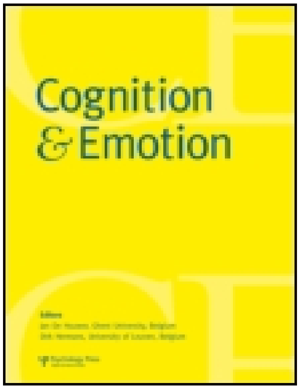

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The effects of verbal labelling on psychophysiology: Objective but not subjective emotion labelling reduces skin-conductance responses to briefly presented pictures

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BRIEF REPORT

The effects of verbal labelling on psychophysiology: Objective but not subjective emotion labelling reduces skin-conductance responses to briefly presented pictures

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Verbally labelling emotional stimuli has been shown to reliably decrease emotional responding. The present study compared the use of identical emotional labels during two types of verbal labelling: subjective labelling of one's own emotional response and objective labelling of the stimulus. We recorded skin conductance responses (SCRs) to emotional pictures presented at four brief durations preceding a backward mask. We observed that as the exposure duration increased, SCRs decreased during objective labelling of the stimuli. However, when participants subjectively labelled their own emotional state, SCRs increased as exposure duration increased. In addition, subjective labelling produced larger SCRs than objective labelling at a shorter exposure duration when the presented stimuli were biologically prepared. These results indicate that only objective labelling results in decreased emotional responding, and describe a novel interaction between bottom-up stimulus characteristics and top-down cognitive effects on physiological responses.

Keywords: Backward mask; Skin conductance; Labelling; Emotion; Biologically prepared.

INTRODUCTION

The process of "putting feelings into words" has been a cornerstone of psychotherapy and emotion regulation for decades. Several lines of research support the idea that verbally labelling an emotional stimulus results in decreased emotional responding. Verbal processing of emotional experience has been shown to be clinically beneficial (Pennebaker, 1997), and the notion that verbal processing of emotions is therapeutic underlies several "talk" therapies (Greenberg, 2002; Linehan,

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1993). Empirically, verbal labelling of negative stimuli has been shown to result in long-lasting decreases in physiological responding to negative and phobic objects (Tabibnia, Lieberman, & Craske, 2008). In addition, several neuroimaging studies have shown that providing an emotion label for a threatening stimulus reduces the amygdala response (Hariri, Mattay, Tessitore, Fera, & Weinberger, 2003) above and beyond verbally labelling the gender or matching the emotion depicted (Lieberman et al., 2007). These effects have exciting implications for the use of labelling as a simple, effective way to reduce emotional responding.

Despite the initial promise of these studies, there are several unanswered questions about the mechanism by which verbal labelling reduces emotional responding. The studies above have employed verbal labelling of the emotional stimulus. This objective evaluation of emotional stimuli may be the key to the down-regulation of physiological responses (Ayduk & Kross, 2008). However, research on emotional evaluation more generally has distinguished between evaluating the properties of the emotional stimuli (objective evaluation) and one's own emotional response (subjective evaluation). These different types of evaluation have been shown to activate distinct prefrontal networks (Lee & Siegle, in press). It is therefore possible that these different types of emotional evaluation have different consequences on emotional outcomes, such as peripheral physiology.

In addition to the objective labelling described above, the effects of subjective labelling are important to investigate. This sort of labelling may actually increase emotional responding. According to appraisal theory, calling one's attention to how an emotional stimulus relates to one's current goals and motivational state should amplify the emotional response (Bermond, 2007; Scherer, Schorr, & Johnstone, 2001). One study found greater SCRs when participants were instructed to view emotional pictures extremely carefully (Damasio, Tranel, & Damasio, 1990), which may have promoted self-relevant processing. However, this study did not directly test the effects of labelling one's own subjective state vs. the pictures themselves. In addition, several neuroimaging studies have investigated the effects of subjective labelling on activity in emotion-responsive regions such as the amygdala. These studies report greater activity (Taylor, Phan, Decker, & Liberzon, 2003) or no change in activity (Hutcherson et al., 2005) in the amygdala due to subjective labelling, but none reports the decreases that are caused by objective labelling. Despite the importance of clarifying the effects of objective versus subjective labelling, no previous studies have directly compared the effects of these two types of labelling on physiological responding.

