Available online at www.sciencedirect.com
ScienceDirect
Biological Psychology 78 (2008) 114–122
BIOLOGICAL PSYCHOLOGY
www.elsevier.com/locate/biopsycho

Distinct effects of attention and affect on pain perception and somatosensory evoked potentials

Ramona Kenntner-Mabiala *, Marta Andreatta, Matthias J. Wieser, Andreas Mühlberger, Paul Pauli

Department of Psychology (Biological Psychology, Clinical Psychology, and Psychotherapy), University of Würzburg, Marcusstraße 9-11, D-97070 Würzburg, Germany

Received 29 August 2007; accepted 23 January 2008
Available online 2 February 2008

Abstract

The influence of affect and attention on sensory and affective pain as well as on somatosensory evoked potentials in response to painful and nonpainful electrical stimuli was investigated in a single experimental design. Affect was induced by pictures from the International Affective Picture System; attention was manipulated by asking participants to focus attention either on the pictures or on the electrical stimuli. Sensory and affective pain ratings were generally lower during exposure to positive compared to negative and neutral pictures. Attention modulated only sensory pain ratings with lower ratings with an attention focus on pictures than with an attention focus on sensory pain. The N150 was modulated by picture valence, the P260 by picture arousal. Furthermore, the P260 was modulated by attention with highest amplitudes with an attention focus on the stimulus intensity. This study provides neurophysiological evidence that attention and affect have distinct effects on pain processing.
© 2008 Elsevier B.V. All rights reserved.

Keywords: Affect; Attention; Electrical stimuli; Emotion; Pain; Somatosensory evoked potentials

1. Introduction

Several correlational studies suggest that negative affective states increase the frequency and magnitude of pain experience (Keefe et al., 2001). In addition, there is growing experimental evidence that positive mood ameliorates whereas negative mood enhances perceived pain (Villemure and Bushnell, 2002).

The motivational priming hypothesis (Lang, 1995) offers a theoretical framework to explain the influence of affect on pain perception. According to this, positively or negatively valenced foreground stimuli activate the appetitive or the defensive part of a biphasically organized motivational system, respectively. Responses to new stimuli are augmented if their valence is congruent with the activated motivational system and reduced if it is incongruent.

This hypothesis has been extensively investigated on the basis of the acoustic startle reflex in animals (Lang et al., 2000) and humans (Vrana et al., 1988). In humans, the International Affective Picture System (IAPS; Lang et al., 1999) proved to be especially useful for affect induction. The IAPS is a standardized set of picture stimuli which systematically varies on the dimensions of valence and arousal. The startle reflex is elicited by a startle probe presented during picture viewing and is registered on the basis of the electromyogram of the muscle orbicularis occuli. Since startle probes are aversive stimuli, the intensity of the startle reflex is enhanced in the context of emotional negative stimuli and dampened in the context of emotional positive stimuli (Lang et al., 1990).

There is increasing evidence for the validity of the motivational priming hypothesis for pain perception with cold pressor pain (de Wied and Verbaten, 2001; Meagher et al., 2001), pressure pain (Arnold et al., 2008; Kenntner-Mabiala et al., 2007), and electrical pain stimuli (Kenntner-Mabiala and Pauli, 2005; Rhudy et al., 2005, 2007). de Wied and Verbaten (2001) presented affective pictures during a cold pressor test and found that negative pictures caused a decrease in pain tolerance while positive pictures had the opposite effect. Meagher et al. (2001) presented affective pictures before a cold pressor test and observed that viewing negatively valenced disgust and fear pictures decreased, while positively valenced erotic pictures increased pain thresholds. Consistently with this,

* Corresponding author. Tel.: +49 931 31 2069; fax: +49 931 31 2733.
E-mail address: kenntner@psychologie.uni-wuerzburg.de
(R. Kenntner-Mabiala).

0301-0511/$ – see front matter © 2008 Elsevier B.V. All rights reserved.
doi:10.1016/j.biopsycho.2008.01.007

a modulation of pressure pain perception by positive, neutral, and negative pictures is reported in healthy volunteers (Kenntner-Mabiala et al., 2007) and in chronic pain patients (Arnold et al., 2008). Rhudy et al. found that the nociceptive flexion reflex (Rhudy et al., 2005) and even autonomic reactions as measured with heart rate and skin conductance resistance in response to electric pain stimuli are modulated by picture valence (Rhudy et al., 2007).

Recently, we validated the assumption of an affective pain modulation by measuring somatosensory evoked potentials in response to painful and nonpainful electrical stimuli during affective picture processing (Kenntner-Mabiala and Pauli, 2005). N150 amplitudes elicited by painful stimuli were lower for positive compared to negative pictures. In contrast, P260 amplitudes elicited by painful and nonpainful stimuli were diminished for arousing compared to neutral pictures. This arousal modulation of the P260 was presumably due to attention grasping properties of arousing pictures.

