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Regret Aversion and Decision Process Quality: Effect of Regret Salience on Decision Process Carefulness

Jochen REB

Singapore Management University, jochenreb@smu.edu.sg

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Jochen Reb

Singapore Management University

Address correspondence to:

Jochen Reb
Singapore Management University
Lee Kong Chian School of Business
50 Stamford Road
Singapore 178899
jochenreb@smu.edu.sg

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ABSTRACT

A considerable amount of past research has examined the effects of regret aversion on which options decision makers choose. However, past research has largely neglected to address the effect of regret aversion on the decision process. We conducted five experiments to examine the effect of making regret salient on decision process quality. We predicted that increased regret aversion would lead to more careful decision processing (cf. Janis & Mann, 1977). The results consistently supported this prediction across the different decision situations, incentive structures, regret salience manipulations, and dependent variables used in the experiments. In all experiments making regret salient led to decision makers taking significantly longer to reach a decision. In Studies 2a, 2b, and 4 it also led participants to collect significantly more information before making a choice. The results suggest that regret aversion can lead to better, in the sense of more careful, decision making. Implications and future directions are discussed.

KEYWORDS: Anticipatory Regret; Decision Process; Decision Process Quality; Regret Aversion; Regret Salience

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When making decisions, such as which job offer to accept, which house to buy, or which medical treatment to take, people often worry about the regret that might potentially result from their choice (e.g., Connolly & Zeelenberg, 2002). Regret aversion has been found to influence choices in a variety of important domains including sexual behavior (Richard, van der Pligt, & de Vries, 1996), negotiation behavior (Larrick & Boles, 1995), health-related decisions (Connolly & Reb, 2003; Wroe, Turner, & Salkovskis, 2004), consumer behavior (Simonson, 1992; Inman & Zeelenberg, 2002), and investment decisions (Seta, McElroy, & Seta, 2001).

How exactly regret aversion affects decision making has been the topic of a considerable amount of research dating back to the very beginnings of modern decision theory (Savage, 1951). However, almost all of the empirical and theoretical research has been concerned with the influence of decision makers' worries about potential future regret on *choice of option* (i.e., which option is chosen). While this research has yielded important results, it has largely neglected another potentially important role of regret aversion in decision making: its influence on the *decision process*. This paper presents several experiments on the effect of regret aversion on the decision process. Specifically, we examine whether heightened regret salience leads to more careful, higher-quality, decision processing as reflected in measures of information collection and decision duration. We start by reviewing past research on regret aversion.

Regret Aversion and Choice of Option

Most research on regret aversion has been concerned with its influence on which option is chosen. A crucial idea guiding this research has been that decision makers – rather than evaluating every option in isolation as in traditional expected utility theory – evaluate options

comparatively. This approach dates back to Savage (1951), who proposed a *minimax regret rule* for decision making under uncertainty (that is, when possible outcomes can be specified but their probabilities cannot). This rule seeks to minimize the possible post-decisional regret for having chosen the relatively worse option. To illustrate, consider a decision maker who needs to decide whether to carry an umbrella or not and anticipates two possible future states of the world: rain or sunshine (Savage, 1951, p. 56). She introspects and derives her utilities for the different outcomes, shown in Table 1, left columns. Next, she comparatively evaluates the options by calculating relative losses. To do so, she subtracts the worse outcome from the better outcome for each possible state of the world (assuming zero regret if the chosen option yielded the better outcome) conditional on the state. This yields a regret matrix as depicted in Table 1, right columns. To minimize the maximum expected regret, she chooses to carry an umbrella, because a relative maximum loss (i.e., regret) of 5 is lower than a relative maximum loss (regret) of 14.

Insert Table 1 around here

The importance of Savage's minimax regret rule lies probably less in its value as a normative and descriptive model of decision making (e.g., Edwards, 1954) than in the fact that several assumptions and characteristics of the model constitute, in whole or in part, important underlying assumptions and guiding principles of much subsequent research on regret aversion. These assumptions are (cf. Connolly & Reb, 2005):

(1) Regret is seen as *aversive*: Decision makers are regret averse and, therefore, have an incentive to avoid, or at least reduce or minimize, regret.

(2) Regret is considered *anticipatable*: In order to avoid regret, decision makers are thought to

predict its intensity for the different options under different states of the world and use these anticipated regret intensities as a basis for choosing the (expected) regret minimizing option.

(3) Anticipated regret is *a function of predicted decision outcomes* (and experienced regret a function of actual outcomes). Other aspects of a decision, such as the decision process, are not explicitly considered.

(4) The intensity of anticipated regret associated with an outcome is driven by a comparison of that outcome with *the outcome that would have resulted from the foregone alternative*, illustrating the importance of counterfactual thoughts about "what might have been" (e.g., Roese & Olson, 1995; Zeelenberg, 1999a).

This focus on the comparative evaluation of outcomes is characteristic of most subsequent work. Perhaps the most well-known example is economic *regret theory*. Loomes and Sugden (1982) define regret as arising from the post-decisional thought of the decision maker that his position would have been better had he chosen differently. Bell (1982), similarly, defines regret as resulting from making the wrong decision, "wrong in the sense that the outcome of their chosen alternative proves to be worse than could have been achieved with another alternative" (p.1156). Thus, economic regret theory models regret-averse decision makers as anticipating their future outcome regrets and taking them into account when making a choice. The main difference to the minimax regret rule is that regret theory assumes known probabilities (risky choice). It proposes that decision makers choose on the basis of a modified expected utility composed of a basic expected utility component to which a component for expected regret. In regret theory this regret component also includes anticipated rejoicing over receiving a relatively better outcome. (In subsequent work the modified expected utility of an option also includes a component for

expected disappointment / elation, e.g. Bell, 1985).

Economic regret theory was intended as a psychologically more accurate alternative to standard expected utility theory. Indeed, the theory has been able to account for Allais' paradox as well as other observed violations of axioms of standard expected utility theory (Bell, 1982). In addition, the argument can be made that taking expected regret into account when making decisions should not be considered irrational (e.g., Loomes & Sugden, 1982; Bell, 1982). In this sense, it appears to be an attractive alternative to the standard theory. Regardless of the theory's normative status, however, recent empirical research suggests that early findings supporting regret theory were due to a methodological artifact (event splitting effect), thus casting serious doubt on the theory's descriptive validity (Humphrey, 1995; Starmer & Sugden, 1993).

While both the minimax regret rule and economic regret theory seem to have failed as descriptive models of choice, the broader idea that individuals tend to prefer the regret minimizing option has been widely supported (e.g., Larrick & Boles, 1995; Mellers, Schwartz, & Ritov, 1999; Pieters & Zeelenberg, 2004; Richard, de Vries, & van der Pligt, 1998; Simonson, 1992; Zeelenberg, Beattie, de Vries, & van der Pligt, 1996; Zeelenberg & Beattie, 1997). For example, work by Mellers and colleagues (Mellers et al, 1999; Mellers, 2000) on *decision affect theory* has shown preferences to be affected by the difference in outcomes between the available options, which their model treats as anticipated regret.

