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Do Positive Illusions of Control Foster Happiness?

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Positive emotions have been shown to benefit from optimistic perceptions, even if these perceptions are illusory (Seligman & Csikszentmihalyi, 2000). The current research investigated the effects of increases and decreases in illusory control on positive and negative emotions. In two studies we experimentally induced changes in illusory perceptions of control (increase vs. decrease of illusory control) and assessed the extent to which these changes, in turn, influenced participants' emotions. Extending prior research, the results of both studies revealed that whereas illusions of personal control over environmental outcomes mitigated the experience of negative emotions, they did not foster positive emotions. Perceiving a loss of illusory control, however, significantly reduced the experience of positive emotions, but had no effect on negative emotions. Implications for emotion theory and intervention programs are discussed.

Keywords: cognitive appraisal, perceived control, optimism, illusions, positive emotions

> "*Men are disturbed not by the things which happen, but by their opinions about the things*"
>
> —(Epictetus [about AD 50–125]; Long, 1991, p. 14)

Researchers working within the field of positive psychology are interested in identifying and describing antecedents of positive emotions with the goal of finding ways to foster them (Seligman & Csikszentmihalyi, 2000; see also Fredrickson, 2001; Isen, 2001). There is a general consensus in this field that it is the perception and interpretation of events, rather than the events themselves, which elicit emotions. This idea traces its roots to numerous philosophers such as Aristotle, Spinoza, Seneca, and Epictetus (see quotation at the top) and is the core assumption of contemporary appraisal theories of emotions (e.g., Lazarus, 1991; Roseman, 2001; Scherer, 2001; for overviews see Ellsworth & Scherer, 2003; Moors, Ellsworth, Scherer, & Frijda, 2013). Appraisal theories posit that "emotional experiences change as a direct result of additions and revisions in the appraisals" (Ellsworth & Scherer, 2003, p. 574; Lazarus, 1991; Roseman, 2001; Scherer, 2001). Most appraisal theories emphasize the key role that *control* appraisals play in individuals' emotional experiences (e.g., Pekrun, 2006; see also Moors et al., 2013). Until now, however, the relation between changes in control appraisals and positive emotions is not well specified. Is it the perception of gaining control, or losing control (or both) that influences positive emotions, and if so, in which direction? Empirical answers to these questions are largely lacking. In this article we empirically demonstrate how changes in control appraisals influence the experience of individuals' positive emotions.

Perceptions of Control and Emotions

It has long been argued that perceiving control is a fundamental human need and may have implications for well-being (Leotti, Iyengar, & Ochsner, 2010; Seligman, 1975; White, 1959). Research provides suggestive evidence that the perception of having control over the environment, even if illusory, fosters happiness (Ellsworth & Scherer, 2003; Moors et al., 2013; Seligman & Csikszentmihalyi, 2000; Taylor & Brown, 1988, see also Pekrun, 2006; Pekrun, Goetz, Titz, & Perry, 2002). Until now, however, no study has directly demonstrated that overoptimistic perceptions of control would lead to enhanced positive emotions.

Perceiving control is defined as assessing a contingency between environmental events and one's own actions (E. A. Skinner, 1996). Research has shown that individuals' control appraisals do not necessarily converge with the amount of control that is actually given. Results indicate that individuals' control appraisals are frequently biased. In many studies participants overestimated the degree of contingency between environmental outcomes and their

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own actions, and perceived contingencies between environmental outcomes and their actions, where none exist (e.g., Alloy & Abramson, 1979; Alloy, Abramson, & Viscusi, 1981; Jenkins & Ward, 1965; Langer, 1975; Whitson & Galinsky, 2008). For example, participants in Jenkins and Ward (1965), who were asked to turn on a light by pressing or not pressing a button, perceived a higher degree of personal control over the onset of the light, the more often the light came on, even when the light was determined by chance. Whether or not such illusions of control elicited positive emotions has, however, not yet been reported.

Previous research provided indirect support for this possibility. Results showed that individuals who lacked control or had experienced a loss of control tended to have elevated levels of negative emotions, with anxiety being one of the common examples (see Pekrun, 2006, for overviews see Ellsworth & Scherer, 2003; Moors et al., 2013). By contrast, those who were experimentally made to believe that they had control reported less anxiety toward the same aversive treatment (e.g., Sanderson, Rapee, & Barlow, 1989; Telch, Silverman, & Schmidt, 1996; Wiech et al., 2006). Because of the fact that positive and negative affect are often found to change in opposite directions (e.g., Russell & Carroll, 1999; Smith & Ellsworth, 1985), it seems reasonable to conclude that the perception of losing control reduces happiness, whereas the perception of gaining control increases happiness.

