THE EFFECTS OF PROCESSING FLUENCY ON JUDGMENT AND PROCESSING STYLE: THREE ESSAYS ON EFFORT PREDICTION, RISK PERCEPTION, AND DISTORTION DETECTION

by

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Abstract

The Effects of Processing Fluency on Judgment and Processing Style: Three Essays on Effort Prediction, Risk Perception, and Distortion Detection

by

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This dissertation investigates the role of processing fluency in human judgment; it consists of three essays.

The first essay, "If it's hard to read, it's hard to do: Processing fluency and effort prediction," examines how the fluency of processing task descriptions influences people's predictions of the effort required for the actual tasks. Three studies show that the same behavior is assumed to take more time, effort, and skill when the print font of the instructions is difficult to read, with adverse effects on the willingness to engage in the behavior. These studies provide first evidence that people misread the difficulty of processing instructions as indicative of the difficulty of executing the behavior, with downstream motivational effects.

The second essay, "If it's hard to pronounce, it must be risky: Processing fluency and risk perception," brings processing fluency to bear on risk perception. Three studies show that low processing fluency fosters the impression that a stimulus is unfamiliar, which in turn results in perceptions of higher risk, independent of whether the risk is desirable or undesirable. In two studies, ostensible food additives were rated as more harmful when their names were difficult rather than easy to pronounce; mediation analyses indicated that this effect is mediated by the perceived novelty of the substance. I n a third study, amusement park rides were rated as more likely to make one sick (an undesirable risk) as well as more exciting and adventurous (a desirable risk)

when their names were difficult rather than easy to pronounce.

The third essay, “Low processing fluency attenuates Moses Illusion: Processing fluency and detection of distortions,” addresses the influence of processing fluency on the detection of semantic distortions by presenting questions in an easy or difficult to read print font . When asked, “How many animals of each kind did Moses take on the Ark?“ most people respond “Two“ despite knowing that Noah rather than Moses was the biblical actor. In two experiments, low processing fluency facilitated detection of the misleading nature of the question and reduced the proportion of erroneous answers. However, low processing fluency also reduced the proportion of correct answers in response to an undistorted question. In both cases, participants were less likely to rely on their spontaneous association when the font was difficult to read, resulting in improved performance on distorted and impaired performance on undistorted questions. These findings provide first evidence that fluency experiences influence individuals’ processing style.

In combination, the findings reported in these essays extend our understanding of the role of processing fluency in human judgment. They highlight that the metacognitive experiences that accompany human thought processes can serve as a source of experiential information that influences judgment and processing style, consistent with the general feelings-as-information framework (Schwarz & Clore, 1983, 2007).

Chapter I: Introduction

Traditional views on judgment and decision making have focused on how people base their judgments on declarative information (for reviews see Higgins, 1996). This view assumes that people deliberately investigate the features of the target or assess the possible outcomes of choices, and subsequently integrate the information through rational calculus to reach a judgment or make a decision (Anderson, 1981; for review see Harless, & Camerer, 1994).

However, more recently, a growing body of research has shown that human judgments do not merely depend on deliberate thought processes and rational calculation, but also our experiential systems such as moods (e.g., Keltner, Ellsworth, & Edwards, 1993; Schwarz & Clore, 1983), bodily feelings (e.g., Strack, Martin & Stepper, 1988; Freedman & Förster, 2000), and metacognitive experiences (e.g, Reber & Schwarz, 1999; Schwarz, Bless, Strack, Klumpp, Ritternauer-Schatka, & Simons, 1991; Zajonc, 1980) influences our judgments, decision making and cognition. For instance, people generally tend to evaluate anything at hand more positively when they are in a positive mood than in negative mood (Schwarz & Clore, 1983), and avoidance arm movements generate more careful information processing than approach arm movements (Friedman & Förster, 2000). From evolutionary perspective, experiential systems had informational value to human beings to help them discriminate between benefits and harms instinctively and rapidly; therefore, they developed even before rational thinking emerged (Slovic & Peters, 2006; Zajonc, 1980). As a result, experiential information has been suggested as both more basic and faster than rational thinking even in modern human beings (Damasio, 1994; Slovic & Peters, 2006; Zajonc, 1980).

The present research intends to investigate the effects of one element of experiential information that plays a substantial role in judgments and decision making: processing fluency. Processing fluency is one of the metacognitive experiences, feelings that accompany cognitive processes such as ease of processing a new stimuli or ease of

recalling information (for review, see Schwarz, 2004). Particularly, processing fluency is a feeling of ease associated with processing new information, and has been shown to affect various judgments including judgments of loudness (Jacoby, Allan, Collins, & Larwill, 1988), clarity (Whittlesea, Jacoby, & Girard, 1990), preference (Zajonc, 1980; 1998), familiarity (e.g., Whittlesea, 1993), and truth (e.g., Reber & Schwarz, 1999).

The present research will examine its effect on novel domains of judgments whose link to fluency are substantial but never investigated, effort prediction and risk perception. In addition, while the effects of various experiential information including mood and bodily feedback on processing styles were demonstrated, the effects of processing fluency were rarely studied in terms of processing style. The present research also demonstrates the fluency effect on processing style, particularly through distortion detection task in communication.

Processing fluency and judgment

Metacognitive experiences refer to cognitive feelings that accompany thought processes, such as how easily something comes to mind or how easily new information is processed. Metacognitive experiences can affect various judgments independent of thought contents (for review see Schwarz 2004). For instance, when people are asked to list ten good attributes of a product, they generated more positive attributes of a product than when they are asked to list two. However, people who list 10 are more likely to report that they dislike the product than people who list 2 since it feels difficult to generate many rather than few, and people infer their own preference based on the feeling of difficulty associated with their thought processes rather than the number of thought contents (e.g., Menon & Raghubir, 2003; Wanke, Bohner, & Jurowitsch, 1997).

Processing fluency is a type of metacognitive experience and refers to ease of identifying stimuli or identifying meanings. Fluent processing can manifest by speedy (Jacoby, 1983) and effortless processing (Schwarz, 1998). Conceptual fluency indicates the ease associated with identifying meanings of new information, and can be increased by semantic relatedness of the materials, the priming of concepts, and rhyming (e.g., Jacoby, 1983; McGlone & Tofighbakhsh, 2000; Roediger, 1990; Reber & Schwarz, 1999; Whittlesea, 1993). Perceptual fluency indicates the ease of identifying stimuli, and figure-ground contrast, visual clarity and print fonts were often used as manipulation of it.

Regardless of whether a variable influences conceptual or perceptual fluency, it has shown parallel effects on various judgments such as preference, familiarity, and truth values: people like fluent stimuli better than disfluent ones and find fluent stimuli more familiar and truer than disfluent stimuli (for review, see Schwarz & Clore, 2007; Schwarz, 2004).

Feeling as information: Affect and Naïve theories

The mechanism underlying these phenomena has been explained by a 'feeling-as-information' account, which argues that feelings are used as a kind of information that people take into account in judgments (Schwarz & Clore, 1983; Schwarz & Clore, 2007). When people encounter a judgment target, they make inferences about their evaluation of the target by asking themselves 'how do I feel about this?' and using their incidental feelings as information about any target at hand. Unless people realize that the current feeling has another source rather than the target itself, their incidental feelings are attributed to the target at hand (Schwarz & Clore, 1983). This account is consistent with Higgins' (1998) paralleling conjecture called the 'aboutness principle' regarding declarative information: people tend to think that declarative thoughts at hand are about whatever at the focus of attention. 'How do I feel about it' heuristic is well represented by mood effect where people tend to evaluate people, objects, and their life overall more positively when they are in a good mood than in a bad mood, even though their current mood may not come from the target of judgment (Gorn, Goldberg, & Basu, 1993; Schwarz & Clore, 1983; for a review see Schwarz & Clore, 2007). In sum, people are sensitive to their feelings but not sensitive to where these feelings come from and misidentify the true source.

Based on this heuristic, feeling of fluency also can be used as information in judgments through affect associated with fluency experience and also naïve theories related to fluency experience (Schwarz, 2004). Fluency is often experienced as genuine affect and influences evaluative judgments (Zajonc, 1980, 2000; Winkielman, Schwarz, Fazendeiro, & Reber, 2003). Research has shown that fluency-disfluency is experienced as a genuine positive-negative affect, respectively. In studies using EMG measurements, a technique to measure electrical activity of facial muscles, objects with high fluency due to priming, long presentation duration, and repeated presentation activated zygomaticus

major (smiling muscles) which represents positive affective experiences while are negatively correlated with the activation of corrugator supercilli (frowning muscles) associated with negative affective experiences (Harmon-Jones & Ellen, 2001; Winkielman & Cacioppo, 2001). Consistent with these results, studies with self-reports also have shown that repeated exposure (Zajonc, 2000) and a speedy thought process (Pronin & Wegner, 2006) have increased the self-reported feeling of positive mood.

As a consequence of these affective reactions, high fluency leads to more positive evaluations of a target such as higher preference and aesthetic judgments, than do low fluency. It is likely that people attribute their positive-negative affect associated with their fluency experience to the target objects and use their feelings as indicative of their own preference of the targets. For instance, everyday objects such as a desk, bird, or plane were preferred more when they were more fluently processed. Reber, Schwarz, & Winkielman (1998) found that subliminal priming of degraded contour of everyday objects increased the liking of the same objects in a later presentation. In addition, this effect was not simply limited to the same modality but was replicated even when the associated words were primed before the pictures were presented (Winkielman et al, 2003). Similar results were reported when processing fluency was manipulated by high-low figure ground contrast and long-short presentation duration (Reber, Schwarz, & Winkielman, 1998). In sum, while positive affect comes from fluency experience, people attribute these feelings to the objects themselves and perceive them as more likeable.

Fluency effects can also be driven by implicit and naïve theories regarding the relationship between fluency and the environment (Schwarz, 2004). Depending on these naïve theories, feeling of fluency, which comes from incidental variables are attributed to the targets of judgments, for instance, exposure duration, familiarity and truth. For instance, naïve theories can relate to relationship between fluency and stimuli presentation (Schwarz, 2004). People falsely infer that they were exposed longer to a visually clear stimulus than unclear one based on their naive theory that long exposure duration leads to high fluency (Whittlesea, Jacoby & Girard, 1990; Witherspoon & Allan, 1985). In this example, fluency experience, which comes from visual clarity, is attributed to another possible source of fluency, exposure duration.

Naïve theories also can relate to the relationship between fluency and one's own

state of knowledge (Schwarz, 2004). For instance, people often infer that fluency may indicate familiarity based on the experience that familiar stimuli are often more easily processed than unfamiliar ones in real life. Therefore, they misjudge stimuli with high fluency as familiar even when the fluency merely results from presentation variables like high figure-ground contrast, long exposure times, or easy to read print fonts (for reviews see Kelley & Rhodes, 2002; Reber, Schwarz, & Winkielman, 2004; Whittlesea, Jacoby, & Girard, 1990). Again, fluency experience is misattributed to familiarity.

This familiarity judgment can also have a downstream effect on truth judgments because feeling of familiarity can be associated with inference of social consensus. This effect was demonstrated by Reber & Schwarz (1999)'s study which showed that participants judged the generic statements such as 'Orsono is a city in Chile' with high figure-ground contrasts as truer than the ones with low figure-ground contrast. Not only the perceptual fluency but also phonemic fluency led to similar results. People found proverbs more truthful when they were presented in a rhyming format as in 'Woes unite foes,' than without rhyming as in 'Woes unite enemies'(Mcglone & Tofighbakhsh, 2000). These results are presumably driven by the tendency to infer truth values based on social consensus, and familiarity indicates high consensus (Weaver, Garcia, Schwarz, & Miller, 2007). As a result, feelings of fluency, which comes from incidental variables such as print fonts and rhyming, is attributed to the truth value of statements.

In conclusion, regardless of affect or naïve theory, when encountering the judgments at hand, people ask themselves, "how do I feel about it?" and attribute feeling of fluency from incidental variables to their judgment of domains at hand.

Current research

The current research intends to introduce judgment domains whose link to fluency is presumed fundamental but not yet thoroughly investigated. Considering that feelings of fluency depend on feelings of speed and effort, judgments relevant to speed and effort should be directly affected by feelings of fluency. The first essay suggests time and effort prediction as one of the substantial domains of judgments under the influence of fluency. The results show that people use the 'how do I feel about' heuristic in time and effort predictions and use the relevant experiential information, that is, the processing fluency, in their judgments.

The second essay addresses the fluency effect on risk perception. Even though it has long been argued that risk perception is mainly derived from experiential systems rather than rational calculation (Damasio, 1994; Loewenstein, Weber, Hsee, & Welch, 2001; Slovic, Finucane, Peters, and MacGregor, 2004), the effects of processing fluency on risk perception is yet to be investigated. Considering feelings of familiarity closely corresponds to both risk perception and processing fluency, the second essay introduces a new link between processing fluency and risk perception. The results demonstrate that risk perception is another domain of judgments which is influenced by the fluency-familiarity naïve theory, and this judgment can be independent of the affective response engendered by fluency.

Based on the familiarity-fluency link, the third essay examines whether low fluency can be used as a problem signal in communication due to engendered feeling of unfamiliarity and influence answers for distorted and undistorted questions. Particularly, people are more likely to detect distortions of a distorted question and report more frequently that they do not know the answer for the undistorted question in low fluency than in high fluency due to a problem signal that low fluency carries. This possibility is investigated through the Moses Illusion task. The results extend the fluency-familiarity naïve theory-based judgments to processing style.

Reference

Anderson, N. H. (1981). *Foundations of information integration theory*. New York: Academic Press.

Damasio, A. R. (1994). *Descartes' error: Emotion, reason, and the human brain*. New York: Putnam.

Friedman, R. S., & Föster, J. (2000). The effects of approach and avoidance motor actions on the elements of creative insight. *Journal of Personality and Social Psychology, 79*, 477-492.

Gorn, G., J., Goldberg, M. E., & Basu, K. (1993). Mood, awareness, and product evaluation. Journal of Consumer Psychology, 2(3), 237-256.

Harless, D. W., & Camerer, C. F. (1994). The predictive utility of generalized expected utilitity theories. *Econometrica, 62*, 1251-1289.

Harmon-Jones, E., & Allen, J. J. B. (2001). The role of affect in the mere exposure effect: Evidence from psychophysiological and individual differences approaches. *Personality and Social Psychology Bulletin, 27*, 889-898.

Higgins, E. T. (1996). Knowledge activation: Accessibility, applicability, and salience. In E. T. Higgins & A. Kruglanski (Eds.), Social psychology: Handbook of basic principles. (pp. 133-168). New York: Guilford Press.

Higgins, E. T. (1998). The aboutness principle: A pervasive influence on human inference. *Social Cognition, 16*, 173-198.

Jacoby, L. L. (1983). Perceptual enhancement: Persistent effects of an experience. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 9*, 21-38.

Jacoby, L. L., Allan, L. G., Collins, J. C., & Larwill, L. K. (1988). Memory influences subjective experience: Noise judgments. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 14,* 240-247.

Kelley, C. M., & Rhodes, M. G. (2002). Making sense and nonsense of experience: Attributions in memory and judgment. *The Psychology of Learning and Motivation, 41*, 293-320.

Keltner, D., Ellsworth, P. C., & Edwards, K. (1993). Beyond simple pessimism: Effects of sadness and anger on social perception, *Journal of Personality and Social Psychology, 64*(5), 740-752.

Lowenstein, G. F., Weber, E. U., Hsee, C. K., & Welch, N. (2001). Risk as feelings. *Psychological Bulletin, 127*(2), 267-286.

McGlone, M. S., & Tofighbakhsh, J. (2000). Birds of a feather flock conjointly (?): Rhyme as Reason in Aphorisms, *Psychological Science, 11*, 424-428.

Menon, G. & Raghubir, P. (2003). Ease of retrieval as an automatic input in judgments: A mere-accessibility framework? *Journal of Consumer Research, 30*, 230-243.

Pronin, E. & Wegner, D. M. (2006). Manic thinking: Independent effects of thought speed and thought content on mood. *Psychological Science, 17*(9), 807-813.

Reber, R., & Schwarz, N. (1999). Effects of perceptual fluency on judgments of truth. *Consciousness and Cognition, 8*, 338-342.

Reber, R., Schwarz, N., & Winkielman, P. (2004). Processing fluency and aesthetic pleasure: Is beauty in the perceiver's processing experience? *Personality and Social Psychology Review, 8,* 364-382.

Reber, R., Winkielman, P., &Schwarz, N. (1998). Effects of perceptual fluency on affective judgments. *Psychological Science, 9*, 45-48.

Roediger, H. L. (1990). Implicit memory: Retention without remembering. *American Psychologist, 45*, 1043-1056.

Schwarz, N. (1998). Accessible content and accessibility experiences: The interplay of declarative and experiential information in judgment. *Personality and Social Psychology Review, 2,* 87-99.

Schwarz, N. (2004). Meta-cognitive experiences in consumer judgment and decision making. *Journal of Consumer Psychology, 14*, 332-348.

Schwarz, N., Bless, H., Strack, F., Klumpp, G., Ritternauer-Schatka, H., & Simons, A. (1991). Ease of retrieval as information: Another look at the availability heuristic. *Journal of Personality and Social Psychology, 61*, 195-202.

Schwarz, N., & Clore, G.L. (1983). Mood, misattribution, and judgments of well-being: Informative and directive functions of affective states. *Journal of Personality and Social Psychology, 45*, 513 - 523.

Schwarz, N., & Clore, G. L. (2007). Feelings and phenomenal experiences. In A. Kruglanski & E. T. Higgins (eds.), *Social psychology. Handbook of basic principles* (2nd ed.; pp. 385-407). New York: Guilford.

Schwarz, N., Sanna, L., Skurnik, I., & Yoon, C. (2007). Metacognitive experiences and the intricacies of setting people straight: Implications for debiasing and public information campaigns. *Advances in Experimental Social Psychology, 39,* 127-161.

Slovic, P. & Peters, E. (2006). Rsk perception and affect. *Current Directions in Psychological Science, 15*(6), 322-325.

Slovic, P, Finucane, M. L., Peters, E., & MacGegor, D. G. (2004). Risk as analysis and risk as feelings: Some thoughts about affect, reason, risk, and rationality. *Risk Analysis, 24*(2), 311-322.

Strack, F., Martin, L. L., & Stepper, S. (1988). Inhibiting and facilitating conditions of the human smile: A nonobtrusive test of the facial feedback hypothesis. *Journal of Personality and Social Psychology, 54*(5), 768-777

Unkelbach, C. (2007). Reversing the Truth Effect: Learning the Interpretation of Processing Fluency in Judgments of Truth. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 33*(1), 219-230.

Wanke, M., Bohner, G., & Jurowitsch, A. (1997).There are many reasons to drive a BMW-Surely you know one: Ease of argument generation influences brand attitudes. *Journal of Consumer Research, 24*, 70-77.

Weaver, K., Garcia, S.M., Schwarz, N., & Miller, D. T. (2007). Inferring the popularity of an opinion from its familiarity: A repetitive voice can sound like a chorus. *Journal of Personality and Social Psychology, 92,* 821-833.

Whittlesea, B. W. A., Jacoby, L. L., & Girard, K. (1990). Illusions of immediate memory: Evidence of an attributional basis for feelings of familiarity and perceptual quality. *Journal of Memory and Language, 29*, 716-732.

Whittlesea, B. W. (1993). Illusions of familiarity. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 19*, 1235-1253.

Winkielman, P. & Cacioppo, J. T. (2001). Mind at ease puts a smile on the face: Psychophysiological evidence that processing facilitation leads to positive affect. *Journal of Personality and Social Psycholgy, 81*, 989-1000.

Winkielman, P., Schwarz, N., Fazendeiro, T. A., & Reber, A. (2003) The hedonic marking of processing fluency: Implications for evaluative judgments. In Musch, J., Klauer, K. C. (Eds.), *The psychology of evaluation: Affective processes in cognition and emotion* (pp. 189-217). Mahwah, NJ: Lawrence Erlbaum.

Witherspoon, D., & Allen, L. G.. (1985). The effects of a prior presentation on temporal judgments in a perceptual identification task. *Memory and Cognition, 13*, 103-111.

Zajonc, R. B. (1980). Feeling and thinking: Preferences need no inference. *American Psychologist, 35*, 151-175.

Zajonc, R. B. (1998). Emotions. In D. Gilbert, S. Fiske, & G. Kindzy (Eds.), *Handbook of*

social psychology (Vol. 1, pp. 591-632). New York: Oxford University Press.

Zajonc, R. B. (2000). Feeling and thinking: Closing the debate over the independence of affect. In J. P. Forgas (Ed.), *Feeling and thinking: The role of affect in social cognition* (pp. 31-58). New York: Cambridge University Press.

Chapter II: If it's hard to read, it's hard to do: Processing fluency and effort prediction (Studies 1-3)

People are more likely to engage in a given behavior the less effort it requires. As numerous studies indicated, high perceived effort is a major impediment to behavior change, from adopting an exercise routine (e.g., DuCharme & Brawley, 1995) to changing one's diet (e.g., Sparks, Guthrie, & Shepherd, 1997). While previous research has shown that task type (e.g., Buehler, Griffin, & Ross, 1994) and previous experience (e.g, Thomas, Handley, & Newstand, 2007) influence the accuracy of effort predictions, little is known about how people estimate the effort involved in a novel behavior. One possibility is that people run a mental simulation of the behavior and infer effort from the fluency of the simulation. If so, incidental variables that affect the ease with which information about the behavior can be processed may play a key role in effort prediction. Especially, considering that people's judgments depend on relevant experiential feelings (Schwarz & Clore, 2007), feeling of fluency can be a very relevant information to any types of judgments relevant to effort. The first essay tested this possibility and demonstrated the effect of print fonts as a manipulation of processing fluency on time and effort predictions.

Effort estimation

In cognitive psychology, estimation of effort was studied mainly in terms of duration estimation of past tasks, and it was considered fundamentally embodied on bodily rhythm or internal clock (e.g., Block, 1990; Fraisse, 1963; Meck & Church, 1983; Poynter, 1989; Zakay, 1989). For instance, Meck and Church (1983) proposed that neural pulses are released and accumulated while people measure an interval, and people depend on the accumulated amount of pulses to estimate durations of past events.

On the other hand, social psychology has rather focused on planning fallacy and overconfidence effect-people's tendency to underestimate time and effort to complete a future task (Buehler, Griffin, & Ross, 1994; Byrahm, 1997; Dunning, Griffin, Milojkovic & Ross, 1990; Hoch, 1985; Kahneman & Tversky, 1979; Thomas, Newstead and Handley,

2003; Sanna & Schwarz, 2004). In various tasks including college assignments (e.g., Newby-Clark, Ross, Buehler, Koehler, & Griffin, 2000) and furniture self-assembly (Byram, 1997), people's prediction of their own task completion time was shown to be shorter than their actual completion time. The mechanism underlying this phenomenon was mainly studied in terms of deliberate thought processes. For instance, a well-known explanation for this phenomenon argues that people take an inside perspective, focusing on specific aspects of a current task rather than outside, considering past experiences on similar tasks (Kahneman & Tversky, 1979). This explanation was supported by studies which investigated people's thought contents in verbal protocols during planning (Buehler, Griffin, & Ross, 1994). Many researchers also tested debiasing techniques targeted on deliberate thought processes such as task decomposing strategies (Kruger & Evans, 2004; Griffin & Buehler, 1999; Tversky & Kahneman, 1983), considering alternative scenarios (Newby-Clark, Ross, Buehler, Koehler, & Griffin, 2000), and recalling and linking the past experience to the current tasks (Buehler et al., 1994; Newby-Clark et al., 2000). On the other hand, experiential systems such as metacognitive experiences as mechanisms underlying effort predictions were under-researched.

Feeling of fluency and judgment of effort

The current research posits that experiential system, particularly, fluency influences prediction of time and effort; high fluency leading to prediction of low effort than low fluency. This hypothesis originates in the possibility that people mistake the feeling of fluency in reading a description of a task and mentally simulating the task as fluency of performing the task. Based on the observation called the 'feeling as information' hypothesis (Higgins, 1998; Schwarz & Clore, 1983; 2007), people usually consider their current feelings as about whatever is the focus of their attention, unless the feelings are attributed to sources other than the target of judgment. As a result, feelings at the moment lead to the feeling-congruent judgments about the target (Schwarz & Clore, 2007). For instance, when people are asked about their life satisfaction when they are in a good mood, they misread their own positive mood as about the target of the judgment (their life overall) and report high life satisfaction unless they realize that their good mood may be coming from other sources, such as nice weather (Schwarz & Clore, 1983). Similarly, feeling of fluency or effort in reading a task description caused by print fonts may also be

considered as about the target of the judgment at hand (the task itself) unless people attribute the feeling of effort to something else. Therefore, high effort in reading will lead to feeling-congruent judgment about the task, i.e. the estimation of high effort required for the task.

This possibility is further supported by the conjecture that the relevance of judgments to present feelings is an important factor in determining whether the feelings are used for judgment. Feelings are more likely to be used in judgments when perceived relevant to the judgment topic rather than when not (Schwarz & Clore, 2007). For instance, affective reactions are relevant to hedonic features rather than instrumental features; therefore, people are more influenced by their current moods when making decisions for experiential purposes (e.g., assessing a movie for an evening out) rather than when making decisions for instrumental purposes (e.g., assessing a movie for a school project) (Pham, 1998). Considering this, judgments regarding efforts should be more likely affected by feelings of effort than any other kinds of feelings because of the relevance of the feelings to the judgment topic.

Current research

The current research proposes high fluency will make the time prediction shorter even when content understanding is equal. Three studies investigated this possibility by using exercise instructions and recipes as task descriptions to predict time and skill of performing the actual tasks. In Study 1 and 2, participants read task instructions (exercise instructions in Study 1 and recipe in Study 2) and predicted time and effort the task would require as well as reporting their willingness to do the task. The processing fluency was manipulated by easy and difficult print fonts, which have been shown to be an effective manipulation of perceptual fluency (Alter, Oppenheimer, Epley, & Norwick, 2006; Norwick & Epley, 2002; Oppenheimer, 2006; Reber & Schwarz, 1999). We expected that people will predict higher speed and lower effort for doing the task when the instructions were printed in easy-to-read fonts than in difficult-to-read fonts. In addition, we expected that people will have higher willingness to do the task in high processing fluency condition presumably because people may prefer the task which requires less effort. Study 3 extended this prediction into a skill judgment of a task, which can be another form of effort prediction. We predicted that people will estimate higher skill for the task

when the task was printed in difficult-to-read fonts than in easy-to-read fonts.