Another important stream of research has shown that individuals' choices are affected by a manipulation of the expected availability of outcome feedback on the foregone option (Zeelenberg et al, 1996; Zeelenberg & Beattie, 1997). The idea is that decision makers worry less about possible future regret when they do not expect to receive outcome feedback on "what could have been." By manipulating individuals' expectations about whether they will receive

feedback on the foregone option or not, preferences towards an option can be influenced. In this way, regret aversion can be used to explain seemingly risk-averse choices. Consider a choice between a safe and a risky option. By choosing the safe option, one can typically avoid outcome feedback on the risky option and, therefore, regret. By choosing the risky option, on the other hand, one runs the risk of experiencing regret should the choice lead to a bad outcome, as one always knows what would have been had one chosen the safe alternative. By changing the situation such that decision makers expect to receive feedback on the outcome of the risky option when the safe option is chosen, thus opening up the possibility of experiencing regret, preferences can been shifted towards the riskier option (Zeelenberg et al, 1996).

Regret Aversion and the Decision Process

Clearly, research on regret aversion following the assumptions set by Savage (1951) has yielded important insights into decision making as illustrated in the examples given. However, we argue that the view of regret aversion espoused in the assumptions described above is too restrictive. We believe that the exclusive focus on the effects of regret aversion on *choice of option* (i.e., which option is chosen) as a result of assumption 3 is unwarranted.[1] Specifically, we argue that regret aversion can also affect the *quality of the decision process*. We base this prediction on two lines of research reviewed below.

Self-blame Regret versus Outcome Regret

Recent research suggests that, in addition to *outcome regret*, decision makers experience and anticipate *self-blame regret* (cf. Connolly & Zeelenberg, 2002; Connolly & Reb, 2005). Whereas *outcome regret* refers to the regret experienced as the result of a comparison of the outcome received with some referent such as the outcome that would have been received had one chosen differently (assumptions 3 & 4), *self-blame regret* refers to the regret experienced as a

result of making an unjustifiable decision. For example, in a consumer preference study (Simonson, 1992), participants primed to think about regret chose the safer option (a SONY, a highly reputed, name-brand product) over the riskier option (a cheaper, no-name product) more often than did participants in a control condition. The SONY reputation, even if costly, appears to justify the choice and inoculate against self-blame regret.

Most of the research on the role of justifiability and regret has been concerned with the justifiability of an *option*. For example, Zeelenberg, van den Bos, van Dijk, and Pieters (2002) showed that a soccer coach who changes the team after winning in the past (a poorly justified decision) is thought to experience more regret following a subsequent loss than a coach who does not change the team. However, the same choice is thought to lead to less intense regret when it takes place after a previous loss (a well-justified decision). Inman and Zeelenberg (2002) found that re-purchasing a product after past bad experience with it was thought to lead to more regret than switching to another product. Similarly, switching to another product from a product after past good experience with it also was thought to lead to more regret than re-purchasing the same product.

Connolly and Reb (2005) suggested that self-blame regret can be either *option regret*, the result of choosing an unjustifiable option, or *decision process regret*, the result of engaging in an unjustifiable decision process. The latter could, for example, refer to a decision maker not collecting an adequate amount of information before choosing which job offer to accept, which stock to invest in, which car to purchase, or which medical treatment to undergo. Recent results of a series of experiments reported in Reb and Connolly (2004) support the prediction that *anticipated* regret is lower when a careful decision process is followed. They presented respondents with scenarios in which a mother has to decide whether or not to vaccinate her

young child. They found across several experiments that respondents expected a mother to experience less regret for a bad outcome when the decision was made carefully (i.e., after talking with several doctors and speaking with friends and family about it) than when it was made carelessly. Similar results have recently been reported for *experienced* regret. Pieters and Zeelenberg (2005) found in a series of studies that intention-behavior inconsistency, taken as an indicator of a low-quality decision process, can increase regret experienced over a decision. In one study (Study 1) they also found that self-reported amount of thinking about the decision, another indicator of decision process quality, was negatively related to experienced regret.

Anticipatory Regret and Vigilant Decision Making

As discussed, recent research suggests that individuals anticipate and experience lower regret for a high-quality, careful decision process than for a low-quality, careless one (Pieters & Zeelenberg, 2005; Reb & Connolly, 2004). While this research shows the link between decision process quality and anticipated and experienced regret, it does not actually speak to the effect of regret aversion on the decision process. However, if decision makers are aware of the relation between a careful decision process and subsequent regret, then regret aversion might lead to more careful decision processing. The same idea was expressed much earlier in Janis and Mann's (1977) conflict theory of decision making. They argued that regret aversion leads to more "vigilant" decision making: "Arousal of anticipatory regret … has the constructive effect of deterring a person from indiscriminately seizing upon a seemingly attractive opportunity without forethought about the consequences" (p. 219). Janis and Mann use *anticipatory regret* as a convenient generic term to refer to the main psychological effects of the various worries that beset a decision maker before any losses actually materialize (p. 222). In a sense, in this model anticipatory regret takes on the important role that anticipated regret has in economic regret

theory.

Janis and Mann (1977) believe that anticipatory regret is mostly functional, leading to vigilant decision making. Thus, individuals feeling anticipatory regret will be more motivated to search for additional options or information concerning existing options and perform a more careful comparison of their options. However, in extreme cases, anticipatory regret can lead to dysfunctional procrastination and decision avoidance. Janis and Mann argue that several circumstances evoke anticipatory regret, such as the salience of relative loss, imminence of loss, and social commitment to a certain decision.

In the following studies, we examine the effect of regret aversion on the decision process. Based on Janis and Mann's (1977) original work and the recent research on decision process quality and regret (Connolly & Reb, 2005; Pieters & Zeelenberg, 2005; Reb & Connolly, 2004) we predict that increased regret aversion, or anticipatory regret, will lead to more careful – or "vigilant" – decision processing. The motivation is both theoretical and applied: to learn more about the role of regret aversion on decision making and to better understand whether this role is beneficial or detrimental.

STUDY 1

We examined the effect of regret aversion on decision process quality by manipulating whether the possibility of experiencing regret as a result of their decision was made salient to participants or not. Consistent with Janis and Mann (1977) we predicted that when the possibility of experiencing regret is highly salient and regret aversion and anticipatory regret, therefore, are increased, decision makers will engage in a more careful decision process as compared to when the regret is less salient. We assessed decision process quality by measuring (1) the amount of time used to reach a decision and (2) the amount of information collected.

Method

Design, Procedure, and Participants

Participants had to choose among four hypothetical options with risky monetary outcomes and positive expected values. Each option had two possible outcomes, one positive and one negative. Before participants were presented with the options, we manipulated regret salience between-subjects by varying outcome feedback expectations across two levels. In the Control condition, decision makers expected to receive outcome feedback only for their chosen option. In the Regret condition, they expected outcome feedback for all options. This manipulation has been successfully used in the past (Zeelenberg et al, 1996; Zeelenberg & Beattie, 1997). When decision makers receive full feedback, they find out if they would have achieved a better outcome had they chosen a different option, which would make them feel regret. Decision makers apparently are aware of this and tend to prefer options that protect them from such feedback, indicating regret aversion.

