Running head: EVIDENCE, PAIN SCHEMA, RECALL TASK

Empirical Evidence of a Chronic Pain Schema Using a Recall Task

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Abstract

The purpose of the proposed investigation was to provide empirical evidence of a pain schema. The effect of various durations of pain experienced on pain schema development was explored. Fifty-one pain patients were recruited from the university community, the Thunder Bay community, and area hospitals. Pain patients were divided into three groups based on pain duration. In addition, sixteen healthy control subjects were recruited from the Thunder Bay community. Each participant completed a free recall task. We hypothesized that patients who had suffered chronic pain syndromes the longest would demonstrate a greater recall bias toward pain-related stimuli. Results failed to support the hypothesis. There were no differences found across pain groups in the number or percentage of pain words recalled. However, pain patients did demonstrate more cognitive bias towards pain-related stimuli overall compared to control participants. Results clearly provide support for the existence of a pain-related self-schema in pain patients. Clinical implications of these findings are discussed in relation to the prevention, assessment, and management of chronic pain.

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During the past decade, a wealth of research has focused on the pain construct and issues associated with the measurement of pain. In fact, the period 2001-2011 has been officially designated the "Decade of Pain Control and Research" (Turk & Okifuji, 2002). As the leading source for work related compensation claims in western societies (Prkachin, Hughes, Schultz, Joy, & Hunt, 2002), chronic pain is recognized as a major health problem. Annual costs associated with pain in North America are estimated in the billions of dollars (Turk & Rudy, 1992). Associated financial costs include direct medical expenses, lost income, lost productivity, compensation payments, and legal charges. Mental health concerns associated with chronic pain include high levels of anxiety and depression, and reduced social and recreational activity (Sullivan, Stanish, Waite, Sullivan, & Tripp, 1998; Turk & Okifuji, 1997).

The financial and psychological costs associated with pain disorders exacted on the individual and society are staggeringly high. Given the magnitude of the problem, more research attempting to increase knowledge of the pain experience and improve assessment techniques is needed. One of the most pervasive problems that continues to evade researchers in this area is the paucity of accurate and reliable methods of assessment (Turk, Wack, & Kerns, 1985). In particular, the highly subjective nature of the pain experience makes the assessment of pain patients problematic. Considering the extensive costs associated with pain disorders, further research investigating effective assessment, management, and treatment strategies is needed.

The International Association for the Study of Pain (IASP) defines pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (IASP, 1994, p. 210). The definition alludes to the subjective nature of pain by referring to sensory and emotional influences on the pain experience (Verhaak, Kerssens, Dekker, Sorbi, & Bensing, 1998).

Another important quality of pain recognized in this definition is the distinction made between "actual or potential tissue damage". Although pain is commonly attributed to tissue damage and disease, an identifiable pathology is not always readily available (Sharp, 2001). In fact, a majority of chronic pain cases are considered psychogenic in origin (Smythe, Gladman, Mader, Peloso, & Abu-Shakra, 1997). In such cases, there is no apparent organic evidence to substantiate claims of pain and the presence and severity of pain can only be inferred. Consequently, the patient is the primary source of information (Leavitt & Sweet, 1986). This constraint poses a unique diagnostic challenge in the assessment of pain patients, distinct from many medical conditions. As a result of the inherent subjectivity of pain and the lack of an absolute relationship between tissue damage and the experience of pain, the quantitative assessment of pain is an elusive and complicated task.

Due to the subjective nature of the chronic pain experience, the assessment of chronic pain patients depends almost entirely on self-reports (Chapman & Brena, 1990). Unfortunately, many self-report measures have questionable validity and are vulnerable to response biases (Robinson et al., 1997). Given that reports of pain are commonly influenced by a motivation for financial gain, self-report measures of chronic pain are particularly susceptible to response biases and deliberate distortion. We propose that a more thorough understanding of the pain experience will enable researchers to develop more reliable and comprehensive assessment measures.

Pain is a multidimensional experience incorporating sensory, behavioral, and psychological components (Aldrich, Eccleston, & Crombez, 2000). The development of more comprehensive assessment measures requires a heightened understanding of each of the various pain dimensions (Anderson, 2001). The significance of the psychological dimension as an important determinant of the pain experience has been firmly established in the pain literature.

Melzack and his colleagues (Melzack & Casey, 1968; Melzack & Wall, 1965) were the first theorists to deviate from the traditional biomedical view of pain and incorporate psychological factors as important determinants of pain. The biomedical view assumes that the experience of pain is always a consequence of tissue damage and is primarily a sensory phenomenon (Turk & Rudy, 1992). In contrast, Melzack and Wall's Gate Control Theory (1965) provides a physiological explanation accounting for the influence of emotions on the pain experience (see Melzack & Wall, 1965, for a review). The theory proposes that the brain plays a more active role in pain perception than previously assumed (Sullivan et al., 2001). Specifically, psychological variables influence brain activity. In turn, signals from brain activity activate physiological pain mechanisms, thereby increasing or decreasing perceived pain (Pinel, 1997). The Gate Control Theory dramatically changed our understanding of the pain experience and advanced the evolutionary process of pain research by incorporating psychological components.

Fordyce (1976) also made a significant contribution toward the understanding of the pain experience, further advancing the evolutionary process of pain research. Fordyce suggested that the experience of pain is not only influenced by psychological factors, but also governed by the psychological principals of operant conditioning. Fordyce observed that pain patients display stereotypical behaviours including verbal complaints, painful gesturing, and withdrawing from ordinary activity (Turk & Okifuji, 1997; Turk et al.,1985). Fordyce's Operant Conditioning Model of pain suggests that because these behaviours are observable, they are subject to the principals of operant conditioning (Turk & Rudy, 1992). Furthermore, conditions manifest in a patient's social environmental tend to reinforce and encourage pain behaviours. Sympathy, attention, and financial compensation can serve as positive reinforcers for pain behaviours (Turk & Rudy, 1992; Turk & Okifuji, 1997). According to Fordyce's theory, pain behaviours continue as a consequence of social environment even after the nocioceptive input has ceased. The social environment acts as an external reinforcer maintaining and increasing the frequency of pain behaviours.

More recently, researchers have shifted the focus from the external reinforcement implicated in the operant model, to internal reinforcement of pain behaviours. Internal cognitive processing also contributes to the maintenance of pain behaviours (Turk & Okifuji, 1997). The operant theory of pain has been replaced by a more cognitive approach to pain research. Although more focus is placed on pain-related information processing, operant concepts have not been ignored in the revolutionary cognitive theories. Behaviours and social reinforcers are still considered essential in understanding the pain experience, but these concepts are interpreted from a cognitive perspective (Sharp, 2001).

In recent years, the cognitive component of pain has received a considerable amount of attention (Sharp, 2001). This shift in focus towards cognitive aspects of the pain experience is essential in advancing knowledge of the experience of pain. Nocioceptive input is modified by emotions and interpretations unique to each individual. Thus, the nocioceptive signal is transformed by cognitive variables into a unique sensory experience (Jovey, 2002).

A plethora of research is accumulating which suggests that chronic pain patients differ (compared to nonpatient populations) with respect to how they process information (Edwards & Pearce, 1994). Cognitive processing specific to chronic pain patients is hypothesized to contribute to and exacerbate the pain experience (Turk & Rudy, 1992). Pincus and Morley (2001) propose that the central premise of cognitive theories of pain is that cognitive appraisals and interpretations of events influence behavioral and emotional output.

In accordance, Turk and Okifuji (2002) presented a biopsychosocial model of chronic pain that incorporates appraisals and interpretations of events. The model is representative of the recent developments in literature focusing on cognitions in chronic pain. The biopsychosocial model emphasizes the important cognitive processes involved in the pain experience, but also recognizes the significant interaction between biological, psychological, and sociocultural variables. The biopsychosocial model emphasizes the significance of information processing specific to pain patients and delineates some of the specific cognitive processes involved. According to the model, the first cognitive process in the pain experience is perception and interpretation of painful stimuli. Secondly, pain patients appraise the significance of the painful symptoms and of their own ability to cope with the pain. Finally, the model suggests that patient beliefs influence the interpretation and appraisal of noxious input, as well as the behavioural output resulting from these processing steps. Interpretations, appraisals, and patient beliefs are general cognitive processes that significantly influence coping and distress associated with the pain experience (Turk & Okifuji, 2002).

Although studies have only recently begun to examine the influence of cognitive factors on the development and maintenance of chronic pain, support for the relationship has been demonstrated repeatedly. For instance, Turk and Okifuji (1997) investigated the multidimensional nature of chronic pain. The authors examined the influence of physical, cognitive, affective, and operant factors on the pain experience. Sixty-three chronic pain patients were administered a series of tests including medical, physical, and psychological assessments. Pain behaviours exhibited by each patient were also assessed using the Pain Behaviour Checklist (Turk et al., 1985). While the relative contribution of each variable was significant and confirmed the multidimensional nature of pain, the relationship between cognitive factors and pain behaviours was particularly impressive (Turk & Okifuji, 1997). Only a minimal association was found between positive social attention and pain behaviours. This study solidified the growing belief in the influence of cognitive factors on pain.

Other researchers have examined the influence of specific cognitive factors on pain. Sullivan et al. (2001) found a remarkable level of consistency in their review of the relationship between catastrophizing and pain. According to empirical studies, catastrophizing increases the frequency of pain behaviours and exacerbates the level of pain and distress (Sullivan et al., 2001). Described as “an exaggerated negative mental set” (Sullivan et al., 2001, p. 53), catastophizing might also be thought of as a negative cognitive response or appraisal style (Sullivan, Bishop, & Pivik, 1995).

Further support for the relationship between catastrophizing and pain comes from another review of cognitive factors in chronic pain, which states that successful coping is dependent on the patient’s ability to avoid catastrophizing (Turk & Rudy, 1992). It has been well established in the pain research that catastrophizing is a cognitive factor that influences the development and maintenance of chronic pain (Crombez, Eccleston, Baeyons, Eelen, 1998; Sullivan et al., 2001; Turk & Rudy, 1992).

Recently, a large portion of the efforts in cognitive pain research has focused on cognitive biases in chronic pain patients. These studies are attempting to establish empirical evidence to support the notion that chronic pain patients selectively process pain related stimuli. Although the results of these studies are not entirely consistent, there is sufficient evidence to conclude that chronic pain patients do selectively process pain related stimuli, (Keogh, Ellery, Hunt, & Hannent, 2001; Pincus & Morley, 2001).