Another limitation of previous labelling studies is that they have used relatively long exposure durations (several seconds). These exposure durations have been useful in demonstrating the effects of labelling when an emotional stimulus can be fully processed, but do not allow for distinguishing between the effects of bottom-up, stimulus-driven responses and the top-down, cognitive influences of labelling. An interesting and important property of emotional stimuli is that they can elicit physiological responses even when they are presented in an extremely degraded fashion, for example presented briefly preceding a backward mask (Öhman & Mineka, 2001; Whalen et al., 1998). It is unknown whether verbal labelling would affect the physiological responses to highly degraded stimuli, or whether more complete awareness of the stimulus is required for labelling to have its down-regulatory effects. It should be noted, however, that physiological responding to stimuli presented at exposure durations that typically preclude conscious processing (< 30–40 ms; Öhman & Mineka, 2001; Whalen et al., 1998, but see Pessoa, Japee, & Ungerleider, 2005) is most often seen in the context of stimuli that are biologically prepared (e.g., emotional faces, spiders, snakes; Öhman & Mineka, 2001). Therefore, if verbal labelling has an effect on physiological responses to stimuli presented in a degraded fashion, it is possible that this effect would interact with the biological preparedness of the stimuli.

The present study therefore aimed to address this gap in the literature by comparing subjective and objective labelling of emotional pictures presented at four durations preceding a backward mask. Participants were asked to provide a label of "pleasant", "unpleasant" or "neutral" on each trial. For half of the trials, participants were asked to use these labels to describe their own emotional state (subjective labelling) and for the other half of the trials to describe the emotional characteristics of the picture (objective labelling). We hypothesised that as the exposure duration of the stimuli increased, SCRs would increase when participants were asked to label their own emotional state. However, we predicted that when asked to label the objective nature of the stimuli, SCRs would decrease as the exposure duration increased. Furthermore, we also explored whether differences at exposure durations that typically do not allow for conscious processing (16.6 and 33.2 ms) would only be apparent for biologically prepared stimuli, whereas at exposure durations that typically allow for conscious processing (66.4 and 132.8 ms) these effects would be seen for both biologically prepared and non-biologically prepared stimuli.

METHODS

Participants

Forty right-handed male volunteers between the ages of 18 and 36 were recruited from the University of Arizona and the surrounding community. In a previous psychophysiological study we observed that in men, the ability to put their own feelings into words correlated positively with SCR responses to pictures, whereas no such association was observed in women (Lane, Allen, Schwartz, & Sechrest, 2000). We were therefore interested in further exploring the relationship between labelling of emotions and physiological responses in men who displayed a wide range of abilities on the Level of Emotional Awareness Scale (LEAS), which indexes the complexity and differentiation of one's emotional experiences.[1] An added advantage was that menstrual-related changes were eliminated as a variable. All potential participants were screened by telephone and were excluded on the basis of sexual orientation (to ensure pleasant responses to heterosexual erotic stimuli), for being a non-native English speaker, having familiarity with the stimulus set, a current or past history of mental illness such as a current major depressive episode or lifetime history of bipolar disorder, neurological disease, colour blindness, current use of psychoactive medications, alcohol abuse or dependence, or drug abuse or dependence. Participants gave written informed consent and were compensated financially for their participation.

