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# How comparing decision outcomes affects subsequent decisions: The carry-over of a comparative mind-set

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## Abstract

In the current paper we investigate how feedback over decision outcomes may affect future decisions. In an experimental study we demonstrate that if people receive feedback over the outcomes they obtained (“factual outcomes”) and the outcomes they would have obtained had they decided differently (“counterfactual outcomes”), they become regret-averse in subsequent decisions. This effect is not only observed when this feedback evoked regret (with counterfactual outcomes being higher than factual outcomes), but even when the feedback evoked no regret (with factual outcomes being equal to counterfactual outcomes). The findings suggest that this effect on subsequent decisions is at least partly due to the transfer of a comparison mind-set triggered in the prior choice.

Keywords: comparison, counterfactuals, decision-making, regret.

## 1 Introduction

Regret is a negative experience that most of us would want to avoid. It stems from comparing an obtained decision outcome to outcomes that might have been had one chosen differently (Van Dijk & Zeelenberg, 2005). Research on regret has consistently shown that the anticipation of regret and the motivation to avoid regret drives many of our decisions. Although the literature on regret distinguishes between *experienced* regret and *anticipated* regret, it does acknowledge a connection between the two in the sense that the experience of current regret may affect the anticipation of future regret (Camille et al., 2004; Coricelli et al., 2005; Cooke, Meyvis, & Schwartz, 2001; Creyer & Ross, 1999; Zeelenberg & Pieters, 2004).

In agreement with this notion, Creyer and Ross (1999, Experiment 2) found that experienced regret on a bidding subsequently led to more risk averse biddings. More specifically, it led people to subsequently prefer high probability, low payoff options over low probability, high payoff options. Also, in the context of consumer decision making, Cooke et al. (2001) showed that experienced regret over a first decision influenced subsequent purchase decisions. In a similar vein, Zeelenberg and Pieters (2004) showed that experienced regret led con-

sumers to switch to a different product.

In these studies, the effect of experienced regret on subsequent decisions was domain-specific, in the sense that for example regret on purchasing a specific product was found to affect subsequent purchases of the same or similar product. More recently, however, Raeva, Mitton, and Schwarzbach (2010) found that the effects of experienced regret might be broader in scope and even extend to decisions in other domains. In their study, regret over a risky decision affected subsequent decisions in an intertemporal choice setting. After playing a gamble, participants who learned that they could have obtained higher outcomes had they decided differently (i.e., had they played another gamble) showed a stronger time preference (i.e., a stronger preference for current over future outcomes; see for an overview, e.g., Frederick, Loewenstein, & O’Donoghue, 2002). Time preference does not refer to a comparison between factual and counterfactual outcomes, and it is not related to the traditional gamble paradigm, and thus pertains to a different domain than the one in which participants experienced regret.

So how should we explain these findings? For the domain-specific effects of experienced regret on subsequent choice, the most straightforward explanation would be that after the experience of regret, decision-makers merely learn that they should not repeat their mistake, and thus change their behavior (i.e., “once bitten, twice shy”). This would be consistent with most models of emotion regulation (Baumeister, Vohs, DeWall, & Zhang, 2007) and more specifically regret regulation (Zeelenberg & Pieters, 2007). For the broader effects of experienced regret, however, such an explanation in terms of learning may not suffice. After all, after experiencing regret

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in a risky setting, it does not directly follow that one can avoid making the same “mistake” by showing a strong time preference.

Note, however, that even for the non-domain specific effects of regret one could envisage a carry-over process by assuming that it is not the specific decision-related regret that carries over to subsequent decisions, but rather that it is a more unspecified nature of regret that carries over. That is, the experience of regret may sensitize decision makers to future experiences of regret, and increase their motivation to avoid (anticipated) regret. Rather than concluding that they do not want to make the same mistake twice, decision makers may reason that they do not want to experience the same negative emotion twice. It is this explanation that was favored by Raeva et al. (2010).