This view is, however, challenged both by theoretical and empirical work suggesting that existing evidence on negative emotions cannot be used to draw inferences about positive emotions and that these should instead be regarded as separable phenomena (e.g., Cacioppo & Berntson, 1994; Diener & Emmons, 1984; Isen, 1984; Larsen, McGraw, & Cacioppo, 2001; Larsen, Norris, & Cacioppo, 2003; Levenson, 1999; Watson, Wiese, Vaidya, & Tellegen, 1999; see also Goetz, Frenzel, Stoeger, & Hall, 2010). Based on this research, we assume that changes in perceived control may influence positive affect in a very different way. Initial empirical evidence for this alternative view is provided by research which reveals that participants who were made to perceive control did *not* report more intense happiness, compared with those who faced a lack of control (Winefield, Barnett, & Tiggemann, 1985). Unfortunately, these data still contain no information regarding the essential question of whether and how changes in control appraisals influence positive emotions. The researchers examined the effects of estimating a specific degree of control, rather than the effects of intrapersonal changes in perceived control. Moreover, they did not disentangle subjective control from objective control. Accordingly, it remains an open question whether and how changes in the mere perception of control may influence positive emotions.

In the present research we addressed the question of whether and how changes in illusory control affect individuals' positive emotions. Appraisal theorists posit that individuals' emotions change as a direct result of changes in their appraisals of the situation. By implication, positive emotions should change with perceived increases or decreases in control. Extant literature suggests that individuals are more emotionally attentive to losses than to gains (e.g., Kahneman & Tversky, 1984, see also Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Cacioppo, Cacioppo, & Gollan, 2014; Taylor, 1991). In line with this view, we expect that compared with gains, losses of illusory control are more potent determinants of positive emotions. Therefore, we examined the effects of both increases ("gains") and decreases ("losses") in illusory control on individuals' positive emotions and investigated whether positive emotions were affected by perceived losses in control more than by perceived gains thereof.

The Present Research

In this research we examined the effects of changes in illusory control on individuals' positive affect. To investigate the effects of changes in illusory control we experimentally induced increases and decreases in illusory perceptions of control, and then examined the extent to which these changes influenced participants' experiences of positive affect. Using a well-established illusory control paradigm (Alloy & Abramson, 1979; Alloy et al., 1981; Jenkins & Ward, 1965), we experimentally dissociated subjective from objective control and manipulated only participants' perceptions of control.

Specifically, participants were instructed to turn on a light on the screen, by pressing (or not pressing) a button, where in fact the light appeared completely at random. During this task, half of the participants were led to believe they were gaining control over the light, whereas the other half was led to believe they were losing control. In previous research, increasing the light-onset frequency led participants to believe they were gaining control over the light, whereas decreasing the light-onset frequency led to the perception of losing control (see Alloy & Abramson, 1979; Alloy et al., 1981; Jenkins & Ward, 1965). Accordingly, in the current research participants performed two consecutive rounds of the light-onset task, where in one condition the light appeared with an increasing frequency (increase in illusory control condition) and in the other it appeared with a decreasing frequency (decrease in illusory control condition). If variations in the light-onset frequency change participants' perceived control and if changes in perceived control are important for positive emotions, we would expect to find our manipulation of control to influence participants' reports of their emotions. To test this assumption, we measured participants' positive affect after each round and then examined the extent to which it changed. In addition, to empirically demonstrate that the impact that changes in the control appraisal exert on positive emotions is different from the impact that changes in the control appraisal exert on negative emotions, we assessed participants' negative affect on a separate scale.

Prior experimental studies on perceptions of control focused on aversive stimuli (see Sanderson et al., 1989; Telch et al., 1996; Wiech et al., 2006). It may well be that the perceived value of the stimulus had influenced the resultant feelings. If so, it is difficult to decide, whether it was perceived control, the perceived value of the stimulus or both that had caused the observed pattern of results (see Winefield et al., 1985). To our knowledge, no study systematically varied the perceived value of the stimulus, and controlled for its impact on the results.

The main interest of this research was to determine the genuine causal effect of increases and decreases in control appraisals on positive emotions. In line with appraisal theories we assume that the emotional impact of these changes can be disentangled from the influence of other factors on emotional experiences (Ellsworth & Scherer, 2003; Lazarus, 1991; Pekrun, 2006). For this reason, we decided to test the effects of increases and decreases in illusory control (i.e., increase and decrease) in a neutral context, that is,

when the experimental outcome was nonaversive. The participants were asked to estimate the extent to which they could control the onset of a light (Study 1). Moreover, we additionally varied the value associated with the onset and offset of the light as an independent factor, and controlled for its impact on the feelings resulting from performing the light-onset task (Study 2).