Behavioural task

One hundred ninety-two trials were presented in two instruction blocks (96 trials per instruction). The order of the two instructions ("How do you feel?" or "What kind of picture is this?") was counterbalanced across participants. Within each block, each trial began with the presentation of the labelling instruction. This instruction was a reminder of previous task training, in which participants were instructed to select labels of pleasant, unpleasant or neutral either "according to the feeling you experience in response to the picture, not how you think the picture would be seen in general or by other people" (subjective) or "according to the content of the picture or how it would be seen in general or by other people" (objective). This instructional image was on the screen for 498 ms, followed by a 332 ms crosshair and a 160 ms pause. The target images were then presented for 16.6, 33.2, 66.4 or 132.8 ms, followed by a mask presented for 99.6 ms. The interval between trials was jittered between 3.5 and 5.4 seconds, yielding an inter-stimulus interval that varied between 4.6 and 6.7 seconds. Picture valence and exposure duration were counterbalanced within instruction block.

[1] No main effects of or interactions with LEAS were observed.

Responses of pleasant, unpleasant or neutral were obtained on a three-button keypad in the subject's right hand.

Visual stimuli

Images were taken from the International Affective Picture System (IAPS) stimulus set (Lang, Bradley, & Cuthbert, 1995). Stimuli were selected from the larger IAPS set to balance for valence and arousal across experimental conditions. The 192 trials were constructed using 96 unique IAPS slides. Each slide was presented twice within the same instruction condition but displayed for two different exposure durations. Slides were divided into two groups of 48, and each group was presented under the same labelling condition for each participant. In each labelling condition, 12 of the pictures were rated as normatively unpleasant (1–4, mean valence rating = 2.73, mean arousal rating = 5.65), 12 as normatively neutral (4.5–5.5, mean valence rating = 5.07, mean arousal rating = 3.61), and 12 as normatively pleasant (6–9, mean valence rating = 7.02, mean arousal rating = 5.22). None of the normative ratings for valence nor arousal differed between the subjective- and objective-labelling conditions (all ps > .27).

Fourteen masks were constructed using Adobe Photoshop™ to fracture and reassemble the target stimuli (IAPS pictures). Masks were equated for the valence and arousal ratings of the component pictures, luminosity, and all masks included a human face in one (and only one) of their component pictures.[2] Stimuli were presented using VisuaStim™ stimulus-presentation goggles (Resonance Technology, Northridge, CA, USA) and DMDX, software for timing and sequence control (Forster & Forster, 2003).

Biological preparedness of the pictures was determined by aggregating ratings of the biological nature of the stimuli by ten faculty and graduate students from the Evolutionary Psychology program at the University of Arizona.[3] The content of pictures rated as biologically prepared included animals, mutilations, raw foods (e.g., fruits and vegetables), erotica, outdoor scenes, and close-ups of human faces. The content of non-biologically prepared pictures included household objects, indoor scenes, sporting events, prepared food (e.g., pizza, chocolate cake), cars, weapons, and complex scenes that rely upon cultural knowledge for their meaning (e.g., KKK members burning crosses).

Ratings of biological preparedness were collected post hoc, therefore the biologically prepared and non-biologically prepared pictures were not equal in number. Twenty-eight of the 96 pictures were rated as non-biologically prepared. A t-test comparing the mean normative ratings for valence showed no significant differences between biologically prepared and non-biologically prepared pleasant, neutral or unpleasant pictures in the subjective instruction condition (all ps > .11) and the objective instruction condition (all ps > .37). The mean normative ratings for arousal were not significantly different for pleasant or unpleasant pictures in the subjective condition (ps > .31) nor the objective condition (ps > .53). Normative arousal ratings for neutral pictures were significantly different in both

[2] We conducted additional analyses to ensure that the SCRs reported here were not due to properties of the masks shown. We found that the results reported here remained significant when partialling out variance in SCRs due to the mask presented.