Study 1

Study 1 measured people's prediction of the objective and subjective time predictions and time-relevant hedonic experiences of an exercise. Participants read the exercise instruction either in easy-to-read or difficult-to-read font and predicted how much time it would take to perform the exercise and how the exercise will be experienced, as well as reporting their intention to incorporate the exercise into their daily lives. We hypothesized that participants would predict that the exercise would take more time and be less hedonic, and also that participants would be less willing to do the exercise when the instructions were printed in difficult-to-read fonts than in easy-to-read fonts.

Method

Participants Twenty U of M students (12 females, 8 males; 19 Whites, 1 Asian) participated in the study.

Procedure Participants filled out three-page questionnaires introduced as a testing for the newly developed warm-up exercise instruction. Half of the participants read the instruction in easy-to-read font (Arial, font size 12) while the other half in difficult-to-read font (Brush455 BT, font size 12). The instructions for static stretching exercise (excerpted from http://www.brianmac.demon.co.uk/dynamic.htm and modified) read as follows and are presented in Figure 1.;

- Tuck your chin into your chest, and then lift your chin upward as far as possible. 6 to 10 repetitions
- Lower your left ear toward your left shoulder and then your right ear toward your right shoulder. 6 to 10 repetitions
- Turn your chin laterally toward your left shoulder and then rotate it toward your right shoulder. 6 to 10 repetitions
- Stand tall, feet slightly wider than shoulder-width apart, knees slightly bent. Keep the back straight at all times
- Swing both arms continuously to an overhead position and then forward, down, and backwards. 6 to 10 repetitions

- Swing both arms out to your sides and then cross them in front of your chest. 6 to 10 repetitions
- With your hands on your hips and feet spread wider than your shoulders, make circles with your hips in a clockwise direction for 10 to 12 repetitions. Then repeat in a counter clockwise direction.
- Extend your arms out to your sides, and twist your torso and hips to the left, shifting your weight on to the left foot. Then twist your torso to the right while shifting your weight to the right foot. 10 to 12 reps on each side.

After reading the instructions, subjects predicted the objective time consumed by the exercise by minute estimates, and subjective time by predicting how quick this exercise would be on a 7-point scale (1-not at all, 7-very). They also predicted time-relevant hedonic experiences of the exercise by answering three questions: 'do you expect that this exercise will drag on?' (1-strongly disagree, 7-strongly agree)', 'how naturally do you think the sequence of movements in this exercise will flow?' (1-not at all, 7-very), and 'how boring do you think this exercise will be?' (1-not at all, 7-very) Finally participants reported how willing they would be to engage in the exercise on a daily basis at home on a 7-point scale (1-not at all, 7-very).

After these reports, as a memory test, participants answered on a separate page either yes or no to the two questions: whether there was a movement such as 'crossing your arms in front of your chest' and 'your feet spreading wider than your shoulders'. After the memory test, as a manipulation check participants indicated how easy or difficult it was to read the font in the instructions on the 7 point scale (1-very difficult, 7-very easy). Finally, demographic information including their age, gender, and ethnicity was collected.

Results

Manipulation and memory checks Participants perceived the easy-to-read font (M=6.3, SD=.82) as significantly easier to read than the hard-to-read font (M=4.3, SD=1.42), $t(18)=3.86$, p=.001. The memory test answers were coded as 1 if they were correct and 0 if they were not. The scores for two questions were combined as an index of the memory test performance. There was no significant difference between easy-to-read (M=1.3,

SD=.48) and hard-to-read condition (*M*=1.2, *SD*=.63) in memory test performance, *t*(18)=.4, *p*=.7. Therefore, we concluded that participants in both conditions read the instructions and remembered them equivalently.

*Time prediction*s Consistent with our hypothesis, participants predicted that the exercise would take fewer minutes when presented in the easy-to-read font (*M*=8.23 minutes, *SD*=5.61) than in the hard-to-read font (*M*=15.1 minutes, *SD*=9.28). This difference was marginally significant, *t*(18)=2.01, *p*=.06. Participants also predicted that the exercise would be significantly quicker when the instructions were printed in easy-to-read fonts (*M*=4.8, *SD*=1.03) than in hard-to-read fonts (*M*=3.5, *SD*=1.35), *t*(18)=2.41, p=.027.

Time-relevant hedonic experiences Three questions regarding time-relevant hedonic experiences (natural, dragging on, and boring) were averaged to form the index of hedonic value after recoded into the positive direction (α=.82). Participants expected that the exercise would be more pleasant after they read the easy to read version (*M*=4.83, *SD*=1.43) than hard to read version (*M*=3.2, *SD*=.83), *t*(18)=3.11, *p*=.006.

Willingness to do As we expected, participants were significantly more willing to perform this exercise on a daily basis at home when they read the easy-to-read version of the instructions (*M*=4.5, *SD*=1.78) than hard-to-read version (*M*=2.9, *SD*=1.6), *t*(18)=2.12, *p*=.048.

The results from study 1 are presented in Table 2.1. and Figure 2.1.

Discussion

Consistent with our hypothesis, participants predicted high speed and low effort (higher hedonic experiences) of the exercise and were more willing to engage in the exercise when the instructions were easier to process. This may be because people misread their feeling of fluency in processing the description as predictive of the task at hand. When people were asked of the speed and effort which to be put in the task, they may have referred back to their feelings at the moment of judgment, and the feeling of fluency of processing the instructions may have been misread as about the actual fluency of doing the task. In addition, this prediction of time and hedonic experiences may have influenced the following evaluative judgments, such as willingness to do the exercise.

Study 2

Study 2 replicated the Study 1 in a different context, a cooking recipe. Participants read a

recipe for a Japanese roll and predicted the time put in cooking as well as their intention to cook. Consistent with study 1, we expected that participants will predict low time for cooking and report more willingness to cook when the recipe was printed in easy-to-read fonts than in difficult-to-read fonts.

Method

Participants Thirty U of M students (age 18-21; 7 males, 23 females; 20 Whites, 2 African Americans, 3 Asians, 5 others) participated in the study.

Procedure Each participant was given a three-page questionnaire package. Half of the participants read the recipe of a kind of Japanese roll (Excerpted from http://www.recipesource.com/ethnic/asia/japanese/indexall.html and modified) composed of 10 steps in an easy to read font (Arial, 12 point font size), and the other half read the same recipe in a hard to read font (Mistral, 12 point font size). The recipe reads as follows;

- In a deep, wide dish, combine soy sauce, honey, garlic and ginger. Add tofu.
- In a large glass bowl, combine rice vinegar and sugar. Add rice in fourths, stirring well after each addition. Stir in scallions and sesame seeds; mix well.
- Place a sheet of seaweed on waxed paper or bamboo mat so that the bottom edge of the seaweed sheet lies along the bottom edge of the paper or mat.
- Moisten hands w/cold water; place one-fifth rice mixture in center of the seaweed sheet, spreading it out evenly to fill sheet.
- Place two strips of tofu in center of seaweed sheet so they run the width of the sheet.
- Place one-fifth of carrots on top, and 2 spinach leaves over that, then one-fifth of alfalfa sprouts.
- Roll seaweed sheet from bottom by gripping both seaweed sheet and waxed paper or mat, using the paper or mat to help you make a tight roll.
- Let rest, seam side down, and repeat with remaining rice mixture and seaweed sheet.
- Wet blade of serrated knife. Slice rolls into rounds about 1 inch thick.
- Pack together tightly in a container with lid.

After reading the recipe, participants estimated how long it would take to make this Japanese roll in minute estimates and also answered a question inquiring their willingness to make this Japanese roll on a 7-point scale (1-not at all, 7-very).

On the next page, participants were tested on their memory of the recipe by answering two yes/no questions: whether the recipe includes carrots and whether it included avocado. In addition, participants also reported how easy it was to read the font of the recipe as a manipulation check and reported their age, gender and ethnicity.

Results

Since the recipe introduces the Japanese roll, an Asian food, we excluded three Asian participants from our analysis in order to maintain participants' equal baseline knowledge regarding the task. Therefore, the total 27 participants were included in the following analysis.

Manipulation and memory checks Participants found the font of the easy to read condition significantly easier (M=6.14, SD=1.29) than the font of the hard-to-read condition (M=2.69, SD=.75), $t(25)=8.39$, $p<.001$. The memory test answers were coded as 1 if they were correct and 0 if they were not. The scores for two questions were combined as an index of the memory test performance. The memory performance of the recipe contents in easy-to-read condition (M=1.93, SD=.27) and hard-to-read condition (M=1.77, SD=.44) were not significantly different, $t(25)=1.15$, p=.26.

Minute estimates Participants provided significantly higher minute estimates in hard-to-read condition (M=36.15, SD=15.3) than easy-to-read condition (M=22.71, SD=13.76), $t(25)=2.4$, p=.024.

Willingness to do Participants were significantly more willing to cook when they read the easy-to-read version of the recipe (M=4.21, SD=1.76) than hard-to-read version (M=2.85, SD=1.68), $t(25)=2.06$, p=.05.

The results from study 2 are presented in Table 2.2..

Discussion

Results of Study 2 confirmed our hypothesis that people predicted lower effort for cooking and were more willing to cook when they found the recipe easier to read. These results were consistent with study 1, which showed people's prediction of high speed and their preference of the easy-to-read task compared to the hard-to-read task. From these

two studies, we could conclude that feeling of fluency in processing task description was used as information in predicting time and effort of doing the task.

With regards to the willingness to cook, consistent with the results from Study 1, participants were more willing to cook the dish when the recipe was printed in easy-to-read fonts than in difficult-to-read fonts.

Study 3

Study 3 replicated the effect of processing fluency in estimation of skill. Estimating the skill needed for a task can be another form of effort prediction, considering that a task which requires much effort will also require much skill. In addition, study 3 also intended to observe whether the effect can be generalized to predicting others' effort as well as one's own by describing the task as performed by someone else (e.g., restaurant). Using the recipe identical to the one in Study 3 but in a different context (recipe used in a restaurant), in Study 3 participants judged skill required to cook the dish in a restaurant. It was hypothesized that people will estimate higher skill required for the dish when the task description was hard-to-read than easy-to-read.

Method

Participants Twenty four U of M students volunteered to participate in the study (10 Males, 14 Females; 16 Whites, 2 Black, 5 Asians, 1 other).

Procedure Each participant was given a three-page questionnaire with the recipe identical to the one in Study 2 but introduced as a recipe used in a Japanese restaurant. Half of the participants read the hard-to-read version while the other half read the easy-to-read version. After reading the recipe, participants rated how much skill would be needed to make this Japanese roll on a 7-point scale (1-not at all, 7-very much). On the next page, participants' memory of the contents was tested with questions identical to the two memory questions in Study 2. Lastly, participants reported the ease of reading on a 7-point scale as well as their demographic information.

Results

Five Asian participants were excluded in the following analysis because of the possible baseline difference in the knowledge of the task from the other participants.

Manipulation Check Participants found the font of the easy-to-read condition

significantly easier (M =6.11, SD=1.45) than the font of the hard-to-read condition (M=2.8, SD=1.03), $t(17)=5.77$, $p<.001$.

Memory check The memory test answers were coded as 1 if they were correct and 0 if they were not. The scores for two questions were combined as an index of the memory test performance. The memory performance of the recipe contents in easy-to-read condition (M=1.8, SD=.42) and hard-to-read condition (M=2, SD=0) were not significantly different, $t(17)=1.42$, $p=.17$.

Skill estimation Consistent with our hypothesis, participants who read the easy-to-read version of the recipe rated that it would require less skill to make the roll (M=4.11, SD=1.27) than did participants who read the hard-to-read version of the recipe (M=5.2, SD=.92), $t(17)=2.16$, $p=.045$

Discussion

The results from Study 3 showed that the effect of the processing fluency replicates in skill judgment. Consistent with our hypothesis, participants estimated less skill required to cook an unknown dish when they found the recipe easier to process. In addition, it was also demonstrated that the effort prediction based on fluency was not limited to prediction of one's own effort but also to others'.

General discussion

The present findings provide the consistent result that processing fluency of task descriptions affects readers' predictions of time, effort and skill required to perform the task. Consistent with our hypothesis, when the description of the task was fluently processed, the task itself was also predicted to be timely. These effects were explained by people's use of feelings as information when it comes to the judgments relevant to the present feelings (Schwarz & Clore, 2006). Since feeling of fluency is the feeling of mental effort, people may have used the feeling of fluency on the relevant judgment domain, such as prediction of effort in performance.

The possibility that people misread difficulty of processing as difficulty of doing was previously suggested by purchase decision deferral under low processing fluency of the product information (Novemsky, Dhar, Schwarz, & Simonson, 2007). Previous research has shown that if it is difficult to make a choice among similarly attractive or unattractive products, people defer the choice (Dhar, 1997). More recent study showed

that manipulation of difficulty of mere perceptual processing of the products information in choice sets, such as print fonts, of the information also led to deferral of the choice (Novemsky, Dhar, Schwarz, & Simonson, 2007); participants deferred the choice between two cordless phones more if the information was printed in hard-to-read print fonts than easy-to-read print fonts. It can be inferred that people misread the difficulty of reading as difficulty of making a choice, that is, difficulty of doing and deferred the choice under low fluency. Along the same line, the present research confirmed again that the difficulty of processing can be misread as a difficulty of performance in a different domain, effort prediction.