Pincus, Pearce, McClelland, Farley, and Vogel (1994) found evidence in support of a pain-related selection bias in chronic pain patients. One hundred and seven patients and 94 controls were presented ambiguous cues and asked to respond with the first word that came to their mind. Chronic pain patients responded with significantly more pain-related words than the control group. For instance, when presented the word “terminal”, pain patients responded with words like “illness” and “growth”. In contrast, control subjects were more likely to respond with words unrelated to pain such as “bus”, “train”, and "airport". Pincus et al. surmise that the tendency for chronic pain patients to respond with more pain associations than controls is because they initially interpret the ambiguous cues as pain related. Results support the notion that cognitive biases exist in patients with chronic pain.

Pearce and Morley (1989) also provided empirical evidence of cognitive biases in chronic pain. Specifically, they found that chronic pain patients demonstrate "attentional" biases toward pain stimuli. Using the Stroop task paradigm, the authors found that the response latency in naming the color of pain related words was greater for pain patients than for the pain-free control groups. The pain-related stimuli were interfering with patients' ability to focus attention on the task. The pain patients were demonstrating attentional biases to pain words.

Another study demonstrating attentional bias to pain-related stimuli in pain patients was conducted by Eccleston (1994). Specifically, Eccleston found that the degree of interference or attentional bias demonstrated by chronic pain patients is dependent on the level of task difficulty. Initially, a group of pain patients were compared with a control group based on performance on a simple numerical task. No significant differences in performance between the two groups were found. In a second experiment, a similar procedure was followed except a more difficult numerical task was employed. Results showed that pain patients demonstrate greater response latency to the more difficult attention-demanding task, compared to the control group.

Eccleston (1994) offered an explanation of these findings based on the theory that attention is a limited resource. Attention-based cognitive coping strategies in pain patients limit the amount of attention available for additional cognitive tasks (Eccleston, 1994). The simple task failed to interfere with performance in pain patients, because little attention was needed to perform the task. The more difficult task did compete with cognitive coping strategies for limited attentional resources, resulting in slowed performance. These findings demonstrate that if task difficulty is great enough, chronic pain patients will demonstrate an attentional bias.

Subsequent attempts to demonstrate attentional biases in chronic pain patients have been inconsistent and largely unsuccessful (Crombez, Hermans, & Adriaenson, 2000). For instance, Asmundson, Kuperos, and Norton (1997) attempted to replicate the Pearce and Morley (1989) study (discussed above) using a dot probe paradigm, but failed to demonstrate an attentional bias in chronic pain patients.

Asmundson et al. (1997) attribute a portion of the disparity between their results and those found by Pearce and Morley (1989) to differences in patient characteristics, such as the specific nature of pain experienced. Furthermore, the authors argue that their choice of assessment measure offered a more direct assessment of an attentional bias compared to the Stroop task paradigm (Pearce & Morley, 1989). The dot probe paradigm offers a neutral stimulus (i.e., dot-probe) and requires a neutral motor response (i.e., key press (Asmundson et al., 1997). In contrast, the Stroop task involves a more complex motor response (production of an appropriate verbal response) and patients are required to interpret a subjective stimulus (word meaning) (Asmundson et al., 1997). The alleged attentional bias demonstrated using the Stroop paradigm (Pearce & Morley, 1989) may actually have been confounded by response bias and secondary cognitive processes (Asmundson et al., 1997). Asmundson et al. suggest, consequently, that caution should be practiced in interpreting results related to attentional biases from the Pearce and

Morley study. Although results failed to provide evidence of attentional biases in pain patients, this study contributed to the cognitive pain research by highlighting potential confounds in pain assessments and refining pain research processes. Future studies of cognitive processing in chronic pain patients should choose assessment measures cautiously.

Crombez and colleagues (2000) suggested that previous inconsistencies in the literature regarding pain-related attentional biases may be at least partially due to a failure to use relevant stimuli. In other words, stimuli used may not have adequately represented "the core concerns of the pain patients" (Crombez et al., 2000, p. 38). Despite their efforts to ensure that pain-related stimuli were relevant to the pain population under study, the study by Crombez and colleagues failed to confirm the presence of an attentional bias to affective pain words. Authors did demonstrate, however, that pain patients shift attention towards "sensory" pain words. Therefore, although authors failed to provide empirical support of a common attentional bias in chronic pain patients, they did expound a more specific feature underlying cognitive biases in chronic pain.

The circumstances under which a cognitive bias in attention becomes influential in the information processing of chronic pain patients is unclear. Keogh and colleagues (2001) suggest that the difficulty in demonstrating an attentional bias in chronic pain patients lies in the failure of many studies to consider the emotional state of the patient. In other words, the influence of such a cognitive bias on information processing in pain patients depends on the patient's level of anxiety, depression, and pain-related fear.

Once again, however, discrepancy plagues the literature in this area. In a following study, Roelofs, Peters, and Vlaeyen (2002) provided evidence that attentional bias is not related to emotional states or trait variables. Both studies (Keogh et al., 2001 and Roelofs et al., 2002) used comparable participant groups (pain-free university students), but differed in the methodological procedures and materials used. Roelofs et al. assessed fear of pain with an experimental pain induction muscle-ischemia procedure. Electrodes were attached to participants' arms and participants are told that they may receive an intense electrical shock during the attention-demanding task. The Stroop task is used in this study to assess a potential attentional bias. In Keogh et al.'s study, the dot probe paradigm was used in place of the Stroop task and no pain-induction procedures were employed.

Future research in this area is needed in order to determine if such disparaging results (common throughout this area of research) are due to variances in methodology or if there is more telling explanation based on actual differences in pain-related cognitions. As much cognitive activity is not available to conscious awareness, the task of assessment is trying (Edwards, Pearce, Collett, & Pugh, 1992). Despite the inconsistencies plaguing the pain literature, there is sufficient data to conclude that chronic pain patients selectively process pain related stimuli. The mechanisms by which these cognitive variables produce their effects, however, are less clear (Turk & Rudy, 1992). Pincus and Morley (2001) suggest that more research attention should be paid to cognitive biases other than attentional biases for which the empirical evidence is weak, in order to better understand cognitive processes in pain patients. In a review of cognitive-processing biases in chronic pain, Pincus and Morley (2001) report that evidence for memory and interpretation biases is more compelling.

For instance, Pincus, Pearce, McClelland, and Turner-Stokes (1993) provided evidence of a memory bias in pain patients. After administering a recall task to a group of pain patients and pain-free controls, the authors were able to confirm the notion that pain patients selectively recalled more pain-related words than healthy controls. Pincus et al. also demonstrated that pain patients show a memory bias only when the pain-related stimuli are encoded in reference to themselves.

A study by Pincus, Fraser and Pearce (1998) provided further evidence of a memory bias in pain patients. Researchers simultaneously investigated the presence of biases on attention and memory. The Stroop task was employed to test for disruptions in attention due to pain and a free recall task assessed biases in memory. In accordance with Pincus and Morley's (2001) conclusions, the study failed to provide evidence of an attentional bias in pain patients, although a memory bias was demonstrated among pain patients. The pain patients recalled more sensory words than controls (Pincus et al., 1998).

Similarly, research has demonstrated an association between overall memory performance and pain. In a study examining the effect of pain and psychological distress on neurocognitive performance, Ieezi, Duckworth, Vuong, Archibald, and Klinck (2004) found a significant association between pain and memory, but failed to find an association between pain and attention after controlling for years of education. Pain severity and psychological distress made significant contributions to the prediction of memory performance.

In summary, the influence of cognitive processes in the experience of chronic pain has been a common focus of pain studies in recent years, but findings have been inconsistent. Generally, research findings support the theory that pain patients selectively process pain-related stimuli (Edwards & Pearce, 1994; Pincus et al., 1994). Findings regarding the specific cognitive mechanisms underlying the pain experience, however, have been less conclusive. For instance, studies examining attentional biases in pain patients have provided mixed results (Asmundson et al., 1997; Crombez et al., 2000; Eccleston, 1994; Pearce & Morley, 1989). Research focusing on memory performance and memory biases in pain patients has been more consistent (Pincus & Morley, 2001; Pincus et al., 1998; Pincus et al., 1993; Iezzi et al., 2004). Therefore, future studies assessing memory bias in pain patients may shed more light on the cognitive processes underlying the pain experience.

By demonstrating evidence of cognitive biases in chronic pain patients, these studies further emphasize the significance of the relationship between cognitive factors and pain in the experience of chronic pain. This is important to study because cognitive processing specific to chronic pain patients appears to influence perceived pain intensity, level of distress, and behavioural activity (Pincus & Morley, 2001). In fact, cognitive interpretations of pain may directly impact a physiological increase in pain (Turk & Rudy, 1992).

Despite the revolutionary advances made in the pain literature in recent years, there is undoubtedly a need for more research. Most notably, we must examine in closer detail how pain is cognitively structured, how chronic pain cognitions interfere with information processing, and more specifically, how or why pain patients develop cognitive biases. In this thesis, we propose that a more thorough examination of cognitive factors is integral to a more complete understanding of pain assessments, of pain management, and of the overall pain experience. As just described, this proposal is quite congruent with an emerging body of literature that has now begun to incorporate cognitive factors in pain research. In particular, information processing and cognitive appraisals in pain patients have been extensively discussed in the pain literature.

Cognitive appraisals determine how incoming information is evaluated and influences how pain patients will respond to the information (Turk & Okifuji, 1997). Cognitive appraisal is a process in which people evaluate the significance of a situation with respect to themselves. According to Lazarus (1993), cognitive appraisals involve primary and secondary appraisal components. A primary appraisal examines the significance of the encounter to the person's well-being, and a secondary appraisal involves a consideration of the person's options and resources for coping with the situation (Smith & Lazarus, 1993). Individual differences in primary and secondary appraisal components will influence how information is evaluated. As applied to pain patients, individual differences in appraisal components will determine levels of distress and observed pain behaviours (Turk & Okifuji, 1997).

A broader cognitive construct, that encompasses cognitive appraisals and information processing, is the self-schema. An individual's self-schema involves the compilation of information regarding beliefs and content about the self, (Swallow & Kuiper, 1987). Self-schema content influences the initial processing of information, the evaluation of that information, and the final output of emotion or behaviours in response to the information. Self-confidence, the degree of focus one places on affective implications, and self-schema complexity are all significant variables in determining how information will be processed (Swallow & Kuiper, 1987). The self-schema is described as a cognitive organization of self-referent information, which incorporates appraisals, views of personal efficacy, and expectations. The self-schema influences perceptions and appraisals of personally relevant environmental events. Individual differences regarding self-schema content and evaluation elements are, consequently, related to each individual's unique experiences (Mathews & MacLeod, 1994; Winter & Kuiper, 1997). For example, a person with high self-confidence and a complex self-schema is more likely to attend to positive information and incorporate that information into their self-schema. Persons with negative self-concepts and less complex self-schemas, however, tend not to incorporate new positive information into their rigid self-schema (Winter & Kuiper, 1997). Self-schema content also influences the evaluation of information. Positive and negative self-evaluative beliefs are key aspects of the self-schema that determine how one evaluates the information they receive. Finally, self-schema content influences behaviour and the expression of emotion, (i.e., the output). Here, individual differences in traits, attitudes, and beliefs predispose people to characteristic expressions of emotions (Winter & Kuiper, 1997).

The self-schema has been discussed extensively in other areas of psychological literature, but primarily within the context of cognitive theories of personality, emotion, and social functioning. The current study is an attempt to demonstrate that the chronic pain experience is another area of the psychological literature that may be schema-driven. To date, research providing empirical evidence of a pain-related self-schema is exceedingly limited, and relatively few studies have even alluded to the existence of a pain-related self-schema. Although literature regarding the self-schema construct has not been applied to cognitive processing in pain patients extensively, it may be easy to see how such a connection might be made.

For instance, self-schema research in personality indicates that schema content influences information processing (Clemmey & Nicassio, 1997). Specifically, individuals demonstrate a tendency to favor information that is consistent with their self-schema, thus avoiding cognitive dissonance (Petersen, Stahlberg, & Dauenheimer, 2000; Rojahn & Pettigrew, 1992). This parallels the research in the pain literature suggesting that pain patients selectively process pain related stimuli.

Also, it has been demonstrated that whether information is schema-relevant or schema-irrelevant will affect an individual's ability to remember the information (Rojahn & Pettigrew, 1992). This finding can be applied to investigations of memory biases in pain patients. This aspect of schema theory may help to confirm and explain the existence of a memory bias in pain patients and further elucidate the cognitive mechanism underlying information processing in pain patients. Perhaps a pain-related self-schema is the underlying mechanism influencing cognitive processing in chronic pain patients.

In 1994, Edwards and Pearce provided support for the notion of schematic representations of pain in chronic pain patients. Chronic pain patients, health care workers, and a control group were administered a word completion task. Chronic pain patients responded with significantly more pain-related completions than the non-pain groups. Edwards and Pearce concluded that the pattern of the pain patients' responses was indicative of schematic representations of pain. By contrasting the responses offered by pain patients and health care workers, Edwards and Pearce further determined that consistent exposure to pain (as experienced by health care workers) is not sufficient to develop pain schemas. Prolonged personal experience with pain is necessary for the development of the cognitive organization indicative of a pain schema. As a preliminary study investigating schematic representations of pain in chronic pain patients, Edwards and Pearce encourage future studies to explore further the nature of a pain schema.

Findings from the Edwards and Pearce (1994) study have interesting implications for current as well as earlier studies in pain research. Many studies of pain utilize pain simulation and lab-induced pain paradigms to examine cognitive processes in chronic pain patients. And as previously indicated, there is much variability in the consistency of the available data based on these studies. This inconsistency is not surprising in light of the findings offered by Edwards and Pearce. Studies that require non-pain participants to simulate responses typical of a chronic pain patient or experimental studies using induced pain, neglect to consider that simulators cannot simulate a cognitive pain schema. Similarly, lab-induced pain should not have the same effect on information processing if pain schemas are causing the biases in cognitive processing.

In summary, Edwards and Pearce confirmed that pain-related self-schemas require personal experience with pain over a prolonged period of time. Studies examining cognitive processes in chronic pain patients have been limited by a failure to address pain duration in schema development as well as by an overall lack of reference to schemas (O'Keeffe, 1989). Failing to address the dynamic relation between pain and pain duration represents a substantial gap in the pain literature. This gap in the literature will be addressed in the current investigation, in which time with pain and corresponding schema development will be assessed.

As an extension of the Edwards and Pearce (1994) study, Griffith, Mclean, and Pearce (1996) examined the potential of a pain schema in chronic pain patients. In accordance with the previous study, pain patients demonstrated biases in information processing and results were interpreted as evidence of a pain-related schema. However, unlike the Edwards and Pearce study, Griffith and colleagues also compared the results across various diagnostic groups. Responses of patients with rheumatic disease, chronic low back pain, and cancer were compared. Authors hypothesized that the central nature of pain common in all three diagnostic groups would produce similarities in processing and schema development. Contrary to expectations, patients' responses demonstrated different patterns of schematic processing across the various diagnostic groups.

Further examination of pain-related schemas in persons with chronic pain may be important in broadening our understanding of the pain experience and may improve the efficiency of pain assessments and the treatment process of chronic pain patients. As schemas have been demonstrated to impact information processes in other areas of psychology, we propose that empirical evidence of a pain-related self-schema may help to resolve some of the inconsistencies currently found in the chronic pain literature regarding biases in cognitive processing. The current study examines the pain schema, a relatively new cognitive construct in pain research.

The Present Study

Although there have been a number of recent studies examining the cognitive biases in chronic pain patients, these studies have not yielded unambiguous answers. Questions regarding the organization and development of these cognitive biases remain. Prior efforts to answer these questions have been limited by a failure to consider personal exposure to pain and time with pain. Based on this apparent gap in the literature, the purpose of the present investigation was to examine the development and organization of a relatively new cognitive construct in pain research, the pain schema.

Cognitive schemas appear to develop over extended periods of time. More specifically, research suggests that pain schema development requires personal experience with pain over an extended period of time. It follows, therefore, that a longer duration of pain experienced will result in an increase in the strength and development of a pain schema as demonstrated by information processing biases. The current investigation intended to establish empirical evidence of a pain schema by demonstrating this concept. We hypothesized that patients who had suffered chronic pain syndromes the longest would demonstrate a greater bias toward pain-related stimuli. If the information processing bias increased over time with pain, it would suggest evidence of a pain schema.

Since pain schemas are believed to influence information processing, a test of information processing would provide evidence of pain schema. Specifically, the presence of a schema may be detected by the time required to process schema consistent stimuli, by the ability to focus attention when encountering distraction tasks, and by the amount of schema-consistent material recalled (Fekken & Holden, 1992). Due to the significant inconsistencies found in the pain literature utilizing the former two paradigms, the present investigation utilized the latter. The literature suggests that the best estimate of cognitive processes in pain patients can be obtained using a recall task (Pincus & Morley, 2001). Specifically, recall tasks using pain-related stimuli encoded in reference to the self provide the best estimate of memory biases in pain patients (Pincus et al., 1993; Pincus & Morley, 2001).

In summary, an attempt was made in the current investigation to replicate previous findings demonstrating an information processing bias in pain patients, and to offer a significant contribution to this area of research by also investigating the effect of varying durations of pain experienced. More specifically, it was hypothesized that pain patients would demonstrate more cognitive bias towards pain-related stimuli compared to control participants. It was predicted that the proportion of self-referent pain-related words recalled would increase as a function of pain duration (group), with participants in the last chronic pain group showing the greatest recall of pain-related stimuli. Information processing bias towards pain-related stimuli was assessed using the number of pain words recalled, the percent of pain words recalled, and the number of pain-related commission errors made (i.e., pain words that were reported, but not presented in the recall task).

Consequently, the present investigation not only assessed the presence of a pain schema, but also pain schema development over time.

Method

Participants

Pain patients were recruited from the university community, the Thunder Bay community, and from area hospitals. In total, 51 pain patients (18 male and 33 female) were included in the study. Pain patients ranged in age from 18 to 64 years of age (M = 38.61, SD = 13.31) and years of education ranged from 5 to 23 years (M = 15.24, SD =

Table 1

Frequency and Percentages of Pain Syndromes Across Pain Groups

Pain Syndrome	Acute N = 10	Intermediate N = 19	Chronic N = 22
Low Back Pain	2 (20%)	2 (11%)	5 (23%)
Fibromyalgia	1 (10%)	2 (11%)	3 (14%)
Motor Vehicle Accident		3 (16%)	
Knees	1 (10%)	4 (21%)	2 (9%)
Neck/Spinal Injury		1 (5%)	5 (23%)
Arthritis	1 (10%)	2 (11%)	2 (9%)
Headaches	2 (20%)		
Phantom Limb	1 (10%)		
Toothache	1 (10%)		
Neuropathic Pain		1 (5%)	
Whiplash		3 (16%)	
Muscle Strain/Tear	1 (10%)	1 (5%)	4 (18%)
Polio			1 (5%)

2.84). The majority of pain patients were married or common-law (47%), 33% were single, and 20% were divorced, separated, or widowed.

Pain patients were divided into three groups based on pain duration. The acute pain group consisted of 10 pain patients who had experienced pain for less than six months (*M* = 3.68 months, *SD* = 2.21). The intermediate pain group consisted of 19 pain patients who had experienced pain for greater than six months, but less than 5 years (*M* = 2.79 years, *SD* = 1.31). Finally, the 22 patients assigned to the chronic pain group experienced pain for greater than five years (*M* = 18.84 years, *SD* = 14.24).[1] Details of the reported pain syndromes are presented in Table 1.

In addition, 16 healthy control subjects (8 male and 8 female) were recruited from the Thunder Bay community. Control subjects were screened for pain-related illness and were excluded from the study if they reported any such illness currently or in their history. Participants in the control group ranged in age from 21 to 60 years of age (*M* = 35.81, *SD* = 13.38) and years of education ranged from 14.22 to 16.65 (*M* = 15.44, *SD* = 2.28). Sixty-three percent of participants in the control group were married or common-law, while 31% were single and 6% were divorced.

Measures

Pain Experiences Inventory –P (PEI-P): The PEI-P developed by Mazmanian and Hewitt (2003) is a demographics questionnaire for pain patients. The questionnaire was used to gather pain patients' demographic information as well as a history of pain experiences.

Footnotes

[1]The grouping criteria decisions followed no theoretical or empirical basis. Initially, groups were to be determined based on restricted durations of pain. Due to difficulties recruiting, the grouping criteria was adjusted to make optimal use of the participants we had.

Pain Experiences Inventory –C (PEI-C): The PEI –C developed by Mazmanian and Hewitt (2003) is a demographics questionnaire for pain-free control participants. The questionnaire was used to gather general demographic information. In addition, this questionnaire served as a screening tool for participants who have experienced or are currently experiencing pain of significant duration related to an injury or illness.

