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Implicit Affect Primes Effort: Basic Processes, Moderators, and Boundary Conditions

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Abstract

This article informs about the implicit-affect-primes-effort (IAPE) model – a theory on the impact of implicit affect on resource mobilization – and research testing this account. Beside basic influences of implicitly processed affective stimuli on behavior, this article highlights moderators and boundary conditions of this process. The IAPE model posits that affect primes implicitly activate mental representations of affective states containing information about performance ease and difficulty. This influences subjective task demand during performance, which determines effort. A series of experiments assessing implicit affect's impact on effort-related cardiovascular response in cognitive tasks revealed replicated support for the IAPE model. Moreover, objective task difficulty and incentive moderated the effect of implicit affect on effort, and especially controlled processing of affect primes and activated concepts turned out to be boundary conditions.

Introduction

The last decades have accumulated abundant evidence for automaticity in human behavior. Implicitly processed stimuli in the environment can activate individuals' knowledge structures that automatically, maybe even unconsciously, translate into behavior. However, the bulk of this research has focused on the effects of implicitly activated goal representations or stereotypes on corresponding behavior (see Bargh & Chartrand, 1999; Custers & Aarts, 2005; Dijksterhuis, 2010; Kruglanski et al., 2002; Wilson, 2002 for overviews). The effects of implicitly processed affective stimuli have received relatively little attention (for exceptions, see Brosschot, Verkuil, & Thayer, 2010; Öhman, Flykt, & Lundquist, 2000; Winkielman, Berridge, & Wilbarger, 2005; Zemack-Rugar, Bettman, & Fitzsimons, 2007). To close this gap, we have developed and tested a theory explaining how implicitly processed affective stimuli can influence the intensity aspect of behavior, which is effort – the mobilization of resources for instrumental actions (Gendolla & Wright, 2009). This "implicit-affect-primes-effort" (IAPE) model (Gendolla, 2012) has stimulated a program of research that tested its predictions for effort-related physiological adjustments during the performance of cognitive tasks. In the remainder of this article, I will outline this theory and initial research that tested it before I will focus on boundary conditions of automaticity.

The central concept in this analysis is *implicit affect*. It describes the automatic, unintentional activation of individuals' mental representations of affective states' (e.g., Quirin, Kazén, & Kuhl, 2009) – without the explicit experience of these states. Implicit affect can be activated by emotional stimuli, like facial expressions of emotions or emotion words, which are processed out of the focus of attention. Such affective stimuli surround people nearly all the time they are awake and process information. While walking in a street, sitting in restaurant, or doing work in the presence of other people, we are confronted with such stimuli all the time. The basic idea of the present work is that such affective stimuli can automatically activate knowledge about emotions and that this activated emotion knowledge can systematically influence behavior.

To give an example, the theory and research presented here posit that a student working on a feasible exam, who "sees" a sad or a fearful face in his visual periphery without consciously attending to it, will automatically start to work harder than another student who processes a smiling or even angry face. Given that we are confronted with emotional stimuli nearly all the time, this can be a process that works very frequently. Additionally, I will outline that the simple effects of implicit affect on effort mobilization are moderated by task context variables like the objective difficulty of a task and boundary conditions related to conscious, controlled processing of emotional stimuli. That is, once the student in our example consciously attends to the emotional face, effects on his behavior will change. However, before explaining in more details how all this works, a short detour via the psychology of effort and its measurement is warranted.

Some Basics About Effort Mobilization and Its Measurement

Psychologists have early recognized that human and most animal behavior is guided by a basic principle of energy conservation (Gibson, 1900; see Richter, 2013; Gendolla & Silvestrini, 2015 for discussions). That is, in pursuing their goals, people mobilize just the resources that are necessary to attain them, but not more. This means that demand or difficulty is the key variable in effort mobilization. This basic principle of behavior has been elaborated and extended in motivational intensity theory (Brehm, 1975; Brehm & Self, 1989). Put in one sentence, this theory posits that *effort rises with subjective task difficulty as long as success is possible and the necessary effort is justified*. That is, effort should rise with the extent of subjective difficulty until (i) demand exceeds a person's abilities (i.e., success is impossible) or (ii) the amount of necessary effort is not justified by success importance that defines the level of "potential motivation" (i.e., the hypothetical maximum of justified effort, see Wright, 2008). If one of these limits is reached, effort drops sharply to avoid wasting resources. Accordingly, subjective demand is the most important variable determining effort, and the importance of success only sets an upper limit to this relationship.