The registration of somatosensory evoked potentials (SEPs) allows the investigation of the temporal course of pain processing in the cortex. There are two main methods for recording SEPs: electrical stimulation and laser heat stimulation (Bromm and Lorenz, 1998; Becker et al., 2000; Kakigi et al., 2000). Since electrical stimuli do not purely activate Aδ and C fibers but also Aα and Aβ fibers which relate to mechanoreception (Kakigi et al., 2000), SEPs in response to painful electrical stimuli are not purely related to pain. However, somatosensory evoked late brain potentials are neither in response to electrical nor in response to laser pain stimuli pain specific, but they vary with the psychological meaning and the demands and task relevance of the stimulus (Picton and Hillyard, 1988). Thus, it is generally acknowledged that somatosensory evoked potentials reflect the activity of neurons involved in a number of different, pain-related and not pain-related processes (Dowman, 1994). However, a great advantage of the electrical method is its simplicity and its availableness in almost each psychobiological laboratory. Furthermore, by means of principal component analysis, parts of the N150–P260 complex of the SEP have been defined as relevant components for the processing of pain (Bromm and Scharein, 1982). In accordance with this, the N150 and the P260 SEP components correlate significantly with reported pain intensity (Chen and Chapman, 1980; Chapman and Jacobson, 1984).

In addition to affect, attention has strong influence on pain as well as on the amplitude of SEP components: Amplitudes of late positive SEP components and pain ratings are higher for attended than for ignored painful stimuli indicating that attention to painful stimuli enhances processing and perception of pain stimuli (Miltner et al., 1989; Beydoun et al., 1994). Interestingly, however, there is also evidence that the attentional effects on pain depend on whether participants focus on the sensory or on the affective aspects of pain: Selectively attending to sensory vs. affective components of pain is associated with less experienced pain as indexed in pain ratings (Ahles et al., 1983), and has also differential effects on laser evoked brain potentials (Bentley et al., 2004).

It is a matter of debate, to which degree affective and attentional effects on pain interact (see de Wied and Verbaten, 2001). Villemure et al. (2003) argued that attention and affect independently alter pain perception. The authors used a thermal pain model and positive and negative odors for affect induction. Attention was manipulated by a task requiring participants to shift attention between the olfactory and the thermal modality. They found that affect influenced pain unpleasantness, and attention altered pain intensity. Kenntner-Mabiala et al. (2007) succeeded to replicate these finding that affect rather modulates affective pain while attention influences only sensory pain with a tonic pressure pain model and positive, neutral, and negative pictures for affect induction.

Since pain unpleasantness is mainly encoded in the anterior cingulate cortex whereas pain intensity is mainly encoded in the primary somatosensory cortex (Price, 2000), the findings of Villemure et al. (2003) and Kenntner-Mabiala and Pauli (2005) suggest that emotion and attention invoke at least partly different neural modulatory circuits. Recent PET and fMRI studies point in the same direction: The attentional pain modulation seems to be mediated by the periaqueductal gray (Tracey et al., 2002) and by the primary somatosensory cortex (Bushnell et al., 1999), whereas the entorhinal cortex (Ploghaus et al., 2001), the amygdala and the anterior cingulate cortex (Petrovic et al., 2004) are discussed to be involved in the affective pain modulation.

1.1. The current study

The aim of the present study was to further investigate whether attention and affect have distinct effects on pain perception as measured by affective and sensory pain ratings as well as somatosensory evoked potentials in response to electrical stimuli. Affect was manipulated with affective pictures, and attention was varied by instructing participants to concentrate on the picture, on the unpleasantness or on the intensity of the electrical stimulus.

According to our previous findings (Kenntner-Mabiala and Pauli, 2005), we expected that N150 amplitudes are modulated by picture valence and P260 amplitudes by picture arousal. Following Miltner et al. (1989), we predicted that attention influences P260 but not N150 amplitudes with highest P260 amplitudes, if attention is directed to the stimulus unpleasantness and lowest P260 amplitudes if attention is focused on the pictures. Following Villemure et al. (2003) and Kenntner-Mabiala et al. (2007), we hypothesized that affect influences pain unpleasantness ratings, and attention influences pain intensity ratings.

2. Methods

2.1. Participants

Participants were 30 right-handed paid volunteers (15 female; mean age = 26.5 years; S.D. = 5.2; range = 18–40 years) who were free of neurological, psychiatric or chronic pain disease. Prior to the experiment, they were informed about the experimental procedure and that they would receive 324 electrical stimuli with half of them being painful. The experimental protocol

دریافت فوری ← متن کامل مقاله

ISIArticles
مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات