A PSYCHOLOGICAL INVESTIGATION OF PAIN PROCESSING

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Abstract

This thesis investigates levels of pain processing (perceptual-motor, schematic and conceptual), following Leventhal and Everhart's (1979, 1984) parallel processing model of pain. The social context (family environment) within which pain occurs was also investigated.

At the perceptual-motor processing level, chronic and acute pain patients were studied using a pharmacological manipulation. Morphine significantly reduced sensory and affective ratings in acute pain, but only affective ratings in chronic pain, indicating that different mechanisms are involved in pain intensity and affect.

At the schematic level, the impact of pain experience was examined in different pain and control populations, and age groups. Memory tasks were used to study priming and elaboration, and processing time was used to assess encoding of pain related information. High pain frequency subjects showed a weak recall bias towards pain related information encoded in self-reference, faster processing of sensory words and a response bias. Children suffering from arthritis exhibited both a memory bias towards sensory information encoded in self-reference and faster encoding, when compared to a control group. Relatives of pain patients did not exhibit an implicit memory bias for pain words.

The results suggest that chronic pain can induce "cognitive" as well as physiological sensitisation irrespective of the biological age of the pain patients, and that personal pain experience is necessary for cognitive biases to develop.

Conceptual processing was also investigated. Chronic pain patients were characterised by higher organic beliefs compared to the controls, but no differences were found between high and low pain frequency subjects or between relatives of pain patients and control groups.

The role of gender and family environment in pain experience and report were also explored. A survey of current pain symptoms and family history of pain and illnesses in a student population showed that young women reported significantly more pain models than men. An investigation of family environment and psychological adjustment in frequent and chronic pain, showed no differences in family functions, anxiety and depression measures between high and low pain frequency subjects, and between families with and without a child suffering from pain.
At the request of the Examiners the following corrections and additions have been made:

CORRECTIONS:-

Acknowledgements para 3 line 2 for "Allistair" read "Alastair"
Page 31 para 4 line 4 for "Gotlip" read "Gotlib"
Page 56 para 1 line 4 for "primary" read "primacy"
Page 56 para 2 line 1 for "english" read "English"
Page 75 para 4 line 8 for "Unrue" read "Unruh"
Page 77 para 1 line 4 for "Unrue" read "Unruh"
Page 89 para 3 line 4 for "indicated with" read "indicated that the group with"
Page 173 para 2 line 1 for "no" read "not"
Page 188 para 1 line 16 for "belief" read "beliefs"
Page 189 para 1 line 5 for "Unrue" read "Unruh"
Page 189 para 4 line 5 for "characteristic" read "characteristic"
Page 194 para 1 line 3 for "use disorder" read "use of disorder"
Page 203 9th reference for "Gotlip" read "Gotlib"
Page 227 para 1 line 3 for "persistent" read "persistent"

ADDITIONS:-

Page 17 Figure 1.1 Elaboration of the parallel processing model as presented in Leventhal & Everhart (1979)
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Chapter 1

Introduction

1.1 The Pain Phenomenon and Theories of Pain Experience

Nowadays, there is a general agreement among experts upon the multidimensional nature of pain experience although this results in difficulties in achieving a unanimous accepted definition of the phenomenon. Merskey et al. (1986) define pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage".

This definition reflects the fact that it is not always possible for medical experts to identify physiological factors which can be held responsible for the pain experience, as well as the contribution of affect and emotion to the resulting appraisal of it. The highly subjective quality of pain renders its investigation difficult in terms of objective measurements and scientists are forced to rely mostly upon self-reports of the experience which can be affected by factors other than the extent of tissue damage or pathology (e.g., individual differences, cultural background). Language and behaviour are almost the only agents that can communicate the quality, the intensity and the psychological impact of pain (in some cases measurements of physiological arousal can be used as indicators of pain impact but these data are rarely available to clinicians at the time of the assessment).

The existence of a body of evidence indicating that serious injury can be sustained without being accompanied by pain, as in cases of soldiers wounded, or even with limbs amputated in battles (Beecher, 1959), in cases of congenital analgesia (Sternbach, 1968), or investigations of patients at hospital emergency departments (Melzack et al. 1982), challenges the previous assumption that the extent of injury in the body is reflected in the intensity of pain experienced. Furthermore, pain can be present and intense in cases where no identifiable physical pathology can be detected, as in tension headaches
(Olesen, 1986), or even long after healing is completed, as shown in studies of low back pain (Loeser, 1980), or branchial plexus avulsion (Parry, 1980). It seems that there is a variable link between injury and pain and that its protective, survival functions in preventing further injury or setting limits in activity to allow for recovery can not always be used to explain either its presence or persistence.