Wechsler Memory Scale – Third Edition (WMS-III): The WMS–III is an individually administered battery of tests. The standardized instrument assesses learning, memory, and working memory (Wechsler, 1997). The following WMS-III subtests were utilized in the present investigation:

Digit Span: Digit Span is an auditory presentation subtest. The examiner reads a series of digits and the examinee is required to recall the series in the same order. Next, the examinee reads a series of digits and the examinee is required to say them in the reverse order.

Logical Memory I: Logical Memory I is an auditory presentation subtest that assesses immediate memory. Examinees are orally presented two short stories, with the second story presented twice. The examinee is asked to recall the two stories.

Pain Patient Profile (P-3): The P-3 is a brief self-report instrument developed by Tollison and Langley (1995). The instrument assesses depression, anxiety, and somatization related to the pain experience. In addition, a Validity Index is included that assesses the probability of response biases. The P-3 has adequate psychometric properties (Tollison & Langley, 1995; McGuire, Harvey, & Shores, 2001).

Visual Analogue Scale (VAS): A VAS assessed current pain intensity. This scale is comprised of a 100-mm line anchored at left and right by the words "no pain" and "worst imaginable pain" (Crombez et al., 2000). Participants were asked to make a dash on the line indicative of their own pain experience.

McGill Pain Questionnaire: The McGill Pain Questionnaire provides quantitative measures of pain. The McGill Pain Questionnaire is a brief questionnaire that consists of sensory, affective, and evaluative pain descriptor words. The questionnaire also includes a pain intensity rating scale as well as other items to determine the properties of pain experience (Melzack, 1975).

Activities Pacing Scale: The Activities Pacing Scale is currently in the process of development and validation. The Activities Pacing Scale is being developed by Cane and Mazmanian (2003) in collaboration with the Pain Clinic in the Queen Elizabeth II Hospital in Halifax, Nova Scotia. This scale was included in the battery of questionnaires for the current study, but results were not incorporated in the data analyses.

Procedure

Initially, all participants provided informed consent (Appendix A). The researchers explained that the study investigated aspects of a person's pain experience and involved a memory task. Participants were asked to complete a demographics questionnaire referred to as the Pain Experiences Inventory (see Appendices B and C). Each participant then completed a free recall task in which 80 pain-related, 80 food-related, and 80 neutral words were randomly presented (Appendix D). Prior to the presentation of the word list, computer instructions were provided that encouraged participants to encode words in reference to themselves (see Appendix E). Each stimulus word was presented on a computer screen for two seconds, with a one second inter-stimulus interval. The first and last five adjectives were neutral and excluded from the analysis to avoid primacy and recency effects (Pincus & Newman, 2001). The pain-related words used in the recall task were drawn from the McGill Pain Questionnaire. Other-category and neutral words were drawn form previously generated word lists. The three groups of words were matched with respect to length and average frequency in the English language. Participants received standardized instructions asking them to recall as many adjectives as they could from the list presented (Appendix F).

Upon completion of the preliminary free recall task, participants were presented a brief distracter task. Participants completed the Digit Span and Logical Memory I subtests of the WMS-III. Once again participants were asked to recall as many adjectives as they could from the original list (Appendix G).

Following the recall task, participants completed a battery of questionnaires designed to measure affect (depression and anxiety), assess pain (intensity, severity, quality), and provide self-ratings of pain-related words. The battery included the Pain Patient Profile (P-3), a Visual Analogue Scale (VAS) of pain, and the McGill Pain Assessment Questionnaire. Upon completion of the questionnaires, participants were presented the pain-related words from the recall task once more and asked to rate each word based on how well each described their own pain experience. Ratings were made on a Likert-type scale ranging from "Does not describe my pain at all" to "Completely describes my pain" (see Appendix H). Finally, participants completed the Activities Pacing Scale. The Activities Pacing Scale results were used in a separate study and were not incorporated in the current thesis. Upon completion of the final questionnaire, participants received a Debriefing Form (Appendix I).

Data Reduction and Analyses

The words recalled by participants in the immediate and delayed recall tasks were divided into six categories: total number of pain words, food words, neutral words, pain commission errors, food commission errors, and neutral commission errors. The number of pain words recalled was also divided by the total number of pain words, food words, and neutral words recalled to obtain the percentage of pain words recalled. Commission errors were not included in the total number of words recalled. In order to eliminate primacy and recency effects, the first and last five neutral adjectives were also excluded from the total number of words recalled. It was observed that commission errors were extremely rare. Overall, only nine participants in the immediate recall task and 15 participants in the delayed recall task made pain-related commission errors and an average of less than one pain-related commission error was made per participant. Therefore, commission errors were dichotomized and treated using non-parametric procedures.

The main analysis performed was a 4 (groups) x 2 (immediate vs. delayed recall) mixed MANOVA. The two dependent variables were number of pain words recalled and percentage of pain words recalled. For the reasons presented above, pain-related commission errors were not included in the parametric analysis. A nonparametric analysis (chi square) was conducted on this dependent variable.

Results

Preliminary Analyses

Data Screening

Prior to any analysis, the data were examined for accuracy of data entry and missing values. The distributions of scores for number of pain words recalled and percentage of pain words recalled were then examined for the presence of univariate outliers. Scores from the immediate and delayed recall tasks were examined. No values exceeded three standard deviations above or below the mean.

Assessing Group Equivalency

Descriptive statistics for the four groups are presented in Table 2. An ANOVA was conducted to determine if the groups were comparable in terms of age and years of education. The four groups of participants were not significantly different in terms of age, $F(3, 63) = 2.56, p > .05$, or years of education, $F(3, 63) = 2.04, p > .05$. A chi square analysis was also conducted in order to determine if the groups were comparable in terms of sex and marital status. The four groups of participants were not significantly different in terms of sex, $\chi^2 (3, N = 67) = 3.78, p > .05$, or marital status, $\chi^2 (15, N = 67) = 17.80, p > .05$.

Descriptive Data

Table 3 lists the mean scores for the four groups for the number of pain words recalled and the percent of pain words recalled.

Assessing Multivariate Assumptions

Before analyses to test the main hypotheses were conducted, the data were examined to ensure that the assumptions of multivariate analysis were met. Multivariate

Table 2

Means and Standard Deviations or Raw Frequency and Percentages for the Nine Variables Used to Assess Group Equivalency Across the Four Groups

Variable	Control N = 16	Acute N = 10	Intermediate N = 19	Chronic N = 22
		Means (Standard Deviations)		
Age (years)	35.81 (13.38)	34.90 (15.60)	34.21 (10.17)	44.09 (13.16)
Education (years)	15.44 (2.28)	16.40 (2.99)	14.11 (2.85)	15.68 (2.53)
		Raw Frequency (Percentage)		
Sex				
Male	8 (50.0)	4 (40.0)	4 (21.1)	10 (45.5)
Female	8 (50.0)	6 (60.0)	15 (78.9)	12 (54.5)
Marital Status				
Single	5 (31.3)	5 (50.0)	8 (42.1)	4 (18.2)
Married	8 (50.0)	1 (10.0)	5 (26.3)	10 (45.5)
Common-Law	2 (12.5)	2 (20.0)	1 (5.3)	5 (22.7)
Widower		1 (10.0)		1 (4.5)
Divorced	1 (6.3)		3 (15.8)	2 (9.1)
Separated		1 (10.0)	2 (10.5)	

Table 3

Mean Pain Bias for the Four Groups as Measured by Number of Pain Words Recalled and Percent Of Pain Words Recalled

Variable	Control N = 16	Acute N = 10	Intermediate N = 19	Chronic N = 22	Overall Mean
Immediate Recall					
Number of Pain Words Recalled	2.56 (1.31)	4.50 (2.55)	3.74 (2.08)	5.05 (3.30)	4.00 (2.62)
Percent of Pain Words Recalled	23.73 (12.25)	36.70 (16.47)	41.43 (20.36)	40.93 (14.82)	36.33 (17.52)
Delayed Recall					
Number of Pain Words Recalled	2.25 (1.13)	4.40 (2.67)	3.05 (1.65)	3.59 (2.82)	3.24 (2.24)
Percent of Pain Words Recalled	25.46 (10.35)	36.36 (14.21)	39.41 (21.95)	35.98 (16.35)	34.50 (17.22)
Overall Mean					
Number of Pain Words Recalled	2.41	4.45	3.40	4.32	3.64
Percent of Pain Words Recalled	24.60	36.53	40.42	38.45	35.00

normality of the distributions was assessed using the formula (skewness / standard error of skewness) < 3 (Tabachnick & Fidell, 2001). The distribution of all dependent variables was minimally skewed in a positive direction.

The Levene test for equality of variances found adequate homogeneity across groups for the number of pain words recalled in the immediate recall task, $F(3, 63) = 2.30, p > .05$, for the percent of pain words recalled in the immediate recall task, $F(3, 63) = 1.02, p > .05$, and for the percent of pain words recalled in the delayed recall task, $F(3, 63) = 1.63, p > .05$. The Levene test for the number of pain words recalled in the delayed recall task indicated slight heterogeneity of variance between groups, $F(3, 63) = 2.96, p = .04$.

The Box's M test of equality of covariance matrices indicated that groups differed in their variance-covariance matrices, $F(30, 5468) = 2.27, p > .05$. The multivariate analysis of variance, however, is reasonably robust even when there are departures from this assumption (Tabachnick & Fidell, 2001).

A correlation matrix of dependent variables was evaluated for multicollinearity. Although some correlation between variables was expected given that one dependent variable (percent of pain words recalled) was derived from the other (number of pain words recalled) in both trials, multicollinearity was not a problem. Significant correlations between dependent variable scores ranged from .31 to .89 with a mean within-group correlation of .54.

The following decisions regarding data analysis were made taking into account the results of the preceding tests of multivariate assumptions. As mentioned, a mixed

MANOVA was performed on the immediate and delayed measures of pain bias as measured by the number of pain words recalled and the percent of pain words recalled using an alpha level of .05. To reduce the impact of minor statistical violations, the conservative Pillai's criterion was chosen to evaluate multivariate significance (Tabachnick & Fidell, 2001). Where MANOVA demonstrated significant main effects, univariate analyses of variance were conducted. The conservative Tukey post-hoc comparisons were conducted on significant effects and interactions with an alpha level of .05.