Effort-related cardiovascular response. In an important further step, Wright (1996) has integrated motivational intensity theory with Obrist's (1981) active coping approach from psychophysiology, permitting an objective, physiological measure of effort mobilization one can even apply to cognitive challenges. Accordingly, beta-adrenergic sympathetic nervous system impact on the heart is proportional to experienced task demand as long as success is possible and the necessary effort is justified. Among noninvasive measures, beta-adrenergic impact becomes best visible in cardiac pre-ejection period (PEP) – a cardiac contractility index defined as the time interval between the onset of left ventricular excitation and the opening of the aortic valve (Berntson, Lozano, Chen, & Cacioppo, 2004). This interval becomes shorter with increased beta-adrenergic impact and is considered a reliable measure of effort mobilization (Kelsey, 2012).

Cardiac contractility can systematically influence other indices of cardiovascular activity, like systolic blood pressure (SBP) – the maximal arterial pressure between two heartbeats (Brownley, Hurwitz, & Schneiderman, 2000). Both PEP and SBP respond to the level of experienced task demand (e.g., Richter, Friedrich, & Gendolla, 2008), incentive (Richter & Gendolla, 2009), and combinations of both (Silvestrini & Gendolla, 2011a), although PEP is the purer and more sensitive effort index. The same applies to other physiological measures of effort mobilization, as, for example, pupil dilatation (e.g., Bijleveld, Custers, & Aarts, 2009; Kahneman, 1973), skin conductance (e.g., Stennett, 1957), or other indices of cardiovascular activity (see Wright & Gendolla, 2012). If one follows the argument that sympathetic beta-adrenergic activity is the purest physiological index of activation and thus resource mobilization, these effort measures are much more compromised and thus less sensitive than measuring cardiac PEP. The only disadvantage with measuring PEP is that it has to be assessed for relatively long periods (20–80 cardiac cycles) to be reliable. This means that it can be hardly assessed in experimental within-person designs with relatively short trials.

The predictions of motivational intensity theory have received ample empirical support using PEP – and also SBP, which is systematically influenced by PEP (see Gendolla, Wright, & Richter, 2012; Gendolla, Tops, & Koole, 2015, part IV; Wright & Gendolla, 2012; Wright & Kirby, 2001, for reviews).[1] Most relevant, the principles of motivational intensity theory have also been applied to explain how implicit affect can influence effort.

The Implicit-Affect-Primes-Effort (IAPE) Model

To explain how implicitly processed affective stimuli can automatically influence effort mobilization, the IAPE model builds on motivational intensity theory (Brehm & Self, 1989). If resource conservation is a basic principle of behavior, people should – also unintentionally – use all available information about task demand in order to avoid wasting effort. Implicitly processed affective stimuli can render such information accessible.

In brief, the IAPE model posits that people learn in everyday life that coping with challenges is easier in some affective states than in others. Consequently, performance ease and difficulty become features of peoples' mental representations of these affective states – their "emotion concepts" (see Niedenthal, 2008) or implicit emotion theories. Implicitly processed affective stimuli like facial expressions or emotion words that are processed out of the focus of attention can render this information accessible. The result are experiences of low or high task demand, which in turn determine the effort people mobilize – as long as success is possible and the necessary effort is justified. This process is depicted in Figure 1.

