

IMPLICIT POSITIVE EMOTION COUNTERACTS EGO DEPLETION

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Previous researchers have shown that individual acts of self-regulation deplete individual psychological resources, resulting in poor subsequent self-regulation and ego depletion. It has also been shown that to counteract ego depletion, besides getting enough sleep or rest, positive emotions are important. In this study we aimed to establish whether or not implicit positive emotion is important in countering ego depletion. In 2 experiments measuring the duration of self-regulation after implicit positive emotion it was found that self-regulation counteracts ego depletion. Participants in an ego-depleted condition were exposed to subliminal positive stimuli and they persisted in subsequent self-regulation longer than another group of participants who were exposed to subliminal neutral stimuli.

Keywords: ego depletion, psychological resources, broaden-and-build theory, self-regulation, implicit positive emotion.

Psychological resources play important roles in individuals carrying out conscious activities. In previous studies it has been shown that an individual consumes a large amount of psychological resources to perform some acts of self-regulation. As a result, at that time, the individual lacks necessary psychological resources, that is, the individual experiences a state of ego depletion, which may lead to inappropriate subsequent self-regulation or out-of-control behavior by that individual (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Muraven,

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Tice, & Baumeister, 1998; Vohs & Heatherton, 2000). Sometimes, inappropriate self-regulation and out-of-control behavior even occurs in areas that have nothing to do with the current situation (Vohs & Faber, 2007). Therefore, recovery from ego depletion has become an important topic in psychological research. In relevant studies it has been shown that getting enough rest or sleep is one effective strategy. For example, in one study (Wagner, Gais, Haider, Verleger, & Born, 2004) it was suggested that sleeping helps people regain resiliency, thereby facilitating their ability to behave with insight. Positive emotions or mood can also counteract ego depletion and facilitate the individual's subsequent self-regulation (Tice, Baumeister, Shmueli, & Muraven, 2007), which is consistent with Fredrickson's (1998) broaden-and-build theory in which she proposed positive emotions not only broadened an individual's momentary thought-action repertoire, but also broadened and built the individual's personal resources, ranging from physical and intellectual resources to social resources (see also Fredrickson, 2005; Fredrickson & Joiner, 2002). That is, positive emotions can help individuals broaden and recapture their psychological resources, allowing them to recover from the effect of negative emotions, and making their subsequent behavior more constructive and creative. Fredrickson and Levenson (1998) expanded the theory using biological functions of positive emotions, and others have found that a positive mood broadened visual attention to positive stimuli (Wadlinger & Isaacowitz, 2006). According to Johnson and Fredrickson (2005), an individual with positive emotive experiences exhibited less own-race bias in face recognition, suggesting that positive emotions improve an individual's cognitive ability. In a study by Miley and Spinella (2006) it was shown that when participants were in a positive emotional state, such as exhibiting high levels of gratitude, their executive functions operated at a much higher level. Isen (2004) suggested that positive affect facilitates thinking and problem solving. They found that positive emotions were efficient in organizing human cognitive activities causing cognitive activity to range much wider, and making cognitive activity more fluent and more flexible. Recently, the findings of more empirical studies have supported the broaden-and-build theory (Burns et al., 2008; Folkman, 2008; Kuroki, 2007), even in studies with nonhuman participants (Boissy et al., 2007).

The aim of these studies in which the broaden-and-build theory of positive emotion has been examined was to examine states of explicit positive emotions in the participants. Since explicit positive emotion can restore individual's psychological resources, is it possible that implicit positive emotions can do this as well?

Originally, emotion resulting from a subliminal stimulus was defined as implicit emotion. For instance, Monahan, Murphy, and Zajonc (2000) required one group of participants to repeatedly observe a subliminal stimulus that

consisted of multiple neutral pictures randomly ordered, while another group of participants did not watch it. The result showed that participants who looked at pictures repeatedly were more likely than those who did not watch the pictures to report that their mood was becoming better. Monahan and colleagues termed this phenomenon the Mere Exposure Effect. Recent research about emotions induced by subliminal stimulus from the Mere Exposure Effect has been applied to research on racial attitude (Smith, Dijksterhuis, & Chalken, 2008). However, some researchers (Berridge & Winkielman, 2003; Winkielman & Berridge, 2004) argued that emotion induced by a subliminal stimulus was not necessarily implicit emotion, because sometimes an individual could be aware of the emotion induced by the subliminal stimulus. Strictly speaking, conscious emotion cannot be defined as implicit emotion. Therefore, so-called *implicit emotion* is an individual's unconscious emotion, which cannot be reported by the individual (Lambie & Marcel, 2002), although, of course, implicit emotion is induced by subliminal stimulus. At present, this type of implicit emotion is induced mainly through the experimental paradigms of Winkielman and Berridge (Winkielman, Berridge, & Wilbarger, 2005).