Even though there are other types of manipulations which can affect fluency such as repeated exposure (Zajonc, 1980) and conceptual difficulty (Kelly & Jacoby, 1998; Roediger, 1990; Whittlesea, 1993), manipulating perceptual fluency can be a better way to examine the effect of fluency independent of thought contents. Research on the planning fallacy and overconfidence effect has shown that repeated encoding and conceptual ease leads to a longer predicted time even though this research did not intend to examine the effects of processing fluency (Byram, 1997; Fischhoff & MacGregr, 1982; Griffin & Tversky, 1992). Due to differential understanding of the contents in different conditions led by these manipulations, deliberate thinking process rather than fluency was more likely to be involved in these results. For instance, these effects may have occurred presumably because people had a hard time mentally representing the components necessary for successful completion when the task is difficult, either by the task characteristic itself or by incomplete encoding (Thomas, Handley, & Newstand, 1997). This possibility was confirmed by the research results that unpacking the task before predicting completion time made the time prediction longer, particularly for difficult tasks rather than easy tasks (Kruger & Evans, 2004). Therefore, the present study demonstrated the effect of fluency independent of thought contents on time predictions more effectively than using other manipulations which can affect declarative information as well as processing fluency.

Considering that many consumer judgments arise within a sequence of related judgments (Bettman 1970, 1971, 1979; Bettman & Park, 1980), effort prediction may work as an a priori judgment in many purchase situations, and can be an important

consumer judgment domain which influences purchase intention. Considering that effort judgment can influence the purchase intention differentially depending on context, marketers for different domains of products may want to use processing fluency of the visual material differentially. For instance, some product domains (such as hand-made products) may value high effort while others (such as fresh orange juice) may value effortless speedy processing. If so, the marketers may want to use low perceptual fluency in introducing the procedure of the hand-made products while high perceptual fluency in introducing the procedure of orange juice production to make their products more valuable. In addition, since effort prediction based on fluency can occur both for prediction of one's own effort and others', marketers may want to introduce a task manual for customers in a perceptually easy-to-process way to imply the low effort the customers themselves will experience, but may want to introduce service tasks performed by the industries with low perceptual fluency to emphasize the industries' high effort and skill to serve the customers.

Table 2.1. Time and effort prediction in easy-to-read and hard-to-read exercise instructions (Study 1)

	Minutes	Quick	Hedonic	Will-to-do
Easy-to-read	8.23 (5.61)	4.8 (1.03)	4.83 (1.43)	4.5 (1.78)
Hard-to-read	15.1 (9.28)	3.5 (1.35)	3.2 (.83)	2.9 (1.6)

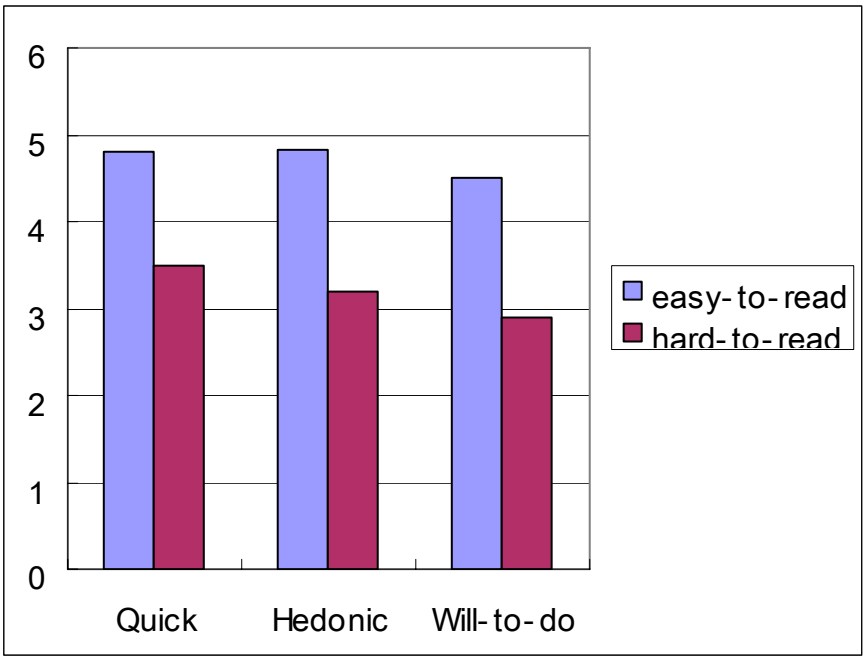

Figure 2. 1. Time and effort predictions in easy-to-read and hard-to-read exercise instructions (Study 1).

Table 2.2. Time and skill prediction in easy-to-read and hard-to read recipes (Study 2 & 3)

	Minutes (Study 2)	Will-to-do (Study 2)	Skill (Study 3)
Easy-to-read	22.71 (13.76)	4.21 (1.76)	4.11 (1.27)
Hard-to-read	36.15 (15.3)	2.85 (1.68)	5.2 (.92)

Reference

Alter, A. A., Oppenheimer, D. M., Epley, N., & Norwick, R. (2006). *Overcoming intuition: Metacognitive difficulty activates analytic reasoning.* Unpublished manuscript, Princeton University.

Bettman, J. R. (1970). Information processing models of consumer behavior. *Journal of Marketing Research, 7*, 370-376.

Bettman, J. R. (1971). The structure of consumer choice processes. *Journal of Marketing Research, 8*, 465-471.

Bettman, J. R. (1979). *An information processing theory of consumer choice.* Reading, MA: Addison-Wesley.

Bettman, J. R. & Park, C. W. (1980). Effects of prior knowledge and experience and phase of the choice process on consumer decision processes. *Journal of Consumer Research, 7*, 234-248.

Block, R. A. (1990). *Cognitive models of psychological time.* Hillsdale, NJ: Erlbaum.

Buehler, R., Griffin, D., & Macdonald, H. (1997). The role of motivated reasoning in optimistic time predictions. *Personality and Social Psychology Bulletin, 23*(3), 238-247.

Buehler, R., Griffin, D., & Ross, M. (1994). Exploring the 'planning fallacy': Why people underestimate their task completion times. *Journal of Personality and Social Psychology, 67*(3), 366-381.

Byram, S. J. (1997). Cognitive and motivational factors influencing time predictions. *Journal of Experimental Psychology: Applied, 3*(3), 236-239.

Clore, G. L., Wyer, R. S., Dienes, B., Gasper, K., Gohm, C., & Isbell, L. (2001). Affective feelings as feedback: Some cognitive consequences. In L. L. Martin & G. L. Clore (eds.), *Theories of mood and cognition: A user's guidebook* (pp.63-84). Mahwah, NJ: Erlbaum

Dhar, R. (1997). Consumer preference for a no-choice option. *Journal of Consumer Research, 24*(2), 215-231.

DuCharme, K. A., & Brawley, L. R. (1995). Predicting the intentions and behaviors of exercise initiates using two forms of self-efficacy. *Journal of Behavioral Medicine, 18*, 479-497

Dunning, D., Griffin, D., Milojkovic, J. D., & Ross, L. (1990). The overconfidence effect in social prediction. *Journal of Personality and Social Psychology, 58*, 568-581.

Fraisse, P. (1963). *The psychology of time* (J. Leith, Tran.). New York: Harper & Row.

Fischhoff, B. & MacGregor, D. (1982). Subjective confidence in forecasts. *Journal of Forecasting, 1,* 155-172.

Griffin, D., & Buehler, R. (1999). Frequency, probability, and prediction: Easy solutions to cognitive illusions. *Cognitive Psychology, 38*(1), 48-78.

Griffin, D., & Tversky, A. (1992). The weighting of evidence and the determinants of confidence. *Cognitive Psychology, 24*, 411-435.

Higgins, E. T. (1998). The aboutness principle: A pervasive influence on human inference. *Social Cognition, 16*, 173-198.

Hoch, S. J. (1985). Counterfactual reasoning and accuracy in predicting personal events. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 11,* 719-731.

Kahneman, D. & Tversky, A. (1979). Intuitive prediction: Biases and corrective procedures. *TIMS Studies in Management Science, 12*, 313-327.

Kelly, C. M., & Jacoby, L. L. (1998). Subjective reports and process dissociation: Fluency, knowing, and feeling. *Acta Psychologica, 98*, 127-140.

Kruger, J., & Evans, M. (2004). If you don't want to be late, enumerate: Unpacking reduces the planning fallacy. *Journal of Experimental Social Psychology, 40*, 586-598.

Meck, W. H., & Church, R. M. (1983). A mode control model of counting and timing processes. *Journal of Experimental Psychology: Animal Behavior Processes, 9*, 320-334.

Newby-Clark, I. R., Ross, M., Bueler, R., Koehler, D. J., & Griffin, D. (2000). People focus on optimistic scenarios and disregard pessimistic scenarios while predicting task completion times. *Journal of Experimental Psychology: Applied, 6*, 171-182.

Novemsky, N., Dhar, R., Schwarz, N., & Simonson, I. (2007). Preference fluency in consumer choice. *Journal of Marketing Research, 14*(3), 347-369

Norwick, R. J., & Epley, N. (November, 2002). *Confidence as inference from subjective experience.* Talk presented at the meeting of the Society for Judgment and Decision

Making, Kansas City, MO.

Oppenheimer, D. M. (2006). Consequences of erudite vernacular utilized irrespective of necessity: Problems with using long words needlessly. *Applied Cognitive Psychology, 20*, 139-156.

Pham, M. T. (1998). Representativeness, relevance, and the use of feelings in decision making. *Journal of Consumer Research, 25*(2), 144.

Poynter, D. (1989). Judging the duration of time intervals: A processes of remembering segments of experience. In I. Levin & D. Zakay (Eds.), *Time and human cognition: A life-span perspective* (pp. 305-331). New York: Elsevier Science.

Reber, R., & Schwarz, N. (1999). Effects of perceptual fluency on judgments of truth. *Consciousness and Cognition, 8*, 338-342.

Roediger, H. L. (1990). Implicit memory: Retention without remembering. *American Psychologist, 45*, 1043-1056.

Sanna, L. J., & Schwarz, N. (2004). Integrating temporal biases: The interplay of focal thoughts and accessibility experiences. *Psychological Science, 15*(7), 474-481.

Schwarz, N. & Clore, G. L. (1983). Mood, misattribution, and judgments of well-being: Informative and directive functions of affective states. *Journal of Personality and Social Psychology, 45*, 513-523.

Schwarz, N., & Clore, G. L. (in press). Feelings and phenomenal experiences. In E. T. Higgins & A. Kruglanski (eds.), *Social psychology. Handbook of basic principles* (2nd ed.; pp. 00-00). New York: Guilford.

Sparks, P., Guthrie, C. A., & Shepherd, R. (1997). The dimensional structure of the perceived behavioral control construct, *Journal of Applied Social Psychology, 27*(5), 417-437

Thomas, K. E., Newstead, S. E., & Handley, S. J. (2003). Exploring the time prediction process: The effects of task experience and complexity on prediction accuracy. *Applied Cognitive psychology, 17*, 655-673.

Thomas, K. E., Handley, S. J., & Newstead, S. E. (2007). The role of prior task experience in temporal misestimation. *The Quarterly Journal of Experimental Psychology, 60*(2), 230-240.

Whittlesea, B. W. (1993). Illusions of familiarity. *Journal of Experimental Psychology:*

Learning, Memory, and Cognition, 19, 1235-1253.

Zakay, D. (1989). Subjective time and attentional resource allocation: An integrated model of time estimation. In I. Levin & D. Zakay (Eds.), *Time and human cognition: A life-span perspective* (pp. 365-397). New York: Elsevier Science.

Chapter III: If it's hard to pronounce, it must be risky: Processing fluency and risk perception (Studies 4-6)

Traditionally, research into risk perception has mostly been guided by expected-utility theory, which assumes that people assess the severity and likelihood of the possible outcomes of choice alternatives and integrate this information through an expectation-based calculus to calibrate risk and reach a decision (for a review see Harless & Camerer, 1994). However, recent research challenged this assumption and demonstrated that subjective perceptions of risk are insensitive to changes in probability and do not reflect a rational calibration of risks (Kahneman & Ritov, 1994; Kahneman, Ritov, & Schkade, 1999).

The role of feelings in risk perception was emphasized by Zajonc (1980), who proposed that fast affective reactions provide a crude but efficient assessment of the environment that allows for speedy reaction to potential harms. Ceteris paribus, familiar stimuli elicit a more positive affective response than unfamiliar stimuli, presumably because their familiarity indicates that they haven't hurt one in previous encounters. To date, the role of feelings of familiarity in risk perception has not been studied extensively; instead, research into the role of experiential information in risk perception has primarily focused on direct effects of positive or negative affect. For instance, Slovic (1987) suggested that positive or negative affect are associated with stimulus representations and serve as heuristic cue in evaluating the risks associated with the stimulus (for review see Slovic, Finucane Peters, and MacGregor, 2004). His research demonstrated that people's evaluation of the potential benefits and harms of an activity show an inverse relationship (Alhakami & Slovic, 1994), in contrast to the assumption that benefits and harms are first evaluated separately and subsequently integrated. In line with this tradition, the risk-as-feelings hypothesis (Loewenstein, Weber, Hsee, & Welch, 2001) postulated that feelings such as worry, fear, dread and anxiety directly affect behaviors, bypassing cognitive evaluations of stimuli.

The present research revisits the familiarity hypothesis and tests whether

metacognitive experiences that are known to influence perceptions of familiarity also influence perceptions of risk. We first review previous research that highlights a close link between processing fluency and perceptions of familiarity and subsequently relate this link to perceptions of risk.

