Biological Psychology 91 (2012) 120–127

Contents lists available at SciVerse ScienceDirect

Biological Psychology

journal homepage: www.elsevier.com/locate/biopsycho

Incentive moderates the impact of implicit anger vs. sadness cues on effort-related cardiac response

Laure Freydefont*, Guido H.E. Gendolla**

Geneva Motivation Lab, Department of Psychology, University of Geneva, Switzerland

ARTICLE INFO

Article history:
Received 13 December 2011
Accepted 10 April 2012
Available online 17 April 2012

Keywords:
Cardiac response
Implicit affect
Anger
Sadness
Incentive
Effort

ABSTRACT

This experiment investigated the combined effect of implicit affect and monetary success incentive on effort-related cardiac response in a 2 (Affect Prime: anger vs. sadness) × 2 (Incentive: low vs. high) between-person design. Sixty-two participants were exposed to affect primes during an objectively difficult short-term memory task. As predicted, by our theorizing about affect primes' systematic impact on subjectively experienced task demand and corresponding effort mobilization, sadness primes led to a weak cardiac pre-ejection period (PEP) response when incentive was low (disengagement), but to a very strong PEP response when incentive was high (high effort). PEP responses were moderate in the anger-prime conditions (low effort). HR responses largely corresponded to those of PEP. The results demonstrate for the first time that high incentive can compensate the effort mobilization deficit of individuals who process sadness primes during a difficult task.

1. Introduction

Recent studies have demonstrated that implicitly activated representations of affective states can systematically influence effort-related cardiovascular response during task performance (see Gendolla, 2012 for a review). The present research examined if affect primes' effects are task-context dependent and if high success incentive can thus compensate the previously found effort-mobilization deficit of people who are exposed to sadness primes during a difficult task. Our analysis is based on the principles of motivational intensity theory (Brehm and Self, 1989), which states that effort in instrumental behavior is mobilized in proportion to subjectively experienced task demand as long as success is possible and justified. Using cardiovascular measures of effort intensity, this motivational principle has received abundant and clear support (see Gendolla et al., 2012b for a review). Moreover research has identified a number of variables influencing subjective demand and the amount of justified effort. The present research deals with the interaction of two of them: (1) affect primes that systematically influence the level of subjective task demand and (2) monetary incentive that defines the level of maximally justified effort.

1.1. Implicit affect prime effects on effort mobilization

Recent studies from our laboratory tested the idea that affect primes, implicitly processed "online" during task performance systematically influence the level of experienced task demand. As outlined in the implicit-affect-primes-effort (IAPE) model (Gendolla, 2012), previous research demonstrated associations between sad mood and difficulty and happy mood and ease (see Gendolla and Brinkmann, 2005; Gendolla, 2012 for reviews). These associations are posited to be part of individuals' affect knowledge (see Niedenthal, 2008) that can be activated by affect primes. In that sense, happiness primes will activate the ease concept, resulting in lower subjective demand, and sadness primes will activate the difficulty concept, resulting in higher subjective demand. Moreover, anger has been found to be associated with approach motivation (Carver and Harmon-Jones, 2009) and experiences of high control and high coping potential (Lerner and Keltner, 2001). Consequently, implicit anger cues should also activate the ease concept, resulting in lower subjective demand, in achievement contexts.

Gendolla and Silvestrini (2011) found evidence for these predictions. Participants worked on attention or short-term memory tasks with "do-your-best" instructions while being exposed to masked facial expressions of happiness, anger, or sadness. As anticipated, exposure to sadness primes resulted in stronger effort-related cardiovascular responses (decreased cardiac pre-ejection

* Corresponding author at: Geneva Motivation Lab, FPSE, Department of Psychology, University of Geneva, 40, Bd. du Pont-d'Arve, CH-1211 Geneva 4, Switzerland.
** Corresponding author at: Geneva Motivation Lab, FPSE, Department of Psychology, University of Geneva, 40, Bd. du Pont-d'Arve, CH-1211 Geneva 4, Switzerland. Tel.: +41 22 379 92 31; fax: +41 22 379 92 16.
E-mail addresses: laure.freydefont@unige.ch (L. Freydefont), guido.gendolla@unige.ch (G.H.E. Gendolla).

0301-0511/$ – see front matter © 2012 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.biopsycho.2012.04.002

period [PEP] and increased systolic blood pressure [SBP]) than exposure to both happiness and anger primes. Moreover, sadness-primes resulted in higher experienced difficulty ratings and higher performance than both happiness and anger primes. No evidence was found for the elicitation of conscious feelings and participants could not distinguish between presented and not presented facial expressions during prime recognition tests, supporting the idea that the observed effects were caused by an implicit process.

A follow-up study by Silvestrini and Gendolla (2011a) manipulated a task-context variable—objective task difficulty of an attention task (easy vs. difficulty)—additionally to the type of affect-prime (happiness vs. sadness). The authors tested the hypothesis that the affect primes and objective difficulty would have an additive effect on subjective task demand—which was found in post task ratings—resulting in a cross-over interaction pattern of effort-related cardiovascular response. Sadness primes increased subjective difficulty and thus resulted in high effort in the objectively easy condition (high subjective difficulty), but in low effort in the difficult condition (disengagement because of too high subjective difficulty). This effect was inversed in the happiness-prime condition. Here, the objectively easy task led to low effort (low subjective difficulty), while effort was high in the objectively difficult condition (high but possible subjective difficulty). Thus, objective task difficulty can moderate affect primes' effects.

