Having second thoughts: Consequences of decision reversibility
Bullens, L.

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You can have peace. Or you can have freedom. Don’t ever count on having both at once.

– R.A. Heinlein
CHAPTER FIVE
ART OR ALGEBRA? HOW DECISION REVERSIBILITY AFFECTS
CREATIVE AND ANALYTICAL PERFORMANCE

This chapter is based on Bullens, L., & van Harreveld, F. Art or Algebra? How decision reversibility affects creative and analytical performance. Manuscript under revision.
Even though people prefer to make reversible rather than irreversible decisions (Gilbert & Ebert, 2002), the opportunity to revise a decision appears to have some unexpected downsides. The reversibility of a choice, for instance, seems to have a detrimental impact on individuals’ evaluation of the decision outcome. More specifically, reversible decisions yield lower levels of choice satisfaction and increased feelings of regret (Bullens, van Harreveld, & Förster, 2011; Gilbert & Ebert, 2002).

Recently, research started to also investigate the motivational effects of decision reversibility. Bullens, van Harreveld, Förster, and Higgins (2013) examined how the mere anticipation of a reversible versus irreversible decision affects people’s regulatory motivation. According to regulatory focus theory (Higgins, 1997, 1998, 2002), there are two self-regulatory systems that can help to achieve a goal; a promotion and a prevention system. Promotion focused individuals are motivated to attain nurturance and usually are concerned with the presence or absence of a positive outcome. Prevention focused individuals, on the other hand, are motivated to attain security and are generally concerned with the presence or absence of a negative outcome. Regulatory focus theory proposes that these systems utilize different means of regulating towards desired end-states, and involve different motivational orientations. While individuals in a promotion focus tend to utilize approach strategic means and show eager and risk-taking behavior, individuals in a prevention focus are inclined to employ avoidance strategic means and demonstrate careful and vigilant behavior (Crowe & Higgins, 1997; Förster, Higgins, & Idson, 1998; Higgins, Roney, Crowe, & Hymes, 1994; Seibt & Förster, 2004).

Bullens, van Harreveld, Förster, and Higgins (2013) examined the relation between the anticipation of decision (ir)reversibility and regulatory motivation. On the basis of research by Bullens, van Harreveld, Förster, and van der Pligt (2013) (see also Hafner, White, and Handley, 2011), they expected reversible decision-makers, compared to irreversible decision-makers, to be relatively more prevention than promotion focused. Specifically, Bullens, van Harreveld, Förster, and van der Pligt (2013) showed that whereas reversible decision-makers attend relatively more to the negative aspects of the chosen and to the positive aspects of the rejected alternative, irreversible decision-makers attend relatively more to the positive aspects of the chosen and to the negative aspects of the rejected alternative. In other words, they demonstrated a focus
on the presence of a negative outcome (indicative of a prevention focus) after reversible decision-making, and a focus on the presence of a positive outcome (indicative of a promotion focus) after irreversible decision-making. On the basis of this finding, Bullens, van Harreveld, Förster, and Higgins (2013) expected a relative prevention motivation more than a promotion motivation after anticipating reversible instead of irreversible decision-making.

To test these predictions, participants in each of the studies were introduced to a reversible or irreversible choice. Immediately after the manipulation of decision reversibility – but before participants actually indicated their (initial) choice – Bullens and colleagues (2013) measured their regulatory focus. They assessed regulatory motivation with a number of indicators; examples are participants’ self-expressed preferences for approach versus avoidance, and their speed and accuracy motivations. They also measured global vs. local reaction time performance to tap into participants’ regulatory motivation, as research has shown that global processing is facilitated for those with a promotion motivation, whereas local processing is facilitated for those with a prevention motivation (Förster & Higgins, 2005). In line with what they expected, Bullens et al. demonstrated that the anticipation of reversible decision-making is relatively more related to a prevention than to a promotion motivation as indicated by a relatively greater concern with avoidance, higher accuracy, local processing, greater outcome value from greater fit with chronic prevention concerns, and a relatively greater interest in prevention-related product features.