Fluency and Familiarity

Because familiar stimuli are often processed more easily than unfamiliar ones (e.g., Haber & Hershenson, 1965; Jacoby & Dallas, 1981), people use the subjective experience of processing fluency in judging the familiarity of stimuli and environments (for a review see Schwarz, 2004). In cognitive research, this fluency-familiarity link gives rise to erroneous recognition judgments for perceptually easy-to-process stimuli (e.g., Whittlesea, Jacoby, & Girard, 1990) and to strong feelings of knowing (e.g., Koriat & Levy-Sadot, 2001). For example, Whittlesea and colleagues (1990) reported that participants were more likely to misidentify novel words as previously seen when they were easy rather than difficult to process, due to the visual clarity of the presentation format. In social psychological research, fluent processing of a statement gives rise to the impression that one has heard it before, suggesting that others share the opinion. Hence, fluently processed stimuli elicit higher estimates of social consensus (e.g., Weaver, Garcia, Schwarz, & Miller, 2007) and are more likely to be accepted as true (e.g., Reber & Schwarz, 1999; for a review see Schwarz, Sanna, Skurnik, & Yoon, 2007).

In light of this fluency-familiarity link, we propose that difficult-to-process stimuli are perceived as less familiar and hence more hazardous than easy-to-process stimuli. The present studies test this prediction by using ease of pronunciation as a manipulation of fluency. Study 4 examines people's hazard ratings of ostensible food additives that are described with easy-to-pronounce or difficult-to-pronounce names. We predict and find that hard-to-pronounce substances are rated as more hazardous than easy-to-pronounce substances. Study 5 replicates this finding and shows that the effect of fluency on risk perception is mediated by perceived familiarity.

Previous research also demonstrated, however, that processing fluency is hedonically marked and that high fluency elicits a positive affective response that can be captured with psychophysiological methods (e.g., Winkielman & Cacioppo, 2001). Although the affective response to processing fluency may itself be a function of the

perceived familiarity of the processed stimulus, it raises the possibility that the influence of familiarity on risk perception is driven by the accompanying affect rather than by familiarity per se. Study 6 addresses this possibility by examining the influence of processing fluency on judgments of a positively valenced risk, namely the adventurousness of amusement park rides. As a large body of research into the role of affect in evaluative judgment demonstrates, positive affect elicits more favorable evaluations than negative affect (see Schwarz & Clore, 2007, for a review). If the effect of fluency on judgments of risk is driven by the affect associated with familiar vs. unfamiliar stimuli, low processing fluency should result in negative evaluations across the board, rendering food additives as well as amusement park rides less appealing. If familiarity itself can serve as an input into judgments of risk, however, low fluency may increase the perceived hazard of food additives (a negative judgment) as well as the perceived adventurousness of amusement rides (a positive judgment). Study 6 supports the latter prediction.

Study 4

Study 4 examined the hypothesis that people perceive fluently processed stimuli as safer than disfluently processed ones. This possibility was tested by asking participants to rate the hazardousness of ostensible food additives with either easy-to-pronounce or difficult-to-pronounce names.

Method

Pretest. Pretest participants (N =15) rated the ease with which the names of 16 ostensible food additives could be pronounced (1=very difficult, 7=very easy). All names were composed of 12 letters and the 5 most easy (e.g., Magnalroxate; α=.7, M=5.04, SD=.88) and most difficult (e.g., Hnegripitrom; α=.71, M=2.15, SD=.7) were selected as stimuli; $t(14)=11.91$, $p<.001$, $p_{rep}=1$, $d=4.4$, for the difference in pronunciation ease.

Participants and procedures: Study 4. Twenty students participated for course credit. They were instructed to imagine that they were reading food labels and asked to judge the hazard posed by different food additives (1= very safe, 7 = very harmful). Five easy and five difficult to pronounce names were presented in two random orders. Presentation order did not affect the results (all $p>.13$) and was dropped from analysis.

Results

As predicted, Study 4 participants rated substances with hard-to-pronounce names (M=4.12, SD=.78) as more harmful than substances with easy-to-pronounce names (M=3.7, SD=.74), $t(19)=2.41$, $p<.03$, $p_{rep}=0.92$, d=.75.

Consistent with the familiarity-risk hypothesis, participants perceived disfluently processed stimuli as more hazardous than fluently processed stimuli. This presumably reflects that disfluently processed stimuli seem less familiar. Study 5 directly addresses this assumption and tests whether judgments of familiarity mediate judgments of risk.

Study 5

In Study 5, participants rated the novelty as well as hazardousness of the food additives presented in Study 4. The key hypothesis holds that the effect of fluency on risk perception is mediated by the perceived familiarity/novelty of the stimuli.

Methods

Participants and procedures: Study 5. Fifteen students participated for course credit. The procedure was identical to study 1 except that participants rated the novelty (1=very old; 7=very new) as well as hazardousness (1= very safe; 7 = very harmful) of each substance, in counterbalanced order. The order in which substances were presented did not affect the results (all p >.18) and was dropped from analysis.

Results

Perceived hazard. Study 5 replicated this finding from Study 4 with hazardousness ratings of M=4.76 (SD=.64) for hard and M=3.68 (SD=.65) easy to pronounce substances, $t(14)=5.46$, $p<.001$, $p_{rep}=1$, d=2. The order of the hazardousness and novelty ratings did not affect these results (all p>.3).

Perceived novelty. Study 5 participants further rated the substances as more novel when their names were difficult (M = 4.72) rather than easy to pronounce (M= 3.69), $F(1, 13) = 28.21$, p <.001, $p_{rep}=1$, $\eta_p^2=.685$ for the main effect. The influence of fluency on novelty ratings was more pronounced when the novelty questions preceded the hazardousness questions (M's=5.14 vs. 3.51, SD's=.38 and .89; $t(6)=4.72$, $p<.01$, $p_{rep}=.97$, d=2.77) than when the question order was reversed (M's=4.35 vs. 3.85, SD's =1.17 and .89; $t(7)=2.24$, $p=.06$, $p_{rep}=.86$, d=1.21); $F(1, 13)=7.93$, $p<.02$, $p_{rep}=.94$, $\eta_p^2=.379$ for the interaction of question order and pronunciation difficulty.

Mediation. To assess whether the influence of fluency on risk judgments is mediated by perceived familiarity we conducted a test of moderated mediation (Muller, Judd, & Yzerbyt, 2005) that takes the observed interaction of question order and pronunciation difficulty on novelty ratings into account. Two criteria need to be met to warrant a test of moderated mediation. First, there should be a significant effect of the treatment on the outcome variable, which does not depend on the moderator. As seen above, fluency had a significant effect on hazardousness ratings that was not moderated by question order, meeting the first criterion. Second, the effect of the treatment on the mediator and/or the partial effect of the mediator on the outcome variable should depend on the moderator. As seen above, fluency had a significant effect on novelty ratings and this effect was moderated by question order, meeting the second criterion. When the treatment effect on the mediator is moderated as above, mediation is established if there is a significant partial effect of the mediator on the dependent variable, controlling for the moderator. To test this possibility, the hazardousness ratings were regressed on fluency, novelty, question order, and the fluency-order and novelty-order interactions. This analysis revealed a significant direct effect of novelty on harm ratings, β=.4, F(1, 24)=6.76, p=.016, meeting the requirements of mediation. In addition, the residual direct effect of fluency on harm ratings remained significant in this regression, β=-.29, F(1, 18.06)=4.8, p=.042, which indicates that the effect of fluency on harm ratings was partially mediated by novelty. No other terms related to question order were significant predictors of harm ratings, all F<1.

Discussion

In sum, these findings indicate (i) that disfluently processed stimuli are perceived as more novel and (ii) more hazardous than fluently processed stimuli. Moreover, the impact of fluency on perceived risk is (iii) partially mediated by perceived novelty. While these findings indicate that processing fluency can influence judgments of risk through their impact on perceived stimulus familiarity, the partial mediation leaves room for a possible contribution of fluency elicited affect. Previous research showed that high processing fluency is experienced as positive (Reber et al., 2004) and gives rise to spontaneous positive affective reactions that can be captured with electromyography

(Winkielman & Cacioppo, 2001). Positive affect consistently results in more positive evaluations (for a review see Schwarz & Clore, 2007). Accordingly, it should attenuate judgments of undesirable risks but increase judgments of desirable risks. Study 3 tests this possibility.

Study 6

Amusement park rides offer a desirable sense of adventure and excitement but are also associated with the undesirable possibility of making one feel sick. Taking advantage of this ambiguity, we presented participants with easy or difficult to pronounce names of amusement park rides, asking some of them to identify rides that are adventurous and exciting and others to identify rides that are too risky, and hence likely to make them feel sick. If fluency-elicited affect is a major contributor to risk perception, it should result in differential effects on judgments of desirable and undesirable risks. No such differential effects should be observed if fluency effects on risk perception are primarily driven by perceived familiarity.

Methods

Pretest. Based on pretest ratings (N = 15) of 20 Native American names we selected 3 easy-to-pronounce (Chunta, Ohanzee, and Tihkoosue) and 3 hard-to-pronounce names (Vaiveahtoishi, Tsiischili, and Heammawihio). The easy names (α=.6, M=4.91 with 7=very easy) were significantly easier to pronounce than the hard names (α=.8, M=3.13), $t(14)=3.04$, $p<.01$, $p_{rep}=.95$, $d=1.4$. In addition, the easy names (α=.61, M=4.45 with 7=very pleasant) were rated as more pleasant than hard names (α=.80, M=3.67), $t(13)=3.03$, $p<.01$, $p_{rep}=.95$, $d=1.17$, consistent with the usually observed positive effect of fluency on liking (Reber et al., 2004). The pre-test results are presented in Table 3.1..

Participants and procedures. Thirty-five students participated for course credit and were randomly assigned to the conditions of a 2 (easy vs. difficult to pronounce names) x 2 (desirable vs. undesirable risk) factorial design.

All participants were asked to imagine that they are visiting an amusement park and are handed a brochure with the names of the rides offered. Participants assigned to the *desirable risk condition* further imagined that they want to identify “very exciting and

adventurous rides" on the basis of the brochure so they would not "waste time on dull ones." Next, they were asked to report their "impression of how adventurous each ride would be" (1 = very dull, 7 = very adventurous). In contrast, participants assigned to the *undesirable risk condition* were asked to imagine that their amusement park visit falls on "a day when you are not feeling very well" and that they want to avoid the rides that "are too risky and adventurous" and guess which ones "are the most risky and hence most likely to make you sick." Next, they rated the risk associated with each ride (1 = very safe, 7 = very risky).

In both conditions, the 3 easy and 3 difficult-to-pronounce names were presented in two random orders. Order of presentation did not affect the results (all $F < 1$*)* and was dropped from analysis.

Results and Discussion

Consistent with Studies 4 and 5, participants assigned to the undesirable risk condition perceived rides with difficult-to-pronounce names as riskier (M=4.35) than rides with easy-to-pronounce names (M=3.02), $t(18)=4.36$, $p<.001$, $p_{rep}=.99$, $d=1.48$. Similarly, participants assigned to the desirable risk condition perceived rides with difficult-to-pronounce names as less dull and more adventurous (M=4.04) than rides with easy-to-pronounce names (M=3.06), $t(15)=2.94$, $p=.01$, $p_{rep}=.95$, $d=1.08$. These parallel effects of processing fluency on perceptions of desirable and undesirable risk are reflected in a main effect of ease of pronunciation, $F(1, 33) = 26.18$, $p<.001$, $p_{rep}=1$, $\eta_p^2 =.442$ that is not qualified by an interaction with the desirability of the rated risk, $F(1,33) = .61$, $p=.44$, $p_{rep}=.42$, $\eta_p^2=.018$. The results are presented in Figure 3.1.

In sum, low processing fluency increased perceptions of desirable as well as undesirable risks. This pattern is compatible with the assumption that fluency influences risk perception through its effects on the perceived novelty of the stimuli (Study 2) and difficult to reconcile with the assumption that fluency-elicited affect plays a major role in the observed results.

General Discussion

In combination, the present results consistently show that people perceive disfluent stimuli as riskier than fluent stimuli. In Studies 4 and 5, this phenomenon was observed

for an undesired risk, namely the perception of hazards imposed by food additives. Participants evaluated substances with difficult-to-pronounce names as more hazardous than substances with easy-to-pronounce names. In addition, Study 5 showed that participants perceived substances with difficult-to-pronounce names as newer and less familiar than substances with easy-to-pronounce names. More important, the perceived novelty of the substance mediated the effect of fluency on perceived risk. Finally, the results of study 6 indicate that the observed fluency effect generalizes to domains in which high risk is considered desirable and has positive connotations, namely the adventurousness of amusement park rides. Participants expected that rides with difficult-to-pronounce names would be more exciting and adventurous than rides with easy-to-pronounce names. Throughout, the observed effects are consistent with the assumption that the perceived familiarity/novelty of a stimulus can serve as a heuristic cue in judgments of risk. Moreover, the predicted fluency-familiarity-risk link has been observed for risks that are considered undesirable, like the hazards imposed by food additives, as well as for risks that are considered desirable, like the adventurousness of amusement park rides. That the same mechanism can increase judgments with negative (hazard) as well as positive (adventurousness) connotations suggests that affect does not play a key role in the influence of fluency on perceptions of risk. Future research may test this conclusion more directly by including a misattribution manipulation that undermines the informative value of any affect that may be experienced (Schwarz & Clore, 1983).

