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Inducing symptoms in high symptom reporters via emotional pictures: The interactive effects of valence and arousal

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ABSTRACT

Objective: Processing unpleasant emotional cues induces elevated reporting of physical symptoms, especially in people with high habitual symptom reporting. The present study examined the role of valence and arousal of emotional pictorial cues on this effect.
Methods: Female participants ($N = 45$; 21 high/24 low habitual symptom reporters) viewed six series of emotional pictures with a homogeneous affective content: low arousal/positive, high arousal/positive, low arousal/negative, high arousal/negative-disgust, high arousal/negative-threat and neutral. Heart rate (HR) and skin conductance level (SCL) were recorded during picture viewing and a symptom checklist and valence and arousal ratings were completed after each trial.
Results: High habitual symptom reporters reported more symptoms than low habitual symptom reporters overall, but this difference was more pronounced when processing unpleasant high arousing cues. No group differences were found on physiological measures for any of the conditions, while perceived valence and arousal both moderated the relationship between habitual symptom reporting and symptom induction.
Conclusion: These findings show an interactive effect of unpleasantness and high arousal on elevated symptom reporting in high habitual symptom reporters, suggesting that different characteristics of emotional cues contribute to a somatic memory activation process leading to the experience of elevated symptoms.

Introduction

Signals generated inside the body are relayed to the brain through a multilayered process (interoception, [1,2]), allowing for considerable variability in the correspondence between physiological activity in the body and the subjective experience of bodily sensations and/or symptoms. Self-reported bodily symptoms that do not correspond to any peripheral physiological dysfunction, often termed as Medically Unexplained Symptoms (MUS), are quite common both in various medical specialties and in the general population [3–5].

Research on MUS has identified several factors that influence the relationship between self-reported symptoms and physiological activity. One such factor is negative affect. Trait negative affect (anxiety, depression or general Negative Affectivity, NA; see [6] for a distinction) has been found consistently to correlate positively with MUS [7–10], while experimentally induced unpleasant mood (state NA) results in more symptom reporting [11] and augmented perception of aversive bodily sensations, e.g. pain [12,13] or dyspnea [14].

Trait negative affect seems to be a necessary, yet not sufficient condition for the presence of MUS. Cross-sectional research indicates that high NA co-occurs with low habitual symptom reporting in daily life, but the reverse combination does not [15]. This finding is in line with experiments simulating the development of MUS in the laboratory: repeated experiences of symptoms (induced by CO_2-enriched air inhalation) in association with harmless cues leads to elevated symptom reports upon presenting the cues alone, but predominantly in persons high on trait NA. Interestingly, symptoms were more easily acquired when the harmless cues had a negative affective valence, and the acquired symptoms were clearly based on activated memories about the original symptom episodes. These findings suggest that when high NA persons are experiencing repeated symptom episodes in life, they are at risk to become high symptom reporters in the absence of objective physiological dysfunction. This occurs more likely in response to unpleasant associated cues, which may trigger representations of these symptom episodes in memory (somatic memories) and bias subjective experience towards feeling bodily symptoms [16–18]. An interaction between pre-existing trait characteristics (trait NA) and situational factors (cues inducing a negative affective state) is therefore suggested to underlie schema-driven (top-down) over-perception of symptoms.

Trying to further examine the role of this interaction in triggering top-down over-perception of symptoms, Bogaerts et al. [19] selected high and low habitual symptom reporters (HSR/LSR) and showed them affective pictures varying on the valence dimension. They found that mere viewing of negatively valent pictures (either related or unrelated to the body) led to a significant elevation of symptom

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reports but only in HSR. They further showed that the effect was moderated by picture-induced state NA.

However, studies investigating the role of affective cues on symptom reporting have focused on valence, the hedonic value of the cues, while the arousal dimension has not been examined. This is an important weakness in view of several theoretical accounts [20,21] suggesting an important role of physiological arousal in biased symptom reporting. Although several studies failed to find any differences between HSR and LSR in physiological arousal, neither in baseline nor in response to a stressor [22,23], arousal may still be an important element triggering top-down processes underlying elevated symptom reports in high symptom reporters (HSR).

The present study aims to delineate how both the valence and arousal dimensions of affective cues influence symptom reporting in interaction with individual differences in habitual symptom reporting. Because patients with MUS score high on habitual symptom reporting [24], the latter variable was used in this study to select a sub-clinical sample of MUS reporters. The picture viewing paradigm [19] was adapted to include systematic variations in the arousal dimension of pleasant and unpleasant pictures.

In sum, participants high and low in habitual symptom reporting (HSR/LSR) were asked to merely watch series of affective pictures while physiological indices of arousal (heart rate and skin conductance levels) were recorded. Self-reported symptoms were recorded after each series. The following hypotheses were advanced:

1) HSR were expected to report more symptoms than LSR in all conditions without corresponding increases in physiological reactivity during picture viewing;
2) symptom reports were expected to be higher during negative and high arousing pictures (independent effects of arousal and valence), with the highest symptom reports presented at the negative/high arousing trial (valence × arousal interaction). Possible differences between two different negative/high arousing conditions, disgust and threat, are examined in an exploratory fashion and no hypotheses were formulated on this difference.
3) an interaction between picture category and group (HSR/LSR) was expected with the difference between high and low symptom reporters being largest after viewing negative/high arousing stimuli;
4) Finally, based on previous findings [19], we expected both state valence and arousal to moderate the effects of group (HSR/LSR) on symptom reporting.