Study 1

The goal of this study was to test the causal effect of gains and losses in illusory control on individuals' positive affect. Participants were asked to gauge the extent to which they could control the onset of a light on the screen. The light appeared on the screen completely at random, but with either an increasing frequency (increase in illusory control condition) or a decreasing frequency (decrease in illusory control condition). After each round, we assessed the extent to which participants perceived themselves to be in control of onset of the light, and their positive and negative affect.

Method

Participants and design. Forty students from the University of Erfurt (33 women, 7 men, age: $M = 20.73$ years, $SD = 2.15$) were randomly assigned to the two conditions of illusory control (increase, decrease). The number of participants invited for this study was set a priori via power analysis (using GPower; Faul, Erdfelder, Buchner, & Lang, 2009). The power analysis using an assumed moderate effect of the manipulation of subjective control ($\eta_p^2 = .10$, based on previous uses of the light-onset paradigm: Gollwitzer & Kinney, 1989; Kaufmann, 2009) suggested a total sample size of 44 participants. Because of the fact that the study was conducted at a small university, putting limits on the size of the experimental participants pool, we had to accept the risk of setting power to a somewhat lower level (0.70). Four of the original 44 participants failed to show up to the study and, thus, could not be replaced. Students were offered research participation credit for taking part in the study.

Procedure. The study took place in a laboratory. Upon entering the laboratory, the participants were greeted by an experimenter and seated each in a cubicle in front of a computer monitor. All instructions were presented on the screen (written in Microsoft Visual Basic). The instructions were as follows:

> Your task is to discover whether you can turn on a blue light on the screen by either pressing or not pressing the button. You will have 40 attempts to press or not press the button and to figure out what makes the light turn on. It is up to you whether or not you can switch on the light by pressing or not pressing the button. (adapted from Alloy et al., 1981)

After the participants pressed (or did not press) the button, they observed either a blue dot flashing in the center of the screen and remaining there for 1.5 s (light-onset) or a screen that remained blank (no light-onset).

Our goal was to induce illusory control. To accomplish that goal, there was no link between individuals' actions (pressing or not pressing the button) and the probability of the light appearing on the screen. Across all trials the light appeared completely at random. However, in one experimental condition the light appeared with an increasing frequency and in the other it appeared with a decreasing frequency across the two rounds. Specifically, in the increase of illusory control condition, the light appeared in 25% of the trials during the first round and in 75% of the trials during the second round. In the decrease of illusory control condition, the light appeared in 75% of the trials during the first round and in 25% of the trials during the second round. A program that combined a randomizer and an algorithmic procedure used in prior research was adopted to ensure that the described percentages of light onset were generated (adapted from Gollwitzer & Kinney, 1989).

Dependent measures. After each round, participants used a 10-point scale (ranging from 0 = *no control* to 10 = *total control*) to estimate the extent to which their acts of pressing or not pressing the button had influenced whether the light came on or remained off. They then completed the German version of the Positive and Negative Affect Scale (PANAS; Krohne, Egloff, Kohlmann, & Tausch, 1996; Watson, Clark, & Tellegen, 1988) consisting of two 10-item scales. Participants were asked to rate how they feel right now, at the present moment. They rated each item on a five-point Likert scale (1 = *very slightly or not at all* to 5 = *very much*). The change in scores (Round 2 minus Round 1) for participants' perceived control, and affect were used as main dependent variables.

Results

Perceived control. As can be seen in Table 1, participants in the *increase* condition showed a positive change score on the judgment of control scale, and those in the *decrease* condition demonstrated a negative change score. A one-way analysis of variance, with the two conditions of Illusory Control (Increase, Decrease) as a between-subjects factor, and the change in the score on the judgment of control scale as a dependent variable, was computed. Results showed a highly significant effect of the manipulation of control, $F(1, 38) = 39.83$, $p < .001$, $\eta_p^2 = .51$. Further, the contrast of the ratings between the two rounds (Round 1 vs. Round 2, see Table 1) was significant within both conditions; *increase* condition: $F(1, 19) = 20.78$, $p < .001$, $\eta_p^2 = .52$, and *decrease* condition: $F(1, 19) = 19.76$, $p < .001$, $\eta_p^2 = .51$. Given that there was no control over the light at all, these results suggest that the experimental manipulation was successful.