Main Analyses

A 4 (groups) x 2 (trials) mixed MANOVA was performed on the number of pain words recalled and percentage of pain words recalled. There was a significant group effect for mean number of pain words recalled and percent of pain words recalled, $F(6, 126) = 2.54, p < .05$. Results also showed a significant main effect of trial for the number of pain words recalled and the percent of pain words recalled, $F(2, 62) = 14.16, p < .001$. Finally, a significant interaction effect between group and trial was found, $F(6, 126) = 2.67, p < .05$. Overall, the strongest effect was found to be for trial, partial $\eta^2 = .31$, but examination of mean number and percent of pain words recalled separately found that the amount of variance explained was rather evenly dispersed among the variables. Group accounted for most of the variance in the percent of pain words recalled, partial $\eta^2 = .14$, while trial, partial $\eta^2 = .25$, and the group x trial interaction, partial $\eta^2 = .20$, accounted for most of the variance in the mean number of pain words recalled. See Table 4 for the amount of variance of the dependent measures accounted for by each of the abovementioned variables.

Table 4

Amount of Variance of the Dependent Measures (partial η^2) Accounted for by Group, Trial, and the Group x Trial Interaction

	Number of Pain Words Recalled	Percent of Pain Words Recalled	Overall Variance Accounted for
Group	.114	.144	.108
Trial	.253	.015	.314
Group x Trial	.198	.053	.113

Follow-up univariate ANOVAs were conducted in order to further investigate the nature of the relationships among the independent variables and the number of pain words recalled. A marginal level of significance was found for the number of pain words recalled across groups, $F(3) = 2.71$, $p = .053$. Tukey post-hoc comparisons revealed that there was a marginal difference between the mean number of pain words recalled by the control group ($M = 2.41$, $SD = 2.28$) and the mean number of pain words recalled by the chronic pain group ($M = 4.32$, $SD = 2.28$), $p = .061$. The control group recalled a smaller mean number of pain words than the chronic pain group. Other group comparisons did not reveal significant differences regarding the number of pain words recalled.

The mean number of pain words recalled was also found to change significantly as a function of trial, $F(1) = 21.30$, $p < .001$. Participants recalled significantly more pain words in the immediate recall condition ($M = 4.00$, $SD = 2.62$) than in the delayed recall condition ($M = 3.24$, $SD = 2.24$).

Finally, results revealed a significant group x trial interaction effect for number of pain words recalled, $F(3) = 5.20$, $p < .01$. As can be seen in Figure 1, time with pain (group) differentially affected recall. Simple effects analyses revealed the source of this interaction to be with the chronic pain and intermediate pain groups. One-way ANOVAs comparing number of pain words recalled across groups demonstrated a significant difference in the immediate recall task, $F\ (3, 63) = 3.27$, $p < .05$, but failed to demonstrate a significant difference in the delayed recall task, $F(3, 63) = 2.28$, $p > .05$. Specifically, a Tukey test revealed a significant difference in the number of pain words recalled (immediate recall) between the control group ($M = 2.56$, $SD = 1.32$) and the chronic pain

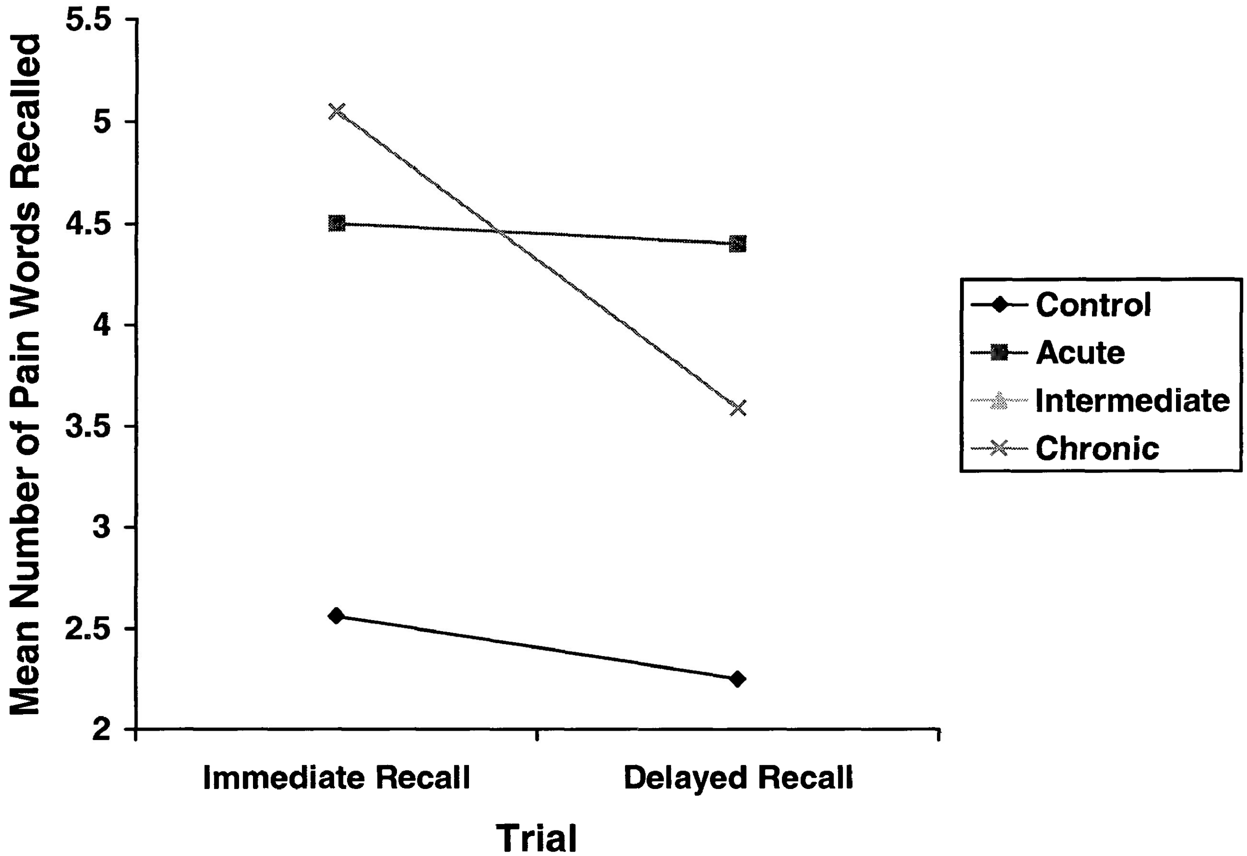

Figure 1. Group x trial interaction effect for number of pain words recalled. Time with pain (group) differentially affected recall. Both the chronic pain and intermediate pain groups show a significant decline in number of pain words recalled in the delayed recall task compared to other groups.

group (*M* = 5.05, *SD* = 3.30), $p < .05$. Paired samples *t* tests showed that the chronic pain group recalled significantly fewer pain words in the delayed recall task than in the immediate recall task $t(21) = 6.20$, $p < .001$. The intermediate pain group also recalled significantly fewer pain words in the delayed recall task than in the immediate recall task $t(18) = 2.31$, $p < .05$. Surprisingly, *t* tests failed to show a significant difference across trials in the number of pain words recalled by the acute pain and control groups. Although the chronic pain group recalled the largest mean number of pain words in the immediate recall task, both the chronic pain and intermediate pain groups show a significant decline in number of pain words recalled in the delayed recall task compared to other groups.

ANOVAs were also conducted on the percent of pain words recalled. A significant main effect for group was found, $F(3) = 3.53$, $p < .05$. Further examination of the data using Tukey's test revealed that there was a significant difference between the control group (*M* = 24.60, *SD* = 3.89) and both the intermediate pain group (*M* = 40.42, *SD* = 3.57) and the chronic pain group (*M* = 38.45, *SD* = 3.32) regarding percent of pain words recalled. The control group recalled a significantly smaller percentage of pain words than either the intermediate or chronic pain group. There was also a marginal level of significance found between the percent of pain words recalled by the control group (*M* = 24.60, *SD* = 15.57) and the percent of pain words recalled by the acute pain group (*M* = 36.53, *SD* = 15.56), $p = .06$. There were no other significant differences found between any of the other groups on percent of pain words recalled. The analyses did not reveal a significant effect for trial, $F(1) = .95$, $p > .05$. Also, there was no significant interaction effect between group and trial on the percent of pain words recalled, $F(3) = 1.17$, $p > .05$.

Since the above analyses failed to identify any significant differences across pain groups on any measure of pain bias, a follow-up analysis was conducted in order to explore the extent to which having pain of any duration affects recall of pain words relative to having no pain. The three pain groups were collapsed into one and compared to the control group using an independent samples *t* test. Results revealed that pain patients demonstrated greater evidence of bias towards pain-related adjectives than controls. In the immediate recall task, pain patients recalled significantly more pain words ($M = 4.45$, $SD = 2.77$) than controls ($M = 2.56$, $SD = 1.31$), $t(65) = 2.63$, $p < .05$, and a significantly greater percentage of pain words ($M = 40.28$, $SD = 17.13$) compared to controls ($M = 23.73$, $SD = 12.25$), $t(65) = 3.58$, $p < .01$. Similarly, in the delayed recall task, pain patients recalled significantly more pain words ($M = 3.55$, $SD = 2.42$) than controls ($M = 2.25$, $SD = 1.13$), $t(65) = 2.07$, $p < .05$, and a significantly greater percentage of pain words ($M = 37.33$, $SD = 18.02$) compared to controls ($M = 25.46$, $SD = 10.35$), $t(65) = 2.50$, $p < .05$.

A 4 x 2 chi square was computed for the immediate recall task comparing the frequency of pain-related commission errors between groups. The difference was found not to be significant, χ^2 (3, $N = 67$) = 2.84, $p > .05$. A 4 x 2 chi square was also computed for the delayed recall task comparing the frequency of pain-related commission errors between groups. A significant difference was found between the observed frequency of pain-related commission errors between groups and expected values, χ^2 (3, $N = 67$) = 8.15, $p < .05$.

In summary, results demonstrated a marginal difference in the number and a significant difference in the percentage of pain words recalled across groups, with the control group recalling fewer pain words and a significantly smaller percentage of pain words than each of the pain groups. However, there were no differences found across pain groups in the number or percentage of pain words recalled. Results also showed a significant difference in the number of pain-related commission errors made in the delayed recall task, with the chronic pain group making more pain-related commission errors than the other three groups.