We do not want to dispute the regret-specific explanations that have been put forward in previous research. However, we do want to draw attention to an additional, as yet unexplored and more general process that may result from the experience of regret: The experience of regret may lead to a carry-over of a comparative mind-set (Xu & Wyer, 2008). One of the defining characteristics of regret is that it is an emotion that it results from comparing “what is” to “what could have been”. When the obtained outcomes (what is) after making a choice compare unfavorably to the outcomes one could have obtained, decision-makers will experience regret. The comparing of decision outcomes is therefore essential to the experience of regret; if you don’t compare, you don’t regret (see Van Dijk & Zeelenberg, 2005; Zeelenberg & Van Dijk, 2005).

In the current paper we draw attention to the consequences of making such a comparison. In particular we suggest the mere fact of making comparative judgments about decision outcomes may already elicit a comparative mind-set, and this mind-set may carry-over to subsequent decisions. Xu and Wyer (2008) recently demonstrated such a carry-over effect in a series of studies on purchase decisions. For example, in one of their experiments, they presented participants with an opportunity to buy one out of four types of products (chocolate bars, potato chips, chewing gum, and pens). To choose and buy one of these products, one needs to compare the products. Consistent with their comparative mind-set idea, participants’ willingness to purchase one of these products increased if previously they had completed a task requiring them to compare animals to each other (e.g., comparing elephants to hippos). In other words, the evoked comparative mind-set in the animals task carried over to the product purchase task. In more general terms, Xu and Wyer (p. 860) described a carry-over of a “*comparative* mind-set that, once activated, persist to influence behaviors and decisions in other situations in which comparison processes might come into play.”

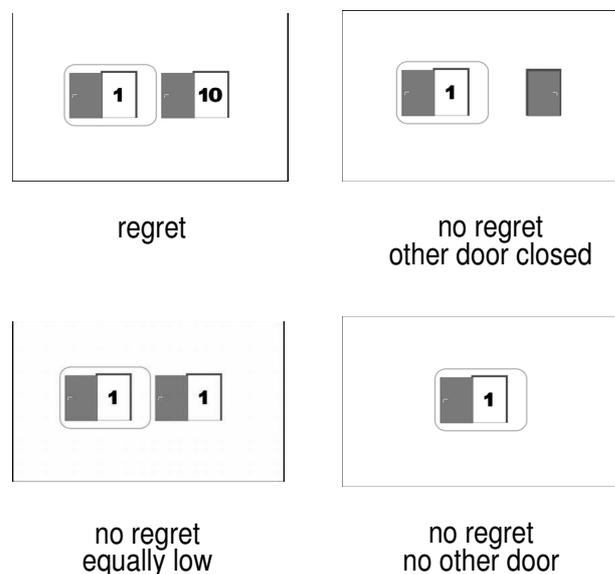
In agreement with these insights we here suggest that the experience of regret, which is critically dependent on the comparison of “what is” to “what could have been”, may evoke a comparative mind-set, and that this comparative mind-set persists to influence subsequent decision-making. To investigate this possibility, we designed an experiment in which participants made two successive decisions. First, we presented participants with a decision task in which they would or would not experience regret. Subsequently, we presented them with a different task (a matching task) in which they had to match two options in terms of attractiveness.

To induce regret on the first task, participants were presented with a situation in which they obtained low outcomes and learned that they would have obtained higher outcomes had they chosen differently. To investigate the idea that—at least part of—the effects of this induction of regret may be attributed to the invoked comparative mind-set, we also included several alternative inductions. In some, we presented our participants with the same low outcomes, but we did not inform them of the outcomes they could have obtained had they chosen differently. In these conditions, participants thus obtained low outcomes but could not compare their outcomes to what could have been. In the absence of a comparison of decision outcomes, people could therefore not regret their decision. This is consistent with Bell (1983, p. 1165), who argued that “Key to the identification of regret as a factor in decision making under uncertainty is the hypothesis that it may matter whether a foregone lottery is resolved or not. This is the predicted phenomenon on which experimentation should be concentrated.” Indeed, studies followed up on this advice and found that decision makers are most likely to anticipate regret when expecting feedback (e.g., Ritov, & Baron, 1995; Zeelenberg, Beattie, Van der Pligt & De Vries, 1996).

