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Positive Thinking Impairs Subsequent Self-Regulation: Focusing on Defensive Pessimists and Optimists

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Abstract

The purpose of this study was to examine effects of positive/negative thinking on the depletion of self-regulatory resources in defensive pessimists and optimists. A laboratory experiment was conducted individually with 90 university students to investigate whether defensive pessimists or optimists exhibited different effects for depletion of resources. Results showed that when participants were instructed to engage in tasks with external pressure and given negative feedback, defensive pessimists required lower levels of self-regulation than did optimists. When participants engaged in an autonomous task and were given positive feedback, this pattern was reversed. That is, even if defensive pessimists receive negative feedback, they prepare carefully for a variety of worst-case scenarios. Therefore it is not necessary for them to expend greater resources, whereas, for defensive pessimists positive thinking does require more use of resources. Future research should examine different effects of manipulation resulting in positive or negative thinking.

Keywords: defensive pessimist, optimist, self-regulation, depletion

1. Introduction

1.1 The Problem

Is it true that positive thinking always leads to high performance and negative thinking always leads to low performance? In this paper we prove evidence to the contrary. Extensive research has suggested that positive thinking results in improved performance and positive images promote mental health and adaptation (e.g., Taylor & Brown, 1988, 1994). That is, a positive outlook enhances achievement motivation and also leads to achievement oriented behaviors such as persistence in challenging situations. On the other hand, negative thinking has been shown to increase apathy, leading to negative results (e.g., Seligman & Mailer, 1967). Persons classified as pessimists may be more apt to lose motivation in challenging situations and give up on hope for success. Therefore, negative thinking, not actual ability, can lead to diminished achievement.

However, Norem and Cantor (1986) have investigated defensive pessimism, which has been shown to be effective regardless of negative thinking on the part of individuals. Defensive pessimism refers to adaptive pessimism that enables negative thinking to work in favor of one's success in a particular situation. Norem and Cantor (1986) defined optimists as individuals who have high expectations for the future based upon acknowledged positive experiences of the past, and have sense of control to the task whereas defined defensive pessimists as those who have low expectations for the future regardless of recognized positive past experiences. Both types of individuals seek to increase the performance levels in various tasks by inducing different strategies in participants (Norem & Illingworth, 1993; Norem & Chang, 2002; Spencer & Norem, 1996; Toyama, 2005). Defensive pessimists often have anxiety and underestimate expectations for future performance. However, for these individuals, this type negative thinking serves as motivation. Because, they can attain higher level of performance, by controlling negative thinking in advance, and preparing carefully for worst case outcomes. In contrast, optimists exhibit high performance without deep consideration about possible challenges. In other words, these individuals seek to increase motivation through high expectations that they will overcome challenges, and therefore they focus on avoiding anxiety. In addition, optimists improve performance

strategically using positive thinking thereby avoiding anxiety. On the other hand, defensive pessimists show reduced performance when using such strategies. It can be said that strategies leading to high performance for optimists have different effects for defensive pessimists.

Recent studies have revealed that defensive pessimists and optimists use different mechanisms to engage in tasks (Norem & Chang, 2002). However, possible reasons for this difference have not been sufficiently researched. In this study, we focus on self-regulation by defensive pessimists and optimists, and use the limited resources model to suggest differences in these mechanisms (Muraven & Baumeister, 2000).

1.2 Limited Resource Model

Self-regulation is the process of overriding or inhibiting automatic, habitual, innate behaviors, urges, emotions, or desires that would otherwise interfere with goal directed behavior (Baumeister, Heatherton, & Tice, 1994; Muraven, Collins, & Nienhaus, 2002; Schmeichel, Vohs, & Baumeister, 2003). A number of studies have suggested that self-regulation is employed through limited resources that are depleted after exertion (Muraven & Baumeister, 2000; Muraven, Tice, & Baumeister, 1998). If that is the case, then after exerting self-regulation, subsequent attempts at self-regulation should be more likely to fail, as this needed strength is diminished.

Previous studies have investigated how self-regulation consumes the resources that are subsequently diminished. Indeed, individuals who had to suppress the thought of a white bear subsequently consumed more alcohol in a situation that called for restraint than individuals who solved math problems (a task that requires far less self-regulation). Specifically, when individuals override their responses, they are subsequently less successful at controlling themselves or responding actively in an unrelated activity (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Tice, Baumeister, Shmueli, & Muraven, 2007).

