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The Effect of Participants' Stress Manipulation on Experimenters' Mood States

Hirotsune Sato[1*], Jun I. Kawahara[2]

[1]Shinshu University, Matsumoto, Japan
[2]Hokkaido University, Sapporo, Japan
Email: *hirotsune@shinshu-u.ac.jp

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Abstract

This study examined whether experimenters' mood states vary as a function of participants' mood states. Thirty unacquainted "Experimenter"-"Participant" pairs participated. Participants delivered an unscripted speech in front of an experimenter while being videotaped. The stress levels of experimenters and participants were measured using a questionnaire and salivary cortisol measurements prior to and following the stress induction. A strong negative relationship was found between changes in the stress indices of the experimenters and those of the participants; a smaller increase in stress among participants was associated with a greater increase in stress among experimenters. This result suggests that stress induction can produce negative side effects among experimenters.

Keywords

Experimenters' Mood States, Stress Induction, Experimental Ethics

1. Introduction

Over the last two decades, an increasing number of studies have demonstrated the impact of mood states on cognitive functioning (e.g., Forgas, 2008; Kawahara & Sato, 2013; Lupien, Maheu, Tu, Fiocco, & Schramek, 2007; Matsumoto, Hwang, & Frank, 2016; Schmid & Schmid, 2010; Schwarz, 1990). A variety of procedures have been used to manipulate mood states, such as immersing participants' hands in icy water, exposing participants to joyful or dreary music, and asking participants to give a speech in front of an audience. Previous research has demonstrated that induced negative mood states impair working memory (Schoofs, Preuss, & Wolf, 2008) and lead to attentional biases toward negative information (Mathews & MacLeod, 2002). Of course, the welfare of participants has been considered in these studies, and great care has been taken to minimize

the risks of experimentally induced negative moods in accordance with ethical guidelines (American Psychological Association, 2017). However, it may be possible that the experimenters, who are a part of the experimental setting, are also highly likely to be susceptible to mood manipulations. To the best of our knowledge, mood states of experimenters have not been systematically examined. In this study, we focused on the impact of mood induction on the mood states of experimenters as well as participants and demonstrated that experimenters are also sensitive to mood manipulations.

Given that socioemotional interactions between participants and experimenters occur in experimental environments, it is reasonable to assume that the mood states of experimenters are related to those of participants. One possibility is that a mood state transfers from participants to experimenters. For example, Neumann & Strack (2000) demonstrated that listening to the sad voice of another individual evoked a negative mood among participants more strongly than did listening to a happy voice. The researchers interpreted this finding in terms of emotional contagion, which is a tendency to experience the emotions of others (Hatfield, Cacioppo, & Rapson, 1992; 1994). If emotional contagion occurs in laboratory environments, the mood states of experimenters would be expected to co-vary with those of participants.

Alternatively, the mood states of participants and those of experimenters may be inversely related. Self-discrepancy theory (Higgins, 1987) assumes that when an individual perceives a discrepancy between the "ought-self" and the "actual-self", s/he experiences agitation-related affect (e.g., anxiety, guilt). For example, Higgins, Bond, Klein, & Strauman (1986) found that participants with a large discrepancy between the actual and ought-self reported higher levels of agitation-related affect than those with a small self-discrepancy. Thus, when an experimenter intends to increase participants' stress, the experimenter would experience stress if the mood induction were unsuccessful. On the other hand, the experimenter's stress would be diminished if participants expressed a feeling of stress.

Our study investigated the impact of stress induction on the mood states of experimenters and examined whether the mood states of experimenters and participants were related. We hypothesized that experimenters' mood states would vary as a function of participants' mood states. Specifically, if the experimenters' negative mood states were induced by the participants' negative mood states (emotional contagion), then we would find a positive relationship between the stress levels of experimenters and participants. Alternatively, if the experimenters' negative mood states were induced by their failure to increase participants' stress levels (self-discrepancy), we would find a negative relationship between the stress levels of experimenters and participants.