In another condition, however, we did inform the participants about the outcome they would have obtained had they chosen differently, but told them that this outcome would have yielded exactly the same outcome. Note that this condition is crucial, because in this condition too, participants would experience no regret, but this no-regret would now be the result of a similar comparison process: in this case, the conclusion that there is nothing to regret also results from a comparison of “what is” with “what could have been.”

This experimental setup allowed us to investigate the plausibility of our general comparative mind-set explanation versus more specific explanations such as the learning and regret sensitivity explanations put forward in prior research. If the effects of experienced regret on the subsequent decisions would primarily be the result of a carry-over of the specific experience of regret, we should find that the effects would be observed only in the con-

Figure 1: Feedback on the initial task. Snap-shots of the doors displayed on the computer screens in four of the five conditions.



dition in which we induced regret. If, however, being in a comparative mind-set would explain the carry-over effects, we should see similar effects on the subsequent task in the induced regret condition as in the condition in which participants learned that the outcomes would have been identical had they chosen differently.

## 2 Experimental setup

We presented our participants with two tasks. The first task (from now on labeled the “initial task”) was used to induce our experimental manipulations. The second task (from now on labeled the “subsequent task”) was used to collect our main dependent measure.

### 2.1 Initial task

In our initial task, we presented some of our participants with a choice between two gambles. These gambles were graphically presented on their computer screen as two doors. Each door offered 50/50 chance to win 1 Euro or 10 Euros. Participants had to choose which door they wanted to open; what would be behind the door of their choosing would be theirs: If it would be 1 Euro, they would gain 1 Euro; if it would be the 10 Euros, they would gain 10 Euros. The participants knew that they would not be eligible to the outcome of the other (non-chosen) door. After participants had made their decision, the chosen door was opened. In all conditions, participants then learned that the outcome was 1 Euro. To in-

duce regret, participants in the “regret condition” then learned what was behind the other door: 10 euros, implying that had they chosen differently, they would have gained 10 euros. In contrast, participants in the “no regret, equally low” learned that behind the other doors was also 1 Euro. A comparison with the own outcomes of 1 Euro thus should elicit no regret (see Figure 1 for a graphical description of our conditions).

In addition to these two conditions, which both presented participants with a comparative context, we also included three additional conditions that did not include this comparison context. In one condition (the “no regret, other door closed” condition), participants were presented with two doors, but we did not inform them about the outcome of the other door; that is, participants were not presented with a comparison and regret was not induced (see Figure 1). In another condition (the “no regret, no other door” condition), we presented the task as one involving only one door such that participants had no choice but merely learned that what would be behind the door would be theirs, and that this could either be 10 euros or 1 Euro, to then find out that the outcome was 1 Euro (see Figure 1). Finally, we also included a condition in which we did not present participants with a door or the possibility of obtaining 1 or 10 euros. These participants merely learned that they received 1 Euro (the “no regret, no door” condition), hence this condition is not shown in Figure 1.

To sum up, we had 5 conditions, of which two conditions were expected to evoke a comparative mind-set (the “regret” and “no regret, equally low” condition). In addition, we had three conditions that were intended to not evoke a comparative mind-set or regret (the “no regret, other door closed”, “no regret, no other door”, and “no regret, no door” condition).

### 2.2 Subsequent task

As our subsequent task, we used a matching task that was different from the initial task. The matching procedure is a common method to assess indifference between two options (e.g., Tversky, Sattath, & Slovic, 1988). Participants are usually presented with two options that are described on two dimensions (e.g., the monetary payoff and the probability associated to the payoff), where for one of the options one attribute value is missing. Participants are instructed to fill in a value for this attribute such that the two options become equally attractive to them (i.e., one would be indifferent between the two options). Our matching task consisted of a sure option and of a gamble offering a 50% chance at 100 Euro and a 50% chance at 1000 Euro (hypothetical payoffs). The participants were required to fill in the monetary payoff of the sure option, by stating the minimal amount of money they would ac-

cept to receive for sure instead of playing the gamble. This amount, called certainty equivalent (CE), was our dependent variable.