In this study, we examine the different effects of positive and negative thinking on the exertion of self-regulation between defensive pessimists and optimists. Positive or negative thinking was manipulated prior to a self-regulation task. All participants were given feedback regarding their performance as reflecting either high or low competence levels. After this manipulation, participants were allowed to choose between two task conditions: autonomous or externally controlled.

Individuals' feeling of competence and autonomy play an important role in determining how depleting a self-regulation activity may be. Feeling low competence by self and forced or pressured by the situation to exert self-regulation may lead to greater depletion of self-regulated resources than exerting self-regulation for high competence by self and more volitional or autonomous reasons. Competence and autonomy support should reduce the magnitude of depletion. Self-Determination Theory (SDT) provides the reason why individuals' feelings of competence and autonomy yield different behavioral outcomes (Deci & Ryan, 1985, 2000).

Humans have a natural desire for competence and autonomy. According to SDT (Deci & Ryan, 1985, 2000), the desire for competence and autonomy increases an individual's intrinsic motivation and enhance psychological well-being. Also whether one has high or low competence on a self-regulated task and whether he/she engages in an autonomous or controlled setting both affect depletion of resources (Muraven & Slessareva, 2003; Muraven, Gagne, & Rosman, 2008; Terada & Ura, 2013). Research has shown that situations where the person's feelings and experiences are acknowledged, where the person is left free to choose a course of action that suits his or her personal needs and desires, and where the person is given information to make the best possible decision, are more conducive to the person's endorsement and commitment to the new course of action, and thus to motivation (Williams et al., 1996). These studies showed that self-regulation in a task where one receives feedback indicating low competence or performing a task in a controlled setting requires greater resource use than self-regulation in tasks where an individual is deemed to have high competence or performs in an autonomous setting.

Based on limit resource model, when optimists engage tasks that require self-regulation, they should consume more resources by engaging in given feedback suggesting low competence or instructed to perform in a controlled setting, rather than in given feedback suggesting high competence or instructed to perform in an autonomy setting. In contrast, this model implies that a defensive pessimist would consume more resources from engaging in high competence or autonomy setting rather than low competence or controlled setting. The reason why is self-verification theory (Swann & Read, 1981).

According to self-verification theory, people want to confirm themselves correctly, and to think their way of thinking and values are not wrong. It can be said that low competence feedback is inconsistent for optimists, and it is difficult for them to confirm themselves. Therefore it is easy to deplete for optimists because it requires a lot

of resources for their processing. High competence feedback is consistent for optimists, and it is not difficult for them to confirm themselves. Therefore they are not depleted without necessary resources to process. Conversely, low competence feedback is consistent for defensive pessimists, and it is not lead to depletion of resources. High competence feedback is inconsistent for defensive pessimists, and it is easy to deplete for defensive pessimists because it requires a lot of resources for processing. Furthermore optimists engage the task in an autonomous setting, they are likely to self-verification than in a controlled setting, because they have sense of control to the task. Defensive pessimists are likely to self-verification in a controlled setting whereas they are not self-verification in an autonomy setting because they haven't sense of control to the task.

1.3 Present Research

The purpose of this study is to clarify the effect of feedback concerning high or low competence on a self-regulated task, and also to examine task orientation, specifically the relationship between autonomy or control, on depletion of self-regulation resources. We examine the following two hypotheses:

(A) If optimists are given feedback suggesting low competence or instructed to perform in a controlled setting, these conditions require greater use of resources than when optimists are given feedback suggesting high competence or are instructed to perform in an autonomous setting, thus leading to faster depletion. Therefore these individuals respond negatively to anxiety and are more likely to fail in a subsequent task. However, if optimists are given feedback concerning high competence or instructed to perform autonomously, they will exhibit high performance in a subsequent task because resource depletion should be buffered.

(B) If defensive pessimists are given feedback that suggests either that low competence or instructions to perform in a controlled setting, these individuals should perceive negative thinking as part of a self-regulation task. Consequently, resource depletion is predicted to be buffered, hence these participants should show high performance in a subsequent task. Conversely, if participants are given feedback suggesting high competence or instructed perform autonomously, they will require more resources and therefore be more likely to fail in a subsequent task.

