# The Effects of Three Different Types of Distraction on Pain Induced by the Iontophoretic Administration of Potassium Ions

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# ABSTRACT

Distraction of attention away from painful sensations is a widely accepted technique for reducing both clinical pain (Copp, 1974; Turk, Meichenbaum, & Genest, 1983), and instances of experimentally induced pain (Fernandez & Turk, 1989; McCaul & Malott, 1984). However there is little research regarding the relative efficacy of different types of distracters.

According to a model proposed by McCaul and Malott (1984), distraction is thought to modify pain perception by competing with pain-sensory information for limited attentional resources. Extending this model to accommodate the multiple resource model of attention (Wickens, 1984), suggests that somatic distraction may be analgesically more potent than visual distraction, while a recent meta-analysis (Fernandez & Turk, 1989) suggests that imagery may be the most effective form of distraction.

The present study examined the effects of three different distracters on pain induced by the iontophoretic administration of potassium ions. 20 subjects underwent four conditions of a repeated measures experimental procedure: somatic distraction; visual distraction; imaginal distraction; and no-distraction control conditions. It was hypothesised that under these conditions; (1) the distracters would raise pain threshold when compared to no-distraction conditions, and (2) that either pain threshold would be raised more or distracter performance would be lowered more (or both) under somatic conditions than under comparable visual conditions.

Findings revealed that all three distraction conditions significantly raised pain threshold when compared to no-distraction control. Of all the distracters, the imaginal task was found to be least effective in raising pain threshold, and despite predictions the somatic distracter was not demonstrated to be any more effective than its visual counterpart. Additionally, the prediction that somatic task performance would be lowered more than visual performance was not confirmed.

These findings were discussed in relation to research by Riley and Levine (1988), and the value of the multiple resource model for extending McCaul and Malott's (1984) information processing model for distraction analgesia was also discussed.

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# CHAPTER ONE

## Introduction

### An Historical Perspective

Historically, pain was viewed as a purely sensory phenomenon. This perspective was provided as early as 1694 by Descartes (cited in Melzack and Wall, 1982) who constructed a model which pictured the pain system as a simple straight-through projection between the site of injury and the brain. Pain has therefore tended to be regarded as an experience determined solely by the quality and intensity of its underlying noxious stimulus. Although there does tend to be a relationship between the severity of pain and the extent of its underlying tissue damage, the vast evidence showing instances where this relationship breaks down demonstrates a need for an alternative pain model.

Beginning with Descartes and prevailing till recently, the simplistic sensory models of pain have tended to obscure other essential components of the pain experience. Their inadequacy is reflected in their failure to account for many of the experimental and clinical findings in the pain literature.

For example, one obvious assumption derived from the sensory approach is that pain can be eliminated by somehow blocking or severing the pathway before pain impulses reach the brain. However, there are many cases where pain is reported to persist even after standard pharmacological and medical treatments are used to block or disrupt pain pathways (Melzack & Wall, 1982; Toomey, Ghia, Mao, & Gregg, 1977; Turk & Rudy, 1986; Wynn Parry, 1980).

Other research by Beecher (1959) revealed that (contrary to the predictions of the sensory models) the context and meaning of the injury can affect pain perception more than the degree of tissue damage. In this now classic study soldiers severely wounded in battle were compared with civilians with surgical wounds which produced a similar degree of tissue damage. It was demonstrated that, in contrast to 83% of the civilians, only 32% of the soldiers complained of enough pain to require morphine.

Additional factors found to influence pain perception have included: social variables such as culture (Clark & Clark, 1980; Sternbach & Tursky, 1965), and group identification (Buss & Portnoy, 1967); as well as cognitive variables like anxiety (Martinez-Urrutia, 1975), sense of control (Copp, 1974; Rosenbaum, 1980), and attention (Beales, 1979; Hodes, Howland, Lightfoot & Cleeland, 1990).

In summary, pain theory has traditionally held that a direct invariant relationship exists between the psychological perceptual dimension of pain and its corresponding physical stimulus dimension. However, this assumption is regarded as a problem in the literature because it fails to account for the many factors outside of tissue damage which may impact on pain perception (Leventhal & Everhart, 1979; Melzack & Wall, 1982). The pain experience is a variable phenomenon - not necessarily having direct correspondence with tissue damage - and is very much determined by emotional, physical, social and cognitive influences (Beecher, 1959; Leventhal & Everhart, 1979; Melzack & Wall, 1965,1982; Melzack, Wall, & Ty, 1982).

## The Gate Control Theory

An alternative to the traditional sensory models of pain, together with a warning of their inadequacy, was proclaimed with the initial formulation of the gate control theory. Essentially, Melzack & Wall (1965) synthesised the critical ingredients from both traditional pain theories as well as neurophysiological and clinical literature into a theory that was compatible with research regarding pain perception available at that time.