Most relevant for the present research, Freydefont et al. (2012) tested if anger-primes have a similar effect as happiness-primes, as suggested by the Gendolla and Silvestrini (2011) findings, and if affect primes have emotion-category or valence-specific effects. Freydefont et al. (2012) manipulated the type of prime (anger vs. sadness) and objective difficulty of a short-term memory task (easy vs. difficult). Effort-related cardiac response occurred as anticipated (weak response in the anger-prime/easy and sadness-prime/difficult conditions and strong response in the anger-prime/difficult and sadness-prime/easy cells). These results replicated the effect of sadness primes found by Silvestrini and Gendolla (2011a) and revealed that the prime effects are emotion-category specific, and showed that the effect of anger primes resembles that of happiness primes.

1.2. The role of incentive

Despite their clear results, our previous studies did not answer one important question: Can high incentive compensate the effort-mobilization deficit of people who are exposed to implicit sadness cues during a difficult task, or is that motivational deficit a fixed effects—e.g., because the primes take effect on cognitive capacity? We addressed this question by manipulating the magnitude of success incentive for a difficult task during which participants processed briefly flashed anger vs. sadness primes. Effort is mobilized proportionally to subjective demand as long as success is possible and justified (Brehm and Self, 1989). Moreover, high incentive increases the amount of justified effort and thus effort-related cardiac response for subjectively difficult tasks (Richter, 2012). This suggests that the effect of sadness primes on effort mobilization is not fixed but moderated by success incentive. More specifically, high incentive should result in high effort when people are primed with sadness during a difficult task, according to this logic.

1.3. Effort mobilization and cardiovascular response

According to Wright's (1996) integration of motivational intensity theory (Brehm and Self, 1989) with Obrist's (1981) active coping approach, beta-adrenergic sympathetic impact on the heart responds proportionally to the level of experienced task demand as long as success is possible and justified. Noninvasively, beta-adrenergic impact is best assessed as increased cardiac contractility and thus shortened cardiac PEP—the time interval between ventricular excitation and the opening of the heart's left ventricular valve (Berntson et al., 2004). In support of Wright's integrative hypothesis, PEP sensitively responds to variations in experienced task demand (Richter et al., 2008), incentive value (Richter and Gendolla, 2009), and combinations of both (Richter, 2010a; Silvestrini and Gendolla, 2011b).

However, to assure that PEP responds as a function of beta-adrenergic sympathetic impact rather than pre- or afterload effects, it is highly recommended to assess blood pressure and heart rate (HR) together with PEP (Sherwood et al., 1990). Another reason for assessing blood pressure is that other studies have quantified effort as reactivity of systolic blood pressure (SBP), which is systematically influenced by cardiac contractility due to its impact on cardiac output (see Gendolla and Richter, 2010; Wright and Kirby, 2001). But because PEP is directly influenced by beta-adrenergic sympathetic impact, it is a more reliable and valid measure of effort (Kelsey, 2012) than SBP (or also DBP), which is additionally influenced by peripheral vascular resistance and can be masked by it (Levick, 2003).

1.4. The present experiment

The present study tested if high incentive can compensate the effort-mobilization deficit of individuals processing sadness primes during the performance of a difficult task. Evidence for this effect would support the idea that affect primes' influence on cardiovascular response is moderated by motivational context variables, rather than being stable. Moreover, we sought for further evidence for the idea that affect-primes' impact on effort-related cardiovascular response is emotion-category specific rather than valence specific. Therefore we investigated primes of two negative emotions—sadness and anger—which were expected to have different motivational effects, and promised participants either low or high monetary reward for success on a difficult short-term memory task.

Our predictions were based on the theorizing outlined in the IAPE model (Gendolla, 2012) and its integration with the principles of motivational intensity theory (Brehm and Self, 1989). The predicted combined effects of sadness vs. anger primes, low vs. high incentive, and varying levels of objective task difficulty are depicted in Fig. 1. Predictions for the prime × objective task difficulty interaction with relatively low incentive depicted in Panel A of Fig. 1 were already tested and supported in the study by Freydefont et al. (2012). Consequently, we focused on the objectively difficult task condition to test if high incentive can compensate the effort mobilization deficit of people primed with sadness when objective difficulty is high. The relevant conditions are marked with the gray boxes in Fig. 1.

As explained above, our main effort-related dependent variable was PEP reactivity. For an objectively difficult task, we expected the weakest PEP response in the sadness-prime/low-incentive condition. Here the high effort necessary due to the high level of subjectively experienced demand was not justified by low incentive, which should lead to disengagement (Freydefont et al., 2012; Silvestrini and Gendolla, 2011a). By contrast, high incentive should boost effort in the sadness-prime condition by justifying the high necessary effort, leading to very strong PEP reactivity. Responses in the two anger-prime conditions were anticipated to fall in between the two sadness-prime cells, because anger is associated with ease, and thus reduces subjective demand (Freydefont et al., 2012; Gendolla and Silvestrini, 2011). Given that high effort was thus not necessary, justifying high effort should have no effect.