[3] Raters were instructed to make a forced-choice decision about the presence of material in the slide that was likely to have "elicited the same emotional response early in evolutionary history." An example was given: snakes have likely provided a threat to humans for many generations, whereas due to the recent invention of the handgun, it is unlikely to have elicited an emotional response until very recently in history. It was clarified that for neutral stimuli, biological relevance was to be indicated if the neutral object would have been present early in evolutionary history (landscapes, trees, etc., as opposed to fire hydrants, hair dryers, etc.). In slides that presented mixed stimuli, raters were instructed that if any prominent object in the slide was biologically relevant, that rating would prevail (e.g., an angry face displayed prominently with several handguns would be biologically relevant due to the featured face). Ratings that were close to equally divided between the raters (17 of 96 images) were decided upon by the rating of an author familiar with the biological relevance literature (KM), again with a bias towards labelling mixed pictures as biologically relevant.

conditions ($p < .026$ and $p < .023$, respectively) with biologically prepared neutral pictures on the average being normatively rated as more arousing than non-biologically prepared neutral pictures. A complete list of IAPS pictures used, with ratings of biological preparedness, is available upon request.

Skin conductance data analysis

SCR was recorded using Biopac MP100 Systems™ bio-amplifiers and two 8 mm Ag/AgCl electrodes filled with KY jelly (chlorhexidine gluconate, glucono delta lactone, glycerin, hydroxyethylcellulose, methylparaben, purified water, sodium hydroxide). Electrodes were attached to the hypothenar eminence (the palm just below the thumb) of the left hand. The SCR signal was sampled at 200 Hz. SCR was measured as the change in electrodermal activity from the prestimulus value to the peak 4–6 seconds later with onset between 1 and 4 seconds after stimulus onset. Trials in which SCR did not rise, steadily declined, or began outside the onset window specified above were assigned a value of zero and included in all subsequent analysis. Trials that showed movement artefact were removed from analysis. Five individuals were removed from analyses due to equipment malfunction in one instruction condition or another, resulting in incomplete within-subject comparisons. An additional three individuals were removed because artefacts were removed in so many trials that not all experimental cells could be filled. Lastly, four subjects were excluded because they failed to produce a single significant SCR during the entire experiment. Among included subjects ($N = 28$), 92.6% of the trials had analysable SCRs to stimuli (including conditions above that resulted in a value of 0 being assigned). SCR amplitudes were square-root corrected, averaged by condition and entered into a repeated-measures general linear GLM in SPSS with Labelling (two levels: subjective and objective), Exposure Duration (four levels: 16.6 ms, 33.2 ms, 66.4 ms and 132.8 ms), Picture Valence (three levels: pleasant, unpleasant and neutral), and Biological Preparedness (two levels: biologically prepared and non-biologically prepared) as within-subject factors.[4]

RESULTS

Skin-conductance responses

Our first hypothesis was that as exposure duration increased, SCRs would increase in the subjective-labelling condition and decrease in the objective-labelling condition. Results of the repeated measures GLM in SPSS supported this hypothesis, revealing an interaction between labelling and exposure duration, $F(3, 25) = 5.28$, $p < .006$. This interaction showed the predicted pattern of increases in SCRs as exposure duration increased when viewed under the subjective-labelling condition, but decreases in SCRs when viewed under the objective-labelling condition.

Post hoc pairwise *t*-tests revealed that larger SCRs were observed during subjective than objective labelling at the two longer exposure durations (comparisons between subjective and objective instructions were $p < .046$ and $p < .014$ for the 66.4 and 132.8 ms exposure durations, respectively) but not the two shorter exposure durations (ps $> .365$).

We also explored whether differences between SCRs in the subjective- vs. objective-labelling conditions at shorter (subliminal) exposure durations would only be observed for biologically prepared stimuli. The second interaction (which qualifies the two-way interaction reported above) was observed between labelling, exposure duration and biological preparedness, $F(3, 25) = 3.28$, $p < .038$. Examining biologically prepared and

[4] Due to the unequal cell sizes that were a result of post hoc ratings of biological preparedness, we also conducted an analogous analysis using a hierarchical linear model (HLM), which is more resistant to missing data and uneven cell sizes. This also allowed for the inclusion of the 8 subjects for whom we did not obtain SCR data for every condition. These results show an almost identical pattern of results, with the exception of a main effect of labelling (subjective > objective, $F = 4.95$, $p < .026$), the reduction of the Labelling × Exposure Duration interaction to a trend ($p = .074$). No other effects changed in significance or direction.