2. Method

In this experiment, participants engaged in laboratory experiments featuring continuous performance in two unrelated tasks, both of which required self-regulation. Employing self-regulation under different conditions (high competence vs. low competence, autonomy vs. control) should be associated with resource depletion and self-regulation in subsequent performances.

2.1 Participants

University freshmen (N = 90, 33 men and 57 woman, Mean age 18.32, *SD* = 0.68) that were recruited from psychology courses in Hiroshima University participated in the study. They had already been registered in a pool of participants during the first class of the psychology courses. We recruited participants from the pool based on a student's interest in this experiment and therefore, they participated voluntarily. Also, the students were in a liberal arts class for first-year students. Therefore, participants were naive about psychological experiments.

The ethical protocol of this experiment was as follows. The experimenter corresponded individually with participants regarding their questions and requests about any negative physical conditions. The experimenter also took appropriate action on occasions when participants complained of mental pain. The experimenter told participants not to hesitate to inform the experimenter when physical, or mental pain increase during the experiment. Moreover, the experimenter gave opportunities to participants to ask questions, and sincerely responded to such questions. Participants were also told that even if they had to terminate the experiment suddenly in the middle of an experiment, it would not lead to any detrimental consequences to the participant and that the experimenter would simply discard the information related to the participant.

We measured Action-Control Scale 90 (Miyamoto, 1996) assessed action-state orientation, individual difference in self-regulation in advance. We calculated the action control score (Note 1). In addition, we asked participants to answer questions on a 12 item defensive pessimism checklist (Norem, 2002; $\alpha = .84$) and calculated the total score (range; 26-74). A high total score indicates a tendency for high defensive pessimism. Participants were classified as optimists (n = 43, *M* = 47.30, *SD* = 7.05) and defensive pessimists (n = 46, *M* = 62.60, *SD* = 5.33) based upon the median total score (*Me* = 55.00). We randomly placed defensive pessimists and optimists across six conditions (three competence condition × two task orientation condition). It should be noted that one participant was excluded from the analysis for not completing the experiment according to procedure.

2.2 Produce

The flow diagram of the present experiment is shown in Figure 1. The experiment was conducted using three types of tasks. The first was the pre-task, which was a fake task for manipulating competence. Confidence level was assessed before the pre-task. After the pre-task, the experimenter gave false feedback for manipulating competence. Following which, confidence was assessed again. We could check the validity of the manipulation of competence. Then, the first-task was conducted in which the task orientation was manipulated by the presence or absence of a selection opportunity. Then, pressure was measured. Lastly, the second-task was conducted, in which measured depletion of self-regulated resource by manipulating positive and negative thinking (competence and task orientation). After the second-task, participants were asked whether they had any questions and then debriefing was conducted.

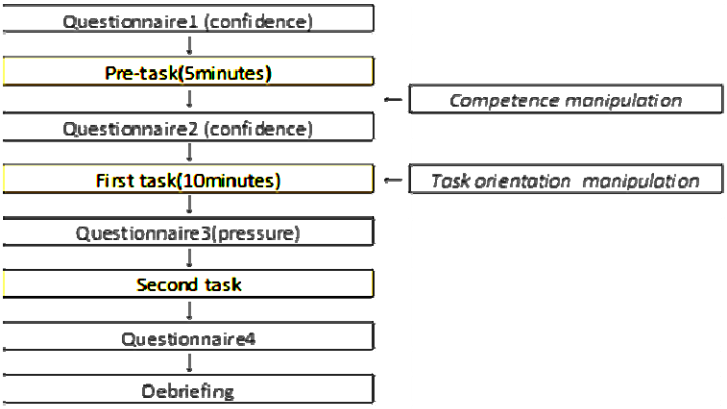

Figure 1. The flow of the present experiment

2.3 Experimental Design

A 2 x 3 x 2 factorial design with participants (defensive pessimist/optimist), with three levels of competence (high/low/no) and two task orientation conditions (autonomous; controlled) as the between-subjects factor was conducted.