The four options were presented on a computer screen using an information display board. Information was hidden unless the decision maker pointed the mouse over an information field. For each option, two fields could be searched (eight fields in total). One field gave the probability and payoff for the first possible outcome, the other gave the same information for the second possible outcome. Only one field could be accessed at a time. Each field could be revisited as many times as desired. After decision makers felt they had sufficiently considered the options they indicated their choice by clicking the appropriate button on the computer screen.

Forty-nine undergraduate students at a large Southwestern public university participated for course credit. They took about 15 minutes to complete the task.

Materials and Manipulation

Participants were randomly assigned to either the Control or the Regret condition. In the Control condition, decision makers were told that after making their choice they would "find out about the outcome of your choice." In the Regret condition, participants were told that after making their choice they would

> find out about the outcome of your choice as well as the outcome of all the options you didn't choose. That means, you will find out if another option would have been better than the one you chose! You'll know, even when you won, whether another option would have won more and, if you lost, whether you could have won had you chosen differently.

In other words, in this condition decision makers expected full feedback on all available options. They were also made aware that such full feedback could lead to the realization that choice of a different option would have been better. After searching the information display as long as they wished, participants indicated their choice among the four options.

The four options had possible outcomes ranging from -20 to 40, probabilities of receiving a positive outcome ranging from 50% to 80% and expected values ranging from 4 to 10. The options were constructed such that the possible loss was constant (-20), but the probabilities increased steadily from a 20% chance to a 50% chance of receiving this negative outcome. At the same time, options with a higher chance of receiving the negative outcome provided bigger wins and higher expected values. Because of these advantages and disadvantages of the options, there was a need to carefully examine the available alternatives to identify the preferred one.

Measures

We used two different indicators of decision process quality: (1) decision duration and

(2) amount of information collected. To assess decision duration, we measured the time decision makers took from the first information collection to the choice. To assess the amount of information collected, we measured how many times decision makers searched each piece of information by moving the mouse pointer over the respective information field on the computer screen. As might be expected given the nature of the measures, both measures were non-normally distributed. We addressed this problem in two ways. First, we performed non-parametric rank tests on the original measures. Second, we transformed the original data by taking their natural logarithm as logarithmic transformations are commonly used to make data more normally distributed.

Results

On average, participants took about 151 seconds (*SD* = 52.32) to reach a decision and searched about 75 pieces of information (*SD* = 36.13). These results suggest that participants took the task seriously, even though no incentives contingent on choice outcomes were offered.

Manipulation Check

As described above, the options were constructed such that they differed in their downside risk of receiving a negative outcome. Because of this feature of the choice set, participants' choices can serve as a check on the manipulation of regret salience. Specifically, based on past research (Zeelenberg et al, 1996; Zeelenberg & Beattie, 1997) one would expect participants in the Regret condition, in which outcome feedback on the foregone options was expected, to be more likely to choose the safe option. The reason is that choice of the risky option leads to a negative outcome with a relatively high probability (50%), whereas the outcome of the foregone safe option is more likely to be positive (80%) and, importantly, participants know they will learn these outcomes. Participants in the Control condition, in

contrast, do not expect to learn about the outcomes of the foregone options, and therefore, should be more likely to choose the riskier options (because of their higher expected value).

Preferences followed this prediction. A chi-square test comparing choice frequencies for the two most and two least risky options in the two conditions was significant, $\chi^2(1)= 5.07$, $p < .05$. In the Control condition, 72.7% of the choices were of one of the high-risk options; in the Regret condition, only 40% were. These findings are consistent with previous research and suggest that the experimental manipulation did indeed manipulate the level of anticipatory regret.

Experimental Effects

A Mann-Whitney test showed a significant difference in decision duration depending on regret salience, $Z = 2.16$, $p < .05$. As expected, decision makers took longer when regret was salient (mean rank = 29.15, M = 167 seconds, SD = 59) than when it was not salient (mean rank = 20.30, M = 133 seconds, SD = 37) (see Figure 1). The result was replicated in an ANOVA on the transformed duration measure, $F(1, 47) = 4.08$, $p < .05$. The increase in the amount of time spent on reaching a decision in the Regret condition was about 25%.

The amount of information searched (measured by how many times information fields were pointed at) also increased by about 20% (mean rank = 27.12, M = 81.65, SD = 42.94, in the Regret condition versus mean rank = 22.61, M = 67.87, SD = 25.45, in the Control condition). However, this difference was not statistically significant, Mann-Whitney test $Z = 1.10$, $p = .27$, *ns* (ANOVA on the transformed measure, $F[1, 47] = .97$, $p = .33$, *ns*).

Insert Figure 1 about here

Ancillary Analyses

We conducted additional exploratory analyses to try and enhance our understanding of the effects of regret aversion on decision processing. These analyses suggest that decision makers in the Regret condition spent *less* time each time they examined any of the four information pieces related to the two high-risk options (mean rank = 861.95) than participants in the Control condition (mean rank = 919.65), Mann-Whitney test $Z = 2.55$, $p = .01$. In contrast, we found no significant differences between the Regret (mean rank = 955.62) and the Control condition (mean rank = 964.74) in time spent examining any of the four information pieces related to the two low-risk options, Mann-Whitney test $Z = .39$, $p = .70$, *ns*.

These findings are interesting in light of the fact that decision makers in the Regret condition were also less likely to end up choosing the two high-risk options. Thus, it appears that while the concern about future regret led decision makers in the Regret condition to spend more time deliberating about the decision overall, they spent less time on average on pieces of information about the riskier options. Subsequently, they also ended up choosing the riskier option less frequently. Consistent with this result are the following additional findings. First, those who ended up choosing one of the two safer options (which was more likely to happen in the Regret condition) had spent significantly *more* time overall on examining these options than the two riskier options, Wilcoxon Signed Ranks Test $Z = 4.02$, $p < .01$. On the other side, those who ended up choosing one of the two riskier options had not, Wilcoxon Signed Ranks Test $Z = .45$, $p = .66$, *ns*. Second, decision makers in the Regret condition spent more time overall on examining the safer (and preferred) options than the riskier options, Wilcoxon Signed Ranks Test $Z = 2.13$, $p < .05$, whereas no such difference existed in the Control condition, Wilcoxon Signed Ranks Test $Z = 1.23$, $p = .22$, *ns*. Third, decision makers in the Regret condition also searched

more pieces of information about the safer (and preferred) options than the riskier options, Wilcoxon Signed Ranks Test $Z = 2.34$, $p < .05$, whereas decision makers in the control condition did not, Wilcoxon Signed Ranks Test $Z = 1.59$, $p = .11$, *ns*.