The setting that we used to gather these data resembled the TV-show game “Deal or no deal”; a game has also been used by others to assess risky decision-making (e.g., Anderson, Harrison, Lau, & Rutström, 2008; De Roos & Sarafidis, 2010). The essence of the game is that there are 20 boxes (containing 20 different amounts of money from 1 Euro to 250,000 Euros) each belonging to one of 20 contestants. One contestant is selected to play the game (the other contestants are only assisting from this point on). The contestant starts opening the boxes of the others one by one, thereby gaining more information on the content of her box. In predetermined intervals, she is presented with a “bank offer”—the opportunity to take for sure some amount of money to give up the amount in her own box—and she is asked the question “Deal or no deal?” If she says “No deal”, she continues to open boxes. If she says “Deal”, she gets the bank offer and gives up the amount in her box. At this point in time the contestant does not know what is in her box. She continues to open boxes until all boxes are opened, thereby revealing the content of the contestant’s box in the end of the game.

In our study, we informed the participants that they were at the end of the game, and that there were only two boxes left; one with 100 Euros and one with 1000 Euros. At this point, participants had to decide whether they wanted to play the gamble (i.e., take what was in their box) or whether they would refrain from gambling and accept the bank offer (BO). Instead of presenting the participants a bank offer (BO), we asked them to indicate their CE, that is, the minimal acceptable bank offer that would keep them from playing the gamble. Note that this CE could then be seen as a proxy for the willingness to play the gamble, with a low CE indicating reluctance to play the gamble. We informed the participants that the CE they listed had no influence whatsoever on the bank offer; i.e., the bank offer would not be determined on the basis of their CE.

With this setup, and with CE being a proxy for the willingness to play the gamble, we expected that a comparative mind-set would result in a lower CE. To see why, it is first of all important to realize that in this “Deal or no deal” setup, participants could anticipate two negative possibilities: (1) playing and losing the gamble, and (2) not playing and learning that they would have won the 1000 Euros if they would have played. Second, it is important to realize that the former scenario (playing and losing the gamble) evokes more negative comparisons than the second scenario (not playing and forgoing a win). Let us explain. Those who decide to play and lose have to face two negative comparisons: The compar-

ison between the obtained 100 Euros and the missed bank offer BO, and the comparison between the obtained 100 Euros and the 1000 Euros from the non-chosen box. In contrast, those who decide not to play and find out that they would have won face only one negative comparison between the obtained BO and the missed 1000 Euros had they played.

Because a comparative mind-set increases the sensitivity to comparison information we anticipated that it may especially increase the reluctance to experience the situation in which multiple negative comparisons can be made. That is, it should result in reluctance to play the gamble. With CE as a proxy for the willingness to play the gamble, a comparative mind-set should thus result in a lower CE.<sup>1</sup>

## 2.3 Predictions

If the carry-over effect would be contingent on the actual experience of regret, one would expect the regret condition to stand out such that the lowest CEs would be observed in the regret condition. If, however, it is the comparative mind-set that carries over, one should find that the lowest CEs would be observed in the two conditions with comparison information (the “regret” and “no regret, equally low” conditions). We expected no differences in CEs for the other conditions in which participants did not receive comparison information and (thus) would not experience regret (the “no regret, other door closed”, “no regret, no other door”, and “no regret, no door” conditions).