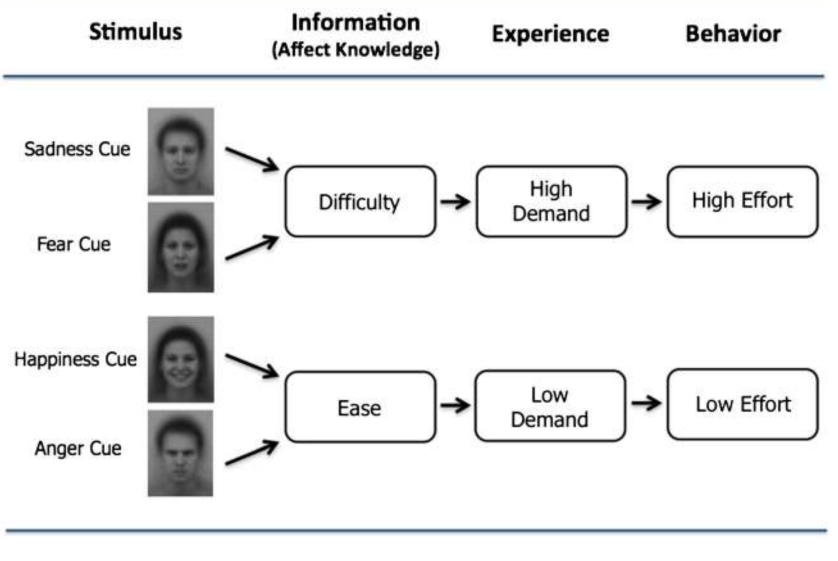

Figure 1 The basic assumptions of the IAPE model. The figure shows the general effect of implicit affect on effort mobilization if no further context variables are manipulated. The emotional expression pictures stem from the Averaged Karolinska Directed Faces (AKDEF) database (Lundqvist & Litton, 1998). The figure is adopted from Gendolla (2012). Copyright: Elsevier (both reprinted with permission).

Affect–demand associations. The IAPE model posits that affect knowledge is a product of learning. Considering evidence for explicitly experienced affective states on subjective demand and thus effort mobilization (see Gendolla & Brinkmann, 2005; Gendolla, Brinkmann, & Silvestrini, 2012), people should learn that performing tasks in a sad mood is subjectively more demanding than performing tasks in a happy mood. That way, ease becomes a feature of their mental representation of happiness, while difficulty becomes a feature of mentally represented sadness. These features become accessible if these mental representations are primed (see Förster & Liberman, 2007) by exposing individuals to implicitly processed sadness or happiness stimuli – like facial expressions of other people that are processed outside the focus of attention. Once rendered accessible, the ease or difficulty features can influence experienced task demand and effort mobilization.

People should also learn to associate fear with difficulty and anger with ease. Anger, in contrast to fear, is typically linked with high optimism, positive expectations, and experiences of high *coping potential* (Lerner & Keltner, 2001) – the subjective capacity people believe to have to master with specific events (Scherer, 2009) like tasks. Given that capacity is inversely related to difficulty, high coping potential reduces the level of experienced demand (e.g., Wright, 1998). Thus, implicitly processed anger stimuli should activate an ease concept and render subjective demand relatively low. The opposite is true for fear: Here, coping potential is typically low, and consequently, implicit activation of the fear concept during task performance should increase subjective demand (see Lerner & Keltner, 2001; Scherer, 1993; Smith & Lazarus, 1990).

Thus, the IAPE model posits that people learn to associate sadness and fear with difficulty, and to associate happiness and anger with ease. The theory is, however, not limited to these exemplary emotions – it can be applied to the mental representation of any affective state that is associated with ease or difficulty. The result is that implicit fear and sadness should lead to higher effort and that implicit happiness and anger should lead to lower effort – as long as success is possible and the necessary effort is justified. The latter specification that is borrowed from motivational intensity theory suggests that implicit affects' effect on effort can be moderated by variables like objective task difficulty and success incentive, as I will outline below.

Empirical Evidence

Simple affect prime effects

In our first experiments (Gendolla & Silvestrini, 2011), we have developed a task-integrated affect priming procedure to test the basic hypothesis that implicitly processed sadness primes that are processed online during cognitive tasks lead to higher effort than both happiness and anger primes. After a habituation period for physiological baseline measures, participants worked on a mental concentration task (Brickenkamp, 1981), in which they had to identify visual target stimuli, or a Sternberg-type short-term memory task (Sternberg, 1966). During the task trials, participants were exposed to blurred pictures of a human facial expression. To achieve suboptimal presentation and implicit processing of these stimuli, they were flashed very briefly.[2] Next followed a "d" or "p" with apostrophes in the mental concentration task (Study 1) or a letter string that had to be memorized in the Sternberg task (Study 2). To prevent fast adaptation to the primes, we presented emotional expressions in only 1/3 of the trials in each prime condition (between persons). The remaining 2/3 of the primes were averaged neutral expressions.