If implicit emotion is unconscious, then does it have a function in broadening and building individuals' psychological resources? To date, the link between implicit emotions and ego resilience has not been addressed in research. Therefore, the current study was an investigation of the link between ego depletion and implicit positive emotions. It was proposed that implicit positive emotion can counteract the effect of ego depletion by promoting the recovery of individuals' psychological resources.

EXPERIMENT 1

METHOD

Eighty sophomores (40 males and 40 females) were invited to participate in the experiment for class credit. The average age was 20.70 ($SD = 1.53$). Participants were randomly assigned to either the ego-depletion group or a control group.

Upon arrival at the laboratory, each participant was told that the session actually consisted of two absolutely separate studies: a thought classification study and a picture cognition study. After giving their informed consent, participants were required to write down all their thoughts on a sheet of white paper measuring 185mm by 260mm for a 5-minute period. Participants in the experimental group were exposed to a condition in which ego depletion would be induced, while those in the control group were exposed to a condition of normal ego resource consumption. The model for ego depletion involves a self-control paradigm developed by Wegner, Schneider, Carter, and White (1987), in which participants engage in tasks that consume a lot of psychological resources

through suppression of some forbidden thought. Instructions for the experimental group were as follows:

This is a study of thought classification. Please list what you are thinking about now on the paper in front of you. In this process, you cannot think about a white bear. If you are thinking about a white bear, please draw a '△' on the back of the paper. Within five minutes, every time you think of a white bear, draw a '△' and count their numbers. Thank you for your cooperation!

Participants in the control group were given the following instructions:

This is a study of thought classification. Please write down what you are thinking about now on the paper in front of you. For instance, if you are thinking about a white bear, please write it down on the paper. Thank you for your cooperation!

Participants were tested in groups, all participants were in the same room, but each was seated at a personal computer and could not see what others were doing. On the computer the opening screen of the experiment led every participant to follow the instructions. Five minutes later, participants were told that the study was over. Then all the participants left the laboratory and were moved to a different room to take part in the picture cognition study that was conducted by another experimenter who did not know the true objective of the study.

Participants from the original control and experimental groups were then divided into two groups randomly (20 in each group), group A and group B. Participants in group A were exposed to the influence of implicit positive emotion, while those in group B were exposed to the influence of implicit neutral emotion. The inducement of implicit positive emotion and implicit neutral emotion followed the study model of Winkielman and Berridge (Berridge & Winkielman, 2003; Winkielman & Cacioppo, 2001). The specific inducement of implicit positive emotion and implicit neutral emotion was as follows:

Each participant in group A and group B separately watched on their personal computers ten pictures of different faces (five male, five female, presented randomly) with neutral emotions and were required to judge the gender of the face after each one was presented. If it was a male, participants were required to push the "M" button; if it was a female, to push the "W" button. The presentation duration of pictures was 400ms. Before presentation of these pictures, participants in group A were made to watch a subliminal stimulus of positive emotion (a smiling face) for 16ms, while participants in group B watched a subliminal stimulus of neutral emotion (a calm face) for 16ms (cf. Winkielman & Berridge, 2004). The pictures to be differentiated were presented immediately after the subliminal stimulus. The time interval between the last picture and the next subliminal stimulus was 400ms. Figure 1 provides an example picture.

Instructions for all participants were as follows:

This is an experiment of picture cognition. Please look carefully at the picture of face that appears on your computer. Then, judge the gender of it. If it is a male, please push the “M” button; if it is a female, please push the “W” button. Thank you for your cooperation!