2. Study 1

In Study 1, we examined the effect of stress on the mood states of experimenters and participants in an experimental situation. To induce stress, we adopted the

Trier Social Stress Test (TSST; Kirschbaum, Pirke, & Hellhammer, 1993), which entails the delivery of an unscripted speech in a hypothetical job interview, followed by a mental arithmetic task (5 min each) in front of an experimenter while being videotaped. While the formal TSST procedure uses three experimenters, we used a single experimenter because it has been confirmed that the stress levels of participants could be increased significantly by a TSST procedure with a single experimenter (Sato, Takenaka, & Kawahara, 2012). We analyzed the relationship between the mood states of experimenters and participants.

2.1. Method

Participants Thirty Japanese same-sex, unacquainted pairs (11 female pairs and 19 male pairs; mean age = 22.63) participated in exchange for monetary remuneration. The experiment was conducted in the afternoon (between 14:00 and 17:00). All participants provided written informed consent and were tested individually.

Procedure Each pair consisted of an individual who was designated the "Experimenter" and another individual who was designated the "Participant." The pairs were brought separately into different rooms and began by completing a self-report scale, the State-Trait Anxiety Inventory-Form JYZ (STAI) (Hidano, Fukuhara, Iwawaki, Soga, & Spielberger, 2000). Saliva samples were then collected using salivettes to obtain a pre-stress baseline measurement. Then, the Experimenter was instructed to read the procedural instructions for the TSST, which was meant to induce stress in the Participant. Meanwhile, the Participant was instructed to prepare a 5-minute speech regarding her or his strengths and weaknesses. Five minutes later, the Participant was brought into the Experimenter's room, and the Experimenter initiated the TSST, and the Experimenter monitored the Participant's nonverbal behavior during the speech, such as eyeblink frequency and the number of times the Participant looked away or down, using a checklist. A video camera was placed in front of the Participant to record the entire session. After the speech, the Participants completed a 5-minute mental arithmetic task. After the activities were completed, the Participant and Experimenter returned to the waiting area and completed a filler task for 10 minutes so that the salivary cortisol response induced by the TSST could develop and reach measureable levels by the end of the task (Kudielka, Schommer, Hellhammer, & Kirschbaum, 2004).

They then completed the self-report scale and underwent saliva sampling (post-stress measurement) again. Finally, the paired participants were debriefed and dismissed.

Pre- and post-stress measurements The STAI consists of 40 items, each of which is rated on a four-point Likert scale, that measure state and trait anxiety. We used only the state-anxiety items (20 items). Half the 20 items measured the presence of anxiety, and the other half measured the absence of anxiety. Saliva samples were collected with salivettes after the completion of STAI questionnaire. The samples were centrifuged at 4000 g for 5 min, and the filtrates were

stored at −40˚C. Salivary cortisol levels were measured in 200-ml saliva samples using a RIA (Gamma Coat; DiaSorin, Stillwater, MN, USA). Assay results showed a range of 0.05 - 3.0 μg/dl and intra-assay coefficients of variation of <5% and <10% for the pre-stress and post-stress assays, respectively.

2.2. Results

Figure 1(a) shows the means of STAI scores and salivary cortisol levels of Experimenter and Participant groups in pre- and post-stress measurements. Within-participant *t*-tests indicated that both Participants and Experimenters had significantly higher scores on the STAI (Participants: $t(29) = -4.06$, $p < 0.001$, Cohen's $d = 1.50$; Experimenters: $t(29) = -3.66$, $p < 0.001$, Cohen's $d = 1.36$) and exhibited higher levels of salivary cortisol (Participants: $t(27) = -3.81$, $p < 0.001$, Cohen's $d = 1.47$; Experimenters: $t(28) = -2.05$, $p < 0.05$, Cohen's $d = 0.77$) in the post-stress than in the pre-stress test measurement. That is, TSST stress induction increased the stress levels of both the Participant and Experimenter groups.