Discussion

In the present study we varied regret salience by manipulating whether decision makers expected full outcome feedback (i.e., feedback on the chosen and the foregone options) or partial outcome feedback (i.e., feedback only on the chosen option). Results showed that when the possibility of experiencing regret as a result of their choice was made salient, decision makers took about 25% longer on average to reach a decision (a statistically significant increase) and searched about 20% more information (not a statistically significantly increase) than when regret was not made salient. These results provide some support for the hypothesis first expressed in Janis and Mann (1977) that increased regret aversion leads to more vigilant decision making.

Ancillary analyses suggest that making regret salient led participants to spend less time on average on pieces of information concerned with the two riskier options. Further, in the Regret condition only did participants search fewer pieces of information, and for a shorter period of time, about the two higher risk options than the two safer options. Subsequently, participants in the Regret condition ended up choosing the riskier options less frequently, consistent with the decision process data.

The effect of regret salience on decision process quality was significant for decision duration but not for the amount of information collected. A possible reason lies in our measure of amount of information collected. As described above, we used a computerized information display board on which information was hidden unless a mouse pointer was moved over it. Thus, only one piece of information could be seen at any one time. In total, however, there were only

eight information fields that could be searched. Most decision makers repeatedly searched these fields. However, participants with good memory did not need to revisit the fields as often as others. This might have weakened the power of the manipulation to affect this measure. To avoid this shortcoming we conducted additional studies in which the information that decision makers can search does not repeat itself. In other words, decision makers can actually search a large amount of *additional* information, rather than simply using search to help their limited working memory capacity.

STUDY 2A

In order to test the robustness of regret aversion's influence on decision process quality as well as address the weakness of the information search measure, Study 2a examined the effect of regret salience on decision process carefulness using a different information search paradigm. In this experiment decision makers were presented with three options about which they were told nothing except that each option's outcome was uncertain and drawn randomly from a probability distribution. Participants were allowed to sample as many outcomes for each of the options as they wanted before making a choice. By sampling outcomes they could try to learn which option was most attractive to them. Each decision maker made several choices among different sets of three options.

Method

Design, Procedure, and Participants

Participants engaged in a computerized decision making task in which they made several choices among three options with uncertain hypothetical monetary consequences. They did not receive any specific information about the outcome distribution of each option. However, they learned that they could "sample" as many outcomes for each option as they wanted before

making their choice. We manipulated regret salience through outcome feedback expectations as in the previous study. One group was told for all of their decisions that they would receive outcome feedback on all options (Regret condition). The other group was told they would receive outcome feedback only on the option they chose (Control condition). After decision makers had sampled as much as they wanted, they chose one option. The computer then randomly drew an outcome from the appropriate distribution for each of the three options. Depending on the regret salience condition, participants then learned the outcome of their chosen option only (Control condition) or of all options (Regret condition). In total, decision makers made five decisions after completing one practice trial. However, because the amount of information collected decreased steadily over each round, suggesting that our manipulation might have lost power over time, we only included the first four decisions in our analyses (the results were replicated in analyses of all five decisions, albeit with somewhat weaker effects).

Eighteen undergraduate students at a large Southwestern public university participated for course credit. They took about 15 minutes to complete the task.

Materials and Manipulation

All participants received written instructions describing the decision task. For each decision, they were told that they had to choose among three options that had uncertain outcomes. They learned that they did not know anything about their chances to lose or win money with each option, but that they could sample outcomes from each option as many times as they liked. It was pointed out that the options might differ in their chances of yielding a good outcome. In fact, the outcomes for the three options for each of the rounds were drawn from uniform distributions that differed in their expected values (ranging from -10 to +80) and ranges (ranging from 100 to 300).

In the Control condition, participants were told that after they made their decision, they would learn the outcome of the chosen option. In the Regret condition, participants were told the following about what would happen after they made their choice.

> …You will then find out about the outcome of your choice as well as the outcome of all the options you didn't choose! That means, you will find out if another option would have been better than the one you chose! Thus, you'll know even if you won whether a bigger win would have been possible and when you lost if you could have won.

After decision makers were done sampling they chose one option. On the next screen decision makers learned the outcome in (hypothetical) US dollars of their option only (Control condition) or of all options (Regret condition).

Measures

Two dependent variables assessed decision process quality. First, we measured decision duration as the time between the first sampling of information and the submission of the decision. Second, we measured amount of information collected by counting how many outcomes participants sampled before making their choice. As in Study 1 both measures were non-normally distributed and we addressed this problem as before by performing non-parametric rank tests on the original measures and ANOVAs on the logarithmically transformed measures.

Results

Decision makers sampled on average about 78 pieces of information per decision (*SD* = 45.96; D1 = 91, D2 = 82, D3 = 75, D4 = 64) and took about 46 seconds to reach a decision (*SD* = 38.04; D1 = 61, D2 = 49, D3 = 43, D4 = 32). As in Study 1, these results indicate that participants took the task seriously even though no monetary incentives contingent on choice

outcomes were offered.

A Mann-Whitney test of rank differences showed a significant effect of regret salience on decision duration, $Z = 2.91$, $p < .01$. As expected, decision makers took longer to reach a decision when regret was salient (mean rank = 44.52, $M = 52.31$ seconds, $SD = 41.50$) than when it was not (mean rank = 30.09, $M = 41.73$ seconds, $SD = 45.36$) (see Figure 2, which also depicts the results of Study 2b described below). Decision duration increased about 25% under heightened regret aversion. The result was confirmed in an ANOVA on the transformed decision duration measure, $F(1, 71) = 7.55$, $p < .01$.

A Mann-Whitney test also revealed a significant effect of regret salience on amount of information collected, $Z = 2.13$, $p < .05$. As expected, decision makers searched more information in the Regret condition (mean rank = 42.36, $M = 91.38$, $SD = 43.98$) than in the Control condition (mean rank = 31.81, $M = 67.88$, $SD = 45.34$) (see Figure 2). Information search increased about 35% when regret was made salient. An ANOVA on the logarithmically transformed measure confirmed the effect of regret salience, $F(1, 71) = 6.68$, $p = .01$.

Insert Figure 2 about here

Discussion

Using a different decision task and different measure of information collection from Study 1, we examined whether increasing regret aversion through a manipulation of regret salience would lead to more careful decision making. We asked decision makers to choose one of three options with uncertain outcomes. Decision makers were given the opportunity to sample as many outcomes from each option as they liked. As measures of decision process quality, we

assessed the duration of the decision and the amount of information collected. Replicating the results of Study 1 in this different decision context we found that making the possibility of experiencing regret as a result of their decision led participants to spend more time on their decision before making a choice. Moreover, decision makers collected significantly more information when regret was salient. Overall, the results again supported our prediction that heightened regret aversion leads decision makers to engage in a higher-quality, more careful ("vigilant") decision process.

Just as with Study 1, one of the potential shortcomings of this experiment was the lack of real monetary incentives. However, it is important to note that in both studies we found a significant effect of regret salience on decision process quality even in the absence of financial incentives. Nevertheless, in the next study, we tried to replicate the results under monetary incentives.