Although it has long been assumed that the preference for fluent and familiar stimuli over disfluent and unfamiliar ones reflects that familiarity indicates safety (e.g., Zajonc, 1980), there has been no research that directly addressed the link between processing fluency and perceptions of risk/safety. The present studies fill this gap, using domains in which risk perception plays an important role in everyday life, namely the safety of food additives and the adventurousness of certain entertainment activities. Another domain where risk perception plays an important role can be economic behaviors such as stock market investment. In fact, one study showed that people expected that stocks with easy-to-pronounce names would do better than hard-named stocks, and easy-named stocks actually experienced the early boost in the stock market (Alter & Oppenheimer, 2006). Even though this research did not directly tap the

participants' risk perception, this phenomenon also might be explained by perceived risk of the stock rather than mere preference. Future research can investigate how fluency can affect people's risky economic behaviors.

Our findings also suggest that marketers may use fluency in a strategic way to influence the impressions that consumers form of their products. For instance, food additives will seem less hazardous when labeled with an easy-to-pronounce name rather than a chemical term, whereas the gear for high risk sports may benefit from names that are less fluent. Moreover, product names may also be varied to alert consumers of associated risks. For example, medications that carry a high risk may be less likely to be overused when labeled with a disfluent name, whereas fluent names may reduce perceived risk for medications intended for daily use. Future research may fruitfully explore these conjectures, paying close attention to whether the effect of name disfluency washes out over time, as may be expected when the name becomes familiar with repeated product use.

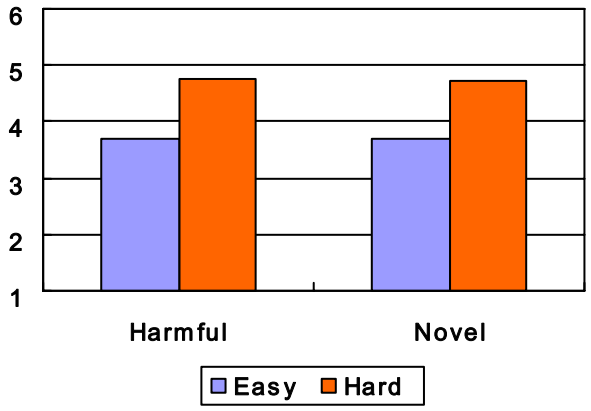

Figure 3.1. Perceived hazard and novelty of the easy and hard named food additives (Study 5)

Table 3.1. Ease of pronunciation and pleasantness of sounds for easy and hard names

	Easy names		
	Chunta	Ohanzee	Tihkoosue
Ease	5.4(1.99)	5.07(1.79)	4.27(1.71)
Pleasant	4.4(1.12)	4.4(1.76)	4.2(1.52)

	Hard names		
	Vaiveahtoishi	Tsiischili	Heammawihio
Ease	2.73(1.87)	3.07(1.79)	3.6(1.72)
Pleasant	3.71(1.49)	3.27(1.79)	3.73(1.49)

References

Alhakami, A. S., & Slovic, P. (1994). A psychological study of the inverse relationship between perceived risk and perceived benefits. *Risk Analysis, 14*, 1085-1096.

Alter, A. A., & Oppenheimner, D. M. (2006). Predicting stock price fluctuations using processing fluency. *Proceedings of the National Academy of Sciences.*

Alter, A. A., Oppenheimer, D. M., Epley, N., & Norwick, R. (2006). *Overcoming intuition: Metacognitive difficulty activates analytic reasoning.* Unpublished manuscript, Princeton University.

Haber, R. N., & Hershenson M. (1965). The effects of repeated brief exposures on growth of a percept. *Journal of Experimental Psychology, 69*, 40-46.

Harless, D. W., & Camerer, C. F. (1994). The predictive utility of generalized expected utilitity theories. *Econometrica, 62*, 1251-1289.

Jacoby, L.L. & Dallas, M. (1981). On the relationship between autobiographical memory and perceptual learning. *Journal of Experimental Psychology: General, 110*,306-340.

Judd, C. M., Kenny, D. A., & McClelland, G. H. (2001). Estimating and testing mediation and moderation in within-subject designs. *Psychological Methods, 6*(2), 115-134.

Kahneman, D., & Ritov, I. (1994). Determinants of stated willingness to pay for public goods: A study in the headline method. *Journal of Risk and Uncertainty, 9*, 5-38.

Kahneman, D., Ritov, I., & Schkade, D. (1999). Economic preferences or attitude expressions? An analysis of dollar responses to public issues. *Journal of Risk and Uncertainty, 19*, 203-237.

Koriat, A., & Levy-Sadot, R. (2001). The combined contributions of the cue familiarity and accessibility heuristics to feelings of knowing. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 27,* 34-53.

Lowenstein, G. F., Weber, E. U., Hsee, C. K., & Welch, N. (2001). Risk as feelings. *Psychological Bulletin, 127*(2), 267-286.

Reber, R., & Schwarz, N. (1999). Effects of perceptual fluency on judgments of truth. *Consciousness and Cognition, 8*, 338-342.

Reber, R., Schwarz, N., & Winkielman, P. (2004). Processing fluency and aesthetic pleasure: Is beauty in the perceiver's processing experience? *Personality and Social*

Psychology Review, 8, 364-382.

Schwarz, N. (2004). Meta-cognitive experiences in consumer judgment and decision making. *Journal of Consumer Psychology, 14*, 332-348.

Schwarz, N., & Clore, G.L. (1983). Mood, misattribution, and judgments of well-being: Informative and directive functions of affective states. *Journal of Personality and Social Psychology, 45*, 513 - 523.

Schwarz, N., & Clore, G. L. (2007). Feelings and phenomenal experiences. In A. Kruglanski & E. T. Higgins (eds.), *Social psychology. Handbook of basic principles* (2nd ed.; pp. 385-407). New York: Guilford.

Schwarz, N., Sanna, L., Skurnik, I., & Yoon, C. (2007). Metacognitive experiences and the intricacies of setting people straight: Implications for debiasing and public information campaigns. *Advances in Experimental Social Psychology, 39,* 127-161.

Slovic, P. (1987). Perception of risk. *Science, 236*, 280-285.

Slovic, P, Finucane, M. L., Peters, E., & MacGegor, D. G. (2004). Risk as analysis and risk as feelings: Some thoughts about affect, reason, risk, and rationality. *Risk Analysis, 24*(2), 311-322.

Weaver, K., Garcia, S.M., Schwarz, N., & Miller, D. T. (2007). Inferring the popularity of an opinion from its familiarity: A repetitive voice can sound like a chorus. *Journal of Personality and Social Psychology, 92,* 821-833.

Whittlesea, B. W. A., Jacoby, L. L., & Girard, K. (1990). Illusions of immediate memory: Evidence of an attributional basis for feelings of familiarity and perceptual quality. *Journal of Memory and Language, 29*, 716-732.

Winkielman, P. & Cacioppo, J. T. (2001). Mind at ease puts a smile on the face: Psychophysiological evidence that processing facilitation leads to positive affect. *Journal of Personality and Social Psycholgy, 81*, 989-1000.

Zajonc, R. B. (1980). Feeling and thinking: Preferences need no inference. *American Psychologist, 35*, 151-175.

Zajonc, R. B. (1998). Emotions. In D. Gilbert, S. Fiske, & G. Kindzy (Eds.), *Handbook of social psychology* (Vol. 1, pp. 591-632). New York: Oxford University Press.

Chapter IV: Low processing fluency attenuates the Moses Illusion: Processing fluency and detection of distortions (Studies 7-8)

When asked, "How many animals of each kind did Moses take on the Ark?" most people respond "two" despite knowing that Noah rather than Moses was the actor in the biblical story (Erickson & Mattson, 1981). This "Moses illusion" bears on an important aspect of human communication: Under which conditions are distortions in utterances and texts likely to be noticed? Previous research addressed a variety of plausible accounts (for a comprehensive review see Park & Reder, 2003), including the possibility that recipients are cooperative communicators (Grice, 1975; Schwarz, 1996) who notice the distortion, but simply correct for it by responding to what the questioner "must have meant." Yet making participants aware that the text may be distorted, or asking them to identify such distortions, does not eliminate the effect (e.g., Bredart & Modolo, 1988; Reder & Kusbit, 1991), in contrast to what a conversational cooperation account would predict.

The currently best supported explanation holds that "distortion detection involves a two-pass process – the first to flag a potential mismatch and the second to invoke a careful inspection that might confirm an erroneous term in the question" (Park &Reder, 2003, p. 282; see also Reder, 1987, 1988). Distorted questions pass the first stage when the semantic overlap between the question and the person's knowledge provides a sufficient match (Carpenter & Grossberg, 1995; Metcalfe, Schwartz & Joaquim, 1993, Park & Reder, 2003), as is the case for the Moses question (e.g., Moses and Noah are both characters in the Old Testament, who received commands from God that were related to water). Low feature-overlap, on the other hand, reliably attenuates or eliminates the Moses illusion (e.g., Erickson & Mattson, 1981; van Oostendorp & de Mul, 1990); for example, it is not obtained when Moses is replaced by "Nixon" in the above question. The observation that distortions remain unnoticed under conditions of sufficient feature overlap is consistent with the assumption that "many of our cognitive operations are driven by familiarity-based heuristics rather than careful matching operations" (Park & Reder, 2003, p. 283).

Taking the notion of familiarity-based heuristics serious, we go beyond the focus on feature overlap and test whether other variables that influence impressions of familiarity also influence the detection of distortions in text. One of these variables is the fluency with which text can be processed, which can be manipulated through easy or difficult to read print fonts (for a review see Schwarz, 2004). We assume that low familiarity triggers more systematic processing and renders it less likely that people report the first answer that comes to mind. Accordingly, they should be more likely to notice distortions in text and less likely to fall prey to the Moses illusion, resulting in improved performance on distorted questions. On the other hand, low familiarity may also lead people to second guess their answers to undistorted questions, potentially hurting performance in that case. Next, we elaborate on the underlying logic and review selected findings.

Fluency, Familiarity, and Processing Style

People correctly assume that familiar material is easier to process than novel material (Schwarz, 2004). Applying this naïve theory, they infer familiarity from high processing fluency, even when the fluency merely results from presentation variables like high figure-ground contrast, long exposure times, or easy to read print fonts (for reviews see Kelley & Rhodes, 2002; Reber, Schwarz, & Winkielman, 2004; Schwarz, 2004). In memory research, this fluency-familiarity link gives rise to erroneous recognition judgments (e.g., Whittlesea, Jacoby, & Girard, 1990) and strong feelings of knowing (e.g., Koriat & Levy-Sadot, 2001). Whittlesea and colleagues' (1990), for example, reported that participants were more likely to misidentify novel words as previously seen when they were easy rather than difficult to process due to the visual clarity of the presentation format. Perceived familiarity, in turn, feeds into other judgments, including judgments of truth.

Numerous studies showed that familiar statements are more likely to be accepted as true. This is the case when perceived familiarity derives from actual previous exposure (e.g., Begg, Anas, & Farinacci, 1992; Skurnik, Yoon, Park, & Schwarz, 2005) as well as when it derives from fluent processing. For example, Reber and Schwarz (1999) found that statements like "Orsono is a city in Chile" were more likely to be judged true when the color contrast of the print font made them easy rather than difficult to read. Similarly,

McGlone and Tofigbaksh (2000) observed that substantively equivalent statements were more likely to be accepted as true when presented in a rhyming (e.g., "woes unite foes") rather than a non-rhyming form (e.g., "woes unite enemies"). This familiarity-truth link reflects that the familiarity of a statement serves as a social consensus cue – if it seems familiar, we presumably heard it before and the belief may be widely shared (for a review see Schwarz, Sanna, Skurnik, & Yoon, 2007). Accordingly, manipulations that increase the perceived familiarity of a belief also increase estimates of how many people share it (Weaver, Garcia, Schwarz, & Miller, 2007). Perceived social consensus, in turn, can serve as a basis for assessing the truth value of beliefs, as Festinger (1954) suggested – if many believe it, there's probably something to it.

These observations indicate that familiar material is more likely to be accepted as true. Given its apparent truth value, familiar material may also receive less scrutiny and less detail-oriented processing than unfamiliar material. Consistent with this conjecture, familiar persuasive messages receive less systematic processing than unfamiliar ones (Claypool, Mackie & Garcia-Marques, 2004; Garcia-Marques & Mackie, 2001) and the familiarity of a person description increases stereotyping, which presumably reflects a heuristic rather than systematic processing strategy (Smith, Miller, & Maitner, 2006).

Finally, people report more confidence in the accuracy of their own thoughts when they are easy rather than difficult to bring to mind (for a review see Petty, Brinol, Tormala, & Wegener, 2007). In combination, these diverse findings indicate that fluently processed material seems more familiar, is more likely to be accepted as true and less likely to be scrutinized. Moreover, people may have more confidence in the associations triggered by such material and may be less likely to second guess them.

The Present Research

Building on this work, the present studies address the role of processing fluency in the detection of distortions in texts. To manipulate processing fluency, we presented an undistorted control question and the Moses question (Study 7) or a variant (Study 8) in an easy or difficult to read print font. Consistent with the research reviewed above, we assume that the text seems less familiar when presented in a difficult rather than easy to read font and that low familiarity triggers more systematic processing. Accordingly, participants who are asked, "How many animals of each kind did Moses take on the

Ark?" should be less likely to rely on their spontaneous association ("two") and more likely to scrutinize the text when the text is difficult to read, realizing that the biblical actor was not Moses. Hence, low fluency should improve performance on distorted questions. However, processing fluency may also affect participants' performance on an undistorted control question, like "Which country is famous for cuckoo clocks, banks and pocket knives?" The less familiar the text seems, the fewer participants may rely on their spontaneous association (Switzerland); if so, low fluency may potentially impair performance on an undistorted question.