To determine whether the increase in the two stress measures merely reflected fatigue as a function of time or whether it reflected interactions between the mood states of the two groups, we calculated the differential scores for the STAI and salivary cortisol levels, subtracting the pre-measurement from the post-measurement and calculated correlation coefficients between those differential scores for Experimenters and Participants (Figure 1(b)). Statistically significant

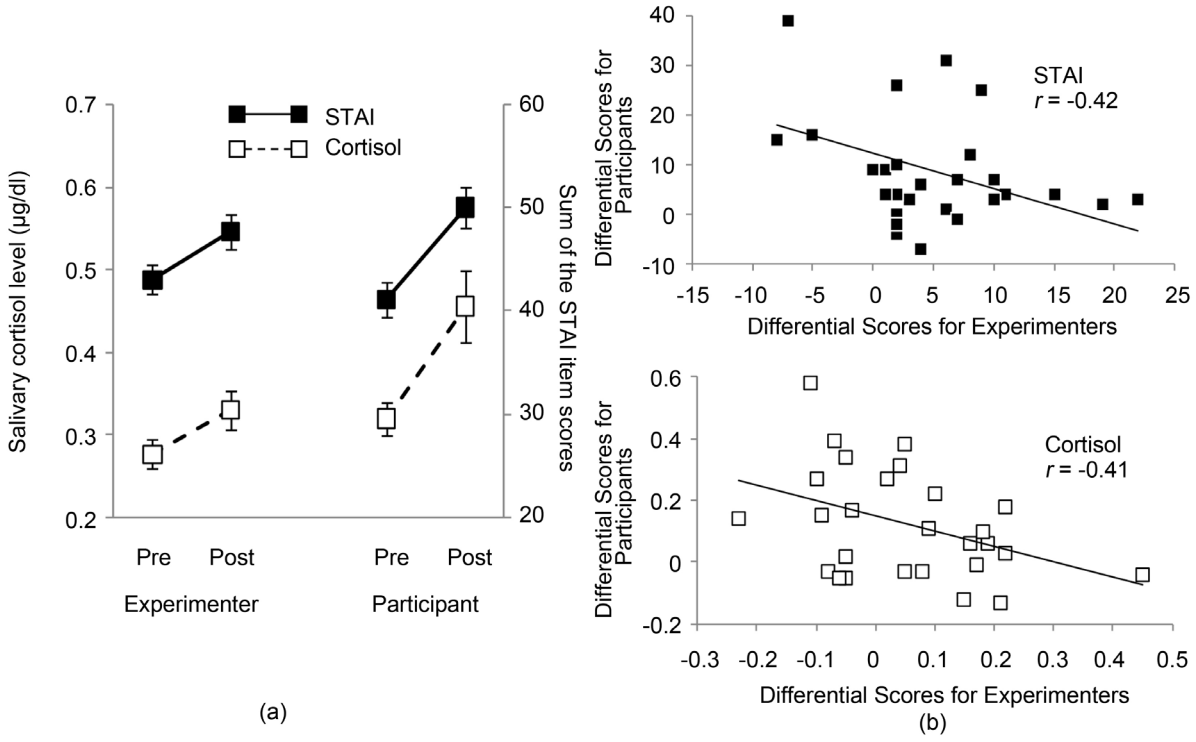

Figure 1. (a) Mean STAI scores and salivary cortisol levels of Experimenter and Participant groups in pre- and post-stress measurements. (b) Correlation coefficients and regression lines between the differential STAI scores (top) and salivary cortisol levels (bottom) in the Experimenter and Participant groups.

negative relationships were found between the differential scores for STAI ($r = -0.42$, $p < 0.05$) and salivary cortisol levels ($r = -0.41$, $p < 0.05$) of Experimenters and Participants. In summary, the changes in mood states of Participants and Experimenters were inversely related.

2.3. Discussion

Study 1 examined the effects of stress induction on the mood states of Experimenters and Participants and demonstrated that stress induction enhanced the negative moods of both Experimenters and Participants, suggesting that the experimenters were subject to the stress manipulation. Importantly, a strong negative relationship was found between the differential scores on the stress indices of the Experimenters and the Participants. In the experiment, Experimenters experienced a greater increase in stress when Participants experienced less increase in stress.