2.4 Task

2.4.1 First Task

Participants were asked to create as many words as possible in 10 minutes under the condition that the first and last Hiragana character was predetermined (Note 2). In order to self-regulate, it is necessary to engage in a task while suppressing a stimulus that could interfere with task performance. The tasks in the current study were carried out under a cover story that emphasized the effect of presentation of background images on task performance. An experimenter presented four categories of various pictures [i.e., mountains as natural scenery, oceans as natural scenery, and buildings and urban landscapes (selection 4 categories × 60 = 240 pieces from the master clip)] and asked participants to choose one category that they would most like to visit (Note 3). The sixty photos of tourist attractions and landscapes for participants to choose from were presented as a slide show on the screen of a laptop placed in front of participants. The word creation task was carried out during the presentation of the 60-photo slide show. Participants were instructed that the slide show would be presented on the laptop screen as part of the experimental purposes and were asked to perform the word creation task in this situation.

2.4.2 Second Task

After a break of three minutes, a second task was performed. Previous research has shown that when people are instructed to continuously perform a difficult or complicated task (e.g., a computing task, a puzzle task) self-regulation is required until they choose to stop this task. The duration of time affects the depletion of the self-regulation resources (Vohs & Schmeichel, 2003). We used a task involving 50 Japanese anagrams (Aoyagi & Hosoda, 1994), which included 10 unsolvable anagrams. It required participants to create a word by rearranging the order of 4 or 5 random characters. They were instructed by an experimenter that they must write the correct answer on a card; however, they were also told they encountered an anagram they could not solve,

they could skip that word. Participants then placed these cards in a card storage box (on the desk) in the order they finished with them. When participants decided they wanted to quit the overall task, they were asked to press the keyboard of their assigned laptop to signal the experimenter. An experimenter measured the time commitment to the task in order to measure depletion of self-regulation resource (Tice et al., 2007).

After the conclusion of the experiment, we explained its true purpose to the participants and gave them an accurate description of experimental tasks. Participants were also asked whether they suspected the true nature of the task, to which they responded on a scale ranging from 1 (*very suspicious*) to 9 (*no doubt at all*). After the debriefing, the experimenter obtained participants' informed consent. If no consent were given, the data of such participants were not to be used in the analysis, and was to be discarded (in this experiment, there were no cases of refusing to participate). Personal data were strictly controlled to protect privacy. All date were statistically treated, and therefore, it was not possible to identify individuals from the data.

2.5 Dependent Variable

Dependent measures were the second task duration times as indicators of depletion.

2.6 Manipulation

2.6.1 Competence

Verbal feedback was used to manipulate a person's perception of his/her own competence. This feedback compared a participant's performance level on a pre-task with performance of other participants. In theory, such feedback should influence a participant's estimate of his/her ability on forthcoming tasks. Specifically, although feedback and instructions were actually false, they should allow participants to judge their own aptitude for succeeding in the two subsequent tasks (Bandura & Jourden, 1991; Miyake, 2000). In the present experiment, the pre-task condition lasted for five minutes; here participants engaged in a task and received false feedback on their performance. Following this, participants were asked to estimate their ability for the two subsequent tasks. To enhance authenticity of feedback (Deci, 1972), we used a remote association task (15 questions) in which success or failure was unclear. Participants were presented two words and then they were asked to find a word that connected the two presented words. After the pre-task, an experimenter manipulated feedback on participant competence of the two subsequent tasks. In high competence condition, "The average score for our students for the previous year was 55 points. You scored 68 points". In low competence condition, "the average score of our students for the previous year was 55 points. You scored 42 points". After this feedback, participants in high and low competence conditions were given instructions regarding the first task. In the no manipulation condition, participants were given instructions for the first task without receiving any feedback on pre-task performance.

2.6.2 Task Orientation

Two orientation conditions were: first, in the controlled condition, participants were able to choose the task in which they wanted to engage, and in the second, an experimenter chose the task. Intrinsic motivation for a task has been shown to increase in the when individuals are allowed to choose their own tasks (Iyengar & Lepper, 1999). This means that opportunity of selection increases autonomy and non-opportunity of selection increases control. Therefore, in this experiment, we manipulated task orientation through the presence or absence of selection opportunity. We prepared four types of the first task. Participants were informed that the number of questions and level of difficulty in these the four types were identical (Note 4). The condition in which participants chose a task was termed "autonomous condition"; in the control condition an experimenter designated the task. Previous studies showed engaging in tasks that have been externally designated puts pressure on individuals and reduces feelings of self-determination. On the other hand, providing a choice of task type enhances feelings of self-determination and increases intrinsic motivation (Deci & Flaste, 1995).