STUDY 2B

Method

The design of Study 2b was largely identical with the design of Study 2a. Participants were randomly assigned to the Control or the Regret condition. Some of the options were changed slightly for variation. The instructions were changed to contain information about the real monetary incentives involved in this study. Specifically, at the beginning of the task, participants received an endowment of $3. They were told that at the end the outcomes of some of their decisions would be added to, or subtracted from, this endowment and the final amount paid to them in cash at the completion of the study. While outcomes were presented as dollars during the experiment, participants were told in the instructions that these experimental dollars would be divided by one hundred to determine the actual payoff. Thus, hundred experimental

dollars corresponded to one real dollar. Participants were also assured that they would not lose any of their own money, though they were not assured any positive payoff. Participants made five decisions after performing one practice trial. The outcomes of Decision 2 and Decision 3 were added to the endowment and paid at the end of the study.

Regret salience was manipulated in the same way as in Study 2a. Decision process quality was again measured by amount of information sampled and decision duration. Both measures were non-normally distributed. We addressed this problem in the same ways as in Study 2a. First, we performed non-parametric analyses on the original measures. Second, we performed ANOVAs on the logarithmically transformed data.

Forty-four undergraduate students at a large Southwestern public university participated for course credit and monetary compensation. They took about 15 minutes to complete the task.

Results

On average participants sampled about 86 pieces of information per decision (*SD* = 76.66, D1 = 95, D2 = 79, D3 = 86, D4 = 88, D5 = 82). Sampling did not decrease significantly over time. Average duration per decision was about 51 seconds (*SD* = 44.55, D1 = 75, D2 = 51, D3 = 48, D4 = 42, D5 = 37). Again, from these results it appears that decision makers took the task seriously.

A Mann-Whitney test of rank differences revealed a significant effect of regret salience on decision duration, $Z = 1.62$, $p = .05$, one-tailed. As expected, decision makers took longer to reach a decision in the Regret condition (mean rank = 117.15, *M* = 55.98, *SD* = 48.76) than in the Control condition (mean rank = 103.22, *M* = 45.64, *SD* = 38.95) (see Figure 2). This result was also confirmed in an ANOVA on the transformed decision duration measure, $F(1, 210) = 4.37$, $p < .05$. The increase in decision duration when regret was salient was about 23%.

A Mann-Whitney test also showed a significant effect of regret salience on amount of information collected, $Z = 2.44$, $p < .05$. As expected, decision makers searched more information in the Regret condition (mean rank = 120.51, $M = 103.51$, $SD = 91.56$) than in the Control condition (mean rank = 99.53, $M = 66.74$, $SD = 49.71$) (see Figure 2). An ANOVA on the logarithmically transformed measure confirmed the effect of regret salience, $F(1, 210) = 8.06$, $p < .01$. The increase in amount of information collected when regret was salient was about 55%.

Discussion

This experiment replicated the design of Study 2a, but with real monetary incentives contingent on the decision outcomes. The results replicate the pattern of findings from Study 2a. We found again that making regret salient led decision makers to engage in a more careful ("vigilant") decision process. Decision duration increased by 23% in the Regret as compared to the Control condition, a significant difference. Amount of information collected was even 55% higher when the possibility of experiencing future regret was salient than when it was not, also a statistically significant difference.

Together, Studies 1 and 2 show that the fear of experiencing regret can lead individuals to engage in higher-quality decision processing. One limitation of these studies is that we always used two dependent variables to assess decision process quality: the duration of the decision and the amount of information collected. Note that the two are necessarily related in our studies in the sense that collecting more information always leads to a longer decision duration (because of the time it takes to collect the information, e.g., completing the movements required to get the information, such as moving the mouse over a specific field on the computer screen). Of course, one way to achieve a higher-quality, more vigilant decision process is to search more external

information (Janis & Mann, 1977). However, collecting more information from the environment is only one aspect of making a decision more carefully. Deliberating about which option to choose (using the information collected) is another important ingredient to careful decision making.

In the following study we examine whether increased regret aversion can also lead to more careful decision making in the sense of a longer deliberation period before a choice is reached. Pieters and Zeelenberg (2005) found self-reported amount of thinking to be negatively correlated to experienced regret. This suggests that making regret salient might actually lead decision makers to deliberate longer before making a choice. To test this idea, we conducted an experiment in which no external information could be searched. This allowed us to examine the effect of regret salience on decision deliberation separately from the amount of time spent on searching external information.

STUDY 3

Method

Design, Procedure, and Participants

Similar to Study 2b, participants engaged in a decision making task with real monetary consequences in which they had to choose one of three options that carried uncertain monetary consequences. They engaged in 20 choices among the same three options. Participants only knew about each option that its outcome was some amount of money drawn randomly from an underlying uniform probability distribution. They did not know the nature (i.e., mean and range) of this distribution. The three options differed in their expected values (ranging from -30 to 20) and their ranges (ranging from 100 to 300). Different from Studies 1 and 2, participants were not given an opportunity to search information before making their choice. Thus, in the present

study, we only assessed decision duration, unconfounded by information collection.

After making their choice, participants learned about the outcome of their decision. They were then given the opportunity to learn the outcome of the alternative option. This was done to implement our regret salience manipulation. Participants were randomly assigned to one of two conditions. In the Regret condition, the possibility of experiencing regret was made salient to decision makers at the beginning of the decision task by pointing out that seeking feedback on the outcomes of foregone options can lead to regret. In the Control condition, no such information was included.

Sixty-four senior business students at a large Southwestern public university participated in exchange for course credit and monetary compensation depending on the outcomes of their decisions.

Materials and Manipulation

All participants were first given written instructions about the choice task. They learned that they were endowed with $3 and told that the outcomes of two of their choices would be added to, or subtracted from, their endowment and paid at the end of the experiment in cash. They were assured that they could not lose any of their own money but were not promised a positive payoff. The decision task was completed on a computer. Before the first decision the experimental manipulation was implemented. In the Control condition, participants read the following.

> After each choice the computer will determine the outcomes of the options. The program will then show you the outcome of the option you chose. You will then be given the choice to see the outcomes of the options you did not choose as well. After that you will go on to the next decision among the same three options.

In the Regret condition, the following sentence was added: “Choosing to receive feedback on the outcomes of the options you did not choose means that you might find out that you had better chosen another option, leading to regret.” After making their choice, participants in all conditions learned about the outcome of their chosen option. If they chose to seek feedback on the foregone options, they received it.

Measures

This study was designed to allow for a measurement of decision quality only in terms of decision deliberation, without the potential confounding of information collection. Thus, no opportunity to collect information was given. To assess decision duration, we measured the amount of time decision makers took from being presented with the three options to submitting their decision by clicking the appropriate button on the computer screen. Because the measure was non-normally distributed, as in the previous studies, we (1) used a non-parametric test and (2) transformed the measure by calculating its natural logarithm for parametric analysis.