The central theories proposed to date to account for the pain phenomenon and some of the evidence on which they are based will be presented briefly. Firstly, those founded in neurophysiology, starting with an outline of the Specificity Theory, which cannot adequately account for all findings, followed by the Gate Control Theory, which is currently accepted, and the Parallel Processing Model of Pain Distress, which elaborates further its neurophysiological findings. This is followed by a consideration of socio-environmental factors which may influence pain experience and includes an outline of the Psychosocial Model of Pain Experience which attempts to incorporate in a unified account how physiological, cognitive and emotional factors in chronic pain experience are affected by social processes. There is then a discussion of cognitive factors involved in the experience of pain, and finally the scope and objectives of the thesis are outlined.
1.2 Neurophysiological Accounts of Pain

1.2.1 The Specificity Theory

The main interpretation of pain under this pioneering theory is based on the concept that disease is an abnormality in the function or structure of body organs and systems, and that pain is a symptom of a biological disease process. Descartes in 1664, suggested that messages from pain receptors in the skin are carried to a pain centre in the brain. A number of recent investigations (reviewed by Rose and Mountcastle 1959; Sinclair 1982) have confirmed the existence of a one-to-one relationship between receptor type, fibre size and quality of sensory experience (cold, warmth, touch and pain) suggesting that for each fibre there is a distinct pathway to a specific centre in the brain and Keele (1957) identified a "pain pathway" in the spinal cord, the spinothalamic tract, which is essential for pain sensation.

The concept of physiological specialisation of skin receptors has thus survived the passage of time. In contrast, the main assumption inherent in specificity theory, that there is a direct connection from a receptor to a brain centre where pain is felt, so that stimulation of the receptor always elicits pain, and only the sensation of pain, is largely disputed (Melzack and Wall, 1988).

1.2.2 The Gate Control Theory

In an attempt to explain phenomena in which pain experience is not closely related to levels of tissue damage, such as phantom limb pain and chronic pain, which cause problems for the specificity theory, Melzack and Wall (1965) formulated the Gate Control theory. They based their theory mainly on neurophysiological investigations and a comprehensive account can be found in Melzack and Wall (1988).

According to Gate Control theory, multiple influences are considered to affect pain experience and its authors explicitly implicated non-biological, psychological factors as playing a key role in pain perception. They suggested that a neural mechanism in the dorsal horns of the spinal cord acts as a "gate" to increase or decrease the flow of impulses along different neurones. This mechanism is able to operate at a pre-conscious level, before pain is perceived or responded to. Peripheral nerve fibres A-delta and C, which facilitate transmission of noxious signals by opening the gate, are stimulated by a variety of signals and deliver impulses to spinal cord transmission (T) cells, which in turn transmit to local reflex circuits and to the brain. Cells comprising the substantia gelatinosa in the spinal cord appear to be responsible for modulating the input from peripheral fibres to spinal cord transmission (T) cells. The T cells receive inhibitory influences from large afferent fibres, the A-alpha fibres. Impulses descending from the
brainstem and the cortex also strongly influence the excitability of transmission (T) cells. It is thought that pain-releasing impulses from the periphery can be blocked at the gate as a result of descending (efferent) impulses originating from higher centre activity related to attention, emotion, memories of past pain experiences, and even pain from other parts of the body (Harris, 1981). The theory proposes the existence of:

a) a Central Control Trigger, a system of large diameter, fast conducting fibres (the A-alpha fibres) which activate selective cognitive processes.

b) a Central Action System, composed by the neural areas underlying the characteristic behaviours and experience that comprise the pain phenomenon, which is activated when the output of the T cells exceeds a critical level.

c) The message transmitted towards the brain thus does not simply convey the existence of nerve impulses in injury detection fibres, but is dependent for its strength on activity in other afferents and on activity in descending pathways. There is no evidence for the existence of a one-to-one relation between receptors and a "pain" centre in the brain. Several parallel systems react and analyse simultaneously the input from an apparent injury, and pain sensation is only triggered if the gate is appropriately set.

d) Gate control theory is compatible with the view that pain, like other sensations, can be characterised in terms of two major dimensions: a) the perception of pain sensation which is related to the intensity, location and duration of the painful stimulus and b) the emotional-evaluative reaction to it, which is dependent on psychological factors like anxiety, expectations, and purely cognitive functions like memory and attention. Some receptors are specialised to select sensory discriminative information while other systems play specialised roles in the motivational/affective dimension of pain (Melzack and Wall, 1988).