2.7 Questionnaire Variables

In order to examine validity of the manipulation of competence, confidence was measured before the pre-task and following the feedback given after pre-task in one item (1: *not confident at all*-9: *highly confident*). In order to confirm validity of manipulation of task orientation, pressure after first task was measured in one item ("I felt pressure in this task"; 1: *not at all*-9: *very true*).

3. Results

3.1 Manipulation Check

3.1.1 Competence

Confidence scores were analyzed by conducting a 3 (competence: high/low/no) × 2 (time: before pre-task/after feedback) ANOVA. There was an effect of interaction ($F(2,86) = 4.39$, $p < .05$). A contrast analysis found that a significant reduction of confidence was observed in low condition [$F(1,86) = 5.86$, $p = .01$: before pre-task ($M = 4.56$) > after feedback ($M = 3.93$)], and increasing of confidence were observed in high condition [$F(1,86) = 2.84$, $p = .09$: before pre-task ($M = 4.06$)< after feedback ($M = 4.51$)]. There were no significant changes in the no competence condition ($F(1,86) = 1.31$, $p = .25$).

A significant difference in confidence was observed in only low condition. Thus, this manipulation was only partially validated. Additionally, there was no significant difference in confidence between high and no competence condition. Therefore, we added the scores for high and no competence participants, and we based our analysis thereafter on two conditions rather than three (Note 5).

3.1.2 Task Orientation

Scores for pressure were analyzed by conducting a 2 (competence: high/low) × 2 (task orientation: autonomy/control) ANOVA. There was a significant interaction effect ($F(1, 85) = 10.55$, $p < .01$). A contrast analysis found that a significant main effect of task orientation was observed in high condition [$F(1, 85) = 11.01$, $p = .00$: control ($M = 6.10$) > autonomy ($M = 4.44$)]. In the autonomous condition, a significant difference was found between high and low conditions [$F(1,85) = 10.31$, $p = .00$: low ($M = 6.40$) > high ($M = 4.44$)]. This manipulation was only partially validated. Nonetheless, if low competence is shown, there is increasing pressure on provision of the selection opportunities.

3.2 Main Analysis

The measurement of self-regulation resources was based on the length of time participants engaged in the second task. A longer duration indicates better self-regulation capacity, and shorter durations indicate depletion of self-regulation resources. A 2 (competence: high/low) × 2 (task orientation: autonomy/controlled) × 2 (principle: defensive pessimist/optimist) ANCOVA was conducted (covariates: action control score). These data appear in Figure 2. There was a significant interaction between competence and motivation ($F(1,79) = 6.68$, $p = .01$). Most tellingly, there was a significant interaction between principle and competence ($F(1,79) = 6.14$, $p = .01$; Figure 2). A contrast analysis found that positive effects correlated with feedback on high competence was observed only in optimists ($F(1,79) = 6.58$, $p = .01$); that is, a corresponding effect was not observed in defensive pessimists ($F(1,79) = 0.92$, ns). When competence was high, optimists engaged in the task significantly longer than defensive pessimists did ($F(1,79) = 5.95$, $p = .01$). In other words, the optimists were the only participants who were showed better regulation due to positive feedback during instruction in the high competence condition. Additionally, there was a significant interaction between principle and task orientation ($F(1,79) = 7.28$, $p = .00$; Figure 3). A contrast analysis found that for participants engaged in the autonomous condition, optimists spent significantly longer times on the task than defensive pessimists ($F(1,79) = 4.69$, $p = .03$), and a simple main effect of task orientation was found in defensive pessimists. If defensive pessimists engaged in the autonomy condition, task time significantly decreased ($F(1,79) = 6.93$, $p = .01$). In other words, for defensive pessimists, engaging in autonomous tasks produces a depletion of self-regulation resources.