non-biologically prepared stimuli separately (see Figure 1), one sees the relationship between labelling and exposure duration described in the two-way interaction above for both stimulus types. However, when comparing SCRs to the subjective- and objective-labelling conditions, post hoc tests indicate that the significantly larger SCRs to the subjective- than objective-labelling conditions appear at a shorter exposure duration for the biologically prepared stimuli (comparisons between subjective and objective instructions were $p = .320$, $p < .041$, $p < .012$, and $p < .022$ for the 16.6, 33.2, 66.4 and 132.8 exposure durations, respectively) than the non-biologically prepared stimuli ($p = .809$, $p = .611$, $p = .344$, and $p < .013$ for the 16.6, 33.2, 66.4 and 132.8 exposure durations, respectively).

No other main effects or interactions reached significance (all ps > .127), with the exception of a trend for an interaction between exposure duration and valence, $F(6, 22) = 2.32$, $p < .07$.[5]

Accuracy of emotion categories

To address the possibility that the interaction described above was due to differences in accuracy in categorising the emotional stimuli, we computed the percent of pictures correctly categorised in each condition.[6] These means are depicted in Figure 2. We observed a main effect of time, $F(3, 39) = 6.76$, $p < .001$, with accuracy increasing with longer exposure durations. We did not see a main effect of-labelling condition or biological preparedness (ps > .16). We did observe an interaction between time, labelling condition, and biological preparedness, $F(3, 39) = 7.98$, $p < .001$. This interaction is shown in Figure 2. However, it is clear that the pattern observed for accuracy is not the same as that observed in SCRs.

Rather, the differences originate largely from an interaction at the longest exposure duration (133.2 ms), in which accuracy is greater during the objective-labelling condition for the non-biologically prepared pictures, but greater during the subjective-labelling condition for the biologically prepared pictures. This interaction at 133.2 ms does little to explain the Condition × Time × Biologically Prepared interaction we observe in SCR, where SCR responses to biologically prepared and non-biologically prepared pictures are comparable in the subjective- and objective-labelling conditions at that exposure duration.

DISCUSSION

The present study aimed to compare the effects of subjective and objective verbal labelling on physiological responses to briefly presented pictures. We observed that when participants provided objective labels, their SCRs decreased as the exposure duration of presented stimuli increased. By contrast, when participants labelled their subjective emotional state their SCRs increased as the exposure duration increased. In addition, we report that this difference between subjective and objective labelling was observed at a shorter exposure duration when the stimuli presented were biologically prepared.

It is reasonable to assume that without any labelling instruction, SCRs might increase with increasing exposure duration. Therefore, the degree to which subjective labelling results in *enhanced* SCRs is unknown. Given the fact that more visual information was presented as exposure duration increased, we are confident in concluding that objective labelling resulted in a significant dampening of SCRs. However, there are several important implications of potentially increased responding in the subjective-labelling condition, which should be investigated thoroughly in the future.

[5] This trend was even weaker in the HLM ($p = .1$). It was characterised by the "typical" SCR pattern during the intermediate exposure durations (33.2 and 66.4 ms; pleasant and unpleasant greater than neutral) but SCRs to neutral pictures larger than those to pleasant or unpleasant pictures during the shortest and longest exposure durations (16.6 and 132.8 ms).

[6] We also examined the distribution of responses across the pleasant, neutral and unpleasant response options. We did not observe differences in these responses by condition ($p > .2$).