Supporting the predictions, both experiments revealed stronger sympathetic nervous system impact on the heart – shorter PEP, higher SBP – in the sadness-prime condition than in both the happiness- and anger-prime conditions. Moreover, participants' reaction times showed that performance on the mental concentration task followed the effort-pattern of the cardiovascular measures. There was no evidence for affect prime effects on conscious affect, which was assessed before and after the task. However, assessed task appraisals revealed higher subjective demand in the sadness-prime condition than in both the implicit anger and happiness cells – which speaks for the IAPE idea that ease and difficulty are features of emotion concepts. These studies provided the first evidence for the systematic impact of implicit affect on effort mobilization as conceptualized in the IAPE model.

No feelings?

To date, none of our implicit affect studies revealed any evidence that the briefly flashed affect primes induced conscious emotional feelings – which in turn could function as direct information for demand appraisals and effort mobilization (see Gendolla & Brinkmann, 2005). Although this is consistent with the IAPE model idea that affect primes influence effort implicitly, zero effects are hardly convincing. Thus, Lasauskaite, Gendolla, and Silvestrini (2013) tried to run a more conclusive experiment. This study was stimulated by evidence that conscious feelings – if they are experienced – lose their effect on evaluative judgments when individuals are warned that their feelings could be manipulated. Under such conditions, judgments are corrected (see Clore, 1992) and conscious feelings lose their informative effect on subjective demand and effort (Gendolla & Krüsken, 2002).

Participants worked on the mental concentration task (Brickenkamp, 1981) in which they were exposed to briefly flashed sadness versus happiness expressions. Most relevant, half the participants were warned that flashes on the screen might influence their emotional feelings during the task. The other participants performed the task without this information. Replicating our above reported findings, we found an affect prime effect on PEP reactivity, which was stronger in the sadness-prime than in happiness-prime condition. Additionally, we found a warning effect: PEP reactivity was generally stronger in the cue condition than in the no-cue condition. The interaction was not significant, and the affect prime effect was not attenuated in the cue condition.

Thus, the cue-manipulation had an effect, but none supporting the idea that the primes had elicited conscious emotional feelings whose impact could be corrected. Rather, it seems that the warning manipulation increased general demand by giving participants two tasks: Attending to the task stimuli and keeping in mind that occurring "flashes" could influence their feelings. Moreover, the affect primes had effects on subjective demand and performance, which were both higher in the sadness-prime condition than in the happiness-prime condition, while no effect on self-reported affect approached significance. Altogether, this suggests that our affect priming procedure influenced effort without inducing conscious emotional feelings whose impact could be corrected.

Moderators: objective task difficulty and incentive

So far, we have seen that affect primes can systematically influence effort implicitly and apparently without eliciting emotional feelings. However, the simple main effect of affect primes on effort can be moderated by task context – in accordance with the principles of motivational intensity theory (Brehm & Self, 1989).

To avoid wasting resources, people should seek and consider all available information about task demand. Consequently, accessible difficulty or ease concepts, activated by affect primes, and information about objective difficulty should have an additive effect on subjective demand. Thus, sadness and fear primes should augment the subjective difficulty of an easy task, resulting in relatively high effort (high subjective difficulty), but leading to low effort for a difficult task (disengagement because of too high difficulty). By contrast, the effect of objective task difficulty should be inverted by happiness or anger primes. Here, an objectively easy task should lead to low effort (low subjective difficulty), whereas effort should be high for an objectively difficult task (high but feasible demand). The result is a prime × difficulty crossover interaction effect on effort, as depicted in Figure 2.

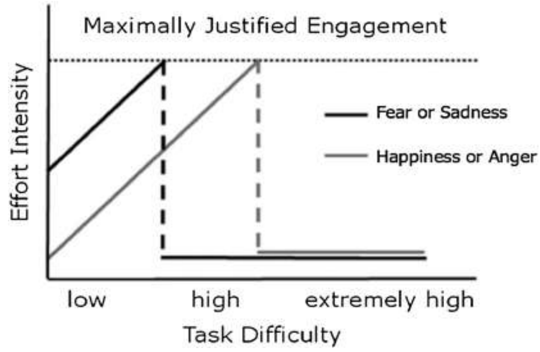

Figure 2 Theoretical predictions for the joint effect of affect primes and objective task difficulty on effort mobilization.