Supplementary Analyses

The following analyses were undertaken in order to determine whether the approach used in our research design or possible confounds could have obfuscated any significant association between time with pain and dependent variables. Additional analyses examined the effect of age, memory, pain intensity, and group organization with respect to pain patients.

As presented above, the main analyses did not find significant differences in the recall of pain-related stimuli across groups of pain patients. Therefore, bivariate correlations were performed to explore whether the restriction of the grouping criteria may have concealed the effect of pain duration on recall of pain-related stimuli. Replacing the nominal variable *group* with the continuous variable *number of months with pain*, the association between pain duration and recall of pain-related stimuli was reassessed. The results of the analyses did not yield significant correlations between pain duration and mean number of pain words recalled, $r(51) = .01$, $p > .05$, or percentage of pain words recalled, $r(51) = .02$, $p > .05$, for the immediate recall task. Results from the delayed recall task also failed to demonstrate significant correlations between pain duration and either mean number of pain words recalled, $r(51) = -.13$, $p > .05$, or percentage of pain words recalled, $r(51) = -.11$, $p > .05$.

Next, partial correlation coefficients were computed between time with pain and measures of pain bias with age being partialled out. The correlations between time with pain and mean number of pain words recalled in the immediate recall task were not significant, $r(48) = .12$, $p > .05$. Similarly, the correlations between time with pain and the percent of pain words recalled in the immediate recall task were not significant, $r(48) = .10$, $p > .05$. Time with pain was not significantly correlated to the mean number of pain words recalled in the delayed recall task, $r(48) = .004$, $p > .05$, or to the percent of pain words recalled in the delayed recall task, $r(48) = -.05$, $p > .05$. Results failed to demonstrate an association between time with pain and measures of pain bias even when age was statistically controlled.

Partial correlations were also computed between time with pain and measures of pain bias with memory ability being partialled out. Participants' scaled scores on the Wechsler Memory Scale –III were used as measures of memory ability. The correlations between time with pain and mean number of pain words recalled in the immediate recall task were not significant, $r(48) = -.01$, $p > .05$. Similarly, the correlations between time with pain and the percent of pain words recalled in the immediate recall task were not significant, $r(48) = .03$, $p > .05$. No significant correlation was found between time with pain and the mean number of pain words recalled in the delayed recall task, $r(48) = -.16$, $p > .05$, or the percentage of pain words recalled in the delayed recall task, $r(48) = -.11$, $p > .05$. Results failed to demonstrate an association between time with pain and measures of pain bias even when memory was statistically controlled.

The next analysis explored whether pain intensity, rather than duration of pain, may have contributed to the observed findings. Self-reports of pain intensity from the Visual Analogue Scale were correlated with mean number and percentage of pain words recalled in the immediate and delayed recall tasks. Control participants were excluded from the analysis. Results failed to show a significant association between pain intensity and either number of pain words recalled, $r(51) = .05, p > .05$, or percentage of pain words recalled, $r(51) = .17, p > .05$ in the immediate recall task. Similarly, pain intensity was not found to correlate significantly with number of words recalled $r(51) = .03, p > .05$, or percentage of words recalled, $r(51) = .17, p > .05$, in the delayed recall task.

Finally, in order to explore the possibility that the proposed pain schema (as measured by bias towards pain-related stimuli) does develop over time, but may develop rapidly, the final analysis focused on the acute pain group. An additional correlational test was conducted comparing number of months with pain and recall of pain-related stimuli, but this time only responses from the acute pain group were considered. Results failed to demonstrate that recall of pain-related stimuli was correlated with time with pain. Number of months with pain was not associated with number of pain words recalled, $r(10) = .01, p > .05$, and percent of pain words recalled, $r(10) = -.39, p > .05$, in the first trial, or with number of pain words recalled, $r(10) = .03, p > .05$, and percent of pain words recalled, $r(10) = -.39, p > .05$, in the second trial.

Discussion

Summary of the Findings

Several main conclusions can be drawn from the results. First, individuals experiencing pain for any length of time appear to process pain-related information differently than individuals with no pain. Overall, participants currently experiencing pain recalled proportionately more pain-related adjectives than control participants. However, there were no differences found across pain groups in the number or percentage of pain words recalled. Interestingly, number of pain-related commission errors in the delayed recall did differ across groups, with the chronic pain group making the greatest number of commission errors.

Analyses examining the number of months with pain (rather than pain groups) also failed to show an association between pain duration and number or percentage of pain words recalled. These findings were present even after the effects of age and memory differences were removed. Controlling for the effect of memory was necessary, as research has revealed that the experience of pain significantly affects memory performance (Iezzi et al., 2004). Failing to find a significant effect of pain duration, we tested the effect of reported pain intensity on the mean number or percent of pain words recalled. Again, results failed to demonstrate a significant association. Finally, an attempt was made to examine the possibility that a pain schema does develop over time, but develops rapidly following the onset of pain. An examination of the acute pain group failed to provide evidence supporting this theory.

Discussion of Results

As previously stated, an attempt was made in the current investigation to replicate previous findings demonstrating an information processing bias in pain patients, and to offer a significant contribution to this area of research by also investigating the effect of varying durations of pain experienced. More specifically, we predicted that pain patients would demonstrate more cognitive bias towards pain-related stimuli compared to control participants. In addition, we hypothesized that the proportion of self-referent pain-related words would increase as a function of pain duration (group), with participants in the chronic pain group showing the greatest recall of pain-related stimuli. However, results failed to support the hypothesis. There was no significant difference found across the acute, intermediate, and chronic pain groups concerning the mean number or percent of pain words recalled. Nor were we able to establish a relationship between months with pain and the mean number or percent of pain words recalled.

These results are not consistent with the existing literature regarding the development of pain-related self-schemas in pain patients. In general, self-schemas result from the compilation of self-relevant information over time (Swallow & Kuiper, 1987). In particular, researchers have proposed that pain-related self-schemas require personal experience with pain over a prolonged period of time (Edwards & Pearce, 1994). Consequently, it would seem logical to assume that pain duration would have a significant effect on the development of cognitive biases (indicative of an underlying pain schema). Pain patient responses in the present study, however, failed to demonstrate the expected association.

One possible explanation for this discrepancy could be that information processing bias in pain patients is not directly related to time with pain, but rather to the intensity of pain experienced. In support of this notion, Pincus and Morley (2001) report that cognitive processes specific to pain patients appear to influence perceived pain intensity. This explanation, however, can be ruled out because the effect of self-reported pain intensity on number and percent of pain words was assessed in the present study and results did not show a significant association.

Although our results failed to provide evidence explaining the conditions required for the development of pain schemas (time with pain was not associated with schema strength), results clearly provide support for the existence of a pain-related self-schema in pain patients. Self-schemas influence information processing and promote greater memory accessibility of personally relevant (i.e., pain) information (Israeli & Stewart, 2001; Rojahn & Pettigrew, 1992; Swallow & Kuiper, 1987). As predicted, pain patients in the present study demonstrated more cognitive bias towards pain-related stimuli compared to control participants. This is consistent with earlier studies demonstrating schematic representations of pain on a variety of information processing tasks (Crombez et al., 2000; Edwards & Pearce, 1994; Pearce & Morley, 1989; Pincus et al., 1998; Pincus et al., 1994; Pincus et al., 1993).

For instance, Edwards and Pearce (1994) found that chronic pain patients responded with significantly more pain-related completions than the non-pain groups on a word completion task. Pearce and Morley (1989) also demonstrated an information processing bias in pain patients. Using the Stroop task paradigm, the authors found that pain patients were demonstrating attentional biases to pain words. Adding further support to the concept of a pain self-schema, Pincus and colleagues (1993) were able to confirm the notion that pain patients selectively recall more pain-related words than healthy controls on a recall task. Taken together, these studies indicate that pain patients demonstrate information processing biases. Specifically, pain patients demonstrate a tendency to favor information that is consistent with their schematic representation of pain. Thus, in the present study we were able to replicate previous findings demonstrating an information processing bias in pain patients indicative of a pain schema.

In short, results clearly provide evidence of a pain schema (as assessed by memory bias), but we are no further ahead with respect to how the pain schema develops. While we were able to find strong evidence of a pain schema measured in several ways (immediate and delayed recall, number and percent of pain words recalled), time with pain was not the factor influencing schema development.

Study Strengths

Overall, the design of the present study is quite sound. A particular strength of the methodology was the use of an experimental cognitive paradigm. As discussed previously, chronic pain is a highly subjective experience and assessments of pain patients are susceptible to response biases. Experimental cognitive paradigms are less subject to the many biases inherent in pain assessment measures (Israeli & Stewart, 2001). Furthermore, the assessment of information processing in pain patients is trying, as much cognitive activity occurs without conscious awareness (Edwards et al., 1992). Experimental cognitive paradigms help to increase understanding of cognitive biases in chronic pain by demonstrating the effect of biases on information processing without participants' awareness.

An additional strength of the present study was our focus on memory biases as measures of a pain schema. The literature suggests that recall tasks using pain-related stimuli encoded in reference to the self provide the best estimate of cognitive processing in pain patients. As previously discussed, earlier studies examining cognitive biases in pain patients have commonly focused on attentional biases. Attempts to demonstrate attentional biases have been inconsistent and largely unsuccessful. We contribute to the cognitive pain research by highlighting inconsistencies in the literature regarding pain-related attentional biases and extend the cognitive pain research by making use of memory biases to examine pain-related schemas.

Our study also capitalized on the use of pain duration and personal experience with pain to examine schema development and the impact of pain on information processing. The current study was the first of its kind to examine the effect of time with pain on pain-related cognitive biases with a clinical population. Although no significant differences between groups of varying pain durations were found, the present study highlights the need to examine further the process of schema development.

Study Limitations

Several limitations of the present study should also be noted. First, it may be argued that our sample was biased. We relied exclusively on volunteers. Characteristics of individuals who volunteer for experiments may differ to some extent from the general pain population, and thus, may influence the generalizability of our findings. For instance, participants were told it was a pain study and may have been unintentionally cued to look for pain words. This could have potentially increased the subjects' pain reporting because of a desire to comply with the perceived wishes of the experimenter. However, since no monetary reward was offered to participants, the impact of demand effects was likely minimal.

Secondly, schema organization and development may be influenced by other cognitive variables not assessed in the current study, for example, catastrophization and coping styles. Future studies should investigate the effect of chronic pain on information processing biases while controlling for the effects of these additional cognitive variables.