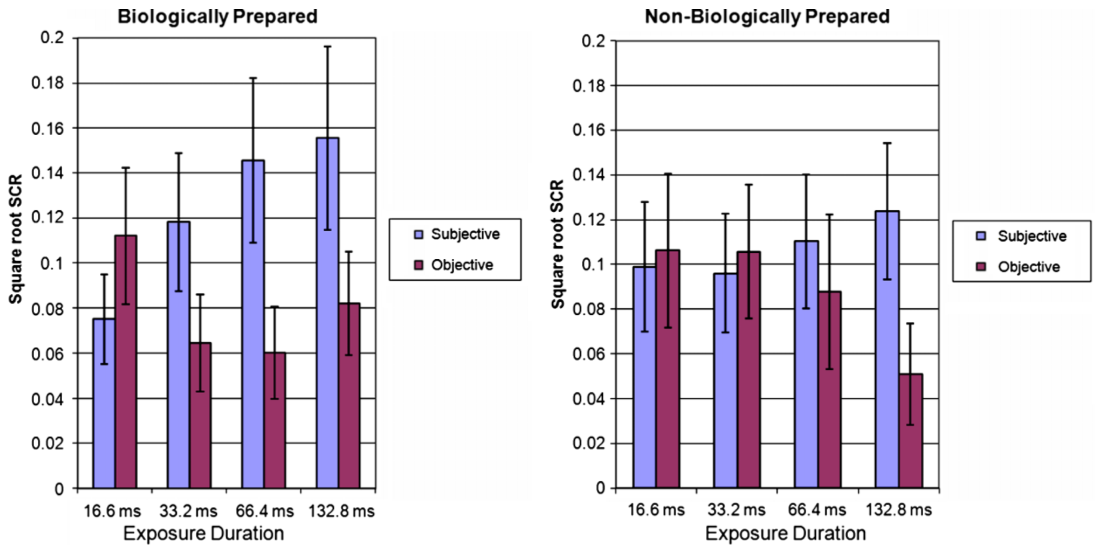

Figure 1. *Square-root corrected skin-conductance responses (SCRs) as a function of labelling condition, biological preparedness of stimuli and exposure duration before the backward mask. SCRs (in units of micro-mhos) were in response to pictures presented at four exposure durations preceding a backward mask, under two instruction conditions. The subjective labelling instruction was: "How do you feel?" The objective labelling instruction was: "What kind of picture is this?" Error bars represent standard error of the mean.*

Taken together, these results provide empirical support for a crucial distinction between two types of verbal labelling. Most of the labelling literature concludes that providing a verbal label for an affective stimulus has a down-regulatory effect (Hariri et al., 2003; Lieberman et al., 2007; Tabibnia et al., 2008). These studies instructed participants to evaluate the content of the picture (Hariri et al., 2003) or the emotion displayed in the picture (Lieberman et al., 2007) and thus utilise objective labels. This is most clear when studies use facial expression stimuli, as "anger" is

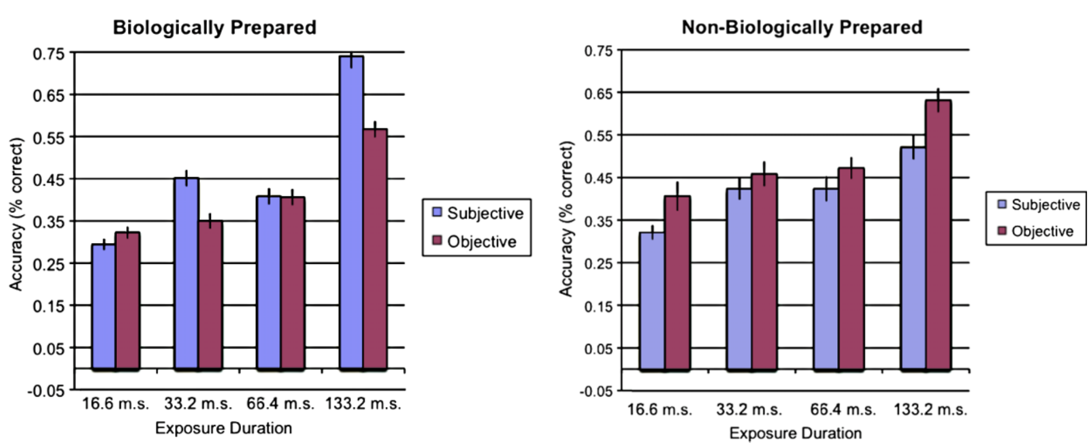

Figure 2. *Mean accuracy (percent correct) of the self-report responses made as a function of labelling condition, biological preparedness of stimuli and exposure duration before the backward mask. "Correct" responses were those that fell into the same category as the normative valence ratings (1–4 unpleasant, 4.5–5.5 neutral, 6–9 pleasant). No differences in the distribution of responses between labelling conditions was observed.*