In an aim to explain their effects, Bullens, van Harreveld, Förster, and Higgins (2013) argued that reversible decision-making renders the possibility of making a wrong choice more salient. This anticipation of failure has been found to strengthen prevention vigilance (e.g., Crowe & Higgins, 1997; Förster et al., 1998; Förster et al., 2001; Higgins, 1998; Higgins et al, 2001; Zhou & Pham, 2004). As another explanation, they referred to research showing that prevention-focused vigilance correlates with feelings of responsibility (e.g., Higgins, Roney, Crowe, & Hymes, 1994). Accordingly, they suggested that the option to revise may augment feelings of pressure and responsibility to make the very best choice as the allowance for corrective action increases people’s subjective feelings of responsibility to end up with the right alternative (Epstude & Roese, 2008; Hafner, White, & Handley, 2011; Roese & Summerville, 2005).
In each of the studies conducted by Bullens and colleagues, the extent to which the decision was reversible, affected regulatory motivation immediately in the pre-decisional phase, i.e. even before participants actually made their reversible or irreversible choice. Up until now, however, it is unclear whether these effects also carry-over to the post-decisional phase and, thus, whether decision reversibility affects performance on subsequent (unrelated) tasks after the decision has been made.

Extant research revealed several cases in which a cognitive procedure activated in one task carried-over to a subsequent, unrelated task (see for instance Förster and Dannenberg, 2010; Förster and Denzler, 2012; Förster, Friedman, and Liberman, 2004). Schooler (2002) and Schooler, Fiore, & Brandimonte (1997) termed this “processing shifts”. These shifts can be transfer-appropriate or transfer-inappropriate. During transfer-appropriate processing shifts, residually activated mechanisms are beneficial for subsequent processing, whereas transfer-inappropriate shifts occur when the elicited mechanisms impair subsequent processing. For example, Macrae and Lewis (2002) demonstrated that face recognition was enhanced after a global processing task (transfer-appropriate shift) and was impaired after a local processing task (transfer-inappropriate shift), most likely because global processing increases (and local processing decreases) the ability to process information in a more holistic way, which, in turn, facilitates face recognition. The present research was designed to determine whether decision reversibility also elicits such processing shifts. More specifically, our goal was to find out whether the motivational effects of decision reversibility also carry-over the post-decisional phase and influence the decision-maker’s performance on a subsequent, unrelated task.

In the current research we focus on the influence of decision reversibility on creative and analytical ability, because regulatory motivation – the motivation that is affected by decision reversibility – is known to impact upon people’s performance on these types of constructs (see, for instance, Förster and Denzler, 2012; Friedman and Förster, 2001). Moreover, finding a relation between decision reversibility and creative versus analytical ability, would demonstrate that the effect of decision reversibility goes beyond its motivational influence, and also affects fundamental human performances. We posit that irreversible decision-making is likely to produce a transfer-appropriate processing shift with respect to creative ability, because creativity appears to profit
especially from the risky, explorative processing style elicited by a promotion motivation (Friedman & Förster, 2001). The opportunity to change one’s mind, on the other hand, is more likely to produce a transfer-appropriate processing shift in the context of analytical problem solving. The latter tends to benefit more from the detail-oriented local processing style elicited by a prevention motivation (e.g., Förster & Denzler, 2012; Seibt & Förster, 2004).

**Creative and analytical performance**

Regulatory motivation, as well as processing style, has been found to affect creativity (Friedman & Förster, 2001). Friedman and Förster predicted that the risky, explorative processing style produced by a promotion motivation would *facilitate* creativity, whereas the risk-averse, safety oriented processing style elicited by a prevention motivation would *undermine* creativity. In one of their studies, participants were primed with a maze task either presented in eager, promotion terms (i.e., a mouse finding its way to a piece of cheese) or in vigilant, prevention terms (i.e., a mouse finding its way to safety from an owl). Subsequently, participants were asked to generate as many creative uses for a brick as possible. In line with their hypothesis, Friedman and Förster demonstrated that those primed with promotion focused eagerness were more creative in their solutions than those primed with prevention focused vigilance. These findings are in line with other studies showing that approach cues, relative to avoidance cues, promote creativity (Friedman & Förster, 2000; 2002).

