 115 participants after including 13 participants (who were excluded in the analyses provided above) yields different results, I conducted a 2 x 2
ANOVA with the mean probability estimate and a chi-square test with the number of people who reported the base rate of professors (i.e., 17.6%) using all 115 participants. The results obtained from the total 115 participants are the exactly same as the results obtained from using the total 102 participants.

**Discussion**

Experiment 2 provides further evidence that subliminally priming the target attribute reduced the bias in low load conditions. In addition, it also demonstrates that cognitive resources are required to reduce the bias since participants subliminally primed with the target attribute based their probability estimates on the description of the person, not on the base rate as did those who were not primed and had a low cognitive load. This impairment implies that the correction process required the involvement of System 2.

One question arises as to the finding that priming the target attribute in the high cognitive load condition did not reduce the judgmental bias. Since both the target attribute and the heuristic attribute are accessible in memory in this condition, individuals may need to decide which one to use. One might argue that the probability estimate in this condition should fall somewhere between the probability estimate in the no priming/high load condition (75%) and the probability estimate in the priming/low load condition (51%). A possible explanation as to why the probability estimate in the target attribute priming/high load condition did not fall somewhere in the middle of the two probability estimates (e.g., 63%) is that reducing cognitive resources may reduce comprehension of the problem. Previous research indicates that the capacity of working memory affects text comprehension (Just & Carpenter, 1980; Kintsch & Van Dijk, 1998), and that a verbal or counting dual task reduces text comprehension (Daneman & Newson, 1992). Since the base rate is provided early in the problem, and the description of
the individual is given near the end of the problem, reducing cognitive resources may impair the 
ability to link the base rate to the description, so increasing the accessibility of target attribute 
will not have an effect on reducing the bias.

**GENERAL DISCUSSION**

The broad goal of this research was to examine whether the subliminal priming of the 
target attribute reduces judgmental biases caused by substituting the target attribute with the 
heuristic attribute. The results of the current research indicate that it will. In Experiment 1, 
participants subliminally primed with the target attribute were less likely to choose or prefer the 
“wrong” option (e.g., 9% tray) than those who were not primed. In Experiment 2, participants 
primed with the target attribute were less likely to show the base-rate neglect, but only with 
sufficient cognitive resources. When participants had limited cognitive resources, the 
nonconscious priming of the target attribute did not produce the bias. This indicates that System 
2 is required to make correct judgments in addition to the increased accessibility of the target 
attribute.

By demonstrating that subliminally priming the target attribute reduces the judgmental 
bias, this research provides strong support for the Model of Heuristic Judgment by 
demonstrating that increasing the accessibility of the target attribute can lead to a decrease in 
likelihood of making the errors. In addition, I find that cognitive resources are required to 
reduce the bias which indicates that System 2 is required.

Finally, this research indicates that priming as a nonconscious/implicit method can 
enhance a judgment in addition to previously known explicit methods such as training statistical 
concepts and providing the problem in frequency format. The effect of priming on judgmental
biases is noteworthy since several of the severe errors of judgment occurred even after subjects were explicitly encouraged to be accurate and were rewarded for the correct answers (Kahneman & Tversky, 1972; Tversky & Kahneman, 1973). Although participants were not aware of the subliminal priming of the target attributes, they still required cognitive resources to reduce the bias.
ESSAY 2. REVERSING EASE-OF-RETRIEVAL EFFECTS WITH DIRECT PRODUCT EXPERIENCE

Since the seminal article by Tversky and Kahneman (1973) on heuristics and biases, the availability heuristic has received a lot of attention from numerous researchers in behavioral decision theory and social cognition. In social cognition, Schwarz et al. (1991) used the underlying process of the availability heuristic to show that individuals use the ease of retrieving instances as a heuristic to judge the number of instances that exist in memory. For example, individuals rated themselves less assertive when asked to recall 12 examples than 6 examples of their assertive behaviors. Even though individuals recalled more examples in the 12 examples condition, they experienced more difficulty in recalling more examples, leading them to infer that they were lower on the trait exemplifying that behavior. Consequently, they judged themselves to be less assertive as compared to those who recalled 6 examples.

Since Schwarz et al. (1991) demonstrated the ease-of-retrieval effect (e.g., recalling or generating a few thoughts has stronger effects on attitudes than recalling or generating more thoughts), it has stimulated a considerable amount of research in social cognition and consumer behavior. However, to the best of my knowledge, little research has investigated the ease-of-retrieval effect in the context of direct product experience (e.g., product testing or trials) which is important to both marketers and consumers. As Bazerman (2001) points out, consumer behavior research has traditionally focused more on information processing and understudied product usage. Investigating the role of direct product experience in consumer behavior is of critical importance to marketers and consumers for several reasons: First, investigating the role of direct product experience will provide practical implications for marketers as many consumer goods firms use product trials as one of their marketing tools and incorporate the results of the
trials into their product development. Second, attitudes formed through direct behavioral experience with an attitude object have been shown to provide better predictions of future behavior than attitudes formed through indirect nonbehavioral experience (Fazio, Zanna, & Cooper, 1978). For example, a child who plays with a new toy (direct experience) will display greater attitude-behavior consistency than a child who reads an advertisement’s description of that toy (indirect experience) (Regan & Fazio, 1977). Moreover, people rarely discount the trustworthiness of their own experience (Smith, 1993), thereby giving more credit to their own experience.

In Essay 2, I examine whether previous findings in the ease-of-retrieval literature will occur with direct product experience. Although the types of tasks which have shown ease-of-retrieval effects vary from recalling six or twelve examples of assertive behaviors from past memory (e.g., Schwarz et al., 1991), to listing two or eight counterarguments against a comprehensive exam proposal after reading persuasive messages (e.g., Tormal, Petty, & Brinol, 2002), to providing one reason or ten reasons for or against choosing one brand (e.g., BMW) over another (e.g., Mercedes) after reading comparative advertisements of two brands (e.g., Wänke, Bohner, & Jurkowitsch, 1997), the consistent finding in these studies is that ease-of-retrieval leads to more favorable judgments and increased agreement with persuasive messages over and above the content of information recalled or generated (Schwarz & Clore, 2007). Contrary to previous research, I suggest the ease-of-retrieval effects will reverse with direct product experience. This is because direct product experience leads individuals to go through a different process to form their attitudes.

In what follows, I discuss the previous research on ease-of-retrieval effects and two theoretical explanations for the reversed ease-of-retrieval effect. Next, I discuss four
experiments which demonstrate the reversed ease-of-retrieval effect with two different sensory products to eliminate alternative explanations of the findings. Finally, I conclude with discussion of findings.

PREVIOUS RESEARCH ON EASE-OF-RETRIEVAL

Do humans make judgments or choices based on the content of their thought? The classical assumption in social cognition (for reviews, see Higgins, 1989; Wyer & Srull, 1989) and consumer cognition (see, e.g., Kiesielius & Sternthal, 1984; for a review, see Kardes, 1994) suggests that judgments are affected by the content of the thought that is accessible at the time of judgment. However, research on ease-of-retrieval, which refers to the ease or difficulty with which some information can be brought to mind (Schwarz, 2004), has shown that this is not always the case. Ease-of-retrieval can replace or qualify the content of thought or recall by serving as another source of information. Consequently, judgments are based not only on the content of their thoughts, but also on whether it is easy or difficult to retrieve or generate their thoughts.

Two Different Streams of Research on Ease-of-Retrieval Effects

Past research on ease-of-retrieval can be categorized into two different streams of research depending on the types of tasks used. The first type of task is recalling instances or behaviors from memory (e.g., Grayson & Schwarz, 1999; Schwarz et al., 1991; Rothman & Schwarz, 1998; Wänke, Bless, & Biller, 1996). Schwarz and his colleagues (1991, Experiment 1), for example, show that participants assessed themselves as more assertive after recalling 6 assertive behaviors than after recalling 12 assertive behaviors. In this case, participants relied
more on their subjective feeling of difficulty in recalling than the content of their assertive behaviors, thereby leading to rating themselves less assertive. This stream of research argues that ease-of-retrieval effects occur under low involvement. When individuals are not involved, they are more likely to use a heuristic processing and rely on the ease-of-recall, whereas when individuals are more involved, they tend to use a systematic processing and rely on the content of information recalled. For instance, Rothman and Schwarz (1998) found that whether individuals have family history of heart disease or not influences perceived vulnerability to heart disease. When personal relevance was low (e.g., absence of a family history of heart disease), individuals reported greater vulnerability after listing three than eight-risk increasing behaviors, whereas when personal relevance was high (e.g., presence of a family history of heart disease), individuals reported greater vulnerability after listed eight than three risk-increasing behaviors.