These results were consistent with the self-discrepancy hypothesis, not the emotional contagion hypothesis. The self-discrepancy perspective suggests that Experimenters can perceive a failure of stress manipulation based on Participant expressions and/or behavior, even when Experimenters do not know a Participant's STAI scores and salivary cortisol levels. Given that the goal of the Experimenters was to induce stress in the Participants, perceiving little increase in stress among the Participants would indicate to the Experimenters that their experimental manipulation was unsuccessful and they had failed to accomplish their task. Under such circumstances, the Experimenters would experience a discrepancy between their ought-selves (who would have successfully induced stress) and their actual selves (who failed to induce stress). According to the self-discrepancy theory (Higgins, 1987), the discrepancy would lead to agitation-related affect, such as anxiety or guilt, in the Experimenters.

Notably, the increase in the stress level of Experimenters after the TSST session in Study 1 cannot be attributed solely to the stress that might have been evoked by behaving as an experimenter in a laboratory situation. If this were the case, changes in the mood states of both Experimenters and Participants would have been unrelated. In fact, the changes in the mood states of these two groups were strongly negatively correlated. Thus, we can conclude that the mood states of the Experimenters depended on those of the Participants.

Hence, this study revealed a strong negative correlation between the differential scores on the stress indices of Experimenters and Participants, reflecting a discrepancy between the stress of Participants, induced by real experimental manipulation, and the stress of the Experimenters, induced by their perception of Participants' stress. However, the present result may be attributed to the fact that the present Experimenters were not actual experimenters but were actually naïve participants undertaking the role of the experimenter. Thus, the Experimenters might have felt stressed because almost none of them had any experience in conducting a psychological experiment, and they had not been trained professionally to prepare for possible emotional reactions in response to experi-

mental manipulations. Given that professional psychologists who experienced in experiments using mood induction are familiar with the procedure, these psychologists may not be affected by participants' reactions.

3. Study 2

The purpose of Study 2 was to test whether professional psychologists would feel stressed in a negative-mood-induction experiment. We adopted a survey method in which participants imagined conducting a stress experiment and compared the degree of negative mood state between professional researchers and nonprofessional undergraduates from Study 1.

3.1. Method

Professional psychologists (n = 39, mean age = 31.25, age range = 22 - 57) were recruited by mailing lists for Japanese psychological researchers and they responded to a web-based survey voluntarily. The professional psychologists who responded engaged in research or in lecturing in psychology for undergraduates/graduates and had experience in conducting psychological experiments involving affect manipulation or stress induction. Undergraduate students (n = 128, mean age = 18.53, age range = 18 - 24) as nonprofessionals were recruited in psychology classes at universities and they responded to a questionnaire voluntarily.

The survey consisted of two phases: a vignette designed to cause participants to imagine a mood-induction situation and questions about the mood states of respondents in that situation. In the vignette, respondents were instructed to read the procedural instructions for the TSST and were asked to imagine a situation in which they conducted the TSST for an imaginary participant. Respondents indicated whether they would experience stress in such a situation (0 = not at all, 1 = feel stressed) and completed the identical measurement used in Study 1 (STAI scale, Hidano et al., 2000). If respondents replied that they would feel stressed, they were also asked to reply to a multiple-response item about why they would feel such a negative mood ("because I will feel sorry for and empathize with the participants," "because I may fail to induce stress in the participants," "because it will be difficult to conduct such an experiment," or "other reasons").

3.2. Results

Slightly more professionals (n = 38, 97.44%) than nonprofessionals (n = 115, 89.84%) reported that they would experience stress in the imaginary situation, although there was no statistically significant difference between the two groups. The mean STAI scores of professionals and nonprofessionals in Study 2 and the STAI score of Experimenters in Study 1 are shown in Table 1. An analysis of variance (ANOVA) indicated no significant differences among the three groups in the STAI scores, suggesting that experienced professional psychologists as well as naïve nonprofessionals would experience a negative mood after conducting a

Table 1. Means and standard deviations of STAI scores and proportions of reasons for a stress response.