the correct label for the expression portrayed by an angry face, whereas "anger" or "fear" could be correct labels for one's subjective state in response to viewing an angry face. This study, therefore, was the first to test the hypothesis that *only* objective labelling would result in down-regulation of physiological responses.

The present results dovetail with the growing understanding of the functional neuroanatomical substrates of different affective evaluative processes. Several studies have identified a network of regions that are more active during (objective) verbal labelling of emotional stimuli. Ventrolateral prefrontal cortex (VLPFC) has been shown to be more active when individuals are performing stimulus-focused evaluation (Lee & Siegle, in press). VLPFC becomes active during cognitive inhibition tasks (Aron, Robbins, & Poldrack, 2004) and is thought to perform a similar inhibitory function during the down-regulation of negative emotion (Lieberman et al., 2007; Ochsner et al., 2004). The right VLFPC has been shown to (indirectly) down-regulate activity in emotion-responsive regions such as the amygdala (Lieberman et al., 2007). However, there is growing evidence that labelling one's subjective state engages midline prefrontal regions such as the rostral anterior cingulate cortex (ACC) and medial prefrontal cortex (Lee & Siegle, 2008). The engagement of different prefrontal networks might play a role in the differential physiological responding we report here.

From a psychological standpoint, viewing an emotional situation from an objective standpoint has long been documented as an effective emotion regulation strategy. Cognitive reappraisal, which is an effective way to decrease negative emotion, often involves viewing a situation from a more objective standpoint, decreasing one's self-involvement (Ochsner et al., 2004). In fact, achieving a more objective vantage point may be one of the most important aspects of using reappraisal to decrease physiological responding (Ayduk & Kross, 2008). The increased awareness of one's subjective emotional state that is required for subjective labelling, however, may not have the same inherent down-regulatory effects. This is consistent with appraisal theory, which indicates that calling attention to one's emotional state may actually have an amplifying effect (Scherer et al., 2001). It is intriguing to consider the possibility that a positive feedback mechanism, whereby repeatedly directing attention towards one's own emotional experiences leads to amplification of those experiences, may underlie phenomena such as depressive rumination. These results do not rule out the possibility that the evaluation and labelling of one's subjective emotional response can lead to the eventual down-regulation of an emotional state. However, the data reported here indicate that, at least initially, subjective labelling does not result in the same diminution of physiological responses associated with objective labelling.

At the same time, it is true that across a variety of therapeutic modalities, heightened emotional arousal is necessary for therapeutic success. This is demonstrated in emotion-focused therapy (Greenberg, 2002) as well as systematic desensitisation (Lang, Melamed, & Hart, 1970). Therefore, the degree of benefit from labelling interventions may be related to the degree of arousal above and beyond whatever cognitive benefit is achieved. However, the physiological "cost" of this arousal might limit an individual's tolerance for subjective labelling. This might explain why some individuals are reluctant, unwilling or unable to focus their attention upon their own emotional states, which in turn can affect their engagement in psychotherapy. It is for this reason that in certain cases therapists arm clients with tools to manage their own physiological arousal before attempting to turn their attention to their own subjective states (Greenberg, 2002).

The physiological effects of subjective labelling compared to a non-labelling condition will be important to investigate in the future. Although we report that objective labelling results in decreased SCRs with increasing exposure durations, inclusion of a non-labelling condition would have allowed us to distinguish between the down-regulatory effects of objective labelling and the potentially amplifying effects of subjective labelling.