Their theory holds that a spinal gating mechanism exists in the substantia gelatinosa of the dorsal horns (in the spinal cord): which acts to either increase or decrease the flow of nerve impulses between the peripheral nerve fibres and the central nervous system. This aspect of the theory means that the pain transmission system can no longer be viewed in terms of a simple one-to-one relay between primary afferents and central pain processes. The gating mechanism is said to be influenced from the "bottom-up" by the relative amount of activity in the large and small diameter fibres. Activity in the large fibres tends to close the gate, whereas activity in the small fibres tends to open the gate; thus either inhibiting or facilitating synaptic transmission to more central cells. The gating mechanism is also said to be influenced by descending impulses from the brain, thereby accommodating the substantial evidence regarding psychological factors and their effects on pain.

In contrast to other models of pain, Mëlzack and Wall's gate control theory (Melzack & Wall, 1965, 1982) provides a good framework for considering the complexity of the pain experience and the role of various cognitive and affective influences on pain. Moreover, although some of the details of the theory have required modification over time, it still serves as an excellent first approximation of the neural mechanisms underlying pain transmission (Price, 1988) as well as being generally accepted as the best model to explain the complexity of the pain experience (Weisenberg, 1987).

The gate control theory offered scope for the recognition of the many potential psychological factors which may impact on the pain experience. Since its conception many studies have confirmed that psychological interventions such as hypnosis (Miller & Bowers, 1986), relaxation training (Clum, Luscomb & Scott, 1982) and cognitive-behavioral therapy (Holmes, Hekmat, Mozingo, 1983; Turner, 1982) all effect pain perception. One factor common to such manipulations is the distraction of attention.

## The Distraction of Attention

Common belief suggests that, if one's attention is focused on a painful stimulus, the pain will be perceived more intensely than if one's attention is distracted away from it. Indeed, people required to evaluate pain coping strategies tend to rate distraction as highly effective when compared to other coping techniques (Ahles, Blanchard, & Leventhal, 1983; Corah, Gale, Illig, 1979; McCaul & Haugtvedt, 1982). This common-sense belief in distraction is not isolated to the opinions of lay individuals only, but extends also, to the writings of researchers who widely accept the pain-controlling effects of distraction, both in instances of clinical pain (Copp, 1974; Turk, Meichenbaum & Genest, 1983), as well as in experimentally induced pain (Fernandez & Turk, 1989; McCaul & Malott, 1984).

### The biological significance of attention

The biological importance of attention in the pain experience needs to be seen in the context of the adaptive and survival functions that pain itself serves. Wall (1979) argued that pain was a need-state which serves to promote healing and recuperation. He went on to propose that the period after injury should be divided into the immediate, acute, and chronic stages reflecting the different behaviours which accompany each phase. In the later acute and chronic phases, attention tends to be directed towards the injury and rest and recuperation is the primary aim of the organism. However, in the immediate phase, it may not be adaptive to focus on, or even experience pain because more important behaviours may be required. Attention may be required to deal with more salient issues such as fighting or escaping to prevent further injury. This may explain anecdotal findings that a pain free period often follows injury in life threatening situations in which pain has no real survival advantage (Wall, 1979). The distraction of attention may also partly explain why rugby players and boxers are said to be able to sustain substantial injury and experience little pain while still competing (Melzack & Wall, 1982). Not only may the distraction of attention be seen as a mechanism by

which pain may be decreased, but also by attending to pain a person may serve to raise its intensity (Pennebaker, 1982). Fields (1988) speculated that an attentional mechanism may be a contributing factor in chronic pain, where pain often persists even after injury has healed. He suggested that by focusing on minor pain a person may actually increase its intensity through central mechanisms that activate the neural transmission of pain.

## Attention redirection strategies

Researchers exploring the impact of attention redirection strategies on pain have explored a variety of pain stimuli along with a wide variety of distracting tasks. These studies typically examine some form of pain (experimentally induced or otherwise) and compare the impact of distraction with control conditions using some form of pain outcome measure. These outcome measures are commonly: pain threshold (the point at which the noxious stimulus is first experienced as painful); pain tolerance (the level at which subjects are unwilling to continue); and pain reports (which usually involve rating a particular dimension of pain). Other less common outcome measures of pain include behavioural observation, electrophysiological correlates of pain, crossmodality matching measures, as well as reports on the emotional/distress response to pain.

The present study will focus on the general area of pain and distraction. The literature review intends to provide a good representative sample of the research in this area. However, because emotional and stress related responses may be indicative of other issues such as anxiety, rather than pain, studies which used these measures exclusively will not be reviewed. Following the review some unanswered issues will be raised and further research will be proposed in order to address them.