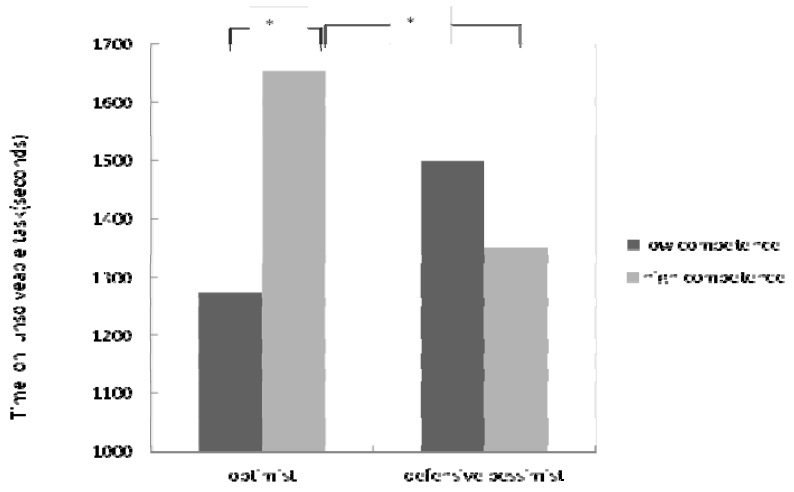

Figure 2. Time spent engaging second task depends on competence and principle

Note.$p < .05$

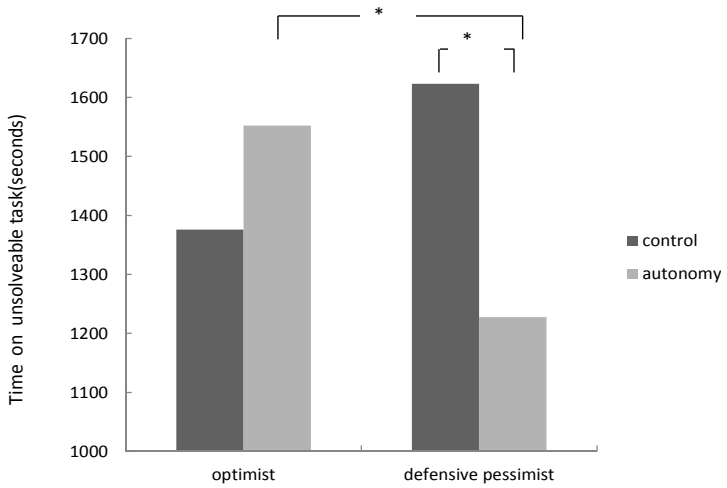

Figure 3. Time spent engaging second task depends on task orientation and principle

Note.$p < .05$

4. Discussion

The present research investigated differences between defensive pessimists and optimists from the perspective of the limited resources model. To examine depletion of self-regulation resources, we manipulated positive/negative thinking on tasks requiring self-regulation by giving feedback (conveying high or low competence) and an explanation about task orientation (autonomy or control) on depletion of self-regulation resources, and results showed this manipulation affected participant performance.

The present research showed that there are differences between optimists and defensive pessimists in task performance. When individuals are instructed to engage in a controlled task or given negative feedback, defensive pessimists do not consume as much of their resources on self-regulation as do optimists. When defensive pessimists engage in autonomous tasks and receive positive feedback, they expend a much greater amount of self-regulation resources than do optimists. That is, it can be said that even if defensive pessimists

receive negative feedback or engage in negative thinking, they prepare carefully for a variety of worst-case scenarios. Therefore it is not necessary expend a great amount of resources in these cases, whereas for these individuals positive thinking requires greater resources. This means that positive thinking by defensive pessimists show negative effects as a result of the depletion of resources.

The present research leads to the following conclusions. When facing educational challenges, even if students who are defensive pessimists received positive comments which are generally regarded as effective such as "It is possible for you to do", and "Choose by yourself", they considered "It is easier to prepare in advance for the worst situation", and "It is easier to get decided by someone". Therefore, positive comments given to them might produce the opposite effect, different from the expected result that they would fail at self-regulation. It can be said that positive don't always results in high performance and negative is not always lead to low performance, and positive thinking have effect to lose strive and persistence to self-regulation for defensive pessimists. In the future, we should reconfirmation education with a view to have positive/negative comments may cause different effect due to difference of self-recognition.