Results and Discussion

On average, participants took about 10 seconds to reach a decision (SD = 6.61). The time of deliberation to reach a decision decreased from 25.77 seconds (SD = 10.35) for the first decision over 13.63 seconds (SD = 7.12) for the second choice to 7.92 seconds (SD = 4.73) in the last round. Nevertheless, even in the last rounds, decision makers spend a non-negligible amount of time thinking about what to do before indicating their choice. Because of the large difference in duration between the first and second round we excluded the first round, in which respondents probably were spending a significant amount of time getting used to the task, from the analyses (all results were replicated in analyses including the first decision).

Manipulation Check

We used participants' decisions to seek or avoid feedback to assess whether our experimental manipulation did indeed manipulate anticipatory regret as intended. Based on past research (Zeelenberg et al, 1996; Zeelenberg & Beattie, 1997) one would expect participants in the Regret condition to be more likely to avoid potentially regret-inducing outcome feedback on the foregone options. This is what we found. In the Regret condition, decision makers avoided feedback 157 times (25.9% of all choices), whereas in the Control condition, they avoided feedback only 25 times (4.1% of all choices), $\chi^2(1)= 112.86$, $p < .001$.

Experimental Effect

A Mann-Whitney test of rank differences revealed a significant effect of regret salience on decision duration, $Z = 17.02$, $p < .001$. As expected, decision makers took longer to reach a decision in the Regret condition (mean rank = 779.64, $M = 12.26$, $SD = 7.52$) than in the Control condition (mean rank = 437.36, $M = 7.27$, $SD = 4.49$). This result was also confirmed in an ANOVA on the transformed decision duration measure, $F(1, 1214) = 329.90$, $p < .001$. The increase in decision duration in the Regret condition was about 69%. These results are consistent with the prediction that making regret salient leads to longer decision deliberation and, more generally, more vigilant decision processing.[2]

STUDY 4

One of the criticisms that could be raised concerning the previous studies is that they presented participants with relatively abstract decision contexts. The choice situations were somewhat lacking in mundane realism and the type of information that could be searched was limited. The purpose of this experiment was to test the hypothesis in a decision situation that had greater similarity with "real-world" decisions. Specifically, in the present study, decision makers

were given the task to invest money. Based on the information provided, they needed to choose between two investment funds that differed in various aspects. We again manipulated regret salience and examined the effect of this manipulation on how many pieces of information decision makers collected and how long they took before reaching a decision.

Method

Design, Procedure, and Participants

Participants engaged in a decision making task in which they had to invest some hypothetical money. They were told that they had already narrowed down their choice to two investment funds and now were about to select one of them. The two options were described on various attributes such as investment objective, geographical allocation, fund charges, and past performance. The specific attribute information for each option was initially hidden but could be accessed by clicking on the attribute name.

The experiment manipulated regret salience between-subjects. Participants in the Control condition began with the decision making task after they had finished reading instructions. We implemented two conditions in which regret was made salient. In the first condition, participants answered three questions related to their anticipatory regret. In the second condition, participants answered these questions and read about the possibility of experiencing regret in their task instructions. This manipulation of regret salience was implemented to test whether the effect would only be obtained when participants were explicitly made aware of the possibility of experiencing regret as a result of their choices (second Regret condition) or whether a more subtle manipulation would have the same effect (first Regret condition).

Fifty-nine business students at a Singaporean university participated in exchange for course credit or monetary compensation.

Materials and Manipulation

All participants were first given general instructions about the task. They were told that they would face a choice between two options and that they would have the opportunity to get some information about the two options before making their choice. They were reminded that there were no right or wrong decisions and answers. They were encouraged to behave as if the decision was for real and they were to actually experience the outcomes of their choices. As a cover story the student participants were then told that they had received a considerable amount of money from a relative that was to be invested for a longer period of time and could only be withdrawn after graduation from university. They further were to assume that they had already narrowed their choice down to two remaining options and now had to make their final decision.

In the Control condition, participants moved to the next screen where they could search information immediately after reading the general task instructions. In order to increase regret salience, participants in the first Regret condition were asked three questions about (1) how much regret they would feel if they chose the worse option, (2) how bad they would feel if they chose the worse option, and (3) how worried they were that they might chose the worse option (for a similar manipulation, see Simonson, 1992). In the second Regret condition, participants read the following as part of the general task instructions and then also answered the three questions before moving on to the next screen:

> Because it will be easy to track the performance of both funds (the one you chose and the one you did not choose) you know that you will find out how well the fund you decide to invest in will perform. In addition, you will also know how well the fund you decide not invest in will perform. As such, in the future you may experience regret over your current decision as you will find out whether the fund you picked will be the better performer.

On the next screen, decision makers saw two columns – one for each option – that listed fourteen attribute names each. The attributes were grouped into three categories, "fund information" (seven attributes), "fund charges" (three attributes), and "past fund performance" (four attributes). The attributes included such matters as investment objective, asset class, geographical allocation, top holdings, risk, initial sales charge, annual management charge, past performance 1 month, and past performance 1 year. By clicking on an attribute name, participants could learn about the attribute value for that fund. For example, when clicking on "investment objective" of the Investment Fund 1, a paragraph describing the objective of this investment fund appeared. The information provided was based on two real existing investment funds.

Measures

As our dependent variables, we measured the number of pieces of information searched as well as the time taken to reach a decision. Time was taken from when participants accessed the page with the attribute information (i.e., after they had read the instructions and, in the Regret conditions, answered the questions used to heighten regret aversion). To analyze the data, as in the previous studies, we (1) used non-parametric tests and (2) transformed the measures by calculating their natural logarithm for parametric analyses.

Results and Discussion

On average, participants took about 138 seconds to reach a decision (SD = 68). In a first set of analyses, we compared whether the two Regret conditions had different effects on decision process quality. Both in parametric (on the original and the transformed measures) and non-parametric analyses we found no significant differences between the two Regret conditions (all p > .49 for decision duration, all p > .25 for information search). Thus we decided to collapse across the two conditions for the analyses reported below.

Experimental Effects

A Mann-Whitney test of rank differences revealed a significant effect of regret salience on decision duration, $Z = 3.02$, $p < .01$. As expected, decision makers took longer to reach a decision in the Regret condition (mean rank = 35.39, $M = 156.71$, $SD = 68.69$) than in the Control condition (mean rank = 21.57, $M = 109.36$, $SD = 59.03$). This result was also confirmed in an ANOVA on the transformed decision duration measure, $F(1, 57) = 9.70$, $p < .01$. The increase in decision duration in the Regret condition was about 43%.

A Mann-Whitney test of rank differences also showed a significant effect of regret salience on amount of information searched, $Z = 2.46$, $p = .01$. As expected, decision makers searched more information before reaching a decision in the Regret condition (mean rank = 34.39, $M = 33.78$, $SD = 12.40$) than in the Control condition (mean rank = 23.13, $M = 25.65$, $SD = 11.02$). This result was also confirmed in an ANOVA on the transformed information search measure, $F(1, 57) = 4.93$, $p < .05$. The increase in the amount of information searched in the Regret condition was about 32%. These results are again consistent with our prediction that making regret salient leads more careful, vigilant decision processing, as indicated by decision duration and information search.