Whereas promotion motivation appears to facilitate creativity, extant research suggests a similar relationship between prevention motivation and analytical performance. Research by Seibt and Förster (2004), for instance, showed that negative stereotypes (triggering a prevention focus) led to better analytical performance (see also Friedman and Förster, 2000). Förster and Denzler (2012) further demonstrated that local processing, which, as argued above, is also related to prevention focused vigilance, facilitated performance on an analytical task. In their research, participants were either induced with a global or a local processing style after which they worked on two different tasks; one measuring creativity and one measuring analytical ability. The creativity task involved coming up with the most creative title for a picture displaying a dog lying on a sofa. For the analytical task, participants worked on four logical reasoning
problems derived from the Graduate Record Examination (GRE) Analytical test (Friedman & Förster, 2000, 2001, and 2002). It was predicted and found that whereas a global processing mode facilitates creativity and impairs analytical ability, a local processing mode reduces creative thought and enhances analytical performance.

Altogether, it thus appears that a promotion motivation increases creative rather than analytical performance, whereas the reverse appears to be true for a prevention motivation. As we alluded to above, the extent to which decisions are reversible directly affects regulatory motivation (Bullens, van Harreveld, Förster, & Higgins, 2013), at least in the period before individuals have actually made their decision. In the present research, we aim to establish whether the relation between reversible decision-making and regulatory motivation also carries-over to the phase after the (initial) decision has been made.

To summarize, we posit that individuals will be more creative after irreversible, rather than reversible decision-making. However, regarding analytical ability, the reverse will be true. People will perform better on an analytical task after having made a reversible instead of an irreversible decision. We will test our assumptions in two studies. In both studies participants will be asked to make a reversible or irreversible choice after which their creativity (Study 1) and analytical ability (Study 2) are assessed.

Study 1

Method

Participants and design. Seventy students (25 males and 45 females; $M_{age} = 20.17, SD_{age} = 1.81$) participated in the study. Because of a technical problem, we lost part of the data of eight participants. Hence, we had to exclude these participants from the analyses. Two additional participants were also excluded from the main analyses because their scores on the dependent variable deviated more than 2 $SD$'s from the mean for the rest of the sample, leaving a sample of sixty participants. The experiment was the first in a testing session with various unrelated experiments. Participants received course credit for their participation. The study was a one factor (irreversible, reversible) between subjects design with creative performance (the brick task, Friedman & Förster, 2001) as the dependent variable.
Materials and procedure. Upon arrival at the laboratory, participants were seated in front of a computer and randomly assigned to one of the two experimental conditions. The computer provided all instructions. The experiment was introduced as a study on decision-making in lotteries (see for a similar procedure Bullens, van Harreveld, and Förster 2011; Bullens, van Harreveld, Förster, and Higgins, 2013, Study 4). Participants were told that draws were going to be held for two different prizes: one for an iPod and one for a portable DVD-player\textsuperscript{13}. Participants were asked to decide which of both prize draws they wanted to enter. This decision was either irreversible or reversible. Those in the irreversible decision condition were told that their decision was final and they would thus not be able to revise their decision at a later stage. Those in the reversible decision condition, on the other hand, were told that their decision was only preliminary and that they would have the opportunity to revise their choice right before the end of the experimental hour, if they wished to do so.

Immediately after participants made their reversible or irreversible choice, they were asked, as a manipulation check, to indicate on a 7-point Likert scale (1 = not at all, 7 = very much) the extent to which they thought the decision had been a reversible one. Subsequently, they were introduced to an ostensibly unrelated task on creativity. For this task, participants were asked to generate as many uses for a brick as they could think of (Friedman & Förster, 2001; Seibt & Förster, 2004). More specifically, they were instructed to be as creative in their solutions as possible. After one minute they were interrupted, and all participants continued with the next part of the experimental session that was outside the focus of the current study. Right before the end of the experimental hour, those in the reversible decision condition returned to the lottery experiment and were told that they could now revise their preliminary choice if they wished to do so. At this point, their decision thus became final. Finally, all participants were thanked for their participation and debriefed.