	Professionals (n = 38)		Nonprofessionals (n = 115)		Study 1 Experimenters-post	
Mood states	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
STAI scores	47.68	7.24	49.81	8.27	47.73	9.25
	Professionals		Nonprofessionals			
Reasons	Frequency	Proportion	Frequency	Proportion		
Feel sorry and empathize	23	58.97%	82	64.06%		
Concerns about experimental failure	13	33.33%	4	3.13%		
Difficulty to conduct an experiment	10	25.64%	26	20.31%		

negative-mood-induction manipulation experiment.

The proportions of each response to the question of why respondents would feel stressed are shown in Table 1. A 2 (group) × 3 (reason) chi-squared test revealed statistically significant differences for the group: χ^2 (2) = 21.15, $p < 0.01$, $\Phi = 0.37$. The adjusted residuals for each cell in the chi-squared test indicated that more professionals than nonprofessionals cited "concerns about experimental failure" as the reason for their stress (adjusted residual = 4.55), and fewer professionals than nonprofessionals cited "feel sorry and empathize" as the reason (adjusted residual = 2.81).

3.3. Discussion

Study 2 examined whether experienced professional psychologists experience stress comparable to that found among the Experimenters in Study 1. The results were affirmative: professionals expected to experience a negative mood state to the same extent as did nonprofessional undergraduates in response to an imaginary stress experiment, suggesting that even experienced experimenters are susceptible to stress manipulations.

Importantly, professional participants reported that their stress would result from concern about the failure of the experiment more frequently than did nonprofessional participants. This result is consistent with the findings of Study 1 and supports the premise of self-discrepancy theory, which predicts that experimenters would experience a discrepancy between their ought-selves (who should successfully induce stress) and their actual selves (who failed to induce stress) when the experimenters perceive that their manipulation is unsuccessful. This discrepancy would then lead to negative mood states.

4. Conclusion

This study examined the effect of stress on the mood states of experimenters and participants in an experiment involving stress induction. Study 1 demonstrated

that stress induction enhanced negative moods of both Experimenters and Participants, suggesting that the experimenters were subject to the stress manipulation. Our study is the first to report to demonstrate that stress manipulation affects the mood state of experimenters. Study 2 examined the possibility that the results of Study 1 simply reflected a lack of professional training for the designated "Experimenters" in techniques for psychological experiments involve mood manipulations. The results of Study 2 indicated that experienced professionals also experienced stress in this situation.

We also examined whether the mood states of experimenters and participants were related and found a strong negative correlation between the stress score of Experimenters and Participants in Study 1. We argue that this negative relationship occurred because the more the experimenters perceived, from participants' behavior or expressions, a failure of the stress manipulation; the more they experienced a discrepancy between their ought-selves and their actual selves. This discrepancy resulted in a negative mood state. This account was supported by the results of Study 2. Our inquiry revealed that experienced professionals reported that they would feel stress in conducting experiments involving stress induction because they would be concerned about the failure of the experiment. Our results suggest that professionals may know how difficult it is for experimenters to induce stress in participants and how stressed experimenters feel when they fail to do so. Even though they have experience with this type of experiment, such knowledge does not seem to alleviate negative reactions.

These findings have implications for experimental studies involving stress induction. Specifically, researchers should be aware that stress induction procedures could have negative side effect for the experimenters, such as research assistants and graduate students. Even though the side effect might be temporal, it could change to chronic one and result in serious health problems including anxiety, insomnia and high blood pressure (Baum & Polsusnzy, 1999). Great care is needed to reduce the risks of experimentally induced negative moods among experimenters in laboratory settings.

The present study revealed that stress induction has an effect on experimenters' mood states; the stress levels of both experimenters and participants increased during the stress-induction trial, but these increases were negatively correlated. An issue that limits the strength of the conclusion of the present study is that actual stress levels of professionals have not been measured. Further studies are needed to examine whether there is a negative impact on experimenters who repeatedly conduct stress-induction experiments.

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