Journal of Psychosomatic Research 71 (2011) 335–341

Contents lists available at ScienceDirect

Journal of Psychosomatic Research

Tactile perceptual processes and their relationship to medically unexplained symptoms and health anxiety

Anna Katzer [a,*], Daniel Oberfeld [b], Wolfgang Hiller [a], Michael Witthöft [a]

[a] Department of Psychology, Clinical Psychology and Psychotherapy, Johannes Gutenberg-Universität Mainz, Germany
[b] Department of Psychology, Experimental Psychology, Johannes Gutenberg-Universität Mainz, Germany

ARTICLE INFO

Article history:
Received 15 October 2010
Received in revised form 1 March 2011
Accepted 24 March 2011

Keywords:
Health anxiety
Hypochondria
Medically unexplained symptoms
Somatic Signal Detection Task
Somatoform disorders
Tactile perception

ABSTRACT

Objective: The Somatic Signal Detection Task (SSDT; Lloyd, Manson, Brown and Poliakoff, 2008) is an innovative paradigm to study perceptual processes related to physical symptoms. It allows examining touch illusions as a laboratory analog of medically unexplained symptoms (MUS) according to the cognitive model of MUS proposed by Brown (2004). The present study compared psychopathologic measures of MUS and health anxiety with SSDT parameters. Furthermore, we aimed to define a reliable measurement of tactile perception threshold.
Methods: 67 participants of a student population reported whether they detected tactile stimuli at their fingertip which were presented in half of the test trials. An additional brief visual stimulus was displayed with a probability of 50%. The rate of false-positive perceptions of the tactile stimulus in its absence, response bias, tactile sensitivity, and tactile perception thresholds was recorded. Questionnaires were used to assess MUS and health anxiety.
Results: The visual stimulus led to a more liberal response criterion (i.e., the tendency to report tactile perceptions irrespective of whether a stimulus was presented or not) and a non-significant increase in tactile sensitivity. The false-alarm rate when reporting the tactile stimulus was correlated with MUS (r=.26). Tactile perception thresholds were measured reliably (r_{tt}=.84).
Conclusion: Some of the SSDT parameters, especially the response criterion (c), were related to self-report-measures of MUS and health anxiety. Previous SSDT results were replicated and extended. Further SSDT studies with clinical samples are needed.

Introduction

Medically unexplained symptoms (MUS) are a common, widespread phenomenon in the general population and in primary health care settings [1]. Concerned persons suffer from bodily complaints that cannot be sufficiently explained by known medical conditions. Although treatments have been developed on the basis of bio-psycho-social models [e.g., 2,3], the precise etiology of MUS and somatoform disorders is still unknown [4,5]. In an innovative model of MUS [4], based on cognitive psychological principles [e.g., 6], the development of MUS is described as the result of alterations in the cognitive system. Two different hypothetical attentional systems (i.e., a primary and a secondary attentional system) are differentiated. These systems select so called “rogue representations” which refer to information related to physical symptoms. The specific contents of these multimodal representations in memory depend on prior experiences (e.g., illness concerning oneself or family members). According to the model, symptom experiences arise from the automatic activation of symptom representations in the primary attentional system (PAS). However, the selection of these symptom representations by the PAS can be moderated and facilitated by the secondary attentional system, e.g., via negative affect, via the generation of disease-confirming information, or via an extensive body-focused attentional style. These processes in the secondary attentional system consecutively facilitate the reactivation of rogue representations.

In essence, Brown [4] conceptualizes MUS as illusory somatosensory phenomena that are subjectively real and that are based on cognitive psychological principles.

According to Lloyd et al. [7] distortions in bodily experience could be created simply by raising the activation of corresponding representations in memory. The researchers argue that this would allow not only to support the validity of the integrative cognitive model [4], but also to create a laboratory analog of MUS that may be investigated under controlled conditions.

Such illusory perceptions are frequent in the normal population and subject of research in cross-modal integration of sensory stimuli.

* Corresponding author at: Department of Psychology, Clinical Psychology and Psychotherapy, Johannes Gutenberg-Universität Mainz, Wallstraße 3, 55122 Mainz, Germany. Tel.: +49 6131 39 39 214; fax: +49 6131 39 39 102.
E-mail address: annakatzer@gmx.de (A. Katzer).

0022-3999/$ – see front matter
doi:10.1016/j.jpsychores.2011.03.009

In this regard, Violentyev, Shimojo, and Shams [8] showed that tactile stimuli provoked visual illusions in healthy individuals and also altered sensitivity (d') when detecting visual stimuli. Vice versa, illusory tactile sensations and an enhancement of tactile sensitivity can be triggered by visual stimuli [9–11].

The somatic signal detection paradigm

The Somatic Signal Detection Task [SSDT; 7] integrates the findings previously described as well as Brown's conception of MUS [4]. It aims at constituting a laboratory model of MUS that allows studying somatoform symptoms as cognitively triggered illusory touch experiences. In the SSDT, a near-threshold tactile stimulus is presented at the fingertip on half of the trials. An auxiliary visual stimulus is presented during the observation interval, with a probability of .5. Thus, there are four types of trial: vibration only, vibration-plus-light, light-only, and no stimulus trials. Illusory touch perceptions are expected to be triggered in the light-only condition, because the visual stimulus is assumed to activate representations of the tactile stimulus [7]. The use of visual stimuli is not directly related to MUS, but it serves as an example in order to create a laboratory model of MUS. This process is understood as a phenomenon of normal multisensory integration, not as a consequence of conditioning [10]. Mirams, Poliakoff, Brown, and Lloyd [11] found that attending to the body had an effect on the number of false alarms (FAs) (i.e., illusory touch experiences) in the SSDT paradigm. Furthermore, the signal detection theory based paradigm [12] allows differentiating sensitivity (d'), the capability to detect the stimuli, and response bias (c), a pre-existing tendency to respond in a certain way to the presented stimuli [13].