Silvestrini and Gendolla (2011b) tested this prediction in an experiment that exposed participants to happiness versus sadness primes during an objectively easy versus difficult version of the mental concentration task. The study revealed the predicted crossover interaction effect on cardiovascular reactivity: Participants in the sadness-prime/easy and happiness-prime/difficult conditions showed shorter PEP and higher SBP, indicating higher effort than in the sadness-prime/difficult and happiness-prime/easy conditions – at least at the beginning of task performance. Moreover, task difficulty ratings revealed the additive effect of objective difficulty and type of affect prime on subjective demand. The effects in the difficult condition were recently replicated for muscular effort in a highly demanding physical endurance task (Blanchfield, Hardy, & Marcora, 2014).

Another experiment (Freydefont, Gendolla, & Silvestrini, 2012) tested if anger primes have a similar effect as happiness primes, as posited by the IAPE model, and if the affect prime effects are emotion category or valence specific. Therefore, participants were exposed to primes of two different negative emotions – anger versus sadness – during an easy versus difficult version of a Sternberg-type short-term memory task. As depicted in Figure 3, PEP reactivity showed the expected crossover interaction pattern: Reactivity in the anger-prime/difficult and the sadness-prime/easy conditions was stronger than in the anger-prime/easy and sadness-prime/difficult conditions.

Finally, Freydefont and Gendolla (2012) found that high performance-contingent monetary incentive could eliminate the effort mobilization deficit of people primed with sadness during a difficult task. We replicated the difficult condition of the Freydefont et al. (2012) experiment and found that high monetary incentive led to strong PEP reactivity in the sadness-prime condition, while low incentive resulted in low effort. Incentive had no effect in an implicit anger condition, which fell in between these cells. These findings were anticipated, considering the principles of motivational intensity theory (Brehm & Self, 1989). Accordingly, sadness primes should lead to higher effort than anger primes when incentive was high, because here the high effort, which was necessary due to the high subjective demand, was justified. With low incentive, it was not. Moreover, incentive should have no effect in the anger-prime condition, because subjective demand should be lower than in the implicit sadness condition, making a justification of high effort unnecessary.

In summary, these studies have revealed replicated evidence for the IAPE model by demonstrating simple affect prime effects on effort and the moderation of these effects by objective task difficulty and performance-contingent incentive. The latter two moderator effects followed the logic of motivational intensity theory by influencing task demand and the level of justified

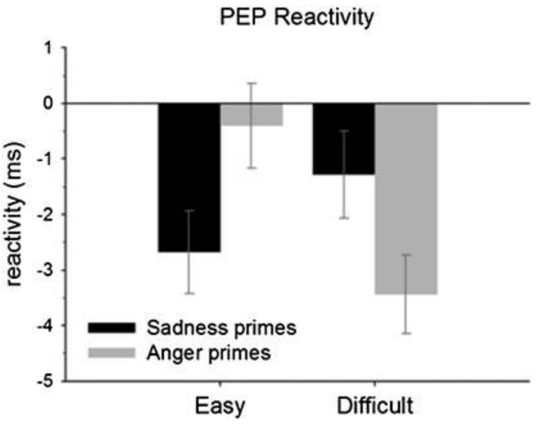

Figure 3 Means and standard errors of cardiac pre-ejection period reactivity (in ms) during task performance in the experiment by Freydefont, Gendolla, and Silvestrini (2012). Copyright: Blackwell (reprinted with permission).

effort. Further experiments investigated general boundary conditions of implicit affects' automatic impact on behavior.

A boundary condition: prime frequency

In the Gendolla and Silvestrini (2011) studies, we had presented affect primes in only 1/3 of the experimental trials to prevent fast habituation to the primes. To test if higher prime rates would really lead to saturation and reduce affect primes' effect on effort, Silvestrini and Gendolla (2011c) presented happiness versus sadness primes in 1/3, 2/3, or 3/3 of the trials of a mental concentration task. Technical problems prevented an analysis of PEP data. However, replicating the results by Gendolla and Silvestrini (2011), SBP reactivity in the 1/3 condition was significantly stronger – indicating higher effort – in the sadness-prime condition than in the happiness-prime cell. This effect was not evident in the 2/3 and 3/3 conditions, resulting in a significant prime × frequency interaction. Thus, high prime frequency emerged as a boundary condition for implicit affect's effect on effort mobilization. As a consequence, we had kept the rule to present emotional expressions in only 1/3 (and neutral expressions in 2/3) of the trials in all experiments reported here.