Positive and negative emotions. Reliabilities for scores related to the affect scales (Round 1, Round 2, and change score [Round 2 minus Round 1]) were αs = .86, .91, .84 (Positive Affect), and αs = .85, .90, .82 (Negative Affect), respectively. The change scores on the affect scales subjected to a 2 (Illusory Control) × 2 (Affect) repeated measures analysis of variance with the two conditions of Illusory control (Increase, Decrease) as between-subjects factor and the Affect (Positive Affect, Negative Affect) as repeated measurement factor yielded a significant interaction effect, $F(1, 38) = 9.51$, $p = .004$, $\eta_p^2 = .20$ (see Table 1). Main effects were not significant (Increase and Decrease of control: $F(1, 38) = 1.12$, $p > .250$, $\eta_p^2 = .03$, Affect: $F(1, 38) = 1.68$, $p = .202$, $\eta_p^2 = .04$).

As can be seen in Table 1, the *increase* condition produced no change in positive emotions, but a substantial reduction in negative emotions, whereas the *decrease* condition resulted in a negative change score for the positive emotions and only a marginal change

Table 1
Descriptive Statistics for the Illusory Control Conditions

Dependent measures	Study 1				Study 2					
	Increase		Decrease		Increase		Decrease		No change	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Judgment of control										
Round 1	1.30	2.03	5.42	2.70	1.06	1.85	5.18	2.71	2.84	2.31
Round 2	4.33	3.09	1.65	2.28	3.53	2.35	3.05	2.14	2.82	2.33
Change	3.04	2.98	−3.78	3.80	2.47	2.15	−2.13	2.93	.03	1.93
Positive affect										
Round 1	2.44	.50	2.83	.72	2.50	.68	2.68	.74	2.57	.78
Round 2	2.45	.74	2.42	.77	2.56	.80	2.29	.80	2.45	.86
Change	.01	.55	−.41	.34	.06	.82	−.39	.67	−.12	.60
Negative affect										
Round 1	1.42	.41	1.33	.45	1.41	.46	1.43	.58	1.40	.39
Round 2	1.22	.26	1.43	.63	1.30	.47	1.48	.68	1.34	.44
Change	−.20	.40	.11	.31	−.11	.34	.04	.44	−.06	.40

in negative emotions. More precisely, we found the contrast of the ratings of positive emotions between the two rounds (Round 1 vs. Round 2, see Table 1) to be nonsignificant in the *increase* condition, $F(1, 19) = 0.07$, $p > .250$, $\eta_p^2 = .00$, but to be significant in the *decrease* condition, $F(1, 19) = 29.06$, $p < .001$, $\eta_p^2 = .61$. Conversely, the contrast of the ratings of negative emotions was significant in the increase condition, $F(1, 19) = 5.10$, $p = .036$, $\eta_p^2 = .21$, and nonsignificant in the decrease condition, $F(1, 19) = 2.32$, $p = .145$, $\eta_p^2 = .11$.

Discussion

The results of this study reveal a differential effect of increases and decreases in illusory control on positive and negative emotions. Increased perceptions of control changed (reduced) the score on the negative affect scale, but did not change the score on the positive affect scale. Conversely, decreased perceptions of control reduced the score on the positive affect scale, whereas the score on the negative affect scale remained unchanged.

These results confirm and extend previous research. In previous research, participants who were made to perceive control did *not* report more intense happiness, compared with those who faced a lack of control (Winefield et al., 1985). Our results suggest that, similarly, increases in the perception of exercising control do not foster happiness, but that happiness may diminish when one perceives a loss of control, even if it is illusory.

In contrast to prior research on perceptions of control that has focused on aversive stimuli, we tested the effects of the induced changes in illusory control in a neutral context, that is, when the stimulus was nonaversive. One could argue that potential effects of changes in illusory control could have been blurred by this fact that the stimulus (i.e., a blue dot flashing on the screen) was rather neutral in nature. Indeed, we cannot rule out the possibility that due to the fact that the stimulus was neutral participants lacked motivation to exert control over it, and that this in turn explains the present results. There is evidence that motivational factors and task instructions, along with task goals, may play a crucial role for the impact of illusory beliefs. For example, participants in Hamerman and Morewedge (2015) were more likely to rely on superstitious beliefs when they pursued performance goals, compared with when they pursued learning goals. Furthermore, participants' emotional responses changed depending on whether they have promotion or prevention concerns (Higgins, Shah, & Friedman, 1997). Accordingly, one may doubt whether the results from this study would be robust against changes in the perceived value of the stimulus. To address this limitation, we conducted a follow-up study in which we changed the perceived value of the stimulus, and examined whether a similar pattern of results emerges when the stimulus is perceived as positive or negative.