Modifications to the original SSDT

In previous studies using the SSDT paradigm [7,10,11,14], the vibration intensity was selected so that participants obtained between 40% and 60% correct responses in a block containing 10 vibration trials and 3 no-vibration trials. A potential problem of this method for selecting the vibration intensity is that due to the use of a one-interval ("yes/no") task, the selected stimulus intensity depends not only on the sensitivity to detect the vibration, but also on the response bias (i.e., the tendency to respond "yes"). Thus, it is somewhat unclear how the vibration intensities presented in previous studies were positioned relative to the psychophysical detection threshold. To avoid effects of response bias on the selection of the vibration intensity, we measured vibrotactile perception thresholds in a two-alternative forced-choice task [e.g., 12,13]. As Green and Swets [13] have noted, one potential reason for a smaller response bias in the two-interval as compared to a one-interval task is that responding, "yes, stimulus present" or "no, stimulus absent" represents a stronger difference in subjective value than responding either "stimulus in interval 1" or "stimulus in interval 2". We applied one of the adaptive procedures most widely used in psychophysics, namely the transformed up–down adaptive procedure proposed by Levitt [15], to determine an individual vibration intensity corresponding to a clearly defined level of performance (70.7% correct) in the two-interval task.

We thus for the first time combined the SSDT paradigm with a precise measurement of the tactile detection threshold, so that the detectability of the vibration signal presented in the SSDT could be expected to be identical for all participants.

Additionally, we used acoustic start cues for signaling the observation intervals, rather than visual start cues [7], in order to prevent interference with the visual accessory stimulus presented in the SSDT or a direction of attention towards the visual auxiliary stimulus [10]. Note that a study published after the completion of the present experiment [10] found that an acoustic or a visual stimulus does not lead to different results.

Aims and hypotheses of the present study

The first aim of our study was to replicate the general findings of previous SSDT studies [7,10,11,14]. Most importantly, we expected an elevated FA rate in the light-only condition in which only the visual stimulus, but no tactile stimulus was presented. In the same line of reasoning, we expected a shift in response bias (c) towards "signal present" responses in trials presenting the visual stimulus. Sensitivity (d') was expected to be augmented in the light-present condition, compatible to the small to medium effects [16] reported in previous SSDT-studies [10,11]. In a subclinical sample, Brown, Brunt, Poliakoff, and Lloyd [14] found that experiencing illusory perceptual events was more likely in subjects with a tendency to somatoform dissociation despite perceptual abilities comparable to normal subjects. Consequently, the second aim of our study was to extend these findings by exploring the relationship between SSDT parameters and MUS in general.

Additionally, interoceptive apperceptions (i.e., subjective sensations of pulses within the index finger (finger pulse) resulting from physiological processes) were addressed. Our aim was to explore if such an unspecific interoceptive feature would be linked to response behavior within the SSDT-paradigm, especially whether false alarms in the light-only condition may be misattributed tactile perceptions due to a tendency to interoceptive sensations.

We also analyzed the relationships between the SSDT parameters, tactile thresholds, finger pulse perceptions, and self-report data. Apart from MUS, health anxiety was chosen as similar models are proposed in this domain [5]. With an explorative approach, we aimed at examining whether the SSDT might be helpful in this context as well.

Method

Participants

68 volunteer participants were recruited at the University of Mainz, Germany. They all provided written informed consent according to the Declaration of Helsinki prior to participation. The study was approved by the Ethics Committee of the German Psychological Society (DGPs; MWWHAK28082008DGPS). Data of one participant had to be removed from the final analysis because of current psychotropic drug intake. Finally, 67 participants (14 men, 20.9%) remained in the sample. All of them were students from different faculties. Their mean age was 23.2 (SD=4.8) years. Those who completed the study were paid 10 Euro for participation or received course credits. A session lasted about three hours. Participants were naïve about the purpose of the study until having passed all stages of the investigation.

Experimental measures

Participants were tested individually in a dimly lit room in front of a console containing a red light emitting diode (LED) and a 1.4 cm×2.3 cm surface which delivered vibrations to the dominant hand's index fingertip. The vibrotactile stimuli were brief pulses (2 ms) presented with a rate of 50 Hz, addressing Pacinian and Meissner mechanoreceptors [17]. The intensity of the applied vibrotactile stimuli was adjusted by a second console panel. The experimenter sat in an angle of 90° to the participant in front of a LCD monitor in order to give instructions and record the participant's responses. The experiment was run with the software Inquisit [18]. Circumaural head-phones (Sennheiser HD 201) were used to apply acoustic signals at a comfortable loudness level at the beginning and the end of the trials. As these head-phones enclose the listener's ear completely with a foam-padded material they provided a good attenuation of ambient noise and of potential sounds produced by the vibration device.