1.2.3 A Parallel Processing Model of Pain Distress

A more detailed model of the cognitive and emotional processing of pain distress was developed by Leventhal and Everhart in 1979. Supporting the existence of the gate system, they attempted to investigate the informational and emotional systems in the further processing of pain signals once they leave the gate system. They distinguished between three different levels of pain processing, which are arranged in a hierarchical structure, and specified a constant interaction among them. The three levels are:

a) perceptual motor processing, which is the innate, lowest level of processing and operates without volitional control. It generates outputs related to features like location, duration and sensory attributes of the noxious stimulation, as well as an emotional response to it, such as distress.
b) schematic or categorical processing, which is a representation of the visual, auditory and somesthetic events associated with the stimulus. Schemata of past pain events constitute memory structures which can influence the processing of current events and are activated automatically. They also act as attention selectors influencing which stimuli will be processed (selective attention) and determining which material will enter focal awareness. Evidence supporting the functions of the schematic level is presented in the model from research into phantom limb pain, hypnosis, attention, sensory information processing, and pain distress.

c) conceptual processing, the highest level of processing and the only one which is under volitional control, is based on the capacity to draw propositional conclusions about two or more emotional episodes. It includes the individual's conceptualisation of pain distress experiences, and it involves the activation of beliefs about causes and consequences of pain distress. These beliefs are important because they can affect the social behaviour of the individuals and their reaction to various expressive and verbal responses to their pain-distress experience, including appraisal and reaction to therapeutic interventions, as well as their adjustment and coping with chronic pain.

The authors emphasise that all three systems are simultaneously active and enrich the pain distress experience. This model is consistent with the principles of the information processing paradigm in psychology, the main concepts of which will be presented later.

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**Figure 1.1** Elaboration of the parallel processing model as presented in Leventhal & Everhart (1979).
The authors suggest, on the basis of neurological evidence, that the perceptual experience of pain is generated by three types of pathways. The first is purely informational. The second generates information mostly about bright, pricking pain and some emotional response. The third is the most clearly emotional-motivational path which seems to produce a generalised arousal state and a specific emotional response such as distress.

Once an individual becomes aware of pain, the noxious stimulus will retrieve and be integrated with schematic memory of earlier pain experiences. It is suggested that the individual forms a schema, or categorical structure that represents the informational and pain-emotion aspects of these experiences. Schemata are critical in the selective blending of primary perceptual motor reactions for the formation of new emotional experiences. Since emotional processing is highly sensitive to interpersonal stimuli and pain is usually experienced in a diverse range of interpersonal situations, each person's schematic system for pain is likely to be complex and to have unique subjective features. Extended painful episodes incorporate a variety of contextual stimuli generated by other people's activities in reacting to one's pain. It was suggested that the notion of schemata needs to be expanded in order to capture the temporal and social extensions that occur in real-life pain experience.

Conceptual processing involves the activation of beliefs about pain-distress. These beliefs will contribute to the pain-distress experience by leading to subsequent behaviors (e.g., reactions to others, shifts in attention) which may then alter perceptual-motor and schematic processing. Some patterns of beliefs may facilitate adaptation to pain-distress while others may inhibit effective coping with painful conditions and/or chronic pain, although there is not enough information available on the exact nature and function of this system.
1.3 Socio-Environmental Factors Influencing Pain Experience

1.3.1 Social Cultural Influences

Several authors have specifically noted the importance of sociocultural factors in beliefs about, and responses to pain (e.g., Bates, Edwards & Anderson, 1993; Zborowski, 1969). The following section does not aim to be exhaustive, but rather indicative of the important findings in this area.

Evidence suggests that most people have a common sensation threshold. Tursky in 1965 for example, found no differences in the level of shock that was first reported as producing a detectable sensation among Americans of Italian, Jewish, Irish, and Old American origin. Ethnic group membership nevertheless, does influence how one perceives, labels, responds to, and communicates pain sensations. In one of the most extreme accounts Kosambi (1967), reported a ritual taking place annually in India where a man is suspended by hooks inserted under the skin of his back, and because his role is to bless the children and crops, he seems to be in a painless condition. The latter is often described as being a product of an "exaltation state", and similar phenomena have been reported in other cultures (e.g., in East Africa, during skull trepanation).