Ancillary Analyses

We conducted additional exploratory analyses to investigate the information search behavior of participants in the Control and Regret conditions in more detail. These analyses yielded some interesting, albeit preliminary, results. First, we counted the number of information fields that a decision maker never visited, i.e., did not check at least once. This count was significantly higher in the Control condition (mean rank = 36.46, $M = 5.65$) than in the Regret condition (mean rank = 25.88, $M = 2.11$), Mann-Whitney test $Z = 2.60$, $p < .01$. This finding

suggests that heightened regret aversion led to more thorough and exhaustive information search. Whereas the majority of participants (72%) in the Regret condition made sure to look at each piece of information at least once, less than half did so in the Control condition (39%).

Second, participants in the Regret, as compared to the Control, condition only searched significantly more information about, and spent more time on, the two categories "fund information" ($Z = 3.02$, $p < .01$ and $Z = 3.12$, $p < .01$, respectively) and "past fund performance" ($Z = 2.07$, $p < .05$ and $Z = 2.95$, $p < .01$, respectively), but not the category "fund charges" ($Z = .23$, $p = .82$, *ns*, and $Z = 1.44$, $p = .15$, *ns*, respectively) (these findings also held when analyzing the data for each option separately). This result is interesting as the "fund charges" category contained such relatively mundane information as the initial sales charge and the annual management charge. Importantly, these charges varied only slightly or not at all between the two funds. As a result, this information was clearly not critical to making a choice between the two options. In other words, making regret salient led decision makers to search more information on *critical* product attributes only, but not on irrelevant attributes.

These additional results, while exploratory in nature, are consistent with the idea that heightened anticipatory regret encourages higher quality decision processing, as theorized.

GENERAL DISCUSSION

A considerable amount of both theoretical (e.g., Bell, 1982; Loomes & Sugden, 1982; Savage, 1951) and empirical (e.g., Connolly & Reb, 2003; Mellers et al, 1999; Richard et al, 1996; Simonson, 1992; Zeelenberg & Beattie, 1996) research has examined the influence of regret aversion on *choice of option* (i.e., which option is chosen). This research has made a significant contribution to our understanding of choice in a variety of domains. However, this research has largely neglected to address the influence of regret aversion on the *decision process*.

In the present research we conducted five experiments to examine the effect of making regret salient on decision process quality. According to Janis and Mann (1977), pre-decisional worries about the possibility of experiencing regret as a result of the decision ("arousal of anticipatory regret", p. 219) lead to more "vigilant", careful decision processing. Related research found that experienced (Pieters & Zeelenberg, 2005) and anticipated regret (Reb & Connolly, 2005) for a bad outcome is reduced by a high-quality decision process. Consistent with Janis and Mann, this research suggests that decision makers who are aware of the connection between decision process quality and regret might engage in more careful decision processing in order to avoid regret. Based on this past research, we predicted that individuals would engage in a higher quality, more careful decision process under increased regret salience.

In all five of our experiments participants made their decisions either in a control or a regret condition. In the latter, we increased anticipatory regret by making salient the possibility of experiencing regret as a result of the decision. We then measured the decision process quality by assessing decision duration and, in all but Study 3, amount of information collected. The results consistently supported the prediction that increased regret salience would lead to more careful decision processing.

None of the experiments reported is without its limitations. Some experiments provided rather abstract, minimal contexts. For example, one could argue that participants might have found it difficult to engage in the decision task of Study 3. However, Study 4 provided a much richer and more meaningful decision context and reached the same conclusion. Some studies could be criticized as no monetary incentives contingent on decision outcome were provided and, therefore, no incentive for careful decision making existed. However, results were replicated across experiments both without (e.g., Study 2a) and with (e.g., Study 2b) monetary incentives

tied to choice outcomes. Taken together, the confidence in the effect of regret salience on decision process carefulness is enhanced by the fact that it was found across the different decision situations, incentive structures, regret salience manipulations, and dependent variables used. For example, the effect held across decision tasks that varied from more abstract contexts to a more concrete context. Further, the effect held across regret salience manipulations that were based on expectations of outcome feedback on foregone options, explicit priming in the instructions, and implicit priming through regret-related questions.

In all experiments making regret salient led to a significantly longer decision duration before a choice was reached. In Studies 2a, 2b, and 4 it also led to significantly more intense information search. Interestingly, even in Study 3, when no information could be collected, decision makers still took longer when the possibility of experiencing regret was made salient. This suggests that regret aversion made participants not only search more (external) information but also deliberate longer, and perhaps process information more carefully, before reaching a decision.

Our studies add to the debate about the rationality and functionality of the role in decision making of regret in particular (e.g., Zeelenberg, 1999b; Bittner, 1992; Sugden, 1985) and emotions in general (e.g., Damasio, 1994; Elster, 1996). It appears that, contrary to much common belief and the long standing philosophical view that emotions impede good decision making, emotions – in the form of anticipatory regret in this case – can actually lead to better, more vigilant decision making. While Sugden (1985) has argued on theoretical grounds that taking regret aversion into account should not be considered irrational, the present studies actually show empirically that it can lead decision makers to search more information and deliberate longer before reaching a choice. Future research should examine the potentially

beneficial effects of increased regret aversion in important domains such as health-related decisions, voting, career decisions, and investment choices. For example, it has been argued that feedback about foregone outcomes can improve financial decisions (Hilton, 2001). The present research suggests that, in addition to actually getting such feedback, worrying about receiving such potentially regret-inducing feedback by itself can lead to more careful decision processing and, thus, possibly better decisions.

Limitations and Future Research

A limitation of the present studies is that we examined only in a very exploratory fashion the specific information processing strategies decision makers used (Study 1 and Study 4). While these analyses provided some suggestive findings, future research could explore the effects of heightened regret aversion on decision processing in more detail. Such process-oriented research (cf. Payne, Bettman, & Johnson, 1993) could also attempt to assess subjective feelings of anticipatory regret or even physiological measures of negative arousal during the decision process. Such measures could be used for mediational analyses that provide more detailed information about the processes through which the effects of regret salience on decision process quality reported in the present research take place.

A related issue is that we used only two types of dependent variables to measure decision process carefulness: decision duration and information sought. Future research could use additional dependent measures, such as recall and comprehension of the information presented about the decision and the available options, or the ability to justify the choice. In addition, future research could try to construct decision situations in which it is relatively undisputed which option is the best. Presumably, regret aversion, by leading decision makers to more careful choices, should also result in better choices.

Related to the last point, an important direction for future research will be to establish potential boundary conditions for the beneficial effects of regret aversion on decision making. Janis and Mann (1977) suggested that too much anticipatory regret can be dysfunctional by leading to procrastination and decision avoidance. In other words, both too little and too much worries about regret might be suboptimal for decision making. Indeed, there is evidence that decision makers sometimes avoid making decisions as a consequence of their regret aversion (e.g., Tykocinski & Pittman, 1998; for a review see Anderson, 2003). What we know very little about so far is just how much worry about future regret might be "too much." Future research should manipulate regret salience across several levels in order to establish whether there is indeed an inverse U-shaped relation between the intensity of the pre-decisional worries about possible regret and the quality of the decision process, as Janis and Mann suggested.