Study 2

In this study we additionally varied the perceived value of the stimulus. In previous research, participants' response behavior changed when they were paid for their performance (Camerer & Hogarth, 1999; Hertwig & Ortmann, 2001). Furthermore, participants' emotional responses changed depending on whether they were led to believe they would get or lose money and, thus, had promotion or prevention concerns (Higgins et al., 1997). For example, Higgins et al. (1997), by framing an experimental task either as an opportunity to get $1 (from a starting point of $4) or to avoid a loss of $1 (from a starting point of $5), induced promotion versus prevention concerns in their participants. Though the monetary outcome was precisely the same in both conditions, their participants demonstrated a different emotional response when the task was framed as a possibility of gaining and not gaining money versus a possibility of losing or not losing money. Participants in the gain condition were more likely to respond with happiness toward the outcome of $1 than those in the loss condition. These results show that mere differences in the instructions and the framing of an experimental task change participants' perceived value of the experimental outcome.

Accordingly, to vary the perceived value of the stimulus, we either told participants they would receive money for bringing on the light or that they would lose money in every trial in which it does not appear on the screen. In fact, all participants who were paid for performing the light-onset task received the same amount of money, irrespective of whether they performed the task in a gain

frame or loss frame, and irrespective of whether they observed the light more frequently (increase of illusory control condition) or less frequently (decrease of illusory control condition). If the perceived value of the stimulus is decisive for the effect of changes in illusory control, we would expect to find a different effect of the manipulation of illusory control in participants who were paid for performing the light-onset task, compared with those who were not paid (Study 1).

Method

Participants and design. One-hundred thirty-nine students from the University of Trier (106 women, 33 men, age: $M = 22.32$ years, $SD = 2.45$) took part in the study. The study was a 3 (Payment: Gain, Loss, No payment) × 3 (Illusory control: Increase, Decrease, No change) factorial between-subjects design. The sample size was determined before data collection by means of power analysis. Using the same assumed values as the power analysis in the first study ($\eta_p^2 = .10$, power = 0.70), the analysis suggested a total sample size of 99 participants. This time, we invited five additional students per experimental condition, so that we could avoid the problem that some participants would refrain from participating in the study and it would not have been possible to have them replaced at a later time. Five participants failed to show up to the study (resulting in a total sample size of 139 participants). Participants were offered research participation credit or alternatively were paid for participation (5 Euro).

Procedure. The procedure was similar to Study 1, with the following modifications. Two groups of participants were told that they would receive money each time the light appeared on the screen. Specifically, in the beginning of the second round, the participants in the first payment condition received the following instructions: "You will get 50 Euro-Cents (€0.5) for each trial, during which the light comes on. By turning on the light as often as possible, you can earn up to 10 Euros (€10)" (monetary gain condition). Participants in the second payment condition were instead presented with the following statement: "You will lose 50 Euro cents (€0.50) for each trial, during which the light does not come on. You now receive a credit of 10 Euros (€10). By turning on the light as often as possible, you will hold the full amount" (monetary loss condition). Participants in the control condition received no such instructions (no payment condition; see Study 1). All instructions were presented on the screen (written in Microsoft Visual Studio).

As in Study 1, changes in illusory control were induced by showing the light across the two rounds either more frequently (increase of illusory control condition: the light appeared in 15% of the trials in Round 1 and 50% of the trials in Round 2) or less frequently (decrease of illusory control condition: the light appeared in 85% of the trials in Round 1 and 50% of the trials in Round 2). To keep the outcome (i.e., amount of money) constant across the payment conditions, such that participants merely perceived it positively or negatively (i.e., as a gain or a loss of money), the light appeared for all participants in 50% of the trials in Round 2. As a result, the outcome was €5 in both the monetary gain and the monetary loss condition. In addition, this time we also included a control condition for the factor of illusory control, in which we held the light-onset frequency constant across the two consecutive rounds of the light-onset task (no change condition).

Dependent measures. After each round, the participants reported their perceived control and their emotions (see Study1). This time, the Positive Affect Scale focused more narrowly on happiness, and the Negative Affect Scale covered a broader range of negative emotions. Therefore, four items of the Positive Affect Scale (i.e., alert, interested, strong, and active) that indicate activation or interest were replaced by items that were more strongly associated with positive feelings (i.e., happy, cheerful, enthusiastic, and satisfied with self), and four items of the Negative Affect Scale (jittery, afraid, guilty, and hostile) were replaced by items that more broadly covered the negative emotion lexicon (i.e., unhappy, angry, depressed, and sad).[1] As in Study 1, changes in the scores for perceived control and on the affect scales were used as main dependent variables.