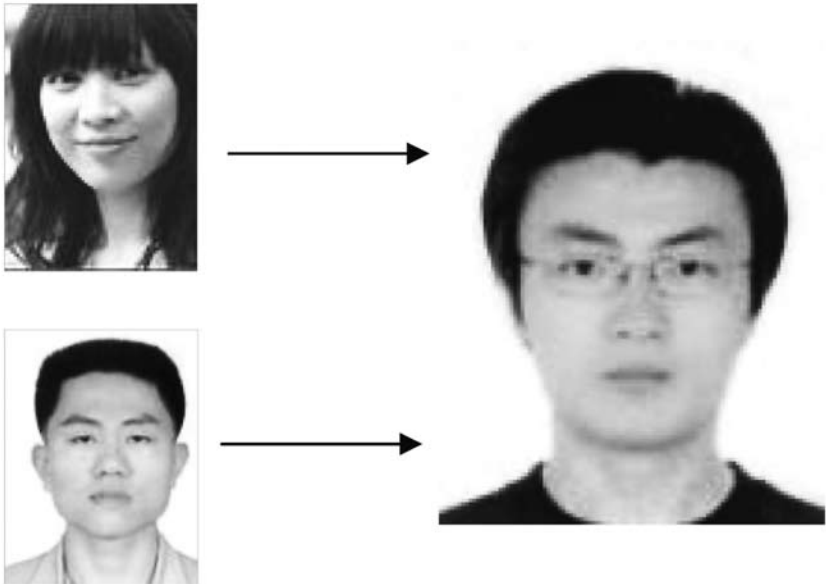


Figure 1: Pictures used in Experiment 1. (The picture on the right is the one to be differentiated, the two pictures on the left are subliminal stimuli.)

After the experiment of picture cognition, each participant was given a rectangular-shaped stick (length 30cm, width 1cm) and a box of glass marbles (used in a children’s game, total of 10 in each box). Participants were required to put as many marbles on the stick. In fact, it was impossible for participants to put all the marbles on the stick (this is a task that consumes a lot of psychological resources and cannot be completed successfully). Instructions for this experiment were as follows:

Please put the marbles on the stick in the box on the desk in front of you. The more marbles you put on, the better you will do. However, when you are putting marbles on the stick, you can use only your fingers and no other means or tools to help you. There is no time limitation in this experiment. It does not matter if one is not on the stick. If you do not want to do this experiment, just raise your hand and leave.

After issuing the instructions, the experimenter left the room. Participants were observed via monitoring equipment and the duration of each participant's attempt was recorded.

RESULTS

Because participants were not given a requirement for the number of marbles they had to place on the stick, we observed the amount of time participants engaged in the task. The results (see Table 1) of all the data calculated through SPSS 12.0 suggested that there were significant differences in effects between participants in the ego-depletion condition in whom implicit positive emotion had been induced and those in whom implicit neutral emotion had been induced ($t = 3.18, p < 0.01$): namely, compared with participants in whom implicit neutral emotion had been induced, those participants in whom implicit positive emotion had been induced continued to attempt the task with the marbles for much longer. The difference in effects between participants in the control group with induced implicit positive emotion and those with induced implicit neutral emotion was not significant ($t = 0.16, p > 0.05$): namely, there were no significant differences in effects between participants with induced implicit positive emotion and implicit neutral emotion. In both the ego-depletion and the control conditions, the difference in the effects between the participants with induced implicit positive emotion and those with implicit neutral emotion was not significant ($t = 1.06, p > 0.05$).

TABLE 1
RESULTS OF EXPERIMENT 1

Participants	Emotion induced	Duration ($M \pm SD$)	t	p
Ego depletion condition ($n = 40$)	IP	472.35 \pm 29.03	3.18	0.003
	IN	444.25 \pm 26.82		
Control condition ($n = 40$)	IP	547.55 \pm 57.79	0.16	0.875
	IN	544.35 \pm 69.88		
All participants ($N = 80$)	IP	509.95 \pm 59.06	1.06	0.294
	IN	494.30 \pm 72.79		

Note: IP = participants in whom implicit positive emotion was induced; IN = participants in whom implicit neutral emotion was induced. The time unit is one second.

EXPERIMENT 2

METHOD

Sixty freshmen (20 males and 40 females) were invited to participate ($M = 18.99, SD = 2.17$) for class credit. Participants in Experiment 2 were randomly assigned to either the ego-depletion group or a control group.

The first part of the procedure of Experiment 2 was exactly the same as for Experiment 1. Following this, each participant was given a very complex maze map and a pencil with an eraser and was required to finish the task of finding the way through the maze. (It was a very complex maze and consumed a lot of participants' psychological resources to finish it. In fact, no participant in the experiment succeeded in finishing it.) Instructions for this test were as follows:

Please find a way out of the maze using a pencil. The starting point is "S"; the ending point is "E". There is no time limit in this experiment. Your mistakes will not be counted and you are not required to finish it successfully. If you do not want to do this task, please raise your hand and then just leave.

After giving the instructions, the experimenter left the laboratory and the participants began to work on the maze independently. Participants were observed via monitoring equipment and the duration of each participant's attempt to find a way out of the maze was recorded.