Interestingly, our finding that higher prime frequency decreased the affect primes' effect contradicts the popular assumption that stronger activation and accessibility of a primed concept increases its impact (see Förster & Liberman, 2007, for a discussion). However, it is also of note that repeated exposure to emotional stimuli usually leads to habituation and thus to a decrease of their respective influence (e.g., Wright et al., 2001). This habituation effect has also been demonstrated in affect priming procedures (e.g., Breiter et al., 1996; Wong & Root, 2003).

Another boundary condition: controlled processing

Primes seem to have particularly strong effects when they are processed automatically. Recent models of behavior priming have thus suggested that primes influence behavior especially if individuals regard the mental contents they activate as a valid basis for their behavior. More specifically, it has been suggested that primes work by influencing persons' current self-concept (Wheeler, DeMarree, & Petty, 2007) or if people misattribute the mental content that primes made accessible to their own thoughts instead of an external source (Loersch & Payne, 2011).

Under such conditions, judgments and behavior are usually assimilated to the accessible mental content. However, if primes are processed in a controlled, deliberative way, this assimilation effect can be significantly attenuated – or even reversed in terms of prime-contrast effects.

For prime effects on judgments, it has already been shown long ago that primes lose their effect when they are clearly visible (e.g., Murphy & Zajonc, 1993) or consciously remembered (e.g., Lombardi, Higgins, & Bargh, 1987). After some initial evidence (e.g., Herr, 1986), similar effects have been found in studies on behavior priming. This suggests that controlled prime processing overrules the tendency to assimilate one's behavior to the accessible mental content that primes activate. In support of this idea, there is evidence that manipulations of doubt (DeMarree et al., 2012), warning of prime appearance and its effects (Lasauskaite Schüpbach, 2013; Loersch & Payne, 2012; Verwijmeren, Karremans, Bernritter, Stroebe, & Wigboldus, 2013), or prime visibility (Chaillou, Giersch, Bonnefond, Custers, & Capa, 2015) attenuate prime effects on behavior. Such controlled prime processing conditions seem to result in behavior correction – which is only possible for conscious processes (Bijleveld, Custers, & Aarts, 2012; Dehaene & Naccache, 2001). We tested two related boundary conditions of automaticity within the IAPE model framework.

Prime warning: cuing effects on demand. The IAPE model posits that implicit affect influences effort mobilization through its effects on subjective demand. Importantly, Schwarz et al. (1991) found that informing people about an external manipulation of their difficulty experiences reduced subjective demands' impact. A study that is reported in detail in the dissertation manuscript by Lasauskaite Schüpbach (2013, chapter 2) applied this effect to test the role of subjective demand in affect primes' effect on effort.

If affect primes influence effort by their impact on subjective difficulty, warning of an external influence on subjective difficulty should reduce their effect. Participants worked on a Sternberg-type short-term memory task of moderate difficulty during which they were exposed to sadness versus happiness primes. Before the task, half the participants were warned that the task presentation might influence experienced task difficulty. We expected this warning to diminish the prime effect on effort. The prime × cue interaction was not significant for PEP, but focused cell contrasts found that the prime conditions differed, as expected, significantly without warning. They did not in the prime warning condition. This lends at least some support to the idea that informing participants that their difficulty experiences could be caused by an external source – the task presentation – reduces the prime effect on effort mobilization.

Moreover, it is of note that informing participants about the possible manipulation of their emotional feelings (rather than subjective demand) had not attenuated the prime effects in the earlier-discussed study by Lasauskaite et al. (2013). The discrepancy between both results is not surprising. There was no evidence that our affect priming procedure induced conscious emotional feelings and thus nothing that could be corrected in the Lasauskaite et al. (2013) study. But apparently, the affect primes influenced experienced task demand in the Lasauskaite Schüpbach (2013) experiment, i.e., an experience that could be corrected.