Results

Perceived control. A 3 (Payment) × 3 (Illusory Control) analysis of variance (ANOVA) with the Payment factor (Gain, Loss, No payment) and the manipulation of Illusory Control (Increase, Decrease, No change) as between subjects factors, and changes in perceived control as dependent variable showed a significant main effect of the control manipulation. Participants in the *increase* condition demonstrated a positive change in perceived control, those in the *decrease* condition showed a negative change score, and in the control condition (no change), there was no substantial change in individuals' perceived control, $F(2, 130) = 43.67$, $p < .001$, $\eta_p^2 = .40$ (see Table 1). The ANOVA showed no other significant effects (Payment factor: $F(2, 130) = 2.88$, $p = .060$, Payment × Control interaction $F(4, 130) = 0.72$, $p > .250$). Within both experimental conditions, the contrast of the ratings between the two rounds (Round 1 vs. Round 2, see Table 1) was significant: *increase* condition, $F(1, 43) = 57.86$, $p < .001$, $\eta_p^2 = .57$, and *decrease* condition, $F(1, 48) = 25.85$, $p < .001$, $\eta_p^2 = .35$. The control condition (no change) produced a nonsignificant contrast, $F(1, 45) = 0.01$, $p > .250$, $\eta_p^2 = .00$.

Emotion. Reliability coefficients of the emotion scores (Round 1, Round 2 ratings, change score [Round 2 minus Round 1]) were αs = .89, .91, .87 (Positive Affect), and αs = .86, .92, .75 (Negative Affect), respectively. A 3 (Payment) × 3 (Illusory control) × 2 (Affect) repeated measurement ANOVA with the change score as dependent variable showed a significant main effect for the manipulation of Illusory control, $F(2, 130) = 3.34$, $p = .039$, $\eta_p^2 = .05$, and a significant Illusory Control × Affect interaction, $F(2, 130) = 7.19$, $p < .001$, $\eta_p^2 = .10$. As can be seen in Table 1, the participants in the *increase* condition showed a reduction in negative emotions, and did not show any change in positive emotions, whereas those in the *decrease* condition and those in the *no change* condition demonstrated reduced positive emotions and no substantial change in negative emotions. The contrast of the ratings of positive emotions between the two rounds (Round 1 vs. Round 2, see Table 1) was significant within the

[1] The PANAS-items in German were: *entschlossen*, *aufmerksam*, *angeregt*, *freudig erregt*, *begeistert*, *stolz*, *wach*, *interessiert*, *aktiv*, and *stark* (Positive Affect), and *ängstlich*, *bekümmert*, *verärgert*, *nervös*, *gereizt*, *beschämt*, *durcheinander*, *erschrocken*, *schuldig*, and *feindselig* (Negative Affect). In Study 2, the last four items were replaced by *heiter*, *fröhlich*, *vergnügt*, and *mit mir zufrieden* (Positive Affect), as well as *unglücklich*, *ärgerlich*, *deprimiert*, and *traurig* (Negative Affect).

decrease condition: $F(1, 48) = 16.18$, $p < .001$, $\eta_p^2 = .25$, and was not significant in either of the two other conditions of illusory control: *increase* condition, $F(1, 43) = 0.25$, $p > .250$, $\eta_p^2 = .01$, and control condition (*no change*), $F(1, 45) = 1.95$, $p = .169$, $\eta_p^2 = .04$. Conversely, the contrast of the ratings of negative emotions between the two rounds was significant within the *increase* condition, $F(1, 43) = 5.02$, $p = .030$, $\eta_p^2 = .10$, and was not significant in either of the two other conditions: *decrease* condition, $F(1, 48) = 0.42$, $p > .250$, $\eta_p^2 = .01$, and *no change*, $F(1, 45) = 1.16$, $p > .250$, $\eta_p^2 = .03$.