Methods

Participants

Female students were recruited via advertisements at the university or via invitation through email and were screened for habitual symptom reporting via the Checklist for Symptoms in Daily Life (CSD; [25]). Participants scoring within predetermined cut-off scores were assigned to the high (≥ 100; HSR, $N = 21$) and low (≤ 75) symptom reporters group (LSR, $N = 21$). Cut-off scores represent the upper and lower quartiles of the questionnaire in large samples from the same population and have been found to successfully discriminate HSR and LSR [19,26]. The questionnaire was re-administered upon arrival in the laboratory and only participants confirming their score within these cut-offs were included. They received 7 euro or course credit for their participation.

Exclusion criteria were any self-reported chronic disorder (e.g. neurological, cardiac, depression, panic disorder, or psychosis) or taking medication regularly (occasional use of allergic medication was not an exclusion criterion). The study was approved by the Multidisciplinary Ethical Committee of the Faculty of Psychology and Educational Sciences of KU Leuven.

Materials

Affective stimuli

The stimuli were pictures drawn from the International Affective Picture System (IAPS; [27]). Using norms for valence, arousal [27], and emotional categorization [28] six series of 15 pictures were created: a neutral series depicting mostly people in various non-emotional contexts, a positive/high arousing series including pictures of sports or entertainment, a positive/low arousing series including pictures of cute animals or babies, a series of negative/low arousing pictures (mostly sadness pictures), and two series of negative/high arousing pictures, one depicting mostly threatening situations and a disgust group including mutilated bodies, dead animals and dirt pictures.[1] Although both are negative/high arousing, threat and disgust pictures were examined separately since disgusting stimuli relate more to contamination and disease [29].

Measures assessing participant characteristics

Habitual Symptom reporting

A modified version of the Checklist for Symptoms in Daily Life [25] was used to assess participants' habitual symptom reporting. In this 39-item questionnaire participants indicate how often they experienced a variety of symptoms from different modalities in the past year on a 5-point Likert Scale (*never*, *seldom*, *sometimes*, *often*, *very often*). The total score (ranging from 39 to 195) was used for participant selection, and its reliability (Chronbach's *alpha*) has been found to exceed the criterion of $>.70$ [19].

Negative Affectivity

Trait and state Negative Affectivity were assessed via the Dutch version [30] of the Positive and Negative Affect Schedule (PANAS; [31]). The PANAS consists of 10 positive and 10 negative adjectives and participants are asked to indicate on a 5-point Likert Scale (*very slightly*, *a little bit*, *moderately*, *quite a lot*, *very much*) the extent to which each adjective describes how they feel in general (trait) or at the moment (state). The questionnaire assesses two subscales, Negative and Positive Affectivity, of which only Negative Affectivity (NA) was used for this study.

Dependent measures

Self-report measures

After each series of pictures (see further), participants completed a set of symptom ratings on a 5-point Likert scale (*not at all*, *a little bit*, *quite strong*, *rather strong*, *very strong*) reporting the extent they experienced each of 10 symptoms during picture viewing. This list of symptoms (*chest tightness*, *pounding of the heart*, *stomach or abdominal cramps*, *headache*, *fatigue*, *not able to breathe deeply*, *rapid heartbeat*, *nausea*, *dizziness*, *muscular pain*) was used to assess momentary symptom reports and has been previously found to discriminate HSR and LSR [32]. Total scores (ranging from 10 to 50) were computed.

Additionally, participants rated their affective state after each experimental trial via a computerized 9-point version of the Self-assessment Manikin (SAM, [33]), a pictorial scale, which was used to assess participants' affect during each trial. Three sets of 9 pictures depicting

[1] Neutral pictures: 1675, 2191, 2200, 2272, 2487, 2514, 2575, 5395, 7037, 7493, 7506, 7550, 7595, 2579, 2595; Positive/low arousal: 1620, 1920, 2311, 2341, 2387, 2388, 2398, 2791, 2345, 4622, 5600, 5831, 7200, 8461, 8497; Negative/low arousal: 2455, 2490, 2722, 2753, 4635, 9001, 9041, 9046, 9220, 9280, 9331, 9342, 9404, 9440, 9471; Positive/high arousal: 2208, 2216, 4574, 5260, 5621, 8021, 8030, 8080, 8190, 8200, 8300, 8370, 8490, 8496, 8540; Negative/high arousal-threat: 1114, 1525, 1932, 2691, 2751, 3530, 5971, 6190, 6250.1, 6312, 6370, 6550, 8485, 9410, 9620; Negative/high arousal – disgust: 1201, 9040, 3100, 3130, 3150, 7380, 8230, 9042, 9140, 9181, 9300, 9373, 9490, 9570, 9571.