Editorial

Attention and pain: merging behavioural and neuroscience investigations

Modern neuroscience is providing novel ways to measure the effects of pain. Engagingly, some of its techniques provide pictorial representations of brain activity, enabling the easy communication of complex processes. This new representationalism seems to promise great hope for the future of pain research. We are persuaded of the scientific benefits that might result by those passionate about these new methods. However there are some concerns that have not been adequately discussed, and there is caution that should be exercised as these investigations develop. With any new method there is always a danger of scientific isolationism as the reference field of the investigation narrows; sometimes, in the worst of cases, leading to the methodological tail wagging the theoretical dog (Beaulieu, 2003). Of course, methodolotry is neither new, nor inevitably unhelpful in science; however, untempered it can create what we have come to think of as a paradigmatic ‘velvet rut’ in which re-discovery and the translation of old ideas into a new ‘objective’ language can become the newly celebrated outputs.

There are historical lessons. At the end of the 19th Century, chronometry, the measurement of response times to perceptual stimuli, had provided a basis for a new scientific psychology (Wundt, 1896), taking it beyond the self-report of experience (Titchener, 1898). However, early chronometry remained ghettoed in a structuralism concerned largely with ‘what happens where and when’ (Angell, 1907). It was only with the rise of a functional psychology, interested in ‘how and why’ behaviour occurs, that chronometry could be put to use in developing behavioural models (Danziger, 1990). As the neurocentric age unfolds we should ensure that these historical lessons are learned (Zimmer, 2004). We run the risk of developing parallel fields of inquiry into central mechanisms of pain that differ only epistemologically. Neuroscience studies of attention to pain have developed in parallel with behavioural science studies of attentional interruption. A stronger science will be developed by intertwining both strands.

Neuroscience studies of attention using techniques such as event related potentials (ERPs), positron emission tomography (PET), electroencephalography (EEG/MEG) and functional magnetic resonance imaging (fMRI) have uncovered the involvement of various brain structures in the attentional modulation of pain. Porro (2003) reviewed these, and included, of interest to us here, the anterior cingulate cortex (ACC) the amygdala (Neugebauer et al., 2004) and the primary and secondary somatosensory cortex (SI and SII). Some of these areas are also typically involved in affect modulation. Villemure and Bushnell (2002) helpfully reviewed this research focussing on the overlapping relationship between affective and attentional modulation of pain. Research has also built on the observation of motoric involvement in pain processing (Derbyshire et al., 1997). Not only does movement affect SI and SII pain-related activity (Nakata et al., 2004), but pain produces activity in structures principally involved in motor preparation and behaviour. We are beginning to understand which brain structures are involved under what stimulus conditions.

Behavioural models of attention may hold the key to understanding the questions of how and why nociception emerges into awareness as pain, how pain displaces other attentional engagements, and how non-pain concerns can displace pain from awareness (distraction)? In exploring the environment in which pain is selected over other information, we know already some of the factors that are important in attending to pain over other stimuli: principally the characteristics of the pain stimulus (its novelty, predictability, intensity, threat value), the characteristics of the person (negative affect, vigilance, pain-related fear, pain catastrophizing), and the characteristics of the environment (escape or avoidance benefit of pain, emotional valence or emotional value of other attentional engagements) (Aldrich et al., 2000; Eccleston and Crombez, 1999; Vlaeyen and Linton, 2000). We are also learning about the attentional processes involved in pain that is expected, imminent, likely, or might arise within a complex environment (Van Damme et al., 2004a,b). Attention is allocated as much for the cues of pain, as for pain itself.

Very welcome are attempts to merge these two lines of research (Bablioni et al., 2004; Dowman, 2004; Lorenz...
et al., 2003). In this issue of PAIN, Buffington et al., (2005) add to this merger in an interesting way. They adopted a functional model of attention and pain in their study of how engagement of attention to a task operates in an environment of either acute or chronic pain. With fMRI they were able to show that different patterns of ACC activation can be found during acute pain and during a sustained attentional task. This is a preliminary study, not without its problems: in particular it is significantly weakened by the small number of participants and missing data that effectively disallow any meaningful analysis of task performance strategies. We remain ignorant as to how engaged with the task the participants were. However, despite its shortcomings, this study is worthy of our scientific attention as it further illustrates the beginning of a paradigm shift we are undergoing in pain imaging research. Going beyond the attraction of representation, Buffington et al. attempted to answer how and why ACC activity changes under behavioural conditions that are experimentally controlled. 

Casey (2000) suggested that a bright future of pain neuroscience is not too far away in which “...we will have merged the physiology and psychology of pain, with profound consequences for neuroscience and the great benefit of patients.” We suggest that this merger will not happen by methodological or technological advancement alone. Needed is a neuroscience of pain that attempts to understand attention within its motivational and emotional context. Humans attend toward or away from pain and the threat of pain for a reason. Attention is part of an action-orientated system that functions to promote avoidance or escape from harm or danger. Experimentally driven models are needed in which both neuroscience and behavioural data are collected in order to understand the processes of engagement with, and disengagement from, pain-related threatening stimuli in a context of multiple competing, motivationally significant, demands for attention.

References


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