The second type of task is listing favorable or unfavorable thoughts about a persuasive message (e.g., Tormala, Falces, Brinõl, & Petty, 2007; Tormala, Petty, & Brinõl, 2002). This stream of research also finds that individuals have more favorable attitudes toward a persuasive communication (e.g., the proposal of comprehensive exams at a university) after listing a small (e.g., 2) than a large number (e.g., 10) of arguments for the persuasive communication or after listing a large (e.g., 10) than a small number (e.g., 2) of arguments against the persuasive communication. However, a different explanation has been provided for this finding. This group of researchers (e.g., Tormala, Falces, Brinõl, & Petty, 2007; Tormala, Petty, & Brinõl, 2002) uses the self-validation hypothesis (Petty, Brinõl, & Tormala, 2002) to explain ease-of-retrieval effects in these situations.

In the persuasion literature, the cognitive response approach argues that consumers’ attitude can change as a function of the amount of valence of thoughts generated by consumers (Greenwald, 1968; Petty, Ostrom, & Brock, 1981; Petty & Wegener, 1998). For example,
Sadler and Tesser (1973) found that participants who thought about a likable partner liked the partner more than did those who were distracted from thinking. Conversely, participants who thought about a dislikable partner liked the partner less than did those who were distracted from thinking (Sadler & Tesser, 1973). Tesser and Conlee (1974) also demonstrated the effect of the amount of thoughts on attitudes by finding that the more time spent thinking about political issues, the greater likelihood of polarization on those issues. These findings indicate that the number of positive and negative thoughts generated while being exposed to a persuasive communication mediates attitude formation and change.

However, according to the self-validation hypothesis (Petty, Brinol, & Tormala, 2002) the number of positive or negative thoughts generated is not sufficient for them to have an impact on judgments. Rather, individuals must have confidence in their thoughts. For instance, even though person A and person B might have the same thought, person A might be more influenced by this thought than person B because person A has greater confidence in his thought. Tormala, Petty, and Brinol (2002) demonstrated that ease-of-retrieval effects are more likely to occur under high- rather than under low-involvement conditions because individuals are more likely to validate own thoughts by considering how confident they are in their thoughts under high-involvement conditions. When participants were asked to generate two thoughts (vs. ten thoughts) in favor of comprehensive exams, they were more confident in their thoughts, leading them to have more favorable attitudes toward the comprehensive exams. In other words, confidence mediated the ease-of-retrieval effects on thoughts, with greater ease of retrieval producing more confidence in their thought, thereby leading to more thought-congruent attitudes.

To summarize, the common finding from these two different groups of researchers is that ease of recalling instances or listing arguments leads to more favorable judgments than
difficulty of recalling instances or listing arguments. However, these two different groups of researchers have a different perspective as to conditions under which ease-of-retrieval effects occur: Schwarz and his colleagues argue that ease-of-retrieval effects are more likely to occur under low-involvement conditions, whereas Petty and his colleagues argue that ease-of-retrieval effects are more likely to occur under high-involvement conditions. In addition, when recalling instances, ease of retrieval indicates the number of instances in memory, while when generating arguments, ease indicates confidence in thoughts.

**Boundary Conditions of Ease-of-Retrieval Effects**

Although I agree with a traditional view about the ease-of-retrieval effects on judgments, I do not believe the ease-of-retrieval effects will occur in all situations. Supportive of my opinion are recent studies which have shown some exceptions to the above findings. First, Tybout, Sternthal, Malaviya, Bakamitsos, and Park (2005) find that the accessibility of task-relevant knowledge determines whether judgments draw on thought content or retrieval ease. When knowledge relevant to judgments is inaccessible or highly accessible, content-based judgments occur. This is because retrieval ease in generating reasons is anticipated to be either difficult or easy, and therefore, is not perceived as diagnostic. On the contrary, when knowledge is moderately accessible, retrieval ease plays an important role in judgments. In their Experiment 2, using Korean participants who have moderate knowledge about Hyundai and BMW and low knowledge about Saab, the ease-of-retrieval effect was observed for both Hyundai and BMW, whereas a content effect was observed for Saab.

Individuals’ affective states can also qualify their reliance on the ease-of-retrieval heuristic. Ruder and Bless (2003) investigated the relationship between individuals’ affective states and their reliance on ease-of-retrieval. Participants affected states were evoked by a
writing task in which they were asked to provide a report about a happy or sad life event. Ease-of-retrieval was manipulated by asking participants to list a few vs. many pro-arguments for an issue (e.g., a change in the German educational system, introducing a highway toll). What they consistently found throughout four studies was that happy participants were more likely to rely on the ease-of-retrieval heuristic, whereas sad participants were more likely to rely on the activated content. Moreover, in their Experiment 3, happy participants no longer relied on the ease-of-retrieval when diagnosticity of ease-of-retrieval was called into question by informing them about the research that had ostensibly demonstrated that the special design of the answer sheet affected ease-of-retrieval. To sum up, the interplay between the affective states and accessibility experience, happy mood fosters heuristic processing (e.g., reliance on accessibility experience) whereas sad mood fosters systematic processing (e.g., reliance on thought content).

Taken together, the aforementioned exceptions to the general findings in research on ease-of-retrieval evince that there are some boundary conditions. Individuals’ knowledge or affective states qualify individuals’ reliance on the ease-of-retrieval heuristic. When individuals have a moderate level of task-relevant knowledge or when they are happy, individuals tend to rely more on the ease-of-retrieval heuristic, whereas when individuals have a low level of task-relevant knowledge or they are sad, they tend to rely more on thought content. These findings suggest that the ease-of-retrieval effect on our judgments can be context-dependent.

**DIRECT PRODUCT EXPERIENCE REVERSES EASE-OF-RETRIEVAL EFFECTS**

The purpose of the present research is to examine whether ease-of-retrieval effect found in past research can be extended to the context of direct product experience. To do so, the present research used a sensory task in which individuals generate a few or many reasons to like
or dislike a product after having an opportunity to directly test the product by applying a tactual stimulus (e.g., a hand lotion) in Experiments 1-3 and tasting a gustatory stimulus (e.g., a drink) in Experiment 4.

When individuals have direct product experience, how will they evaluate a product when it is easy or difficult to generate reasons why they like or dislike a product? In a persuasive context in which consumers simply read a persuasive message (without directly interacting with the target object) and generate thoughts about the persuasive message (e.g., Tormala, Petty, & Brinol, 2002), the goal of the persuasive message is to make consumers believe the message regardless of whether the message itself may or may not be true. The easier to generate thoughts related to the persuasive message, the greater confidence consumers have in their thoughts, which results in greater persuasion. However, the more difficult to generate thoughts related to the persuasive message, the lower confidence consumers have in their thoughts, which results in less persuasion. Thus, the degree of persuasion is influenced by whether it is easy or difficult to generate thoughts related to the persuasive message.

Contrary to the persuasive context, in a usage situation where consumers have direct experience with a product, the experience that consumers obtain is real, and consumers are asked to generate thoughts about a product based on their real experience. So, regardless of the number of thoughts that they generate, consumers will be confident in their thoughts because they believe that their thoughts are based on the real experience (Smith, 1993). Since confidence no longer influences consumers’ attitudes toward the product, I suggest that after directly experiencing the product, consumers will have polarized attitudes toward the product depending on how many thoughts that they generate. When individuals generate positive thoughts about a product, generating more thoughts will result in more positive attitudes toward the product. However, when individuals generate negative thoughts about a product, they will
have less positive attitudes toward the product. In what follows, I will propose two potential theoretical explanations for these predictions – a number of thoughts explanation and an effort explanation, and provide specific hypotheses.

The Number of Thoughts Explanation

The first explanation – the number of thoughts explanation draws on the self-validation hypothesis (Petty, Brinõl, & Tormala, 2002), which was discussed previously. This hypothesis posits that understanding the number of positive and negative thoughts that individuals have is not sufficient to predict their attitudes. Rather, understanding how confident individuals are in their thoughts is also important. Petty, Brinõl, and Tormala (2002) found that the relationship between thoughts and attitudes was greater to the extent that confidence was high rather than low. When individuals generated positive thoughts, greater confidence was associated with more persuasion. However, when individuals generated negative thoughts, greater confidence was associated with reduced persuasion. In sum, confidence increased the impact of thought valence on attitudes.

Consistent with the self-validation hypothesis, Tormala, Petty, and Brinõl (2002) found the ease of retrieval effect under high-elaboration conditions and the number of thoughts effect under low-elaboration conditions: Under high-elaboration conditions, individuals were more influenced by their thoughts when few rather than many were generated, and this was mediated by the confidence that participants had in those thoughts. However, under low-elaboration conditions, individuals were more influenced by their thoughts when many rather than few were generated because they may have simply relied on the number of thoughts that they generated, which reflects a numerosity heuristic. However, confidence was not measured under low-
elaboration conditions. Note that the finding under low-elaboration conditions is consistent with the prediction from the cognitive response approach.

In the current research, I believe that individuals who have direct product experience will have equally high confidence in their thoughts, regardless of the number of thoughts that they generate about a product, because their thoughts are based on their direct product experience. In other words, since their thoughts are presumed to be based on direct product experience, individuals trust their thoughts without needing to rely on subjective feeling of ease or difficulty (i.e., how easy was it to generate these thoughts?). This leads individuals to have more consistent attitudes based on the number and valence of their thoughts. The more positive thoughts that individuals generate about the product, the more positive attitudes toward the product they form. Conversely, the more negative thoughts that individuals generate about the product, the more negative attitudes toward the product they form. However, in the absence of direct product experience, individuals are less confident in their thoughts since they are not based on direct product experience, which makes them rely on subjective feeling of ease or difficulty (i.e., how easy was it to generate these thoughts?).

**The Effort Explanation**

The second explanation is the effort explanation. Contrary to the cognitive response approach in which the amount of time to think or distraction was manipulated, this research directly manipulates the number of thoughts by asking participants to generate a few (e.g., two reasons to like a product) or many thoughts (e.g., eight reasons to like a product). What is critical in this research is that the manipulation of the number of thoughts will make participants directly experience subjective ease with generating a few thoughts and subjective difficulty with
generating many thoughts, and that it is the effort put into generating the thoughts that drives the effect, not the number of thoughts per se.

Then, why increasing effort in the direct produce experience results in more polarized attitudes? Compared to participants in the cognitive response approach who simply read a persuasive message, participants in the present research will have a stronger desire to understand their experience (Byrne & Clore, 1967; Cohen, Stotland, & Wolfe, 1955; Festinger, 1954; Kelly, 1955; Pervin, 1963; White, 1959) because they actively interact with a product by directly using it. This desire to understand their experience makes individuals more engaged in the task in which they are asked to generate thoughts about the product. This active engagement leads individuals to interpret subjective difficulty as the effort that they put into understanding their experience. In other words, individuals interpret their effort as a process of understanding their experience. The more effort they put into understanding their product experience, the more they value their thoughts, and the more polarized attitudes they will have. The more positive thoughts that individuals generate about the product, the more positive attitudes toward the product they form. Conversely, the more negative thoughts that individuals generate about the product, the more negative attitudes toward the product they form.

Recent research also proposes that the effect of subjective difficulty on judgments can be reversed when individuals have different interpretations of subjective difficulty (Brinol, Petty, & Tormala, 2006; Labroo & Kim, 2009; Pocheptsova, Labroo, & Dhar, 2010). For instance, Brinõl, Petty, and Tormala (2006) showed how the evaluative meaning of subjective ease or difficulty can be malleable. When difficulty (ease) was described as negative (positive), these researchers replicated the traditional ease-of-retrieval effect by demonstrating that participants reported more favorable attitudes toward comprehensive exams after listing 2 favorable thoughts than 10 favorable thoughts. However, when difficulty (ease) was described
as positive (negative), the effect was reversed. Participants reported more favorable attitudes toward comprehensive exams after listing 10 favorable thoughts than 2 favorable thoughts. Another recent study also suggests that individuals can interpret subjective difficulty as something positive when pursuing an important goal by showing that individuals find a product more useful in satisfying a goal when they feel subjective difficulty than subjective ease because individuals associate effort with the effectiveness of a means to fulfill the goal (Labroo & Kim, 2009).

While I have proposed the two possible explanations for why the reversed ease-of-retrieval effects occur, it may be difficult to determine which explanation actually causes the effect since generating many positive or negative thoughts about a product will require more effort. It may also be that both are required to product the effect.

Hypotheses

To summarize, both the number of thoughts explanation and the effort explanation predict the reversed ease-of-retrieval effects in a direct product experience condition. However, I predict the traditional ease-of-retrieval effect in a no direct product experience condition.

H1: In the no direct product experience condition, the more positive thoughts participants generate about a product, the less positive attitudes they will have toward the product.

H2a: In the direct product experience condition, the more positive thoughts participants generate about a product, the more positive attitudes they will have toward the product.

H2b: In the direct product experience condition, the more negative thoughts participants generate about a product, the less positive attitudes they will have toward the product.
I conducted four experiments to test these hypotheses. In Experiment 1, I directly compare direct product experience and no direct product experience, and show the traditional ease-of-retrieval effect in the no direct product experience condition and the reversed ease-of-retrieval effect in the direct product experience condition. In the no direct product experience condition, participants form more positive attitudes toward a hand lotion when generating two reasons than eight reasons to like the hand lotion. However, in the direct product experience condition, participants form more positive attitudes toward the hand lotion when generating eight reasons than two reasons. In Experiment 2, I replicate the reversed ease-of-retrieval effect with both in positive and negative thoughts, and find these effects under both high and low involvement. Experiment 3 rules out another alternative account—a thought-content-effect account by using a yoked design, and demonstrates that participants incorporate their subjective feeling from generating reasons into forming their attitudes. To generalize the findings of Experiments 1 – 3, Experiment 4 employs a different product type—a soft drink.

**EXPERIMENT 1**

The purposes of Experiment 1 were twofold. First, Experiment 1 aimed to examine how ease-of-retrieval affects judgments in direct product experience. To do so, the main task of Experiment 1 was disguised as a new product trial task. A hand lotion was selected as a target product since it has tactual features which make having direct experience with the hand lotion critical to the evaluation of the hand lotion. Participants were told that a (hypothetical) company wanted to launch a new hand lotion in a market in the near future. Half of the participants read a description of how it feels to use the hand lotion and then applied the hand lotion on their hand. The other half of participants read a description of how it feels to use the hand lotion, but
did not apply it on their hand. The description of how it feels to use the hand lotion mentioned four product features related to product experience (“This hand lotion absorbs well into your hands. It has gentle fragrance. It is very moisturizing. It makes your hands soft and smooth.”), which were based on a pretest in which we asked participants to describe their experience with using the hand lotion. I used a hand lotion which was not sold in North America to avoid any possible confounding effects by using a hand lotion that may be familiar to the participants.

The second purpose of Experiment 1 was to test whether confidence in thoughts mediates attitudes based on the self-validation hypothesis explanation of ease-of-retrieval effects (e.g., Tormala, Falces, Brinõl, & Petty 2007; Tormala, Petty, & Brinõl 2002). Tormala, Petty, and Brinõl (2002) found that people are more confident in their thoughts when generating a few rather than many thoughts, and this confidence in thoughts mediated the effects of ease of generating thoughts on attitudes. In the present research, I expect to replicate this finding in the no direct product experience condition. However, in the direct product experience condition, I expect that people’s confidence will not differ whether they generate a few or many thoughts. This is because people are already sure about their thoughts since their thoughts are based on their experience with the product that they just have used. Prior research has shown that attitudes based on direct experience were indeed more accessible from memory and were associated with greater confidence than those based on indirect experience (Fazio, Chen, McDonel, & Sherman 1982; Fazio, Zanna, & Cooper, 1978). In addition, Smith (1993) also reported that people rarely discount the trustworthiness of their own experience when they have used the product. This suggests that, regardless of the number of thoughts, people will have strong confidence in their thoughts in the direct product experience condition.

**Method**
Pretests. Prior to the main experiment, I conducted two pretests. The purpose of the first pretest was to measure the attitudes of the hand lotion after using it without generating any reasons. If the experience of using the hand lotion is very positive or negative, it may overwhelm the reasons for liking or disliking. I asked 29 participants to evaluate the hand lotion using two 11-point scales with the following anchors: do not like at all-very much and very bad texture-very good texture. Liking and texture were combined to create an attitude index (Cronbach’s $\alpha = 0.80$), which indicates that the attitude toward the hand lotion was neutral to slightly positive ($M = 6.65$).

The second pretest was conducted to assess the level of product knowledge of participants from the same participant pool as will be used in the experiment. Tybout, Sternthal, Malaviya, Bakamitsos, and Park (2005) found that product knowledge accessibility moderates the effect of subjective feeling on judgments. Using Korean participants who have moderate knowledge about Hyundai and BMW and low knowledge about Saab, these researchers found the ease-of-retrieval effect for both Hyundai and BMW, but a content effect for Saab. Since moderate knowledge induces the ease-of-retrieval effect, it is important to show the reversed ease-of-retrieval effect with moderate knowledge to rule out any effect due to knowledge difference. In this study, I used the hand lotion, so there may be gender differences in the amount of knowledge about hand lotion because females are more likely to use hand lotions than males. To check this possibility, I conducted a pretest measuring product knowledge on two 7-point scales – product familiarity (1 = very unfamiliar vs. 7 = very familiar) and product experience (1 = very inexperienced vs. 7 = very experienced; Mishra, Umesh, & Stem, 1993; Park & Lessig, 1981; Tybout et al., 2005). These two scales were combined to form a composite Product Knowledge Index (Cronbach’s $\alpha = 0.91$). The pretest revealed that female students ($M = 4.94$) had significantly higher product knowledge than male students ($M = 3.20$; $F$
\( (1, 48) = 17.72, p < .001 \), supporting my expectation about gender difference in product knowledge. In addition, female students had a moderate level of knowledge about hand lotion whereas male students had a low level of knowledge.

**Participants and Design.** Based on the pretest which indicates that females (males) have the moderate (low) level of product knowledge about hand lotion, I included only female students from the same population in the present experiment and the following experiments (Experiments 2 and 3). The second reason to have only female students is that the target market of hand lotions is, in general, female consumers who care more about the condition of their hands than male consumers. Participants were 102 female undergraduate students who participated in the experiment in exchange for course credit. The students were randomly assigned to the conditions of a 2 (Number of Reasons: 2 vs. 8) x 2 (Product Experience: direct product experience vs. no direct product experience) between-participants design.

**Material and Procedure.** Upon arrival, participants were informed that they would participate in an experiment testing a new hand lotion that a company wanted to launch in a market. Participants were told that the target market of this new hand lotion was young adults and their opinions about the product would be incorporated in the development of the hand lotion. Next, participants were provided the description of how it feels to use the hand lotion. After reading this description, participants in the direct product experience condition were asked to apply the hand lotion on their hands and generate 2 or 8 reasons that they like the hand lotion, whereas participants in the no direct product experience condition were asked to generate 2 or 8 reasons that they liked the hand lotion without using it (simply based on the description that they read). Next, they rated how much they liked the hand lotion on an 11-point scale (we used only liking in Experiment 1 since it is difficult to evaluate the texture of the hand lotion by simply reading the description without using the hand lotion). They reported perceived difficulty in
generating reasons on an 11-point scale (1 = not at all difficult vs. 11 = very difficult; Menon & Raghubir 2003), and their confidence in reasons (1 = very unconfident vs. 11 = very confident).

Results

**Perceived Difficulty.** Perceived difficulty was analyzed using a 2 (Number of Reasons: 2 vs. 8) x 2 (Product Experience: direct product experience vs. no direct product experience) ANOVA. I obtained only a significant main effect of Number of Reasons (F (1, 98) = 42.13, p < .001), indicating that participants found it more difficult to generate 8 (M = 6.71) than 2 reasons (M = 3.48).

**Attitudes toward the Hand Lotion.** To analyze the liking of the hand lotion, I conducted the same 2 x 2 ANOVA, and obtained only a significant interaction effect of Number of Reasons by Product Experience (F (1, 97) = 7.08, p = .009). When participants did not have direct product experience with the hand lotion, participants liked the hand lotion more when generating 2 reasons (M = 7.14) than 8 reasons (M = 6.40; F (1, 51) = 3.73, p = .05). However, when participants had direct product experience with the hand lotion, participants liked the hand lotion more when generating 8 (M = 7.26) than 2 reasons (M = 6.44; F (1, 45) = 3.37, p = .07) (see Figure 3).

**Confidence in Reasons.** Since I expected a difference between 2 reasons and 8 reasons in the no direct product experience condition and no difference between 2 reasons and 8 reasons in the direct experience condition, I conducted a series of contrasts based on Rosenthal and Rosnow (1985). A one-way between subjects ANOVA showed a significant difference among the four conditions in Confidence in Reasons (F(3,98) = 4.11, p = .009). In the no direct experience condition, a Tukey’s HSD comparison revealed that participants were significantly more confident when generating 2 reasons (M = 7.59) than 8 reasons (M = 6.00; p = .02). This
result is consistent with the result obtained by Tormala, Petty, and Brinôl (2002) under the similar condition. However, when participants had direct product experience with the hand lotion, which is a unique characteristic of the present research, a Tukey’s HSD comparison indicated no difference between 2 reasons ($M = 7.84$) and 8 reasons ($M = 7.35$; $p = .83$) (see Figure 4). This indicates that having direct product experience enhances confidence regardless of the number of reasons that participants generated.

**Mediation Analyses.** To examine whether confidence in reasons mediates the effect of number of reasons on liking in the no direct product experience conditions as found by Tormala, Petty, and Brinôl (2002), I conducted a series of regression analyses. The results indicated a marginally significant effect of Number of Reasons on Liking ($b = -.12$, SE = .07, $t(52) = -1.77$, $p = .08$) and a significant effect of Number of Reasons on Confidence in Reasons ($b = -.26$, SE = .08, $t(52) = -3.30$, $p = .002$). The marginally significant effect of Number of Reasons on Liking became insignificant ($b = -.005$, SE = .06, $t(51) = -.08$, $p = .93$) once I included Confidence in Reasons in the regression model ($b = .45$, SE = .10, $t(51) = 4.26$, $p < .001$). To directly test whether Confidence in Reasons mediated the effect of Number of Reasons on Liking, I performed 1,000 bootstrap resamples using Preacher and Hayes’s (2008) SPSS macro, as recommended by Zhao, Lynch, and Chen (2010). To test the significance of the indirect pathway (i.e., the path from number of reasons to liking via confidence in reasons), I considered the biased-corrected 95% confidence interval. Because this interval (-.219 to -.035) did not include zero, and the effect of Number of Reasons on Liking became non-significant after I controlled for Confidence in Reasons ($b = -.12$, $t(52) = -1.77$, $p = .08$ vs. $b = -.005$, $t(51) = -.08$, $p = .94$), I concluded that Confidence in Reasons mediated the effect of Number of Reasons on Liking in the no direct product experience condition.
Discussion

Experiment 1 presents several noteworthy findings. First, it replicates previous research (Tormala, Petty, & Brinöl, 2002) by finding that, when individuals do not have direct product experience, subjective ease of generating thoughts leads to more positive product attitudes than subjective difficulty of generating reasons, and this effect was mediated by confidence in reasons. Second, contrary to previous research, the current study finds that, when individuals do have direct product experience, generating more thoughts results in more positive product attitudes. Finally, the analyses of confidence in reasons reveal that individuals have different levels of confidence depending on whether they have direct product experience with the hand lotion or not. Without direct product experience, subjective ease or difficulty influences individuals’ confidence. The subjective ease (vs. difficulty) leads consumers to have a higher (vs. lower) level of confidence about the thoughts that they generate. This higher level of confidence, in turn, makes individuals like a product more, which is consistent with previous research (Tormala, Petty, & Brinöl, 2002). On the contrary, with direct product experience, individuals have equally a higher level of confidence irrespective of their subjective ease or difficulty, which is consistent with attitude research on direct experience (Fazio et al, 1982). This indicates that confidence no longer influence attitudes.

Related to the findings of Experiment 1, there is an alternative account which explains for the finding of Experiment 1 — a motivation account. According to Rothman and Schwarz (1998), individuals use the content of thoughts when making judgment with high motivation whereas the metacognitive experience or ease-of-retrieval has a stronger effect on judgments under low motivation. One might argue that having direct experience with the hand lotion could make participants more motivated to understand their product experience compared to having no direct experience with the hand lotion. In other words, it could be the high level of motivation
(not direct experience with a product itself) which may lead them to rely on thought content rather than ease-of-retrieval. Experiment 2 was conducted to show whether the effect holds under both high motivation and low motivation.

EXPERIMENT 2

The purposes of Experiment 2 were threefold. First, Experiment 2 aimed to rule out the motivation account for the findings of Experiment 1 by manipulating motivation as high vs. low based on persuasion literature (Maheswaran & Sternthal, 1990; Petty, Harkins, & Williams, 1980). According to Rothman and Schwarz (1998), when individuals are highly motivated, they tend to rely more on the content of thoughts than ease-of-retrieval. Related to the findings of Experiment 1, one may argue that participants in the direct experience condition were highly motivated than participants in the no direct experience condition, and it is the high motivation that drives the effect. If findings in the direct product experience condition in Experiment 1 are due to a high motivation, not the direct product experience itself, a low motivation manipulation should eliminate the effects found with direct product experience in Experiment 1. However, if I still find the same effect under both a low motivation and a high motivation condition, this can rule out the motivation account. It is also important to show the reversed ease-of-retrieval effect under both high and low motivation since Schwarz and his colleagues propose the ease-of-retrieval effect under the low motivation and the thought-content effect under the high motivation whereas Tormala and his colleagues propose the ease-of-retrieval effect under the high motivation and the thought-content effect under the low motivation.

Second, Experiment 2 examines whether the findings obtained by asking participants to list positive thoughts (reasons that they like a hand lotion) in Experiment 1 can be extended to
negative thoughts (reasons that they do not like a hand lotion). When participants list the negative reasons, I expect that participants will have more negative attitudes toward the hand lotion when listing 8 negative reasons than 2 negative reasons.

The third purpose of Experiment 2 was to see whether simply using the hand lotion without reading a description of how it feels like to use the hand lotion leads to the same results.

**Method**

**Participants and Design.** Ninety-five female undergraduate students were randomly assigned to the conditions of a 2 (Number of Reasons: 2 vs. 8) x 2 (Valence of Reasons: positive vs. negative) x 2 (Motivation: high vs. low) between-participants design.

**Material and Procedure.** The procedures are the same as in Experiment 1 except for two modifications. First, I asked participants to generate either positive or negative reasons. Second, based on persuasion literature (Maheswaran & Sternthal, 1990; Petty, Harkins, & Williams, 1980), I manipulated motivation as high and low to examine the effect of motivation on product attitudes. Upon arrival, participants were informed that they would participate in an experiment testing a new hand lotion that a company wanted to launch in a market. Participants in the high motivation condition were told that the target market of this new hand lotion was young adults, that they were among a small number of respondents who were participating in the survey, and that their opinions were very important to the marketers of this company. Participants in the low motivation condition were told that this company was developing this new hand lotion for older adults. They were also informed that they were among a large number of respondents who were participating in the survey, that their opinions might be used after aggregating them with those of other groups, and that their individual opinions would remain anonymous (Maheswaran & Sternthal, 1990; Petty, Harkins, & Williams, 1980). All
participants were asked to apply the hand lotion on their hands and generate 2 or 8 positive or negative reasons. Next, they completed two 11-point scales for measuring their attitudes toward the hand lotion (do not like at all-like very much and very bad texture-very good texture) and perceived difficulty in generating the reasons (not at all/very difficult; Menon & Raghubir, 2003). Finally, the participants’ motivation level was measured using a 7-point scale (not motivated at all/extremely motivated; Maheswaran & Sternthal, 1990).

Results

Motivation. The level of motivation was analyzed using a one-factor ANOVA (Motivation: high vs. low). Consistent to findings in past research (Maheswaran & Sternthal, 1990; Petty, Harkins, & Williams, 1980), the motivation manipulation yielded a significant difference in motivation between two conditions. I found that participants were less motivated in the low motivation condition ($M = 4.28$) than in the high motivation condition ($M = 5.02$; $F(1, 91) = 12.24, p = .001$), which is similar to the difference obtained by Maheswaran and Sternthal (1990) using the same scale ($M_{low} = 4.11$ and $M_{high} = 5.02$; $F(1, 143) = 35.0, p < .001$).

Perceived Difficulty. A 2 x 2 x 2 ANOVA on perceived difficulty yielded a main effect of Number of Reasons ($F(1, 87) = 29.87, p < .001$). No other effects were significant. Generating 8 reasons ($M = 6.96$) was perceived to be significantly more difficult than generating 2 reasons ($M = 4.18$).

Attitudes toward the Hand Lotion. Since the attitudes of the hand lotion measured on the two 11-point scales (liking and texture) were highly consistent (Cronbach’s $\alpha = .76$), I formed an overall attitude index toward the hand lotion and conducted a 2 (Number of Reasons: 2 vs. 8) x 2 (Valence of Reasons: positive vs. negative) x 2 (Motivation: high vs. low) ANOVA. A main effect of Motivation ($F(1, 87) = .62, p = .43$), the two-way interactions of motivation
with Number of reasons \( (F(1, 87) = 0.01, p = 0.91) \) and Valence of Reasons \( (F(1, 87) = 0.26, p = 0.61) \), and the three-way interaction (Number of Reasons x Valence of Reasons x Motivation: \( F(1, 87) = 0.42, p = 0.52 \) were not significant. As hypothesized, I found only a main effect of Valence of Reasons \( (F(1, 87) = 37.30, p < 0.001) \) and an interaction between Number of Reasons by Valence of Reasons \( (F(1, 87) = 10.60, p = 0.002) \) (see Figure 5). The main effect of Valence of Reasons indicated more positive attitudes in the positive-reasons conditions \( (M = 7.19) \) than in the negative-reasons conditions \( (M = 4.92) \). Of greater importance, however, is the finding of a significant interaction between Number of Reasons and Valence of Reasons. For the positive reasons conditions, participants evaluated the hand lotion more favorably when generating 8 reasons \( (M = 7.75) \) than 2 reasons \( (M = 6.56; F(1, 47) = 5.36, p = 0.02) \). However, in the negative reasons conditions, participants evaluated the hand lotion less favorably when generating 8 reasons \( (M = 4.40) \) than 2 reasons \( (M = 5.50; F(1, 44) = 5.31, p = 0.02) \). These findings indicate that even though the Motivation manipulation was successful, the low and high motivation conditions had similar patterns of product attitudes.

**Discussion**

By replicating the findings of Experiment 1, Experiment 2 provides further evidence for my expectation that having direct product experience induces the reversed ease-of-retrieval effect. Generating more reasons to like a product leads to more positive attitudes toward the product while generating more (vs. a few) reasons for not liking the product results in more negative attitudes toward the product. Importantly, Experiment 2 successfully ruled out the motivation account by showing the reversed ease-of-retrieval effect not only under high motivation but also under low motivation. This implies that the findings are not driven by the high level of motivation, and it is direct product experience which elicits the effect.
EXPERIMENT 3

Experiment 3 was conducted to rule out another alternative explanation, the effect of thought content on product attitudes. Related to the two potential explanations, although I replicated the findings using the hand lotion under both high and low motivation, one may still argue that the effects found in previous Experiments 1 and 2 are not due to the difficulty of generating reasons or the number of reasons generate, but are due to reliance on the content of reasons generated. A procedure used to determine whether the participants used ease-of-retrieval as opposed to the content of the recalled information when making the judgments is the use of a yoked design. One group of participants generates a few or many instances or arguments from memory in order to make a judgment, while a second group of participants reads the instances or arguments generated by the first group to make a judgment. The first group of participants can use both their subjective feeling of ease or difficulty and the content of their arguments, whereas the second group of participants has only the content of the arguments while lacking the subjective feeling. If the pattern of judgments in the first group differs from the pattern of judgments in the second group, it indicates that the first group relies on the ease or difficulty, not on the content of the arguments when making the judgments. For instance, Wänke, Bless, and Biller (1996) had one set of participants generated either 3 or 7 arguments that were either in favor or opposed to using public transportation and another set of participants read the arguments that were generated by other participants. For the pro-arguments conditions, the generators showed the ease-of-retrieval effect (e.g., more positive attitudes after generating 3 than 7 arguments), while the readers who lacked the subjective experience showed the opposite pattern (e.g., more positive attitudes after reading 7 than 3 arguments).
To determine whether the participants used ease-of-retrieval as opposed to the content of the recalled information in the previous experiments, Experiment 3 employed a yoked design which was used by Wänke, Bless, and Biller (1996). For the yoked design, I used the data from the high motivation condition in Experiment 2 and provided the same high motivation instructions to the participants since they will be more likely to rely on the content of the information in this condition (Rothman & Schwarz, 1998). If participants form similar attitudes toward the product under this condition, it indicates that participants in previous experiments (Experiments 1 and 2) formed their attitudes based on the content and number of reasons and that the amount of effort had no effect. Conversely, if participants form different attitudes toward the product under this condition, it indicates that the amount of effort influenced participants’ attitudes.

Method

Participants and Design. Participants were 48 female undergraduate students who participated in the experiment in exchange for course credit. The students were randomly assigned to the conditions of a 2 (Number of Reasons: 2 vs. 8) x 2 (Valence of Reasons: positive vs. negative) between-participants design.

Material and Procedure. The procedures are the same as in Experiment 2 except participants read the reasons instead of generating them. After reading the same instructions about the hand lotion used in the high motivation condition of Experiment 2 and applying it on hands, each participant (reader) was presented with the reasons generated by another participant (generator) from the high motivation condition of Experiment 2. Participants in positive (negative)-reasons-generation conditions were asked to read two or eight reasons why another participant liked (did not like) the hand lotion. Next, they completed the same two 11-point
items of product attitudes (i.e., liking and texture) and an 11-point item for measuring difficulty of reading reasons. And then, they answered how persuasive/compelling the reasons were (Tsai & McGill, 2010; Wänke, Bless, & Biller, 1996). Wänke, Bless, and Biller (1996) reported that readers rated the arguments equally compelling in the easy and difficulty conditions although they found a marginally significant effect of valence such that positive arguments were rated as more compelling than negative arguments. I also included two 9-point scales used in past research – persuasiveness (not persuasive at all-very persuasive; Tsai & McGill, 2010) and compellingness (not compelling at all-very compelling; Wänke, Bless, & Biller, 1996) to examine whether readers rate the quality of reasons differently depending on the number of reasons within the same valence.

Results

**Difficulty of Reading.** Difficulty of reading was analyzed by a 2 (Number of reasons: 2 vs. 8) x 2 (Valence of Reasons: positive vs. negative) ANOVA. Neither the main effect of Number of Reasons ($F < 1$) or Valence of Reasons ($F (1, 44) = 2.00, p = .16$) nor the interaction ($F < 1$) were significant: There were no perceived difference in the difficulty of reading across conditions.

**Quality of Reasons.** Two measures – persuasiveness and compellingness were combined to form a Quality Index (Cronbach’s $\alpha = 0.87$). A 2 x 2 ANOVA revealed that the main effect of Number of Reasons ($F (1, 44) = 1.49, p = .23$) and Valence of Reasons ($F (1, 44) = .67, p = .47$) nor the interaction effect ($F (1, 44) = 1.24, p = .27$) were significant (see Table 1). A separate ANOVA on each item also yielded insignificant effects. This result indicates that participants did not find any difference in the compellingness or persuasiveness across conditions.
Attitudes toward the Hand Lotion. I formed an overall attitude index using liking and texture (Cronbach’s $\alpha = .87$) similar to Experiment 2 and conducted the same 2 x 2 ANOVA. Supportive of my expectation, I found only main effects of Valence of Reasons in the attitude index ($F(1, 44) = 8.66, p = .005$), indicating that participants evaluated the hand lotion more positively in the positive-reasons conditions ($M = 7.67$) than in the negative-reasons conditions ($M = 6.16$). However, both the main effect of Number of Reasons ($F(1, 44) = .57, p = .45$) and the interaction were not significant ($F(1, 44) = .54, p = .47$) (see Figure 6). Please note that for the positive reasons conditions, participants’ attitudes in the 2 reasons condition were directionally higher than participants’ attitudes in the 8 reasons condition, while for the negative reasons conditions, participants’ attitudes were virtually identical in the 2 reasons condition and the 8 reasons condition. These findings are different from the findings in the high motivation condition of Experiment 2. This indicates that readers who did not have subjective feeling of ease or difficulty relied on only the valence of the reasons, leading to more positive attitudes after reading the positive reasons than the negative reasons.

Discussion

Experiment 3 rules out the alternative account, the effect of thought content on product attitudes. By using a yoked design where individuals read reasons others generated instead of writing reasons themselves, I showed that individuals (readers) who did not have subjective feeling of ease or difficulty did not show any differences in their attitude in the number of reasons within the same valence, which is different from findings in Experiment 2. In other words, only generators who write their own reasons and feel metacognitive experience (i.e., subjective feeling of ease or difficulty) show the magnified effect of metacognitive experience on product attitudes. The findings of Experiment 3 indicate that reading the reasons has a
different effect than generating them. It supports the view that the participants in the previous experiments did not use the content of the reasons when forming their attitudes. It also suggests that they may not have used the number of reasons. It is also clear that generating the reasons takes more effort than reading them. Consequently, these findings support the effort explanation, but do not entirely rule out the number of thoughts explanation because it is possible that generating reasons has a different effect than reading them.

**EXPERIMENT 4**

Experiments 1 and 2 found the reversed ease-of-retrieval effect with hand lotion and female participants. A natural question that may arise is whether the findings of the previous experiments can be generalized. Can the findings be extended to a different product category in which gender does not matter? To address this question, I used a soft drink in Experiment 4 since the gender of participants is not important in soft drinks in evaluating a new soft drink compared to hand lotions. I created a soft drink by mixing a grape juice (2/3) and a green tea (1/3) to eliminate any possible confounding effects caused by using a soft drink with which participants are familiar. I designed the drink so that the experience of tasting the drink would be evaluated as neutral without having individuals generate reasons. If the experience of tasting the drink is very positive or negative, it would be most likely to overwhelm the reasons for liking or disliking. To test this idea, I had a pretest where participants evaluated the drink without generating any reasons.

**Method**
**Pretest.** To examine whether participants form neutral attitudes toward the soft drink without having a reason-generation task, I asked 28 participants to evaluate the drink right after they tasted the drink. I assessed participants’ attitudes using two 11-point scales with the following anchors: do not like at all-like very much and taste very bad-taste very good. I combined these two scales to create an attitude index (Cronbach’s $\alpha = .92$). Participants formed a neutral to slightly positive attitude toward the drink ($M = 6.78$) without generating any reasons.

**Participants and Design.** Fifty-seven undergraduate students participated in the experiment in exchange for course credit. The students were randomly assigned to the conditions of a 2 (Number of Reasons: 2 vs. 10) x 2 (Valence of Reasons: positive vs. negative) between-participants design.

**Material and Procedure.** Upon arrival, participants were informed that they would participate in testing a new product. They were told that they would test a new soft drink that a company wanted to launch in a market in the near future. They were given a questionnaire which included the following instructions. They were told that the company had developed the soft drink targeting young adults (e.g., university students, workers in their late 20’s or early 30’s), and that their opinions about the soft drink would be incorporated in the development of the soft drink. Next, they were asked to drink a cup of the soft drink in front of them and answer the following questions. Participants in the positive reasons conditions were asked to write down 2 or 10 reasons why they liked the drink on the questionnaire. Participants in negative reasons conditions were asked to list 2 or 10 reasons why they did not like the drink. They then completed two 11-point scales for measuring attitudes toward the drink (do not like at all-like very much, taste very bad-taste very good) and an 11-point scale for measuring perceived difficulty (Menon & Raghubir, 2003).
Results

**Perceived Difficulty.** The perceived difficulty of generating reasons was analyzed by a 2 (Number of Reasons: 2 vs. 10) x 2 (Valence of Reasons: positive vs. negative) ANOVA. The analysis revealed a main effect of Number of Reasons ($F(1, 53) = 14.13, p < .001$), indicating that participants found it more difficult to list 10 ($M = 7.93$) than 2 reasons ($M = 5.43$), regardless of the valence of reasons (positive or negative).

**Attitudes toward the Drink.** I formed an overall attitude index by averaging liking and taste (Cronbach’s $\alpha = .96$). An analysis on the overall attitude index yielded a main effect of Valence of Reasons ($F(1, 53) = 5.53, p = .02$) and a significant interaction of Valence of Reasons by Number of Reasons ($F(1, 53) = 12.17, p = .001$). Participants showed a more positive attitude toward the drink in the positive-reasons conditions ($M = 7.21$) than the negative reasons conditions ($M = 5.81$). As expected, in the positive reasons conditions, participants showed a more positive attitude toward the drink when generating 10 reasons ($M = 8.46$) than 2 reasons ($M = 6.13$; $F(1, 26) = 6.50, p = .01$). However, the reverse was true for the negative reasons conditions. Participants showed a more negative attitude toward the drink when generating 10 reasons ($M = 5.00$) than 2 reasons ($M = 6.81$; $F(1, 27) = 5.64, p = .02$) (see Figure 7).

Discussion

Experiment 4 replicated the findings of previous experiments using a different product type – a drink. Similar to the findings of Experiments 1 and 2, after directly experiencing the drink, participants liked the drink more when generating 10 positive reasons than 2 positive reasons. However, they liked the drink less when generating 10 negative reasons than 2
negative reasons. Again, I found the polarized attitudes based on the number of thoughts and the valence of thoughts.

**GENERAL DISCUSSION**

The objective of this research was to examine whether ease-of-retrieval effects found in past research can be extended to the context of direct product experience. Prior research has found that subjective ease will have a greater effect on attitudes than subjective difficulty in various tasks such as recalling instances from memory (e.g., Schwarz et al., 1991) and listing arguments about a persuasive message (e.g., Tormala et al., 2007; Tormala, Petty, & Brinõl, 2002). This is because individuals use subjective feeling of ease or difficulty that they experience while recalling instances or generating arguments when forming the judgments. When individuals feel subjective difficulty (vs. ease), this difficulty leads individuals to form the attitudes that are less consistent with their thoughts by either questioning the availability of instances or by lowering confidence in their arguments.

Contrary to prior research, I demonstrated the reversed ease-of-retrieval effects with direct product experience. In Experiment 1, I directly compared direct product experience with no direct product experience. I found that individuals with direct product experience form more positive attitudes toward a product when generating many positive thoughts about a product than a few positive thoughts about the product. However, individuals without direct product experience form more positive attitudes toward a product when generating a few positive thoughts about the product than many positive thoughts about the product, replicating the traditional ease-of-retrieval effect. Further, consistent with prior research, I demonstrated that individuals’ confidence is affected by subjective ease or difficulty only when they do not have
direct product experience. However, when individuals have direct product experience, their confidence is equally high and is not affected by subjective ease or difficulty because individuals are already confident about their thoughts based on the product experience.

In Experiment 2, I replicated the reversed ease-of-retrieval effect when generating negative thoughts. Individuals with direct product experience form more negative attitudes toward a product when generating many negative thoughts about the product than a few negative thoughts. Importantly, I demonstrated the reversed ease-of-retrieval effect under both high and low motivation conditions. Prior research has suggested that the traditional ease-of-retrieval effect is more likely to occur under either a high motivation condition (Tormala et al., 2007; Tormala, Petty, & Brinõl, 2002) or a low motivation condition (Grayson & Schwarz, 1999; Schwarz et al., 1991; Rothman & Schwarz, 1998) depending on the tasks or researchers. Schwarz and his colleagues propose that the ease-of-retrieval effect is more likely to occur under the low motivation condition because individuals tend to use ease-of-retrieval as a heuristic cue under the low motivation condition while individuals tend to rely more on thought content under the high motivation condition (Grayson & Schwarz, 1999; Schwarz et al., 1991; Rothman & Schwarz, 1998). On the contrary, Tormala and his colleagues argue that the ease-of-retrieval effect is more likely to occur under the high motivation condition because individuals tend to validate their thoughts by considering how confident they are in their thoughts and they use the number of thoughts as a heuristic cue under the low motivation condition (Tormala et al., 2007; Tormala, Petty, & Brinõl, 2002). So, if I had found the reversed ease-of-retrieval effect only under the high motivation or only under low motivation, this would suggest that the level of motivation drives the effect. However, since I found the reversed ease-of-retrieval effects under both the high and the low motivation conditions, this suggests that it is
the effect of product experience that elicits the reversed ease-of-retrieval effect, not the level of motivation.

Using a yoke design, Experiment 3 provided direct evidence for whether individuals rely simply on thought contents or they incorporate subjective feeling of ease or difficulty into forming judgments. I found that, individuals who read the reasons generated by others (readers) did not show the reversed ease-of-retrieval effect because they did not have the subjective feeling of difficulty. This finding support the view that individuals in the previous experiments did not simply rely on the content of reasons when forming attitudes, but they incorporated the subjective feeling of ease or difficulty into forming the attitudes. Although this finding provides more support for the effort explanation than the number of thoughts explanation, one may still argue that individuals rely on the number of thoughts only when it is their thoughts, not others’. So, further research is required to determine which explanation is responsible for the effect.

Since I only used female participants who have more knowledge about a hand lotion used in Experiments 1 – 3, one may question the generalizability of my findings. To address this concern, in the final experiment, I replicate the reversed ease-of-retrieval effect using a different sensory product – a soft drink with having both male and female participants.

Although the current research brings a new perspective on research on ease-of-retrieval effects, further research is required to demonstrate whether the findings of the current research can be generalized to different product situations. As my pretests showed, I used products which elicit neutral attitudes without generating any reasons to like or dislike about the products, which allows some room to adjust the attitudes by generating more thoughts. It would be interesting to see whether the effect would hold for a product whose product experience is extremely bad (e.g., a hand lotion with a very sticky texture and a bad odor, a soft drink with a very bad taste). Second, the products used in the current research are those where attitudes
toward the products are based primarily on their sensory attributes (Degeratu et al., 2000). In other words, having direct experience with these products is crucial to understand the quality of these products through the use of the senses. It would be interesting to test whether the ease-of-retrieval effects will reverse with products where attitudes toward the products are not based only on the sensory attributes of the products.

Although the current research ruled out two alternative accounts – the motivation account and the thought content account, further research is required to determine whether the number of thoughts explanation or the effort explanation drives the reversed ease-of-retrieval effect, or whether both are required. However, it may be difficult to disentangle these two explanations given that the effort put into generation reasons is associated with the number of thoughts. In other words, as the number of thoughts increases, the effort put into generating thoughts also increases.

Another future research avenue is to examine whether our findings using two different types of sensory products (e.g., a hand lotion (a tactual product) and a drink (a gustatory product) can be extended to other sensory product consumption situations such as listening audios and taking relaxation massage.
CONCLUSION

The broad goal of my dissertation research is to examine how heuristic cues influence people’s judgments. In the first essay, I directly test the Model of Heuristic Judgment (Kahneman & Frederick, 2002, 2005) by examining whether making target attributes, instead of heuristic attributes, more accessible reduces judgmental biases. According to the Model of Heuristic Judgment (Kahneman & Frederick, 2002, 2005), systematic biases occur because individuals substitute the heuristic attributes, that are more accessible in memory, for the target attributes, that are less accessible in memory. To explain how individuals make biases and correct them, the Model of Heuristic Judgment also proposes a dual process model: The processes of System 1 are automatic, fast, intuitive, and effortless, whereas the processes of System 2 are controlled, slow, deliberative, and effortful. When individuals use System 1 to make a judgment, they tend to make a biased judgment because System 1 is fast and more likely to use the heuristic attribute which quickly comes to mind instead of the target attribute. In order to correct the biased judgment, System 2 must identify the error and correct it. The implication of the Model of Heuristic Judgment is that increasing the accessibility of the target attributes should reduce biased judgments.

In the first essay, I examined whether the increased accessibility of the target attributes will reduce judgmental biases using two different judgmental tasks – the jelly beans task in Experiment 1 and the professor-and-non-professor problem in Experiment 2. I manipulated the accessibility of the target attributes versus the heuristic attributes by nonconsciously priming individuals with the target attributes. When individuals were not primed with the target attributes, they tended to use the heuristic attributes (e.g., frequency, representative heuristic) which come readily to mind. Due to this tendency, individuals made more judgmental biases by
choosing the wrong option (e.g., choosing the 9% tray over the 10% tray) or relying on representative heuristic than base rate (e.g., estimating the probability that a person is a professor very high despite the low base rate). However, when individuals were subliminally primed with the target attribute (e.g., probability), they actually reduced their judgmental biases by choosing the correct option (e.g., choosing the 10% tray over the 9% tray) and relying more on the base rate (e.g., estimating the probability that a person is a professor closer to the base rate) due to the increased accessibility of the target attribute. Another important finding of the first essay is that priming the heuristic attribute did not increase judgmental biases because the heuristic attribute is readily accessible, and therefore the effect of the heuristic attribute priming becomes redundant. Based on these two judgmental tasks, the first essay succeeds in demonstrating that making the target attribute more accessible can reduce the judgmental biases. Nonetheless, this is only true when individuals have enough cognitive resources. With reduced cognitive resources, making the concept of probability more accessible fails to reduce the judgmental biases, which indicates that System 2 is required in reducing the biases. Taken together, the first essay demonstrates that the nonconscious priming of the target attribute can reduce the judgmental biases only when individuals have enough cognitive resources.

The first essay of my dissertation contributes to prior research on heuristics and biases in several ways. First, it provides strong support for the Model of Heuristic Judgment (Kahneman & Frederick, 2002, 2005) by showing that priming the heuristic attribute does not increase judgmental biases since the heuristic attribute is already readily accessible in mind. Second, it tests the implication of the Model of Heuristic Judgment (Kahneman & Frederick, 2002, 2005) by demonstrating that priming the target attribute reduces judgmental biases, which has not been examined in prior research. Third, consistent with the Model of Heuristic Judgment (Kahneman & Frederick, 2002, 2005), it emphasizes the importance of enough
cognitive resources to reduce the biases by showing that cognitive load impairs the process of correcting the biases even when the target attribute is made more accessible. Finally, it adds to the literature on reducing judgmental biases by suggesting priming as a nonconscious/implicit method to reduce the biases in addition to previously known explicit methods such as training statistical concepts and providing problems in frequency formats.

In the second essay, I examined the effect of generating a few or many reasons for liking or disliking a product after using the product. Previous research has found that recalling or generating a few instances or arguments has a greater effect on attitudes than recalling or generating many instances or arguments. This has been termed the ease-of-retrieval effect. Previous research on ease-of-retrieval effects has mainly examined indirect experience situations such as recalling assertive instances from memory (Schwarz et al., 1991), listing arguments in favor of the policy of comprehensive exams (Tormala, Petty, & Brinol, 2002), and generating thoughts about brands after reading the comparative advertisements of the brands (Wänke, Bohner, & Jurkowitch, 1997). For example, individuals form more favorable attitudes toward the comprehensive exams when generating a few arguments in favor of the comprehensive exams than when generating many arguments (Tormala, Petty, & Brinol, 2002). However, I propose that when individuals use the product and then generate a few or many reasons to like or dislike the product, the ease-of-retrieval effect will reverse: Individuals form more positive (negative) attitudes toward the product when they generate many reasons to like (dislike) the product than when they generate a few reasons to like (dislike) the product.

In the first experiment, I directly compared a no direct product experience condition (e.g., read a description of a hand lotion) with a direct product experience condition (e.g., read a description of a hand lotion and use the hand lotion). I found the traditional ease-of-retrieval effect in the no direct product experience condition and the reversed ease-of-retrieval effect in
the direct product experience condition. In the no direct product experience condition, individuals formed more positive attitudes toward a hand lotion when generating a few positive thoughts about the hand lotion than generating many positive thoughts. However, in the direct product experience condition, individuals formed more positive attitudes toward the hand lotion when generating many positive thoughts than when generating a few positive thoughts. Moreover, I also found that confidence in thoughts mediated the effect of the number of thoughts on attitudes, replicating previous research (Tormala, Petty, & Brinõl, 2002). In the second experiment, I replicated the reversed ease-of-retrieval effect when individuals generated negative thoughts. Importantly, I demonstrated the reversed ease-of-retrieval effect under both a high motivation condition and a low motivation condition, which rules out the motivation account. In the third experiment where I used a yoked design, I found that individuals who read the reasons generated by others did not demonstrate the reversed ease-of-retrieval effect because they did not have the subjective feeling of difficulty. This indicates that the effect cannot be explained simply by the reliance of though-content, and that participants incorporated the subjective feeling from generating the reasons when forming attitudes. In the fourth experiment, I replicated the reversed ease-of-retrieval effect using a different product – a soft drink.