RESULTS

The index of the experimental result was the time duration of the participants' attempt to get out of the maze. The results of Experiment 2 (see Table 2) showed that the difference of the effects between participants in the ego-depletion condition with induced implicit positive emotion and those with induced implicit neutral emotion was significant ($t = 4.19, p < 0.001$): namely, compared with participants who were in a state of induced implicit neutral emotion, participants with induced implicit positive emotion went on attempting to find the route through the maze for much longer. The difference in effects between participants in the control group with induced implicit positive emotion and implicit neutral emotion was not significant ($t = 0.09, p > 0.05$). In both the ego-depletion and the control groups, the difference in effects between the participants with induced implicit positive emotion and those with induced implicit neutral emotion was significant ($t = 2.22, p < 0.05$).

TABLE 2
RESULTS OF EXPERIMENT 2

Participants	Emotion induced	Duration ($M \pm SD$)	t	p
Ego depletion condition ($n = 30$)	IP	1185.80 \pm 217.10	4.19	0.000
	IN	925.60 \pm 103.13		
Control condition ($n = 30$)	IP	1223.20 \pm 245.61	0.09	0.926
	IN	1214.67 \pm 253.57		
All participants ($N = 60$)	IP	1204.50 \pm 228.55	2.22	0.030
	IN	1070.13 \pm 240.39		

Note: IP = participants in whom implicit positive emotion was induced; IN = participants in whom implicit neutral emotion was induced. The time unit is one second.

GENERAL DISCUSSION AND CONCLUSION

Self-regulation is not only an important function of an individual's consciousness but also an important indication of human social features. Therefore, self-regulation has both practical and theoretical importance in human development. Self-regulation depends on individual psychological resources. Once individuals consume too much of their psychological resources for self-regulation of some behavior or psychological activities, subsequent self-regulation becomes more difficult, and then irrational behavior can occur (Muraven, Collins, Shiffman, & Paty, 2005; Stucke & Baumeister, 2006). The basic premise of these two experiments was that individuals' self-regulation could consume a lot of psychological resources. At the same time, in the two experiments it was repeatedly proved that inducing implicit positive emotion could play an important role in counteracting the effect of ego depletion. The aim of the design concept of these two experiments was to create a state of ego depletion by causing participants to perform an initial act of self-regulation and then measuring the time duration of a seemingly unrelated task that was another self-regulated action. The second self-regulated action in Experiment 1 was a task that was impossible to succeed in finishing. In this task, what was needed was repeated practice rather than intelligence. In the process of practicing, individuals would become physically fatigued easily. The self-regulated action in Experiment 2 was a task that could be finished but was very difficult. This task depended more on intelligence and mental agility. In this process, participants would become mentally fatigued easily. The results of these two sorts of self-regulated tasks showed that the psychological resource of individuals could be increased to a certain extent to counteract the effect of ego depletion when implicit positive emotion was induced. The results of our two experiments were consistent with our hypothesis.

Of greatest importance, there were significant differences in the effects between participants in the ego-depletion condition in whom implicit positive emotion was induced and those in whom implicit neutral emotion was induced in Experiment 1. However, there were no significant difference in effects for all 80 participants between those in whom implicit positive emotion had been induced and those in whom implicit neutral emotion had been induced. Our results suggest that inducing implicit positive emotion was not so helpful for individuals who were not in the ego-depletion condition. The results contradict the idea in the broaden-and-build theory that when individuals are in a normal state (not ego depleted), explicit positive emotion can serve the broaden-and-build function too (Fredrickson, 1998, 2005; Fredrickson & Joiner, 2002). Our proposition was also proved by the result recorded with participants in the control condition in the two experiments. We found no significant difference in effects between participants

with induced implicit positive emotion and those with induced implicit neutral emotion. Based on these results, we propose that inducement of explicit positive emotion may be the preferred way to regain psychological resources to counteract the effect of ego depletion.

But why were the differences in the effects between all the participants with induced implicit positive emotion and all the participants with induced implicit neutral emotion significant in Experiment 2? These results suggest that implicit positive emotion would have a greater effect on intelligence. Of course, proof of this supposition awaits the findings of future studies.

Securing and maintaining psychological resources is one of the great epistemic human goals. In combination with the findings of other recent studies of explicit positive emotions (Tice et al., 2007), results of the present study indicated that implicit positive emotion could also promote recovery of psychological resources when individuals were experiencing ego depletion. Thus, in this research understanding of the broaden-and-build theory has been extended. We hope that our findings will stimulate further inquiry of a more complex nature about the effects of implicit positive emotion in counteracting ego-depletion.

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