Additionally, the ANOVA yielded a significant main effect for the Payment factor, $F(2, 130) = 12.90$, $p < .001$, $\eta_p^2 = .17$, and a significant Payment × Affect interaction, $F(2, 130) = 31.68$, $p < .001$, $\eta_p^2 = .33$. Interactions of the factors of payment and control did not reach the level of significance, Payment × Control: $F(4, 130) = 0.31$, and Payment × Control × Affect: $F(4, 130) = 0.39$ (both $p > .250$). The participants who were led to believe that they would receive a monetary gain demonstrated an increase in positive emotions ($M = 0.39$, $SD = 0.73$) and a reduction in negative emotions ($M = -0.23$, $SD = 0.28$), whereas those who received the monetary loss instructions showed a reduction in positive emotions ($M = -0.54$, $SD = 0.69$) and an increase in negative emotions ($M = 0.16$, $SD = 0.48$). Participants in the no payment condition showed a reduction in positive emotions ($M = -0.29$, $SD = 0.36$) and no change in negative emotions ($M = -0.06$, $SD = 0.30$). For the positive emotions the contrast of the ratings between the two rounds (Round 1, Round 2) was significant within all conditions, monetary gain: $F(1, 43) = 12.43$, $p = .001$, $\eta_p^2 = .22$ ($M = 2.53$, $SD = 0.76$; $M = 2.92$, $SD = 0.78$), monetary loss: $F(1, 46) = 28.04$, $p < .001$, $\eta_p^2 = .38$ ($M = 2.73$, $SD = 0.73$; $M = 2.19$, $SD = 0.74$), and the control condition (no payment): $F(1, 47) = 30.89$, $p < .001$, $\eta_p^2 = .40$ ($M = 2.50$, $SD = 0.70$; $M = 2.21$, $SD = 0.74$). For the negative emotions the contrast of the ratings between the two rounds was significant within the monetary gain condition: $F(1, 43) = 30.50$, $p < .001$, $\eta_p^2 = .42$ ($M = 1.46$, $SD = 0.48$; $M = 1.23$, $SD = 0.39$), and the monetary loss condition: $F(1, 46) = 4.82$, $p = .033$, $\eta_p^2 = .10$ ($M = 1.52$, $SD = 0.60$; $M = 1.67$, $SD = 0.69$), and was not significant in the no payment condition, $F(1, 47) = 1.96$, $p = .168$, $\eta_p^2 = .04$ ($M = 1.27$, $SD = 0.30$; $M = 1.21$, $SD = 0.37$).

Discussion

The results of Study 2 replicate the finding from the first study. As in the first study, the participants' positive affect decreased in the condition of decreases in illusory control, but remained unchanged in the condition of an increasing illusory control. The negative affect again remained unchanged in the decrease in illusory control condition, and was reduced in the increase of illusory control condition. It seems relatively unlikely that these results could be attributed to the value of the stimulus. If this alternative explanation would be correct, a different pattern of results should have emerged. The current study revealed that compared with the manipulation of perceived control, the manipulation of the factor of valence (gain, loss, no payment) produced a very different effect. The manipulation of the value factor influenced both types of affect in an opposite manner. Relative to the perception of gaining control, gaining money for turning on the light increased participants' positive emotions and decreased their negative emotions. Conversely, relative to the perception of losing control, losing money resulted in increases in participants' negative affect and decreases in their positive affect. More important, the results of this study replicated the reported effects of the changes in illusory control, both in the monetary gain frame and the monetary loss frame, and when participants had promotion concerns or prevention concerns. Accordingly, the results of this study render it unlikely that the effects of increases and decreases in illusory control could be attributed to the value of the stimulus, and suggest they are relatively robust regardless of changes in participants' goals and concerns.

Furthermore, this study replicated the finding from the first study with modified affect scales. Though it is argued that the PANAS broadly taps the affective lexicon (Watson et al., 1988), it may be considered as critical that the Positive Affect Scale gauges activation and interest in addition to positive emotions (Watson et al., 1999). The Negative Affect Scale, on the other hand, focuses primarily on feelings of anxiety and fear (nearly one half of the 10 items), but is limited with respect to assessing other negative emotions, such as anger (two items) and sadness (one item). Research suggests that perceptions of control may, similarly, affect individuals' experience of anger (e.g., Neumann, 2000; Winefield et al., 1985) and sadness (e.g., Siemer, Mauss, & Gross, 2007). Because of the fact that in this study the Positive Affect Scale focused more on happiness, and the Negative Affect Scale covered a broader range of negative emotions, the results of this study also show that the observed pattern of results is not limited to the use of the PANAS scales.

General Discussion

Extending previous research this series of studies examined the impact of changes in control appraisals on individuals' positive emotions. The results of the current investigation further support the notion that negative emotions should not be used to make predictions about positive emotions. We found a pattern of results for positive emotions that did *not* correspond to the pattern of results for negative emotions. More specifically, our results show that although mitigating the experience of negative emotions, illusions of personal control did not foster positive emotions. Perceiving a loss of illusory control, however, significantly reduced the experiences of positive emotions, and had no effect on negative emotions. These results suggest that, compared with negative emotions, positive emotions were related to losses of illusory control (but not gains thereof).