Study 7

Method

Pretest of font ease. Five undergraduates read the sentence "Switzerland is famous for cuckoo clocks, banks and pocket knives" printed in light grey brush script MT font with font size 12; another five read the same sentence in black Arial font with font size 12. The sample sentences are presented in Figure 4.1. Participants rated the ease with which they could read the text (1 = very difficult, 7 = very easy). Confirming the intended variation in ease of reading, they reported that the Arial font was easier to read ($M = 6.8$, $SD = .45$) than the Brush Script MT font ($M = 4.2$, $SD = 1.3$), $t(8) = 4.22$, $p < .01$.

Main experiment. Thirty-two undergraduates participated for course credit. They were randomly assigned to an *easy*- vs. *difficult-to-read* condition. The instructions (modeled after Erickson & Mattson, 1981) read, "You will read couple of trivia questions and answer them. You can write the answer in the blank. In case you do not know the answer, please write 'don't know.' You may or may not encounter ill-formed questions which do not have correct answers if taken literally. For instance, you might see the question 'Why was President Gerald Ford forced to resign his office?' In fact, Gerald Ford was not forced to resign. Please, write 'can't say' for this type of questions."

Depending on condition, participants were presented with two questions printed in a hard-to-read or easy-to-read font, as described above. The first (control) question did not have a distortion. It read, "Which country is famous for cuckoo clocks, chocolate, banks, and pocket knives?" (Switzerland). The second, distorted question read, "How many animals of each kind did Moses take on the Ark?" (taken from Erickson & Mattson, 1981). This question replaces the correct actor, Noah, with Moses and should be

answered “can’t say.” Answering “2” indicates the Moses illusion.

Results

Distorted question. As predicted, a difficult-to-read print font attenuated the Moses illusion. As shown in Table 4.1, 88% (15 out of 17) of the participants answered “2” in response to the Moses question when the font was easy to read, whereas only 53% (8 out of 15) did so when it was difficult to read, $z = 2.5$, $p < .02$ (contrast on proportions, Rosenthal & Rosnow, 1985). Conversely, when the font was easy to read, 6% (1 out of 17) of the participants provided the correct answer “can’t say,” whereas 40% (6 out of 15) did so when the font was difficult to read, $z = 2.66$, $p<.01$.

Undistorted question. None of the participants answered ‘can’t say’ to the control question, indicating that they did not consider it distorted. Nevertheless, the print font affected their answers, as shown in Table 4.1. When the font was easy to read, 88% (15 out of 17) of the participants correctly answered “Switzerland,” whereas only 53% (8 out of 15) did so when it was difficult to read, $z = 2.5$, $p < .02$. Moreover, participants were more likely to name a country other than Switzerland, $z = 2.27$, $p < .03$, and to report that they “don’t know,” $z=1.97$, $p<.05$, when the font was hard rather than easy to read.

In sum, low processing fluency, induced through a difficult to read print font, improved performance on a distorted question and impaired performance on an undistorted question, as theoretically predicted. Study 8 tests the robustness of this finding with a different distorted question.

Study 8

Method

This experiment followed the procedures of Study 7, except that the distorted question read, “In the biblical story, what was Joshua swallowed by?” (taken from Erickson & Mattson, 1981). This question replaces the correct actor Jonah with Joshua and should be answered with “can’t say;” answers like “whale” or “fish” indicate the illusion. Sixty undergraduates participated for course credit and were randomly assigned to the easy- or difficult-to-read condition.

Results

Distorted question. As shown in Table 4.2, the results replicate the earlier findings. 47% (14 out of 30) of the participants answered “fish” or “whale” in response to the

Joshua question when the font was easy to read, whereas only 23% (7 out of 30) did so when it was difficult to read, $z = 2.09$, $p < .04$ (contrast on proportions, Rosenthal & Rosnow, 1985). Conversely, 40% (12 out of 30) correctly answered "can't say" when the font was difficult to read, whereas only 23% (7 out of 30) did so when it was easy to read, $z = 1.41$, $p = .16$. Finally, 9 participants (30%) in the easy-to-read condition and 11 participants (37%) in the hard-to-read condition reported that they did not know the answer, reflecting that the Jonah story is less well known than the Noah's Ark story used in Study 7.

Undistorted question. Participants' answers to the undistorted question also followed the pattern of Study 7, although the differences failed to reach significance (see Table 2). Again, more participants answered "don't know" the font was difficult rather than easy to read, $z = 1.48$, $p = .14$, and fewer provided the correct answer "Switzerland," $z = 1.02$, *ns*.

Combined Analysis

To assess the robustness of the results across both experiments, we used Rosenthal's (1978) procedures for combining results of independent studies. This analysis confirms the overall reliability of the observed patterns. When the question was *distorted*, participants were less likely to give an erroneous substantive answer, $z = 3.26$, $p < .002$, and more likely to recognize the distortion (as indicated by answering "can't say), $z = 2.89$, $p < .004$, when the font was difficult rather than easy to read. When the question was *undistorted*, participants were less likely to give a correct substantive answer, $z = 2.5$, $p < .02$, and more likely to report that they "don't know", $z = 2.45$, $p < .02$, when the font was difficult rather than easy to read.

Discussion

The present studies extend our understanding of the role of processing fluency in human judgment. Earlier research indicated that fluently processed material seems more familiar (Kelley & Rhodes, 2002; Schwarz, 2004), is more likely to be accepted as true (McGlone & Tofighbahsh, 2000; Reber & Schwarz, 1999), and less likely to be scrutinized (Claypool, Mackie & Garcia-Marques, 2004; Garcia-Marques & Mackie, 2001). Moreover, opinions based on fluently processed material are held with greater confidence (Petty et al., 2007), whereas disfluent processing reduces confidence and

fosters decision deferral (Novemsky, Dhar, Schwarz, & Simonson, 2007). Our findings suggest that the same logic applies to the process of question answering. When the question is easy to process, the content seems familiar and people rely on the first answer that comes to mind, probably feeling that the answer is pretty obvious. When the question is difficult to process, the material seems less familiar and people may be less inclined to assume that their first association is the correct one.

How this affects performance depends on the nature of the question. When the question is distorted -- as in "How many animals of each kind did Moses take on the Ark?" --closer consideration reveals that Moses was not the biblical actor and hence one's spontaneous answer "2" does not apply. But the same signal of low familiarity may make one wonder whether Switzerland is really the land of cuckoo clocks and pocket knives, fostering an erroneous "don't know" response. Hence, low processing fluency improves performance when one's spontaneous answer is wrong, but impairs performance when one's spontaneous answer is correct.

Note that this diverging influence of processing fluency on answers to distorted and undistorted questions is incompatible with a potential concern arising from our use of print fonts as a fluency manipulation. Reading a question printed in a difficult font presumably requires more attention and this alone may be sufficient to facilitate distortion detection. Yet increased attention would not predict the observed impaired performance on an undistorted question. Next we turn to the broader implications of these findings.

Detecting Distortions in Text

Most accounts of the Moses illusion assign a prominent role to the semantic overlap between the question and participants' knowledge (for a review see Park & Reder, 2003). Our findings suggest that semantic overlap is just one of the many variables that facilitate fluent processing, giving rise to a feeling of familiarity. Hence, any of the variables known to affect processing fluency should also affect the size of the Moses illusion, consistent with the observation that "many of our cognitive operations are driven by familiarity-based heuristics rather than careful matching operations" (Park & Reder, 2003, p. 283). Relevant variables include semantic (e.g., Reder, 1988) and phonetic (e.g., Shafto & MacKay, 2000) similarity as well as all presentation variables that facilitate

fluent processing (for a review see Reber et al., 2004). In the case of visual presentations, prime candidates include the readability of the print font (as in the present studies), the degree of figure-ground contrast, the presence or absence of visual noise, and exposure frequency and duration. In the case of auditory presentations, prime candidates include the acoustic clarity of the presentation and the presence or absence of distracting noise. Moreover, presentation variables that impair processing fluency should lose their impact when participants' attention is drawn to them, thus inviting an attribution of the experienced difficulty to the contextual variable rather than the to-be-processed material (see Schwarz, 2004, for a review).

Ironically, these variables run counter to what common sense would suggest. When asked to advise a communicator on how to present material in a way that minimizes the detection of semantic distortions, most readers would probably opt for presentation formats that "hide" the distortion rather than for presentation formats that facilitate easy processing. Yet our data suggest that it is exactly *easy* processing that interferes with distortion detection, presumably by fostering the perception that the material is familiar.

Fluency and Processing Style

From a broader perspective, the subjective experience of processing difficulty may influence individuals' processing strategies in ways that parallel the influence of other experiential "problem" signals. Previous research found, for example, that sad moods (e.g., Bless, Bohner, Schwarz, & Strack, 1990) or bodily avoidance feedback (e.g., Friedman & Förster, 2000) foster more detail-oriented analytic processing, presumably because they alert the person of a potential "problem" that requires attention (for comprehensive reviews see Schwarz, 2002; Schwarz & Clore, 2007). Consistent with this conjecture, Alter, Oppenheimer, Epley, and Norwick (2007) reported that manipulations that increased experienced processing difficulty improved participants' performance on reasoning tasks by evoking a more analytic processing style. This possibility provides a promising avenue for future research.

Figure 4.1. Easy-to-read (top) and difficult-to-read (bottom) font samples.

Table 4.1: Frequency of answers in Study 7

	Moses Question (Distorted)			
	2	Don't know	Can't say	Total
Easy to read	88% (15/17)	6% (1/17)	6% (1/17)	100% (17/17)
Hard to read	53% (8/15)	7% (1/15)	40% (6/15)	100% (15/15)
	Switzerland Question (Undistorted)			
	Switzerland	Don't know	Other countries	Total
Easy to read	88% (15/17)	6% (1/17)	6% (1/17)	100% (17/17)
Hard to read	53% (8/15)	20% (3/15)	26% (4/15)	100% (15/15)

Table 4.2: Frequency of answers in Study 8

	Joshua Question (Distorted)			
	Whale or fish	Don't know	Can't say	Total
Easy to read	47% (14/30)	30% (9/30)	23% (7/30)	100% (30/30)
Hard to read	23% (7/30)	37% (11/30)	40% (12/30)	100% (30/30)

	Switzerland Question (Undistorted)			
	Switzerland	Don't know	Other countries	Total
Easy to read	63% (19/30)	20% (6/30)	17% (5/30)	100% (30/30)
Hard to read	50% (15/30)	37% (11/30)	13% (4/30)	100% (30/30)

References

Alter, A. A., Oppenheimer, D. M., Epley, N., & Norwick, R. (2007). Overcoming intuition: Metacognitive difficulty activates analytic reasoning. *Journal of Experimental Psychology: General, 136*(4), 569-576.

Begg, I. M., Anas, A., & Farinacci, C. (1992). Dissociation of processes in belief: Source recollection, statement familiarity, and the illusion of truth. *Journal of Experimental Psychology: General*, *121*, 446-458.

Bless, H., Bohner, G., Schwarz, N., & Strack, F. (1990). Mood and persuasion: A cognitive response analysis. *Personality and Social Psychology Bulletin, 16*, 331-345.

Bredart, S., & Modolo, K. (1988). Moses strikes again; Focalization effect on a semantic illusion. *Acta Psycologica, 67*(2), 135-144.

Carpenter**,** G & Grossberg, S. (1995). A neural network architecture for autonomous learning, recognition, and prediction in a nonstationary world. In S. F., Zornetzer, J. L., Davis, C., Lau, & T., McKenna (Ed.), *An introduction to neural and electronic networks (2nd Ed)* (pp. 465-482*).* San Diego, CA, US: Academic Press, Inc.

Claypool, H. M., Mackie, D. M., & Garcia-Marques, T. (2004). The effects of personal relevance and repetition on persuasive processing. *Social cognition, 22*(3), 310-335.

Erickson, T. A., & Mattson, M. E. (1981). From words to meaning: A semantic illusion. *Journal of Verbal Learning and Verbal Behavior, 20*, 540-552.

Festinger, L. (1954). A theory of social comparison processes. *Human Relations, 7,* 123-146.

Friedman, R.S., & Förster, J. (2000). The effects of approach and avoidance motor actions on the elements of creative insight. *Journal of Personality and Social Psychology*, *79*, 477-492.

Garcia-Marques, T., Mackie, D.M. (2001) The feeling of familiarity as a regulator of persuasive processing. *Social Cognition, 19*(1), 9-34.

Grice, H. P. (1975). Logic and conversation. In P. Cole, & J.L. Morgan (Eds.), *Syntax and semantics, Vol.3: Speech acts* (pp. 41 - 58). New York: Academic Press.

Kelley, C. M., & Rhodes, M. G. (2002). Making sense and nonsense of experience: Attributions in memory and judgment. *The Psychology of Learning and Motivation,*

41, 293-320.

Koriat, A., & Levy-Sadot, R. (2001). The combined contributions of the cue familiarity and accessibility heuristics to feelings of knowing. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 27,* 34-53.

McGlone, M. S., & Tofighbakhsh, J. (2000). Birds of a feather flock conjointly (?): Rhyme as Reason in Aphorisms, *Psychological Science, 11*, 424-428.