Prime awareness. As discussed above, sadness primes lead to stronger effort than happiness or anger primes in easy tasks but have the opposite effect in objectively difficult tasks (Freydefont, Gendolla & Silvestrini, 2012; Silvestrini & Gendolla, 2011b; see also Blanchfield et al., 2014). We tested if this effect is limited to implicitly processed affect primes or if it is also valid if the primes are clearly visible. We drew on seminal studies by Murphy and Zajonc (1993) reporting prime-congruent assimilation effects on evaluative judgments of neutral targets if affect primes were presented very briefly. The evaluations were more positive if smiling faces preceded the targets than if angry faces did. However, when the primes were clearly visible, there was a trend to a prime-contrast effect in participants' judgments, suggesting controlled processing and correction of the prime influence. Referring to effort mobilization, we reasoned that our affect priming effects reported so far depend on unawareness of the external influence. Consciousness of task irrelevant affective stimuli should induce suspicion and thus result in behavior correction. The result should be a significantly reduced or even reversed (i.e., contrast) effect of the primes, which can occur if external influences become aware (Herr, 1986). To test these assumptions, participants in a study by Lasauskaite Schüpbach, Gendolla, and Silvestrini (2014) had to decide if arithmetic equations appearing on a computer screen were correct or not (cf. Bijleveld, Custers, & Aarts, 2010). During this task, we presented sadness versus happiness primes either very briefly ("suboptimally") or clearly visible ("optimally"). Moreover, the time participants had for their correctness decisions rendered the task objectively easy or difficult. As presented in Figure 4, the manipulations yielded a significant three-way interaction on PEP responses, supporting the idea that clearly visible primes resulted in a prime-contrast effect on effort. In both prime presentation conditions, effects in the difficult condition were stronger than in the easy condition – presumably, because the easy condition was in fact very easy, leaving little space for effects on experienced demand during performance. However, if the primes were briefly flashed, their effect replicated the findings by Silvestrini and Gendolla (2011b): stronger PEP responses in the happiness-difficult condition than in the sadness-difficult cell. Most relevant, this effect was reversed in the long prime presentation condition. Moreover, neither the briefly flashed primes nor the clearly visible primes had effects on conscious affect. According to these findings, affective stimuli resulted in a prime-contrast effect on effort mobilization, suggesting a controlled behavior correction process when participants were aware of the primes' affective content. That is, prime awareness seems to be a boundary condition of automaticity.

A recent study by Chaillou et al. (2015) revealed corresponding results. Here, briefly flashed positive primes lead to lower performance and weaker fronto-central contingent negative variation (CNV), a neural measure of cognitive effort. This effect was not significant when the primes were clearly visible.

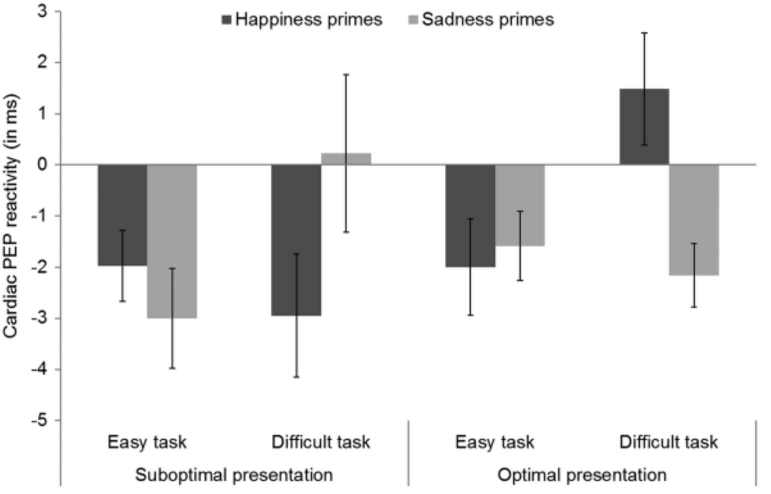

Figure 4 Means and standard errors of cardiac pre-ejection period reactivity (in ms) during task performance in the experiment by Lasauskaite Schüpbach et al. (2014). "Suboptimal" primes were presented very briefly; "optimal" primes were clearly visible. Copyright: Springer (reprinted with permission).

The deeper motivational reason for behavior correction effects as those reported above may rely in psychological reactance (Brehm, 1966). If people prefer autonomy and basically think that they act in accordance with their own decisions, they should dislike being manipulated (cf. Ryan & Deci, 2000). Visible primes, which have nothing to do with a task itself or warnings that "flickers" appearing during a task could influence one's experience of task demand, should elicit suspicion that one is manipulated, leading to behavior correction with the effect of attenuated prime effects – or even contrast effects in the case of overcorrection.