A third methodological limitation of the present study was the small sample sizes. Difficulty recruiting pain participants, especially for the acute pain group, resulted in less than optimal sample sizes. Difficulty recruiting pain participants also required us to employ a lenient grouping criterion. Stricter group selection criteria may have better controlled for potential confounds as well as overlap between groups.

Stricter selection criteria may have also provided a more uniform sample. On account of the small sample sizes, individuals with different clinical pain conditions were grouped together for evaluation. Research suggests that within each specific diagnosis, patients differ considerably in how they are affected by pain (Turk & Rudy, 1992) and how they respond to treatment (Turk & Okifuji, 1997). As previously mentioned, Griffith and colleagues (1996) found preliminary evidence indicating that patients with different pain disorders demonstrate different patterns of schematic processing. Therefore, future studies of cognitive biases in pain patients may require further clarification using homogeneous samples of pain diagnoses. However, since the present study was focused on chronic pain more generally, heterogeneous samples of pain patients were deemed appropriate. While each pain patient is unique, some common principles and developmental processes apply to all types of pain (Jovey, 2002). This is particularly relevant with respect to pain management, because pain management programs treat a variety of diagnoses. Therefore, an overall understanding of cognitive biases in pain patients may be more practical when applied to clinical setting.

Clinical Implications

As previously stated, earlier studies have demonstrated that cognitive processes appear to influence perceived pain intensity as well as the ability to manage pain (Turk & Okifuji, 1997; Turk & Rudy, 1992). It has been suggested that by modifying nocioceptive input, cognitive perceptions of the pain experience may in fact directly impact a physiological increase in pain (Jovey, 2002; Turk & Rudy, 1992). Consequently, it is imperative that research efforts continue to examine the cognitive processes underlying the pain experience. Although research has demonstrated repeatedly that pain patients selectively process pain related stimuli (Edwards & Pearce, 1994; Pincus et al., 1994), how these biases develop has yet to be determined. Researchers need to further explore the process of schema development in pain patients.

Prevention. The process of schema development in pain patients is important to explore further because the initial development of these pain-related cognitive schema may contribute to the transition from acute pain to chronic pain syndromes (Bayer, Coverdale, Chiang, & Bangs, 1998). In other words, better understanding the cognitive processes involved in schema development might help to reduce the prevalence of developing chronic pain.

Acute pain is one of the most common complaints heard in medical clinics today (Goldman, 2002) and is usually caused by identifiable tissue damage (Jovey, 2002). Acute pain is regarded as functional in that it serves as a warning to avoid activities that may cause further injury (Goldman, 2002). However, inadequate management of acute pain may have detrimental long-term consequences. Individuals with acute pain develop pain-related cognitive schema that lead to selective monitoring of pain-related stimuli.

These cognitive biases appear to perpetuate complaints of pain long after the initial injury and may contribute to the presentation of the maladaptive behaviours exhibited by chronic pain patients (Goldman, 2002; Turk & Okifuji, 2002; Turk & Rudy, 1992). Specifically, research suggests that somatic symptoms may occur as a result of pain-related cognitive schema (Bayer et al., 1998). A better understanding of the development of pain-related cognitive schema may permit improved management of acute pain and consequently help to prevent the development of chronic pain. An attempt was made in the present study to examine the development of the pain schema in acute pain patients, but findings failed to establish that acute pain patients have a cognitive bias towards pain-related stimuli. The failure to demonstrate evidence of a pain schema in acute pain patients may be partially due to an insufficient number of participants in the acute pain group.

Assessment. The findings from the present study also have implications for the assessment of pain patients. Adequate measures of pain schemas may help to identify individuals with chronic pain. Furthermore, the existence of a cognitive pain schema may be applied to clinical assessments to help to differentiate true chronic pain sufferers from malingerers. There is a need for more efficient and reliable methods of identifying malingering respondents in pain assessments. The importance of which is undeniable in light of the current restructuring in our health care system towards cost-efficiency. As previously stated, annual costs associated with pain in North America are estimated in the billions of dollars (Turk & Rudy, 1992). The pain schema needs to be further evaluated for its potential to improve pain patient assessment procedures. In particular, the use of pain schemas is a promising technique in the detection of malingering.

Treatment. Finally, schema theory may be relevant not only to the prevention and assessment of chronic pain, but also to treatment and pain management techniques. The existence of a pain-related cognitive schema lends support to the use of cognitive behavioral therapy (CBT) as treatment for chronic pain patients. There has been a growing recognition that patient beliefs, appraisals, and expectations are associated with pain perception. Specifically, pain patients tend to believe they have no control over their situation, have negative appraisals about their situation, and have negative expectations regarding their ability to cope (Turk & Rudy, 1992). These beliefs, appraisals, and expectations are all important components of a schema (Swallow & Kuiper, 1987) that are believed to contribute to the exacerbation of pain. Therefore, treatment efforts aimed at identifying and reducing the impact of individual schema components are promising. In CBT, there is interest in the patient's beliefs, appraisals, and expectations regarding his or her pain, as well as in the modification of theses maladaptive schema components (Jovey, 2002).

Although CBT has generally been found to be effective in reducing the negative cognitive processes associated with chronic pain, (Kerns, Turk, Holzman, & Rudy, 1986) the mechanisms of change have yet to be determined (Turk & Rudy, 1992). Knowledge of the development and organization of pain schemas may guide treatment design as well as the development of strategies for reducing the impact of chronic pain. Based on findings from the present study as well as previous studies demonstrating evidence of a cognitive pain schema, it is recommended that treatments focus on reducing the impact of pain schemas.

Directions for Future Research

Although there have been major strides in understanding the complex relationship between pain and cognitive variables, future research will help to clarify further the relationship. In particular, future research is needed to examine the organization of pain schemas over longer periods of time. Longitudinal research could further refine our understanding of how pain schemas develop and change over time. Studies incorporating more stringent grouping criteria than that used in the present study might also improve our understanding of pain schema development over time.

An attempt was made in the present study to examine pain schema development in the early stages of the pain experience. Results failed to expound the process of schema development in acute pain patients. Future research with a larger sample may be more effective in clarifying pain schema development in the early stages of the pain experience. As discussed previously, identifying and modifying maladaptive cognitive processes associated with acute pain may help in the prevention of chronic pain syndromes. Efforts to reduce the prevalence of chronic pain are becoming even more critical as the demographics of our population change. The prevalence of chronic pain problems increases with age (Jovey, 2002). Therefore, in an aging population, the need for more research aimed at prevention is clear.

Summary of Research

Similar to previous research, the present study examined cognitive biases in pain patients indicative of an underlying pain schema. However, our study extended the pain literature in making use of pain duration to examine the development and organization of the pain schema. Specifically, we hypothesized that patients who had suffered chronic pain syndromes the longest would demonstrate a greater recall bias toward pain-related stimuli consistent with schema theory predictions. We also predicted that pain patients would remember more pain words than controls. Predictions were based on the theory that pain patients develop a pain-related schema that generates biases in information processing.

Although we failed to provide an explanation of how pain schemas develop, the present study contributed to the pain literature by providing empirical evidence of a pain schema. We increased the robustness of pain research by replicating previous findings demonstrating a cognitive bias toward pain-related stimuli in pain patients.

Further examination of pain-related schemas in persons with chronic pain may be important in broadening our understanding of the pain experience. Relatively little research has tested schema theory predictions regarding enhanced memory for schema-congruent cues among pain patients. Research testing schema theory predictions may be relevant not only to understanding the pain experience, but also to reducing the incidence of chronic pain syndromes, improving assessment techniques, and advancing management strategies.

As with any field of scientific inquiry, our knowledge and understanding of chronic pain is an evolving process. The traditional biomedical view, Melzack and Wall's Gate Control theory, and Fordyce's operant theory of pain have all contributed significantly to the evolutionary process of pain research. The more recent shift in focus towards cognitive aspects of pain is essential in advancing knowledge of the experience of pain. The current study lends support for the importance of cognitive variables in understanding chronic pain, further advancing the evolutionary process of pain research.

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Appendix A

Consent Form

CONSENT FORM

This study is being conducted by Jenny Hewitt under the supervision of Dr. Dwight Mazmanian of the Department of Psychology at Lakehead University. The study will investigate aspects of a person's pain experience and assess his or her memory. The purpose of the study is to examine the association between pain and memory. Participants will be asked to complete a few brief questionnaires about pain experiences as well as several memory tasks, one of which will be presented on a computer. The session will take between 45 and 90 minutes of your time.

- Participation in this study is voluntary and you may withdraw at any time without explanation and without penalty.

- All information provided is anonymous and will be kept confidential.

- All information collected during the study will be number coded and any reports of this study will not identify you as a participant.

- In accordance with university policy, the data collected will be securely stored for seven years at Lakehead University and remain anonymous and confidential.

There are no known physical or psychological risks associated with participating in this study. The benefits of participating in this study include being a part of research that could advance knowledge about issues associated with pain as well as attaining an educational experience about pain.

I have read and understood the consent form, and I agree to participate in this study under these conditions.

Name (Please Print): ______________________________

Signed: ____

Date: ____

Appendix B

Pain Experiences Inventory- Patient Version

Pain Experiences Inventory - P

Please remember that all of the information you provide will be kept strictly confidential. Please answer the following questions as truthfully and accurately as possible.

Participant # ________ **Date ________________**

Age ________________ **Sex** **Male** ☐ **Female** ☐

Marital Status

- **Single** ☐
- **Married** ☐
- **Common-Law** ☐
- **Widow / Widower** ☐
- **Divorced** ☐
- **Separated** ☐

Education

Indicate the highest level of education that you have attained:

____

____

____

What is your present occupation? ____________________

____

Are you currently working? **Yes** ☐ **No** ☐

If the answer to the above question is "No", please explain: ______________________________

____

____

____

On what date did you receive your injury / injuries?

____

What type of injury / injuries do you have?

____

____

What is your current diagnosis (if known)?

____

What medication(s) are you currently taking (if any)?

____

How long have you been taking your current medication(s)? ______________________________

Do you have any other medical conditions? **Yes** ☐ **No** ☐

If your answer to the above question was "Yes", please explain: ______________________________

____

Do you have any psychological or emotional conditions? **Yes** ☐ **No** ☐

If your answer to the above question was "Yes", please describe: ______________________________

____

Thank you for your cooperation.

Appendix C

Pain Experiences Inventory – Control Version

Pain Experiences Inventory - C

Please remember that all of the information you provide will be kept strictly confidential. Please answer the following questions as truthfully and accurately as possible.