Previous effects of labelling have been reported in response to biologically prepared stimuli presented for clearly supraliminal exposure durations. We observed an interaction between the labelling condition and the biological preparedness of the pictures, such that objective labelling resulted in decreased responding at shorter exposure durations when the stimulus was biologically prepared. No differences between subjective and objective labelling were observed at the shortest exposure duration, which is important for two reasons. First, the simple instruction to label objectively does not result in decreased responses to any presented stimulus. Second, this indicates that a certain amount of stimulus information (whatever is transmitted at 33.2 ms) must be available before labelling can affect the physiological response. However, these differences were only true of the biologically prepared stimuli—no differences due to labelling were observed for non-biologically prepared stimuli until they were exposed for the longest duration (132.8 ms). Therefore, the effects of labelling at brief exposure durations depend upon how much emotional information is transmitted in that short amount of time (which is likely greater for biologically prepared stimuli).

The present study paves the way for several follow-up questions to be addressed in the future. First, we studied only men. The participants we chose had a wide range of abilities to put their feelings into words, but this ability did not predict SCRs in this task. Women show greater physiological responding to emotion stimuli than men (Bradley, Codispoti, Sabatinelli, & Lang, 2001), but they also tend to describe their own emotions more readily than men (Feldman Barrett, Lane, Sechrest, & Schwartz, 2000). Only future work can reveal whether women display comparable responses to subjective and objective labelling.

The present study focused on the distinction between objective and subjective labelling. However, there are different types of subjective labelling that are important to consider: verbal labels that create new meaning versus pre-rehearsed labelling based on previous conceptions. In contrast to a pre-rehearsed, rote labelling of one's experience, Werner and Kaplan (1963) argued that putting experiences into words is the way that we come to know what we have experienced. This distinction appears to have therapeutic implications. Many years ago, Gendlin (1978) sought to identify in the first evaluation session which patients would go on to benefit from psychotherapy. He determined that the best predictor of later success was when a patient "groped for words." By contrast, patients who reported on their experiences in a fluent manner did less well in therapy, presumably because their verbal labels constituted previously acquired conceptions.

It is possible that with the current paradigm we have created a method for studying verbal labelling that is experience dependent. The observation that labelling effects got stronger as exposure duration increased provides evidence that labelling was influenced by the experience induced by the stimulus. It also may capture a common phenomenon in psychotherapy, which is the challenge of attaching a verbal label to at-times elusive subjective experiences or bodily felt referents (Greenberg, 2002). It will be important in future research to determine whether verbal labelling that involves pre-rehearsed rote labelling has less-strong effects on physiological arousal.

In addition, in the present study we did not evaluate individual differences in perceptual detection of our masked stimuli (Pessoa et al., 2005). Psychometric calibration of exposure durations might ensure that conditions that were classified as sub- and supra-liminally perceived were valid.

Lastly, the differences we observed between biologically prepared and non-biologically prepared stimuli were based on post hoc sorting of the IAPS images according to ratings from evolutionary psychologists. Future studies should explore these same effects using pictures selected a priori to represent biologically prepared or non-biologically prepared stimuli. On a related note, although we are confident that our results survive statistical correction for the idiosyncratic assignment of pictures to each condition, future studies should employ counterbalancing of particular stimuli to each labelling condition.

CONCLUSION

The present study aimed to compare the effects of subjective and objective labelling on SCRs to briefly presented stimuli. We observed that objective, but not subjective, labelling resulted in diminished physiological responding as exposure duration increased. In addition, we observed that the divergent effects of labelling emerged at an earlier exposure duration when the presented stimuli were biologically prepared. These findings help to specify that objective, but not subjective, labelling results in decreased physiological responding. In addition, these results describe a novel interaction between biological preparedness and verbal labelling. Taken together, these results could help refine the way verbal labelling impacts emotional processing, emotion–attention interactions, and emotion regulation and have implications for ways to monitor the success of psychotherapies that involve labelling of one's own emotional states.

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