Results and Discussion

Manipulation check. Results revealed that those in the reversible decision condition considered the decision to be more reversible ($M = 3.36, SD = 1.87$) than those in the irreversible decision condition ($M = 1.57, SD = .88$), $t(58) = -4.95, p < .001$. Only

\textsuperscript{13} The actual lottery took place immediately after the data collection.
one of the participants in the reversible condition changed the preliminary choice. This is in accordance with earlier work (e.g., Bullens et al. 2011; Bullens, van Harreveld, Förster, & Higgins, 2013; Gilbert & Ebert, 2002).

**Creative performance.** We asked two independent raters to rate the creativity of each generated use for a brick on a 9-point Likert scale (1 = *very uncreative*, 9 = *very creative*). Both raters were blind to experimental conditions. Inter-rater agreement was high ($r = .75, p = .000$). For each participant, we then calculated a mean creativity score for all the uses for a brick generated. An example of an uncreative solution was “to build a house with it”, an example of a creative solution was “to use it as a musical instrument”.

Results revealed that the reversibility of the decision significantly affected participants’ creativity, $t(58) = 2.12, p = .038$. As expected, the mean creativity score in the irreversible decision condition was higher ($M = 3.81, SD = 1.14$) than in the reversible decision condition ($M = 3.22, SD = .95$). The total number of creative solutions did not vary across conditions [$t(58) = -.15, p = .880$]. Hence, in line with our hypothesis, people having made an irreversible decision become more creative than people having made a reversible choice. Apparently, the processes activated by the irreversibility of the choice, carried-over to the post-decisional phase and affected the decision-makers’ creative performance on a subsequent, unrelated task.

As we already discussed in the introduction, while creativity profits from promotion focused eagerness or global processing, analytical problem solving is known to benefit from a prevention motivation or local processing (Förster & Denzler, 2012; Seibt & Förster, 2004). Accordingly, we propose analytical ability to be better after reversible decision-making than after irreversible decision-making. Thus, we aim to show that decision reversibility does not simply *impair* performance, but that whether reversible or irreversible decision-making is beneficial to performance depends on the task one is engaged in. Study 2 was designed to specifically test whether these assumptions concerning the relation between decision reversibility and analytical problem solving are correct.
Study 2

Method

Participants and design. Fifty students (16 males and 34 females; \( M_{\text{age}} = 20.88, \ SD_{\text{age}} = 3.08 \)) participated in the study. Three participants were excluded from the analyses because their scores on the dependent variable deviated more than 2 \( SD \)'s from the mean for the rest of the sample, leaving a sample of forty-seven participants. The experiment was the first in a testing session with several unrelated experiments. Participants received course credit or a monetary reward for their participation. The study was a one factor (irreversible vs. reversible) between subjects design with performance on the four GRE analytical tasks as the main dependent variable.

Materials and procedure. On arrival, participants were seated in front of a computer and randomly allocated to one of two experimental conditions. Participants were then introduced to a task allegedly measuring their emotional intelligence (see for a similar procedure Bullens, van Harreveld, Förster, and Higgins, 2013, Study 1). They were told that some researchers argue that emotional intelligence can be determined by measuring one's ability in evaluating others on the basis of a personality description, and that the current research was designed to determine whether this assumption is correct. All participants were asked to imagine themselves working for an employment agency and were presented with the descriptions of four job applicants applying for a position as a car dealer. Participants had to decide which applicant was best suited for this job and performance on this task (as a measure of ability in evaluating others) ostensibly provided their emotional intelligence score.

The decision between the four job candidates was either irreversible or reversible. Participants assigned to the irreversible decision condition were told that they would not be able to revise their decision at a later point in time. Their decision was thus final. Participants assigned to the reversible decision condition, on the other hand, were told that their choice was only preliminary and that they would have the opportunity to revise their decision right before the end of the experimental hour, if they wished to do so.
After receiving the instructions, participants started the task and decided which of the four candidates was most appropriate for the job. Immediately after this decision they were asked, as a manipulation check, to indicate on a 7-point Likert scale ranging from not at all (1) to very much (7) the extent to which they thought their decision had been a reversible one. Subsequently, they were introduced to an ostensibly unrelated task on analytical performance. For this task, participants were asked to solve four different logical reasoning problems from the Graduate Record Examination (GRE) Analytical test (Friedman and Förster, 2000, 2001, and 2002), translated into Dutch. More specifically, they were asked to evaluate the truth-value of four propositions given an initial set of essential facts. Participants were given five minutes to solve these problems.