The second essay contributes to the ease-of-retrieval effect literature by expanding the scope of the ease-of-retrieval effect to direct product experience situations which previous research has not examined. Importantly, it brings a new perspective to the ease-of-retrieval effect literature by demonstrating that generating many thoughts (reasons), which is more difficult, can result in more polarized attitudes when it accompanies with direct product experience. Finally, it opens up new avenues for future research that could deepen our understanding of consumers’ diverse product experience. Since the products used in the second essay are products where attitudes toward the products are primarily based on their sensory
attributes, it would be worthwhile to test whether ease-of-retrieval effects will reverse in different product types where attitudes toward products are not based only on the sensory attribute of the products.
### APPENDIX 1. TABLES

*Table 1.* Experiment 3 (Essay 2): Quality of reasons as a function of Number of Reasons and Valence of Reasons.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Positive Reasons</th>
<th></th>
<th>Negative Reasons</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 reasons</td>
<td>8 reasons</td>
<td>2 reasons</td>
<td>8 reasons</td>
</tr>
<tr>
<td>Quality of reasons</td>
<td>6.05</td>
<td>6.00</td>
<td>6.20</td>
<td>5.00</td>
</tr>
<tr>
<td></td>
<td>(2.04)</td>
<td>(1.49)</td>
<td>(1.70)</td>
<td>(1.90)</td>
</tr>
</tbody>
</table>

*Note.* Numbers in parentheses are standard deviations.
APPENDIX 2. FIGURES

Figure 1. Plot of average ranks for nine outcomes for Tom W. (adopted from Kahneman, 2003)
Figure 2. Experiment 2 (Essay 1): Probability estimate that the person is a professor as a function of priming and cognitive load.
Figure 3. Experiment 1 (Essay 2): Liking toward the hand lotion as a function of Number of Reasons and Product Experience
Figure 4. Experiment 1 (Essay 2): Confidence in Reasons as a function of Number of Reasons and Product Experience
Figure 5. Experiment 2 (Essay 2): Attitude index toward the hand lotion as a function of Number of Reasons and Valence of Reasons
Figure 6. Experiment 3 (Essay 2): Attitude index toward the hand lotion as a function of Number of Reasons and Valence of Reasons
Figure 7. Experiment 4 (Essay 2): Attitude index toward the drink as a function of Number of Reasons and Valence of Reasons
APPENDIX 3. EXPERIMENTAL MATERIAL IN EXPERIMENT 1 (ESSAY 1)

As you can see, there are two trays on the table. One tray (Tray A) contains 10 jelly beans (1 red bean and 9 white beans) while the other tray (Tray B) contains 100 jelly beans (9 red beans and 91 white beans). If you draw a red jelly bean, you can participate in a lottery in which the winner will receive $50. However, if you draw a white jelly bean, you will win nothing.

Given the information provided above, which of the two trays do you prefer to choose from? Please check one tray that you prefer for your actual drawing.

| Tray A (  ) | Tray B (  ) |
APPENDIX 4. EXPERIMENTAL MATERIAL IN EXPERIMENT 2 (ESSAY 1)

A panel of psychologists has conducted a survey of the 125 scientific staff in one university. The survey sample of the scientific staff contains 17.6 % professors and 82.4 % non-professors. Each participant of this survey has been described by a short personality sketch.

You will find on your form one description, chosen at random from the 125 available descriptions. Please indicate your probability that the person described is a professor, on a scale from 0 to 100.

Mr. Jakubowsky is a very busy man. He is about 40 years old and has an international reputation. For a couple of years he has been heading two research projects. He frequently attends international conventions and likes to wear a suit and a tie.

What is the probability that Mr. Jakubowsky is a professor?  (          ) %
APPENDIX 5. EXPERIMENTAL MATERIAL IN EXPERIMENT 1 (ESSAY 2)

Recently, a company has developed a new hand lotion. The major target market for this hand lotion is young adults (e.g., university students, workers in their late 20’s or early 30’s). Your opinions about this hand lotion will be incorporated in the development of the hand lotion.

Please read the descriptions of the hand lotion that the company provide.

This hand lotion absorbs well into your hands. It has gentle fragrance. It is very moisturizing. It makes your hands soft and smooth.

**No direct product experience condition**: After reading the above instructions, participants were asked to generate 2 or 8 reasons to like the hand lotion.

**Direct product experience condition**: After reading the above instruction, participants were asked to use a hand lotion before generating 2 or 8 reasons to like the hand lotion.

Please write down 2 reasons that you like this hand lotion.

<table>
<thead>
<tr>
<th>Reasons of liking</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
</tr>
</tbody>
</table>

- **Overall, how much do you like the hand lotion?**
  - Don’t like at all
    - 1
    - 2
    - 3
    - 4
    - 5
    - 6
    - 7
    - 8
    - 9
    - 10
    - Like Very much
      - 11

- **How difficult was it to generate the reasons?**
  - Not at all difficult
    - 1
    - 2
    - 3
    - 4
    - 5
    - 6
    - 7
    - 8
    - 9
    - 10
    - Very difficult
      - 11

- **How confident are you in the reasons you generated?**
  - Very Unconfident
    - 1
    - 2
    - 3
    - 4
    - 5
    - 6
    - 7
    - 8
    - 9
    - 10
    - Very confident
      - 11
APPENDIX 6. EXPERIMENTAL MATERIAL IN EXPERIMENT 2 (ESSAY 2)

High motivation condition:
Recently, a company has developed a new hand lotion. The major target market for this hand lotion is young adults (e.g., university students, workers in their late 20’s or early 30’s). You are part of a small number of respondents who are participating in the survey. Your opinions are very important to the marketers of this company.

Low motivation condition:
Recently, a company has developed a new hand lotion. The major target market for this hand lotion is older adults. You are among a large number of respondents who are participating in the survey. Your opinions might be used after aggregating them with those of other groups. Your individual opinions would remain anonymous.

Please apply the hand lotion on your hands and make sure it well-absorbed into your hands.

Please write down 2 reasons that you like this hand lotion.

<table>
<thead>
<tr>
<th>Reasons of liking</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
</tr>
</tbody>
</table>

➢ Overall, how much do you like the hand lotion?
Don't like
at all
1 2 3 4 5 6 7 8 9 10 11
Like
Very much

➢ How was the texture of the hand lotion?
Very bad
1 2 3 4 5 6 7 8 9 10 11
Very good

➢ How difficult was it to generate the reasons?
Not at all
difficult
1 2 3 4 5 6 7 8 9 10 11
Very
difficult

➢ How much were you motivated to perform this task?
Not at all
1 2 3 4 5 6
Extremely
7
APPENDIX 7. EXPERIMENTAL MATERIAL IN EXPERIMENT 3 (ESSAY 2)

Recently, a company has developed a new hand lotion. The major target market for this hand lotion is young adults (e.g., university students, workers in their late 20’s or early 30’s). You are part of a small number of respondents who are participating in the survey. Your opinions are very important to the marketers of this company.

Please apply the hand lotion on your hands and make sure it well-absorbed into your hands.

In an earlier study, university students have been asked to list why they like this hand lotion. The reasons that one of the students generated are shown below. Please read these reasons very carefully.

<table>
<thead>
<tr>
<th>Reasons of Liking</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The fragrance is good.</td>
</tr>
<tr>
<td>2. My hands become soft.</td>
</tr>
</tbody>
</table>

- Overall, how much do you like the hand lotion?
  
  Don’t like at all
  1  2  3  4  5  6  7  8  9  10  11
  Like Very much

- How was the texture of the hand lotion?
  
  Very bad
  1  2  3  4  5  6  7  8  9  10  11
  Very good

- How difficult was it to read the reasons?
  
  Not at all
difficult
  1  2  3  4  5  6  7  8  9  10  11

  Very
difficult

- Overall, how persuasive were the reasons that the other student generated?
  
  Not persuasive at all
  1  2  3  4  5  6  7  8  9
  Very persuasive

- Overall, how compelling were the reasons that the other student generated?
  
  Not compelling at all
  1  2  3  4  5  6  7  8  9
  Very compelling
APPENDIX 8. EXPERIMENTAL MATERIAL IN EXPERIMENT 4 (ESSAY 2)

Recently, a company has developed a new soft drink. The major target market for this soft drink is young adults (e.g., university students, workers in their late 20’s or early 30’s). Your opinions about this soft drink will be incorporated in the development of the soft drink.

Please drink one cup of this drink in front of you.

Please write down 2 reasons that you like this soft drink.

<table>
<thead>
<tr>
<th>Reasons of liking</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
</tr>
</tbody>
</table>

- Overall, how much do you like the soft drink?
  Don’t like
  at all
  1  2  3  4  5  6  7  8  9  10  11
  Like
  Very much
  11

- How was the taste of the soft drink?
  Very bad
  1  2  3  4  5  6  7  8  9  10  11
  Very good

- How difficult was it to generate the reasons?
  Not at all
difficult
  1  2  3  4  5  6  7  8  9  10  11
  Very
difficult

- What is your gender?  1) Male  2) Female
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