4.1 Future Prospects

The current experiment has two improvements. First, to obtain answers to 12 items of the defensive pessimism checklist (Norem, 2002), participants were grouped as defensive pessimists and optimists by median of the total scores. However, in the present study, overall scores were high, thus the median score reflected this trend. It should be noted that participants classified as optimists in this experiment are not necessarily engaged in positive thinking. Future research should use a larger sample, thus allowing a better classification of defensive pessimists and optimists. Also, it would be useful to choose participants with high self-evaluation at completion of task (for example good or above average), and ask them how they expect to perform on subsequent tasks. Researchers could classify participants who give positive answers (good/above average) as optimists, and those who respond negatively (not so good/poor) as defensive pessimists.

Second, the validity of the manipulation of experimental condition should be improved. We manipulated competence through feedback to participants. However, we did not observe a significant increase of confidence in the high competence condition. There may be various factors involved in feedback in a high competence condition. Deci (1972) points out that positive feedback by others not only increased high competence but also it increased pressure for better performance. In fact, positive feedback based on comparison to others reduced intrinsic motivation and proactive approach of challenges. When positive feedback based on comparison to others and positive feedback without comparison was evaluated, intrinsic motivation and interest increased in the latter (Deci, 1972). In other words, there is a possibility that feedback, by means of performance comparisons, increases pressure and decreases competence. In the future, setting new conditions based (e.g., Hurlock, 1925) on positive feedback, such as a "praise" condition could create a sense of high competence without comparison of performances. In addition, it should be noted that there was not complete independence of manipulation regarding competence and task orientation in this experiment. To classify each manipulation clearly, it may be necessary to increase pressure and allow autonomous choice in non-related task situations.

4.2 Limitation

In this study, we attempted to explicate the effects of positive and negative thinking on the depletion of self-regulatory resources in defensive pessimists and optimists. The results of this study are limited by two considerations. Firstly, the interpretation of the results should be made cautiously, because in this study, alternative explanations that might influence results, or extrinsic factors were not eliminated. Therefore, it is necessary to more precisely repeat this experiment with other comparison groups, in order to obtain further clarification. Also, the paradigm of this experiment that used limited resources does not exclude the possible effects of time differences. Therefore, it is necessary to use another paradigms. Secondly, the possibility of application in the real world cannot argue unconditionally. Because it may not be possible to execute such a proper intervention, there is a limitation regarding our interpretation of results. There are needs for further research.

4.3 Highlights

- We investigated differences between defensive pessimists and optimists from the limited resources model.
- Negative thinking is not necessary expend a great amount of resources for defensive pessimists.
- For defensive pessimists positive thinking requires greater resources.

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Notes

Note 1. A stressful situation is presented, and two types of action options in response to that situation are presented. A represents action-oriented choices, B represents state-oriented choices. Participants responded which one applies to their choice of A or B for each situation. If a participant chooses (A) action-oriented they are given one point, if a participant chooses (B) state-oriented they are given a score of 0 (the action control scale simply the score of each item; range 0-6, $M = 2.57$, $SD = 1.35$).

Note 2. The Japanese language has three common writing systems: Hiragana, Katakana, and Kanji. Hiragana is the most basic and all Japanese words can be constructed from Hiragana characters.

Note 3. We selected 240 high image photographs (landscape) from the collection of material that was recorded in "master clips 303,000 PlusV3 Royalty-free (H2O software)".

Note 4. The breakdown of participant selection for the choice task was A; 21, B; 13, C; 6, D; 4. The task given to participants in the control condition was the same as that in the autonomous condition. It should be noted that participants were instructed there were four types of task, but in reality, all tasks were the same.

Note 5. Confidence scores were analyzed by conducting a 2 (competence: high/low) × 2(time: before pre-task/after feedback) ANOVA. There was a main effect of time ($F(1,87) = 2.99$, $p < .10$; before pre-task [M =4 .45)> after feedback($M = 4.17$), $p = .08$)] and interaction ($F(1,87) = 4.06$, $p < .05$). A contrast analysis found that a significant reduction of confidence was observed in low condition, [$F(1,87) = 5.66$, p = .01: before pre-task ($M = 4.56$) > after feedback ($M = 3.93$)]. There were no significant changes observed in high condition ($F(1,87) = 0.12$, $p = .72$).