## 2.4 Method

### 2.4.1 Design and participants

We manipulated the feedback on the initial task in a between-subjects design. Five conditions were included, of which two were intended to evoke a comparative mind-set (“regret” vs. “no regret, equally low” condition) and the other were not (“no regret, other door closed” vs. “no regret, no other door” vs. “no regret, no door”). Students ( $N = 169$ ) at Leiden University participated voluntarily. Five participants (3%) provided an answer that fell outside of the domain of the task (an amount smaller than 100 or greater than 1,000 for the certainty equivalent). These participants were excluded from the further analysis. The data from 164 participants (46 males (28%); 118 females (72%); and  $M_{Age} = 21$  years) were considered in the statistical analysis.

<sup>1</sup>One could also interpret this as a prediction that regret aversion would lead people to show risk aversive behavior. But note that regret aversion may sometimes also lead to risk-seeking behavior (Ritov, 1996; Zeelenberg et al., 1996).

## 2.4.2 Procedure

Each participant was seated in an individual cubicle equipped with a PC and randomly assigned to one of the five conditions.

Participants in the “no regret, no door” condition only read that they received 1 Euro. Participants in the other conditions were presented with the initial task. In the “regret” condition, the “no regret, equally low” condition, and the “no regret, other door closed” condition, participants saw two identical doors on their computer screen and read:

*Before we begin with the survey, we will first determine how much you will get paid for your participation. You could be paid either 1 € or 10 €. How much you will receive, depends on your decision. You must choose between two doors, door A and door B. Behind each door there is a 50–50 chance to be 1 € or 10 €.*

The participants indicated their choice with a mouse-click. A green rounded square then highlighted the chosen door. After this, the participants learned the outcome of the chosen door, indicating that they gained 1 Euro. In the “regret” condition, participants learned that the outcome behind the other door was 10 euros. This was done by graphically displaying the opened door with 10 euros (see Figure 1). In the “no regret, equally low” condition, participants learned that the outcome behind the other door was also 1 Euro. In the “no regret, other door closed”, participants did not learn the outcome of the other door.

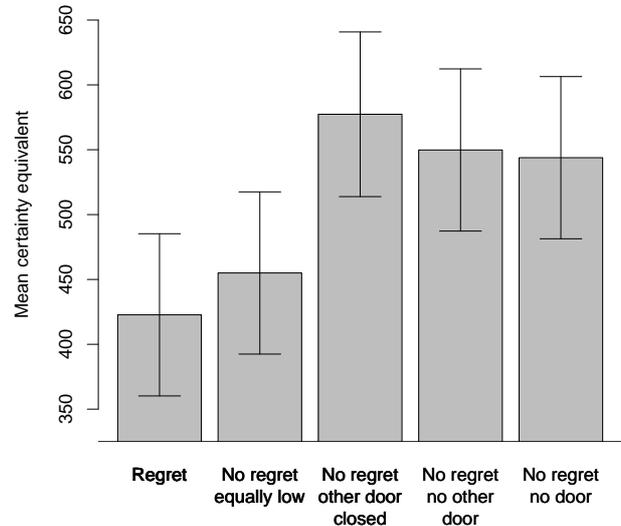
Participants in the “no regret, no other door” condition saw only one door and were informed that the outcome of the door was randomly selected by the software. These participants too then learned that the outcome was 1 Euro.

In the subsequent task, all participants were presented with the matching task. As a cover story for this part, participants were told that they participated in a survey for the TV game show “Deal or no deal” aiming at improving the game. Participants were first presented with a brief explanation of the rules of the game on their computer screen. They were instructed that the rule of “Deal or no deal” states that, irrespectively of whether the bank offer is accepted or not, the game is only over when all boxes are opened. After that, the participants read the following scenario:

*Imagine you are at the final stage of game. There are only two boxes left: 100 € and 1000 €. What is the lowest offer you would accept from the bank?*

In this context, participants thus expected that they would find out whether they won 1,000 Euros or 100 Euros on the gamble. They indicated what would be the smallest amount they would accept in exchange of the gamble (i.e., the certainty equivalent, CE - our dependent variable). The position of the 100 Euros and 1,000 Eu-

Figure 2: Mean certainty equivalents in the different experimental conditions. The error bars correspond to the 95% confidence interval.



ros, and the blank space for the bank offer on this screen resembled the format used in the TV game show “Deal or no deal”. After participants indicated their CE, the experiment was ended, and the participants were thanked and debriefed.