As soon as they finished the analytical task, all participants continued with the next part of the experimental session that was outside the focus of the current study. At the end of the experimental session, those in the reversible decision condition returned to the emotional intelligence experiment and were told that they could now revise their prior decision if they wished to do so. At this point their decision thus became final. Finally, all participants were thanked for their participation and debriefed.

Results and Discussion

Manipulation check. Results demonstrated that participants assigned to the reversible decision condition considered the decision to be more reversible ($M = 3.39$, $SD = 1.50$) than those in the irreversible decision condition ($M = 1.58$, $SD = .83$), $t(45) = -5.14, p < .001$. None of the participants in the reversible decision condition changed their initial choice.

Analytical performance. A t-test revealed that the reversibility of the decision significantly affected participants’ performance on the Graduate Record Examination (GRE) Analytical test, $t (45) = -2.17, p = .035$. The number of GRE problems solved in the reversible decision condition was higher ($M = 2.52$, $SD = .59$) than in the irreversible decision condition ($M = 2.08$, $SD = .78$). Hence, as expected, analytical performance was better after a reversible decision than after an irreversible decision.
General Discussion

In two studies we demonstrated that the processes activated by the reversibility of a choice carry-over to the post-decisional phase, and, as such, affect individual’s creativity and analytical performance. More specifically, in Study 1 we showed that participants are more creative after irreversible than after reversible decision-making. In Study 2, we subsequently demonstrated that analytical ability profits more from reversible rather than irreversible decision-making. Thus, the results of Study 1 and 2 show that the effects of decision reversibility on task performance differ as a function of the requirements of the task. After having made an irreversible decision, people are likely to do better on a task requiring creativity. After having made a reversible decision, a task requiring analytical ability seems more appropriate. These findings support our idea that irreversible decisions elicit a processing shift (Schooler, 2002; Schooler et al., 1997) towards promotion (global) orientations. This processing shift, in turn, facilitates performance on creativity tasks (requiring abstract thought), and undermines analytical performance (requiring relatively concrete processing). Reversible decisions, on the other hand, elicit a processing shift towards prevention (local) orientations, thereby facilitating analytical performance, and undermining creativity.

Although we specifically view the present effects as a result of these processing shifts – particularly because the relations among all factors (reversible decision-making, regulatory focus, and creative versus analytical ability) are now established, we cannot entirely rule out that other mechanisms account for the current findings as well. One such mechanism, for instance, could be counterfactual thinking. In the context of decision reversibility, research showed more counterfactual thinking after reversible than after irreversible decision-making (see Hafner, White, & Handley, 2011). A counterfactual thinking mode has generally been found to impair performance on tasks requiring novel ideas (Kray, Galinsky, & Wong, 2006). On the basis of this it could be argued that the negative relation between reversible decision-making and creative generation is actually the result of a ‘counterfactual thinking’ mindset. However, the possible role of counterfactual thinking seems less clear-cut when explaining the relation between decision reversibility and analytical problem solving. Research by Markman, Lindberg, Kray, and Galinsky (2007) investigated the relation between additive (e.g., “If only I had”) versus subtractive (e.g., “If only I hadn’t”) counterfactual
thinking mindsets on creative versus analytical ability and found that whereas additive mindsets facilitate creative generation, subtractive counterfactual thinking mindsets facilitate performance on analytical problem solving tasks. Hence, these findings suggest that, only when reversible decision-making would specifically yield a subtractive rather than an additive counterfactual thinking mindset, one could actually advocate the possible role of counterfactual thinking in the current research. Unfortunately, Hafner et al. (2011) did not distinguish between additive versus subtractive counterfactuals; thus it remains unclear which type of counterfactuals is actually triggered by reversible decision-making. The mediating role of counterfactual thinking in the relation between decision reversibility and creative versus analytical ability, therefore, is currently speculative at most. To sum up, while we believe that the present findings are driven by the aforementioned processing shifts, future research should determine whether this is indeed the case, and whether other mechanisms such as counterfactual thinking are (also) at play.