Participant # ________ **Date ________________**

Age ________________ **Sex** **Male** ☐ **Female** ☐

Marital Status

- **Single** ☐
- **Married** ☐
- **Common-Law** ☐
- **Widow / Widower** ☐
- **Divorced** ☐
- **Separated** ☐

Education

Indicate the highest level of education that you have attained:

____

____

____

What is your present occupation? ____________________

____

Are you currently working? **Yes** ☐ **No** ☐

If the answer to the above question is "No", please explain: ____

____

____

____

Are you currently, or have you in the past experienced pain related to an injury or illness which lasted three months or more? Yes ☐ No ☐

If your answer to the above question was "Yes", please describe: ______________________________

____

Are you currently taking any medication? Yes ☐
No ☐

If your answer to the above question was "Yes", please describe: ______________________________

____

Do you have any medical conditions? Yes ☐
No ☐

If your answer to the above question was "Yes", please explain: ______________________________

____

Do you have any psychological or emotional conditions?
Yes ☐
No ☐

If your answer to the above question was "Yes", please describe: ______________________________

____

Thank you for your cooperation.

Appendix D

Word List

WORD LIST

Pain		Food		Neutral	
Hot	Crushing	Eat	Appetite	Son	Crickets
Dull	Scalding	Cake	Tomatoes	Seek	Backbone
Sore	Tingling	Food	Doughnut	Copy	Builders
Taut	Smarting	Feed	Molasses	Spur	Thrilled
Numb	Stinging	Milk	Saucepan	Lamp	Bluebird
Cool	Wretched	Meat	Frosting	Flag	Clarinet
Cold	Blinding	Corn	Stuffing	Crib	Dinosaur
Sharp	Annoying	Sauce	Flavored	Frame	Stairway
Itchy	Piercing	Piece	Cherries	Paper	Hardware
Heavy	Freezing	Taste	Lemonade	Grass	Pavement
Cruel	Dreadful	Bread	Pastries	Cliff	Upstream
Tight	Horrible	Fruit	Mandarin	Slang	Archives
Boring	Quivering	Dinner	Breakfast	Cotton	Populated
Aching	Throbbing	Supper	Vegetable	Poetic	Bartender
Tender	Wrenching	Butter	Hamburger	Stormy	Signature
Tiring	Splitting	Hungry	Seasoning	Polite	Clubhouse
Pulsing	Sickening	Lobster	Delicious	Pianist	Blessings
Beating	Frightful	Cookies	Chocolate	Portion	Checklist
Jumping	Punishing	Chicken	Pepperoni	Chimney	Seniority
Cutting	Miserable	Mustard	Spaghetti	Feather	Signature
Gnawing	Spreading	Avocado	Nutrients	Novelty	Amazement
Tugging	Radiating	Seafood	Groceries	Rescued	Apologize
Pulling	Squeezing	Muffins	Pineapple	Rabbits	Ornaments
Burning	Agonizing	Pumpkin	Marinated	Eyebrow	Narration
Searing	Torturing	Blended	Microwave	Shampoo	Offspring
Hurting	Flickering	Toasted	Tablespoon	Massage	Photograph
Rasping	Lacerating	Vanilla	Restaurant	Costume	Earthquake
Fearful	Exhausting	Bananas	Strawberry	Volcano	Headlights
Vicious	Terrifying	Grilled	Appetizing	Tourist	Parenthood
Killing	Unbearable	Recipes	Grapefruit	Infancy	Flattering
Intense	Nauseating	Vinegar	Peppermint	Luggage	Observable
Drawing	Discomfort	Pudding	Shortening	Cousins	Simplicity
Tearing	Suffocating	Coconut	Ingredients	Pillows	Elimination
Nagging	Troublesome	Cabbage	Cauliflower	Scarlet	Millionaire
Pounding	Penetrating	Desserts	Nutritional	Elegance	Fingerprint
Flashing	Distressing	Broccoli	Scrumptious	Forehead	Candlelight
Shooting	Excruciating	Sandwich	Refrigerator	Scramble	Illustration
Pricking		Cocktail		Teachers	
Drilling		Potatoes		Downtown	
Stabbing		Crackers		Romantic	
Pinching		Barbecue		Landlord	
Pressing		Waitress		Princess	
Cramping		Beverage		Curtains	

Appendix E

Computer Instructions
Recall Task

You are going to see a list of words on the computer screen.

Each word will be presented to you for TWO seconds.

Please study the words carefully, as they will only be shown once.

Some of these words might relate to you, others may not.

If you have any questions, please ask the experimenter now.

Otherwise press the SPACEBAR to begin.

Appendix F

Standardized Recall Instructions
Immediate Recall

RECALL

PARTICIPANT #: ____ **GROUP #:** ____ **DATE:** ____

Please write down as many words as you can remember from the list presented to you on the computer screen:

____	____
____	____
____	____
____	____
____	____
____	____
____	____
____	____
____	____
____	____
____	____
____	____
____	____
____	____
____	____
____	____

Appendix G

Standardized Recall Instructions
Delayed Recall

RECALL – 2

PARTICIPANT #: ____ GROUP #: ____ DATE: ______

Please write down as many words as you can remember from the list presented to you earlier on the computer screen:

____________________	____________________
____________________	____________________
____________________	____________________
____________________	____________________
____________________	____________________
____________________	____________________
____________________	____________________
____________________	____________________
____________________	____________________
____________________	____________________
____________________	____________________
____________________	____________________
____________________	____________________
____________________	____________________
____________________	____________________
____________________	____________________

Appendix H

Likert-type Rating Scales for Pain Words

PARTICIPANT # ______ GROUP ____ DATE __________

Please rate the following words on how well they describe your personal pain experience:

1 = Does not describe my pain at all
7 = Completely describes my pain

Gnawing	1	2	3	4	5	6	7
Dull	1	2	3	4	5	6	7
Tender	1	2	3	4	5	6	7
Cutting	1	2	3	4	5	6	7
Exhausting	1	2	3	4	5	6	7
Penetrating	1	2	3	4	5	6	7
Fearful	1	2	3	4	5	6	7
Sharp	1	2	3	4	5	6	7
Lacerating	1	2	3	4	5	6	7
Radiating	1	2	3	4	5	6	7
Nagging	1	2	3	4	5	6	7
Tight	1	2	3	4	5	6	7
Flashing	1	2	3	4	5	6	7

1 = Does not describe my pain at all
7 = Completely describes my pain

Excruciating	1	2	3	4	5	6	7
Punishing	1	2	3	4	5	6	7
Tiring	1	2	3	4	5	6	7
Taut	1	2	3	4	5	6	7
Suffocating	1	2	3	4	5	6	7
Jumping	1	2	3	4	5	6	7
Unbearable	1	2	3	4	5	6	7
Hot	1	2	3	4	5	6	7
Tugging	1	2	3	4	5	6	7
Pulling	1	2	3	4	5	6	7
Burning	1	2	3	4	5	6	7
Searing	1	2	3	4	5	6	7
Hurting	1	2	3	4	5	6	7
Rasping	1	2	3	4	5	6	7
Cold	1	2	3	4	5	6	7
Boring	1	2	3	4	5	6	7

1 = Does not describe my pain at all
7 = Completely describes my pain

Vicious	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Killing	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Intense	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Drawing	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Tearing	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Cruel	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Pounding	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Shooting	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Pricking	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Drilling	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Throbbing	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Stabbing	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Pinching	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Pressing	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Cramping	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Crushing	**1**	**2**	**3**	**4**	**5**	**6**	**7**

1 = Does not describe my pain at all
7 = Completely describes my pain

Scalding	1	2	3	4	5	6	7
Tingling	1	2	3	4	5	6	7
Smarting	1	2	3	4	5	6	7
Stinging	1	2	3	4	5	6	7
Wretched	1	2	3	4	5	6	7
Blinding	1	2	3	4	5	6	7
Annoying	1	2	3	4	5	6	7
Piercing	1	2	3	4	5	6	7
Freezing	1	2	3	4	5	6	7
Sore	1	2	3	4	5	6	7
Dreadful	1	2	3	4	5	6	7
Horrible	1	2	3	4	5	6	7
Quivering	1	2	3	4	5	6	7
Wrenching	1	2	3	4	5	6	7
Splitting	1	2	3	4	5	6	7
Sickening	1	2	3	4	5	6	7

1 = Does not describe my pain at all
7 = Completely describes my pain

Cool	1	2	3	4	5	6	7
Frightful	1	2	3	4	5	6	7
Beating	1	2	3	4	5	6	7
Miserable	1	2	3	4	5	6	7
Spreading	1	2	3	4	5	6	7
Heavy	1	2	3	4	5	6	7
Squeezing	1	2	3	4	5	6	7
Agonizing	1	2	3	4	5	6	7
Torturing	1	2	3	4	5	6	7
Flickering	1	2	3	4	5	6	7
Itchy	1	2	3	4	5	6	7
Numb	1	2	3	4	5	6	7
Terrifying	1	2	3	4	5	6	7
Nauseating	1	2	3	4	5	6	7
Discomfort	1	2	3	4	5	6	7
Troublesome	1	2	3	4	5	6	7

1 = Does not describe my pain at all
7 = Completely describes my pain

Distressing	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Aching	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Pulsing	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Appendix I

Debriefing Form

DEBRIEFING FORM

Thank you for participating in this study. The purpose of the present study was to investigate aspects of a person's pain experience and assess his or her memory. Specifically, we were interested in how a person's pain experience influences information processing. In this study it is hypothesized that participants who have suffered pain the longest will demonstrate a greater recall bias toward pain-related stimuli. In other words, participants who have suffered pain the longest will recall more words related to pain compared to participants who have suffered pain for a shorter time. The principle researchers are Jenny Hewitt, Masters of Arts student in Clinical Psychology at Lakehead University and Dr. Dwight Mazmanian, Associate Professor, Department of Psychology, Lakehead University.

If you would like a brief summary of the results you may obtain them by printing your name and permanent mailing address on the address form. Results will not likely be available before August 2004. If you have any questions or concerns regarding this study please contact Jenny Hewitt or Dr. Dwight Mazmanian of the Department of Psychology at Lakehead University (see below for contact information).

If participating in this study or completing the questionnaires has distressed you or has raised personal issues that you would like to discuss, or if you just need someone to talk to, the following organizations are available: L.U. Health and Counseling Center (807-343-8361), Peer Support Line (807-343-8255), and Chaplain (807-343-8018). Thank you very much.

If you have Internet access and would like to learn more about pain, please visit the following website:

http://www.cpa.ca/factsheets/chronic_pain.htm

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