In addition to such an experimental manipulation of regret salience, future research should also try to identify individuals who chronically exhibit abnormally high (and low) levels of regret aversion and examine their decision processing and choices, similar to the research by Schwartz and colleagues on individual differences in experiencing regret (Schwartz et al, 2002). Such research on individual differences in regret aversion strength could also examine the relation to other individual difference measures that have been shown to affect the carefulness of cognitive processing, such as need for cognition (Cacioppo & Petty, 1982).

Intense regret aversion might have another negative consequence in addition to leading to procrastination and decision avoidance. In the present studies decision makers collected more information and spent more cognitive resources and time on making the decision, all of which can be considered a decision cost (cf. Beach & Mitchell, 1978; Payne et al, 1993). Such costs can only be justified by their ability to improve the chances of receiving a better decision outcome.

Thus, under conditions when information search and deliberation time is costly, increased regret aversion might lead to a suboptimal balancing of the costs of making a careful decision and the expected benefits of this high-quality decision process.

Common to the present studies was that information search was relatively effortless and inexpensive. Specifically, no money (hypothetical or real) had to be paid to gain information that might help achieve better (hypothetical or real) decision outcomes. Future research could introduce costs of information search and decision duration. In such a situation, there are two sorts of potentially regrettable errors: over-sampling (reducing payoffs due to excessive sampling costs) and under-sampling (reducing payoffs due to poorer option selection). Balancing these costs is known to be a difficult cognitive task (e.g., Connolly, 1988; Edwards, 1965). It is possible that under such conditions increased regret aversion will lead to over-sampling and reduced overall decision outcomes. On the other hand, decision makers under high regret salience might interpret “careful decision making” in a more flexible way and take the possibility of experiencing regret as a result of sampling too much into account and neither over- nor under-sample.

Further, future research should examine decision contexts in which exhaustive information search and careful deliberation would be considered less justifiable and, therefore, more regrettable. In some contexts, many individuals might believe that choice should be driven by emotions and intuition, such as the decision whether to marry someone or whether to have children, or by social norms and one’s conscience, such as ethical decisions (and cultural factors might lead to important differences about which decision contexts call for such choices). It is possible that increased regret aversion might lead to less careful decision processing and a stronger reliance on gut feelings in these contexts.

Finally, the present research raises the question as to how the effect of anticipatory regret on decision processing and choice is similar to, and different from, the effects of accountability expectations. Research on accountability has also found that, under certain conditions, the expectation of having to account for one's decision can lead to more careful decision processing and the choice of less risky options (e.g., Lerner & Tetlock, 1999; Tetlock & Boettger, 1994). Conceptually, it seems that regret aversion is concerned more with trying to make decisions that *oneself* perceives as justifiable, and trying to avoid *self*-blame, whereas accountability is concerned more with trying to make decisions that *others* perceive as justifiable, and trying to avoid being blamed by others. To what extent these different motivations lead to different or similar decision processing and choice strategies is an interesting question for future research.

Conclusion

Past research has shown the importance of regret aversion in determining individuals' choices (e.g., Mellers et al, 1999; Simonson, 1992; Zeelenberg, 1999a). Building on Janis and Mann's (1977) discussion of the influence of anticipatory regret on decision making, the present research has demonstrated how regret aversion affects not only which option is chosen but also the pre-choice decision process. The results are encouraging. It appears that increasing pre-decisional regret aversion can lead to higher-quality, more "vigilant" decision processing.

FOOTNOTES

1 Assumption 4, while not the topic of the present investigation, has also been criticized as too restrictive. Specifically, reference standards other than the foregone outcome, such as the pre-decisional status quo, have been shown to affect regret (Connolly, Ordóñez, and Coughlan, 1997). Of course, dropping Assumption 3, as we do in the following, implies the dropping of Assumption 4 as well since it refers to comparisons of *outcomes*.

2 Note that the effect of the regret salience manipulation may be have been confounded with an effect of experienced regret on subsequent decision duration. In particular, it may have been that receiving a relatively negative outcome resulted in experiencing regret, which then resulted in longer decision deliberation during the subsequent decision. Because participants in the Control condition sought feedback more often, they were more likely to experience regret as a result of having missed out on a better outcome. This may have led them to deliberate longer before making their next choice, thus leading to an underestimation of the true effect size of the regret salience manipulation. However, additional analyses found that how bad the received outcome was relative to the foregone outcomes (for those who sought full feedback) did not significantly predict subsequent decision duration, $p > .15$.

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Table 1: Illustration of Savage's Minimax Regret Rule

	Utility		Relative Loss / Regret	
	State		State	
Action	Rain	Shine	Rain	Shine
Carry	4	5	0	5
Don't Carry	-10	10	14	0

Notes. Positive numbers in the two rightmost columns indicate regret or a relative loss.

Figure 1: Mean Pieces of Information Collected and Mean Decision Duration Depending on Regret Salience, Study 1

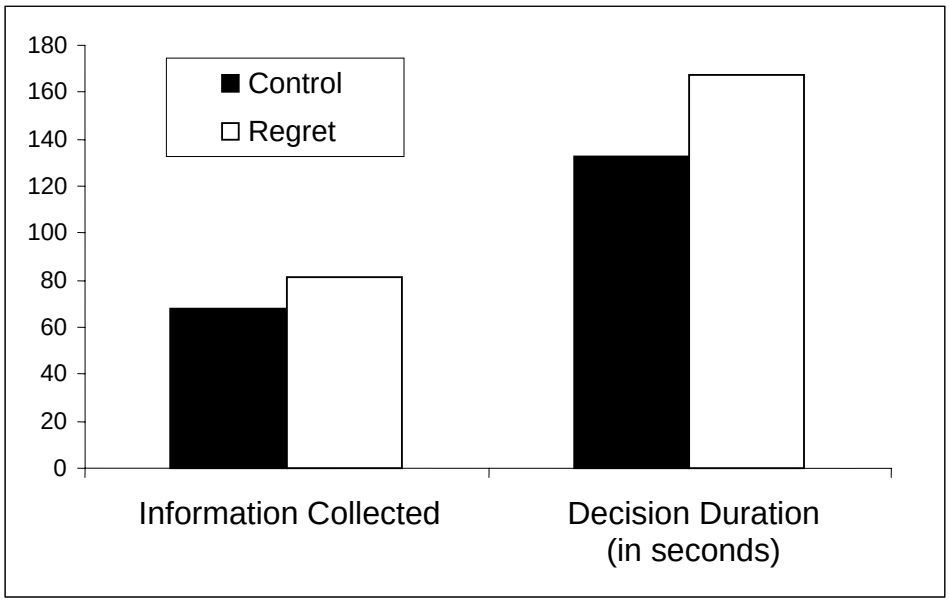

Figure 2: Mean Pieces of Information Collected and Mean Decision Duration Depending on Regret Salience in Study 2a (Hypothetical) and Study 2b (Real Monetary Incentives)