So far, research exploring the effects of reversible versus irreversible decision-making mainly showed reversible decision-making to have rather detrimental consequences (Bullens et al., 2011; Bullens, Förster, van Harreveld, & Liberman, 2011; Bullens, van Harreveld, Förster, & Higgins, 2013; Bullens, van Harreveld, Förster, & van der Pligt, 2013; Gilbert & Ebert, 2002). The results of the present studies, however, reveal that in some cases reversible decision-making is in fact relatively beneficial and that having the opportunity to revise a choice is not as unequivocally detrimental as research up until now seems to suggest. More specifically, whether it is good or bad to engage in a task while still contemplating a reversible decision very much depends on the nature of this task. Reversible (compared to irreversible) decisions impair creative thought but foster analytical performance. Future research should investigate whether there are more circumstances in which, or other tasks for which, reversible decision-making is actually a good thing.

In the future, one may also want to consider possible factors moderating the relationship between decision reversibility and creative and analytical performance. For instance, whereas the present studies show that the type of decision (reversible or irreversible) directly influences creative and analytical performance, one may argue that variations in other contextual factors possibly affect these findings. To give an example,
in research examining the effects of regulatory motivation, regulatory focus is generally induced by using framing methods, i.e. by framing a task in terms of gains versus non-gains and loss versus non-losses (e.g., Higgins, Shah, & Friedman, 1997; Idson, Liberman, & Higgins, 2000). Similarly, a decisional task could also be framed in a way that either induces a promotion or a prevention orientation. For instance, one may frame the decision about whether or not to see a dentist in terms of ‘preventing cavities’ – which will more likely induce a prevention orientation, or in terms of ‘taking good care of one’s teeth’ – which will more likely induce a promotion orientation. As such, one may suggest that the regulatory motivation induced by the type of framing (whether the decision is framed in promotion or prevention terms) will subsequently interact with the regulatory motivation induced by the reversibility of the choice, and, hence, will influence the relation between decision reversibility and creative and analytical performance. Accordingly, one would then suggest that a reversible choice on whether or not to visit a dentist, especially reduces creative performance (or increases analytical ability) when this decision is framed in a prevention manner. Instead, when the same reversible choice is framed in a promotion way, the detrimental effects on creativity will likely diminish or may even disappear.

The temporal distance of the event one has to make a decision about, may have a similar moderating impact on the effects found in the current research. According to construal level theory (CLT; Liberman & Trope, 1998; for a review see Trope and Liberman, 2003), decisions regarding distant future events are generally represented in terms of more abstract, general and decontextualized features (high-level construals) rather than in terms of more concrete, contextual, and incidental details of the events (low-level construals). To illustrate, a person deciding whether or not to visit a dentist half a year from now, may think about this visit in terms of “taking care of one’s health” which is a more global representation of the event, whereas a person deciding on whether or not to visit the dentist in two days, may construe the same visit in terms of “filling up a cavity” being a more local representation.

Previous research has demonstrated a link between temporal distance and creative and analytical ability (Förster, Friedman, & Liberman, 2004). More specifically, it has been shown that distant future time perspectives facilitate creative and undermine analytical ability, whereas the reverse appears to be true for near future
events. On this basis, one may suggest that a reversible decision on whether or not to visit a dentist would especially reduce creative performance (or increase analytical ability) when this visit to the dentist is planned in the near future. Instead, when the same visit is planned in the distant future, the detrimental effects on creative ability may possibly diminish or may even disappear. Finding such moderating effects would specifically show that rather than the mere difference in type of decision (i.e., whether the decision is reversible or irreversible), also other contextual factors (e.g., the specific content of the choice) are important to consider when making predictions about people’s future performance on tasks requiring creative or analytical ability.