## 2.5 Results

A single-factor, between-groups, ANOVA on participants’ certainty equivalents yielded a significant effect of condition,  $F(4, 159) = 4.43$ ;  $p < .01$ . The results of a series of LSD comparisons ( $p < .05$ ), confirmed our predictions. As Figure 2 shows, CEs for the two comparative conditions (“regret” and “no regret, equally low”) were lower than the means of the other conditions, thereby supporting the idea of a carry-over effect of a comparison mind-set. Thus, participants in the regret condition ( $M = 422.73$ ;  $SD = 198.47$ ) and the “no regret, equally low” condition ( $M = 455.00$ ;  $SD = 151.18$ ) reported significantly lower ( $p < .05$ ) CEs than did the participants in the participants in the “no regret, other door closed” condition ( $M = 577.34$ ;  $SD = 188.29$ ) and in the “no regret, no other door” condition ( $M = 549.82$ ;  $SD = 194.49$ ) and the “no regret, no door” condition ( $M = 543.88$ ;  $SD = 172.93$ ). Importantly, the mean CE in the regret condition did not differ significantly ( $p > .05$ ) from the mean CE in the “no regret, equally low” condition.

## 3 Discussion

The experience of regret may affect future decisions. With this general idea as a starting point, we set out

to study why experienced regret may carry-over to subsequent decisions. Previous research primarily offered regret-specific explanations. The most straightforward explanation was a learning explanation: after the experience of regret people may want to avoid making the same mistake twice. A related explanation was that the experience of regret increases people's sensitivity to regret (Raeva et al., 2010), such that they may become even more motivated than before to avoid regret. Whereas these explanations both consider the experience of regret as the immediate cause, we suggested a more general explanation by assuming that it is the comparison mind-set (Xu & Wyer, 2008), rather than the specific experience of regret that carries over.

Our findings support the evoked mind-set explanation. After all, we observed similar effects for the two conditions that were similar to the extent that they both provided comparison, but dissimilar with regard to experienced regret (i.e., the "no regret, equally low" condition, and the "regret" condition). The fact that these two conditions stood out suggests that comparison mind-set explanation may be more important for these carry-over effects than the mere fact of whether or not the people experienced regret. These findings are important because they suggest a much more general explanation that previous research did and (thus) suggest a wider range of behavioral carry-over effects. While there is no regret without a comparison, there can be comparison without regret.

Whereas Xu and Wyer (2008) already showed that a comparison mind set may generalize from comparing animals to purchase decisions, our current findings would suggest similar carry-over effects—via a similar process—after the experience of regret but also after the experience of no regret (i.e., when the comparison revealed that factual and counterfactual outcomes were identical). In this respect, our findings may also be related to a previous study suggesting that constructing counterfactuals produces a counterfactual thinking mind-set. Galinsky and Moskowitz (2000) found that the exposure to events where a better alternative outcome almost occurred triggered a mind-set of mental simulations that subsequently affected behavior in an unrelated domain. To illustrate, in one of their experiments, Galinsky and Moskowitz first presented participants with scenarios about a woman (Jane), who was at a rock concert. At the intermission it was announced that a fan would win a trip around the world and that the seat number currently occupied would determine the winner. In all scenarios Jane did not win the trip, but in half of these scenarios the authors also introduced the following counterfactual event: Jane would have won it if she had not switched her seat in the beginning of the concert. Subsequently, participants were presented with a problem-solving task. In this task, participants were presented with a candle, a full book of

matches, a box filled with tacks, and a corkboard fixed to a wall. Participants' task was to attach the candle to the corkboard in such a way that the candle burns properly and does not drip wax on the floor. The solution of the task is that the box of tacks should be emptied, the box tacked to the corkboard, and the candle placed inside the box. But this solution requires participants to realize that the box can be used as a surface that can be tacked to the wall. Thus, one should simulate an alternative function of the box to solve the problem. The results revealed that the solution rate for the candle task was significantly higher for participants who first had made a counterfactual comparison. These findings are relevant to our study, as they suggest that a prior exposure to counterfactuals can promote the making of mental simulations on subsequent tasks. But again note, however, that the process we describe is even more general, because we describe a carry-over effect that is not restricted to the availability of a better alternative, but was also observed in the case of an equal alternative.