Metcalfe, J., & Schwartz, B. L., Joaquim, S. G.. (1993) The cue-familiarity heuristic in metacognition. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 19*, 851-864.

Novemsky, N., Dhar, R., Schwarz, N., & Simonson, I. (2007). Preference fluency in consumer choice. *Journal of Marketing Research. 14*(3), 347-369

Park, H & Reder, L. M, (2003). Moses illusion. In R. F. Pohl (Ed.), *Cognitive illusions* (pp. 275-292). New York, NY: Psychology Press.

Petty, R. E., Brinol, P., Tormala, Z. L., & Wegener, D. T. (2007). The role of metacognition in social judgment. In A. Kruglanski & E. T. Higgins (eds.), *Social psychology. Handbook of basic principles* (2nd ed.; pp. 385-407). New York: Guilford.

Reber, R., & Schwarz, N. (1999). Effects of perceptual fluency on judgments of truth. *Consciousness and Cognition, 8*, 338-342.

Reber, R., Schwarz, N., & Winkielman, P. (2004). Processing fluency and aesthetic pleasure: Is beauty in the perceiver's processing experience? *Personality and Social Psychology Review, 8,* 364-382.

Reder, L. M. (1987). Strategy selection in question answering. *Congnitive Psychology*, 19, 90-138.

Reder, L. M. (1988). Strategic control of retrieval strategies. In G. Bower (Ed.), *The psychology of learning and motivation* (Vol. 22). San Diego, CA: Academic Press.

Reder, L. M., & Kusbit, G.W. (1991). Locus of the Moses illusion: Imperfect encoding, retrieval or match? *Journal of Memory and Language, 30,* 385-406.

Rosenthal, R. (1978). Combining results of independent studies. *Psychological Bulletin,85,* 185-193.

Rosenthal, R. & Rosnow, R. (1985). *Contrast analysis: Focused comparisons in the*

analysis of variance. Cambridge, MA: Cambridge University Press.

Schwarz, N. (1996). *Cognition and communication: Judgmental biases, research methods, and the logic of conversation*. Hillsdale, NJ: Erlbaum.

Schwarz, N. (2002). Situated cognition and the wisdom of feelings: Cognitive tuning. In L. Feldman Barrett & P. Salovey (Eds.), *The wisdom in feelings* (pp.144-166). New York: Guilford.

Schwarz, N. (2004). Meta-cognitive experiences in consumer judgment and decision making. *Journal of Consumer Psychology, 14*, 332-348.

Schwarz, N., & Clore, G. L. (2007). Feelings and phenomenal experiences. In A. Kruglanski & E. T. Higgins (eds.), *Social psychology. Handbook of basic principles* (2nd ed.; pp. 385-407). New York: Guilford.

Schwarz, N., Sanna, L., Skurnik, I., & Yoon, C. (2007). Metacognitive experiences and the intricacies of setting people straight: Implications for debiasing and public information campaigns. *Advances in Experimental Social Psychology, 39,* 127-161.

Shafto, M., & MacKay, D. G. (2000). The Moses, Mega-Moses, and Armstrong illusions: Integrating language comprehension and semantic memory. *Psychological Science, 11,* 372-378.

Skurnik, I., Yoon, C., Park, D.C., & Schwarz, N. (2005). How warnings about false claims become recommendations. *Journal of Consumer Research, 31*, 713-724.

Smith, E. R., Miller, D.A., & Maitner, A.T. (2006). Familiarity can increase stereotyping. *Journal of Experimental Social Psychology, 42*(4), 471-478.

Van Oostendorp, H., & de Mul, S. (1990). Moses beats Adam: A semantic relatedness effect on a semantic illusion. *Acta Psychologica, 74*, 35-46.

Whittlesea, B. W. A., Jacoby, L. L., & Girard, K. (1990). Illusions of immediate memory: Evidence of an attributional basis for feelings of familiarity and perceptual quality. *Journal of Memory and Language, 29*, 716-732.

Weaver, K., Garcia, S.M., Schwarz, N., & Miller, D. T. (2007). Inferring the popularity of an opinion from its familiarity: A repetitive voice can sound like a chorus. *Journal of Personality and Social Psychology, 92,* 821-833.

Chapter V: Conclusions

This dissertation documents the effects of processing fluency on judgments and processing style. Particularly, this dissertation demonstrates the fluency effects on novel judgment domains, such as effort prediction and risk perception, and the Moses illusion task which examines people's processing style.

This research is based on the proposition that people's judgments and processing styles are not only influenced by deliberate processing of information content but also by subjective experiences associated with information processing (Schwarz & Clore, 2007). One of these experiences is how easy or difficult it feels to process the information, and previous research has shown that the feeling of fluency influences various judgments such as familiarity, truth, and preference based on affect generated by fluency and naïve theories that people have regarding the relationship between information processing and the world or mental processes (for review, see Schwarz, 2004).

Especially, these effects are considered to be driven by a misattribution process called the "how do I feel about it" heuristic (Higgins, 1998; Schwarz & Clore, 1983). When making judgments, people ask themselves "how do I feel about this?" and use their current feelings as information to evaluate the target. Since people tend to be insensitive to the source of their feelings, as long as they do not identify the true source of their feelings, they attribute their incidental feelings to the target of judgments. Fluency can be one of these feelings that are attributed to the judgment domain at hand.

Summary of Findings

The results from eight experiments presented in this dissertation confirm this proposition. Throughout, the results show that while stimuli content or knowledge of stimuli were equivalent, the variable which influences feeling of ease such as print fonts and pronunciation ease influences judgments and processing style.

In the first essay, the exercise instructions and recipes led to differential estimation of effort when they were printed in fonts with different levels of ease. This effect held even when the content of the instructions and memory of this content were

identical across the conditions. These results imply that people's effort of reading or mental simulation is misattributed to the effort of doing.

In the second essay, hard-to-pronounce food additives and amusement park rides were perceived as riskier than easy-to-pronounce ones. The results also showed that easy-to-pronounce food additives were perceived as more novel and this perceived novelty mediated the fluency effect on risk perception. In addition, regardless of whether the risk was desirable (excitement and adventure) or undesirable (making one sick), disfluency always led to higher risk assessment. Therefore, these results confirmed that the fluency effect on risk perception is not a simple judgment of desirability driven by positive-negative affect associated with fluency-disfluency, respectively, but is driven by a feeling of familiarity.

The third essay examined fluency effects on processing style. The results showed that people more easily detected semantic distortions of a misleading question such as "How many animals of each kind did Moses take on the Ark?" when the question was hard to read than easy to read. In addition, participants also reported more 'don't know' answers when there was no distortion in a question. These results suggest that disfluency functions as a potential problem signal, generates more careful processing, and takes people's responses away from spontaneous answers.

Theoretical implications

While the fluency effect has been mainly studied in terms of preference, truth, and familiarity, the present findings demonstrated the effects of fluency on novel domains of judgment, effort prediction and risk perception, and processing style that were rarely examined previously in terms of processing fluency.

The first essay taps into an important area of research, prediction of effort, which is very prevalent in everyday life but rarely investigated. While previous research has mainly dealt with how thought content regarding tasks (e.g, Buehler, Griffin, & Ross, 1994) influences judgments of effort, the present research proposes that feelings associated with thought processes can act as a factor to influence effort prediction. While it is not yet clear whether these feelings are simply associated with reading or also with mental simulation, the present results show that feelings particularly relevant to the domain of judgments can be utilized as information in judgments.

The second essay confirms the previously proposed 'risk-as-feelings' hypothesis (Loewenstein, Weber, Hsee, & Welch, 2001; Slovic, et. al., 2004) and proposes that the feeling of fluency is indicative of level of risks. While previous research has focused on the apparently substantial feelings such as dread and anxiety (Loewenstein, Weber, Hsee, & Welch, 2001), the present research demonstrates that small differences in information presentation which influences feeling of fluency can lead to big differences in risk perception.

The results from the third essay are consistent with the conjecture that any experiential information that alerts the person to a potential "problem" leads to careful inspection of the stimuli at hand. The previous research showed that a sad mood (e.g., Bless, Bohner, Schwarz, & Strack, 1990) and avoidance bodily movement (e.g., Friedman & Förster, 2000) worked as this "problem signal" and led to careful information processing. The present research proposes that feelings associated with cognitive processes can also have informational value regarding the state of environments.

Practical implications

These findings also have a lot of practical implications. Many decisions in everyday life involve estimation of effort. As shown in the first essay, predicting hard work may decrease motivation for various tasks such as exercise and cooking. In addition, people also predict how much effort is put in to a certain product to estimate whether the price is fair. In some domains such as organic products, less effort and processing of materials are more valued while in others, such as hand-made products, more effort is valued. Therefore, depending on the desirability of effort, marketers may want to present their product information either in easy-to-process or in difficult-to-process ways. Policy makers may also want to pay attention to the fluency of product information to prevent consumers being deceived by these feelings.

Many situations in everyday life also involve estimation of risks, and these risks can be either desirable or undesirable. For instance, insurance and food industries may value low risks associated with their products. Since fluency leads to low risk assessment, marketers may want to present their product names or information in easy-to-process way. On the other hand, there are also products where risks can be desirable, as in adventure rides and risk-seeking sports. In these domains, hard-to-process product names or

information may be more profitable. In addition, policy makers also may want to pay careful attention not only to the content of product information but also to fluency associated with this content in order to prevent consumers becoming aware of the actual level of risks associated with the products, especially in a high stakes product domain such as health care products.

Fluency effects on processing style also have implications for message designing. Fine prints are commonly used to deceive consumers of undesirable information related to products. This may prevent consumers from noticing and reading the information. However, as long as the information is noticed, hard-to-process presentation of deceptive information may generate even more careful processing of the information.

Future directions

This dissertation focused on the effects of ease in information processing. While feeling of difficulty can come from cognitive difficulty in information processing, it can also come from bodily feelings. Future research can deal with whether the bodily experience of difficulty can lead to the same effect. For instance, haptic experience of roughness, such as filling out a questionnaire on a rough paper, or the bodily experience of heaviness, such as wearing a heavy backpack, may generate similar effects as fluency since they are all associated with a feeling of difficulty. If people misattribute their feeling of physical difficulty on tasks at hand as they did with the fluency experience, any type of physical difficulty experience may also influence effort prediction, risk perception, and processing styles.

Each essay can lead to much promising future research. The mechanism underlying effort prediction in the first essay is not yet obvious, and future research might address this issue more closely. Previous research has shown that when reading names of manipulable objects, such as hammer, the neural circuit corresponding to that manipulation (e.g., grasping) is activated (e.g., Chao & Martin, 2000). If mental simulation is used in effort prediction of activities in the first essay, there is a possibility that fluency also influences the speed of activation of the neural circuits corresponding to the movements described in the instructions. Future research using brain imaging may be able to tap into the issue of whether the present findings are based on embodied effects.

Since fluency influences risk perception as demonstrated in the second essay,

there is vast possibilities that fluency may also influence risk related decisions. For instance, status quo bias may emerge more when choice sets are harder to process. In addition, safer options may be chosen more when choices are presented in a hard-to-process way and this effect may be mediated by perceived risks of the choice situation itself. In addition, depending on the individual difference of risk-seeking tendencies, preference of fluency-disfluency may vary: risk-seeking people may prefer hard-to-process stimuli while risk-averse people may prefer easy-to-process stimuli. Future research can be extended to decision tasks and individual differences.

Future research can also examine whether the results from the third essay can be extended to various problems that require careful information processing. For instance, future research may address whether disfluency can increase the accuracy of the responses to multiple choice questions with misleading decoys and whether noticeable yet hard-to-process warning signs are processed more carefully than easy-to-process warning signs.

Reference

Bless, H., Bohner, G., Schwarz, N., & Strack, F. (1990). Mood and persuasion: A cognitive response analysis. *Personality and Social Psychology Bulletin, 16*, 331-345.

Buehler, R., Griffin, D., & Ross, M. (1994). Exploring the 'planning fallacy': why people underestimate their task completion times. *Journal of Personality and Social Psychology, 67*(3), 366-381.

Chao, L. L., & Martin, A. (2000). Representation of manipulable man-made objects in dorsal streams. *Neuroimage, 12*, 478-484.

Friedman, R.S., & Förster, J. (2000). The effects of approach and avoidance motor actions on the elements of creative insight. *Journal of Personality and Social Psychology*, *79*, 477-492.

Higgins, E. T. (1998). The aboutness principle: A pervasive influence on human inference. *Social Cognition, 16*, 173-198.

Lowenstein, G. F., Weber, E. U., Hsee, C. K., & Welch, N. (2001). Risk as feelings. *Psychological Bulletin, 127*(2), 267-286.

Schwarz, N. (2004). Meta-cognitive experiences in consumer judgment and decision making. *Journal of Consumer Psychology, 14*, 332-348.

Schwarz, N., & Clore, G.L. (1983). Mood, misattribution, and judgments of well-being: Informative and directive functions of affective states. *Journal of Personality and Social Psychology, 45*, 513 - 523.

Schwarz, N., & Clore, G. L. (2007). Feelings and phenomenal experiences. In A. Kruglanski & E. T. Higgins (eds.), *Social psychology. Handbook of basic principles* (2nd ed.; pp. 385-407). New York: Guilford.

Slovic, P, Finucane, M. L., Peters, E., & MacGegor, D. G. (2004). Risk as analysis and risk as feelings: Some thoughts about affect, reason, risk, and rationality. *Risk Analysis, 24*(2), 311-322.