Summary and Conclusions

As presented now, there is replicated evidence that the mere implicit activation of emotion concepts can systematically influence effort mobilization operationalized as cardiac PEP – a sensitive measure of sympathetic nervous system impact on the heart and thus resource mobilization (Kelsey, 2012; Wright, 1996). The reported evidence supports the process posited in the IAPE model (Gendolla, 2012). Accordingly, mental representations of affective states comprise information about performance ease or difficulty, which can be made accessible by implicit affective stimuli that are processed during cognitive tasks outside the focus of attention. The effect of activated affect knowledge on behavior depends on the momentary *accessibility* and *applicability* of its features, which is context dependent. Thus, activating the happiness concept may result in friendly behavior in affiliation contexts, because friendliness is a feature of happiness that is highly applicable here. However, in achievement contexts, performance ease or difficulty should be highly relevant and applicable to comply with the principle of resource conservation.

As presented now, there is well-replicated evidence for the IAPE model in terms of effects on effort mobilization. However, one could ask if there is also evidence that affect primes that are processed in achievement situations really activate knowledge about the ease or difficulty of instrumental behavior. Some of our studies have provided support for this idea (Gendolla & Silvestrini, 2011; Lasauskaite Schüpbach, 2013; Silvestrini & Gendolla, 2011c): Participants who were primed with sadness reported to have experienced higher demand than those who were primed with anger or happiness. However, clearer evidence could be provided by more direct measures of the accessibility of the ease versus difficulty concepts in response to masked affect primes with implicit measures. First evidence for such links exists from research with a procedural priming procedure (Lasauskaite Schüpbach, 2013, chapter 5).

In a larger perspective, the reported simple implicit affect effects contribute to the evidence for automaticity in behavior (see Bargh & Chartrand, 1999; Custers & Aarts, 2005; Dijksterhuis, 2010; Wilson, 2002). However, the research discussed in this article is the first that focused on the systematic impact of implicit affect on effort. Usually, research on automaticity in resource mobilization has focused on implicitly processed incentive cues and justified effort (e.g., Aarts, Custers, & Marien, 2008; Bijleveld et al., 2012; Capa, Cleeremans, Bustin, & Hansenne, 2011; Pessiglione & Leberton, 2015; Silvia, 2012). The present research made an important step forward in understanding automaticity in effort mobilization by considering the principle of resource conservation, its elaborations, and the impact of links between implicit affect, and ease and difficulty experiences.

Moreover, I have reported evidence for moderations of implicit affects' effect on effort by objective task difficulty and performance-related incentive. These moderators operated according to the well-supported principles of motivational intensity theory (Brehm & Self, 1989). They systematically influenced subjective demand and maximally justified effort, which in turn influence effort in compliance with the basic principle of resource conservation. Furthermore, I have also discussed general boundary conditions of automaticity related to the adaptation to affect primes and controlled rather than automatic processing of primes and the concepts they activate. Together with other research on moderators and boundary conditions of automaticity (e.g., Cesario, Plaks, Hagiwara, Navarrete, & Higgins, 2010; DeMarree et al., 2012; Loersch & Payne, 2012; Silvestrini & Gendolla, 2013; Verwijmeren et al., 2013), this helps to understand the conditions under which automaticity in behavior works.

Identifying moderators and boundary conditions of automaticity is important for understanding when, why, and how automaticity functions. Without recognizing moderators and boundary conditions and their underlying psychological processes, one could only expect general main effects of behavior priming procedures and conclude that automaticity is very fragile or does not really exist if such main effects do not occur (Dijksterhuis, Van Knippenberg, & Holland, 2014). Therefore, the present analysis has first provided theory-based evidence for main effects of affect primes on effort, then reported evidence for systematic theory-based moderation of those effects, and finally informed about general boundary conditions of automaticity. I hope this contributes to a better understanding of the conditions under which automaticity works.

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Short Biography

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Notes

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[1] For more detailed discussion of the physiological reasons why PEP (and SBP) are widely accepted operationalizations of effort mobilization, see, for example, Gendolla (2012), Gendolla and Silvestrini (2015), Kelsey (2012), or Richter et al. (2008).

[2] I prefer using the term "suboptimally presented" to refer to very briefly flashed visual stimuli. The frequently used term "subliminal" should be reserved to procedures that assure that stimuli are presented below persons' individual threshold of perceptual awareness.

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