One could of course argue that even the presence of an equal alternative decision outcome could have induced a feeling in participants that the alternative could have been better. In other words, even when they would experience no regret, the mere presence of feedback on the other outcome could elicit a concern about regret (that could have occurred but did not occur), and could elicit an "it could have been different" feeling. Note, however, that this interpretation is not too different from our interpretation, because the counterfactual "it could have been different" basically refers to the comparison process (i.e., you can only think about something being different if you compare).

At this point it is also relevant to address the potential importance of disappointment. In our study, we focused on regret, but having a low outcome may also result in disappointment. Disappointment results from a comparison between actual outcomes and expected outcomes. If you obtain lower outcomes than you had expected (or hoped for), you may be disappointed. Note, however, that disappointment and its underlying comparison cannot account for our findings, because, with the exception of our control condition, disappointment would be a constant in our design. In all experimental conditions, participants received 1 euro where they might have hoped to obtain 10 euros.

By concluding that disappointment would not explain the pattern of results, we do not mean to imply that disappointment can never instigate a comparative mind-set. We do tentatively suggest, however, that in general its influence on subsequent decisions may be less intense. To understand why, it is important to acknowledge that regret and disappointment result from different types of comparison. Regret results from a comparison of deci-

sion outcomes: that is, the comparison of what is, with what would have been “*had I decided differently*”. Disappointment results from a different type of comparison, namely the comparison of what is with what could have been “*had another state of the world occurred*.” (See also Zeelenberg, Van Dijk, Manstead & Van der Pligt, 1998.) The distinction between both types of comparisons is crucial, because we investigate how prior decisions affect future decisions. Comparison feedback on prior decision outcomes (i.e., the outcomes you would have obtained had you decided to choose option a vs. option b) may then be more influential than feedback on outcomes that are unrelated to different decision options, but instead to the outcomes of one option only (e.g., the outcomes you would obtain if state x of the world would occur or state y; e.g. if you would earn 1 or 10 Euros). Put differently, we suggest that not all comparative mind-sets may be alike, and that not all comparison mind-sets may equally affect subsequent decision. The findings we obtained here suggest that a comparative mind-set evoked by a comparison of decision outcomes may have the strongest effect on subsequent decisions. Whereas our current data support such a view, it would be relevant to conduct more research to investigate this idea.

With this remark we also come to the boundary conditions of the carry-over effect. The notion of a carried-over comparative mind-set implies the tendency to compare spills over to subsequent situations that do not have to be directly related to the situation in which the comparative mind-set was evoked. As noted, Xu and Wyr (2008, p. 860) made the restriction that that a comparative mind-set may affect behavior and decisions “in other situations in which comparison processes might come into play.” In other words, there is no need to expect that after feedback on different decision outcomes you suddenly start comparing the height of the people standing before you in line in your local supermarket. It is more likely, however, that with two lines to choose from you are more likely to consider the length of the lines.

Taken together, the current findings suggest a new interpretation of a known behavioral effect. The experience of regret may alter the risk attitude in subsequent tasks, but the underlying process may be more fueled by the experienced comparison mind-set than by the experienced regret. As a result, the phenomenon appears to be more general, and not restricted to situations in which people experience regret, but can even be observed in situations in which people—after a comparison of factual and counterfactual decision outcomes—experience no regret at all. Interestingly, this notion also suggests that similar effects might be observed after elation, i.e., if people find out that their factual outcomes are higher than the counterfactual outcomes. It may be interesting for future research to investigate this implication as well.

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