It is worth noting that most prior studies focused on participants' reactions toward a stressful and aversive stimulus that appeared controllable or uncontrollable (Sanderson et al., 1989; Telch et al., 1996; Wiech et al., 2006). However, no study had systematically varied the value of the stimulus to examine the impact of this factor on the results. By additionally manipulating the perceived value of the stimulus, we examined the impact of this factor and empirically demonstrated that similar results emerged when the factor of valence was changed (Study 2). That is, our results suggest that the reported effects of changes in illusory control occur regardless of whether the stimulus is perceived as positive, as negative or neutral.

There are several possible explanations of the present results. It could be argued that positive emotions change in the condition of

a decreasing perceived degree of control because individuals are more emotionally attentive to losses than to gains (e.g., Baumeister et al., 2001; Cacioppo et al., 2014; Kahneman & Tversky, 1984; Taylor, 1991). However, if this explanation of the results is valid, we would expect to find effects on the negative emotions. We found, however, that negative emotions were *not* influenced in the condition of a decreasing degree of perceived control. Accordingly, we have to consider this explanation of the results to be unlikely. The asymmetrical change in positive and negative emotions suggests that more than one single theoretical mechanism can account for the observed pattern of results. Looking at the literature it seems reasonable to assume that positive and negative emotions changed according to changes in perceived control in a very different way because the functions of positive emotions and negative emotions differ from each other in fundamental ways. Negative affect occurs primarily in threatening situations. It is assumed that it narrows one's momentary attention and thought-action repertoire to promote a quick action. Positive affect, by contrast, occurs in nonthreatening situations. It is assumed to broaden one's momentary attention and thought-action-repertoire, which, in turn serves to enable creative and flexible thinking and to build one's enduring personal resources (Isen, 2001). Some researchers also call this the "undoing" function of positive emotions (Fredrickson, 2001; Levenson, 1999).

The findings from the present research suggest that the functions of positive emotions (e.g., "undoing") are adaptive and are required in situations in which a person obtains a desired event (see the increase in positive affect in the monetary gain condition: Study 2). These functions are, however, are no longer needed in situations in which the individual feels increasingly capable of producing an event and, thus, has the opportunity to effectively take action (see the null-effect of the increase in illusory control on positive affect: Studies 1 and 2). Moreover, these functions become maladaptive in situations in which he or she feels increasingly helpless in producing events, and is potentially required to take action to prevent a possible harmful outcome (see the decrease in positive affect following the decrease in illusory control: Studies 1 and 2).

Overall, our findings are consistent with new developments in the field of positive psychology that question the notion that control over environmental stimuli would be required for happiness. For example, during the last decade mindfulness has moved into the focus of research. Practicing mindfulness appears to be incompatible with the assumption that the perception of control is an ingredient of happiness. To achieve mindfulness individuals may engage in meditation—a practice that specifically instructs individuals to stop attempting to exercise control over environmental outcomes. Contrary to the idea that the perception of control would make us happy, results broadly suggest that the practice of mindfulness leads to increases in well-being (e.g., Brown & Ryan, 2003; Brown, Ryan, & Creswell, 2007; Shapiro, Brown, & Biegel, 2007). Extending this knowledge, the present results suggest that even though the perception of control does not make individuals happy, it is not easy to stop attempting to exercise control over environmental outcomes because this may immediately lower one's current positive affect.

This implication of the present findings may be considered in research that recently started to systematically assess potential adverse effects of mindfulness training (van Dam et al., 2018 for an overview). However, although the present research provided new insights into the relation between perceived control and positive emotions, some unresolved questions remain. It would be interesting to study whether individuals' positive emotions are similarly more affected by losses in illusory control than by gains thereof in social domains (e.g., Fast, Gruenfeld, Sivanathan, & Galinsky, 2009) and other cultures (e.g., Mondillon et al., 2005). The effects of gains and losses of illusory control may be investigated in future studies by using the same experimental paradigm but social stimuli (instead of a blue dot) or samples from different cultures.

Taken together, the findings from this research do not support the idea that happiness arises from overoptimistic control perceptions. Indeed, the present results give reason to assume that inducing illusory perceptions of personal control is not recommendable for the promotion of positive emotions and well-being. Rather than increasing overoptimistic perceptions of control, it seems important that once established illusory perceptions of personal control over the environment can be protected from a loss, because a loss of illusory control would lower one's current positive affect. As such, the present findings are consistent with the notion that people may be "disturbed [. . .] by their opinions about the things" (Epictetus, as quoted in the epigraph), and may serve to refine current theory as well as intervention programs geared toward fostering positive emotions and well-being.

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