Cross-cultural differences also have been reported in the literature in pain detection thresholds. Hardy et al. in 1952, found that levels of radiant heat that are reported as painful by people of Mediterranean origin (such as Italian and Jews) are described merely as warmth by Northern Europeans. Clark and Clark in 1980, investigated pain perception thresholds of Nepalese porters in comparison to occidental visitors and the former were found much more stoical, requiring much higher intensities of electric shock before they labelled them as painful than the latter, whilst both of them were equally sensitive to changes in electric shock.

Differences in pain tolerance levels were also found to occur, at least partially, due to a cultural background effect. Sternbach and Tursky (1965) reported in an American sample that women of Italian origin tolerated less shock than women of Old American or Jewish origin. Lambert et al. (1960) found that women of Jewish origin when compared to Protestant ones, increased their tolerance levels after they were told that their religious group tolerated pain more poorly than others. Analogous effects were observed by Zborowski (1952) and were explained in terms of differences in attitudes and beliefs about pain and pain expression rather than differences in pain sensations themselves. Following a similar line, Craig and Prkachin (1978) tested women exposed to tolerant and intolerant social models using electric shocks and measured psychophysiological indices of pain response (e.g., heart rate, palmar skin conductance) as well as verbal descriptions. They found that changes in pain indices associated with exposure to a
tolerant model reflected variations in fundamental characteristics of the painful experiences such as nonpalmar skin potential and heart rate reactivity as opposed to suppression of information.

The interplay between social and biological influences becomes apparent when gender differences in the experience and report of pain are also taken into account. Women tend to suffer from more non-fatal chronic pain conditions than men (Verbrugge, 1985) and seek more medical care than men. As the relationship between gender and pain is specifically addressed in Chapter 3, the available evidence in the literature will be reviewed in more detail there. However, it is worth noting here, Unruh's (1996) conclusion in a recent major review of evidence on gender variations in clinical pain experience that women may be more vulnerable than men to unwarranted psychogenic attributions by health care providers, and are in fact more likely than men to experience actual recurrent pains. On the basis of the review Unruh suggests that both biological mechanisms, and psychosocial factors should be studied further, to explain differences in the experience and the meaning of pain between sexes.

The above findings have major implications in our understanding of pain insofar as it is identified and measured mostly by the observation of expressive behaviour and language usage, which can be biased by sociocultural, environmental, cognitive, situational, and personality factors. All of the latter may contribute to the interpretation and labelling of an actual pain sensation and can be broadly characterised under the term "psychological factors".

1.3.2 Family Influences in Pain Experience

It has been suggested with some justification, that the family plays a key role in the transmission of sociocultural influences on pain, as well as in the development of pain language, at least in their earliest representation and formulation in an individual (Fabrega and Tyma, 1976). Family membership has been proposed to act in several plausible ways, influencing conceptualisation, learning and interpretation of painful experience (Turk et al. 1987). In chronic pain conditions, the role of family in the aetiology, maintenance and exacerbation of chronic pain has been investigated and evidence for the importance of the family in the health of its members has been generally forthcoming (Litman 1974, Hulka et al. 1972, Reiss, 1982). Its influence also exists in the way that the individuals define their symptoms (Turk et al. 1985). The question that arises is why, and in what way does the family exert its influence, what mechanisms are involved and how they operate.
This next three sections provide brief reviews of the main findings in this area of research covering the different theoretical approaches (psychodynamic, cognitive-behavioural, and systemic) to the subject.

1.3.3 Psychodynamic Theories

From the psychodynamic point of view the evidence of high incidence of pain complaints in families has been interpreted as an indicator of a specific "pain prone" personality type. Engel (1959) in an influential paper proposed that the presence of pain in a pain prone individual often does not require peripheral stimulation, arguing that pain may become an important means of regulating the individual's psyche. The pain prone patient was characterised by him as having a family history of aggressive and hostile relationships, developing pain upon a (threatened) loss, showing a prominence of guilt, aggression, and having a history of suffering and defeat. In this context, the pain symptom symbolises the somatic expression of unresolved conflict. He illustrated his theory with several case studies but neither control methods nor quantitative evidence were presented in support.

Blumer and Heilbronn (1982), following this line of research, referred to chronic pain as a variant of depressive disease, suggesting that a substantial number of pain patients may develop a pain problem because of family characteristics that include depression, alcoholism, spouse abuse, and family members suffering from pain and other dehabilitating physical problems. They presented data indicating that 63% of their chronic pain patients had a family member or close friend with physical handicap or deformity. Adler et al. (1989) examined patterns of developmental psychosocial experiences among groups of patients suffering from: "psychogenic" pain, organic pain, psychogenic bodily symptoms, and organic disease. Compared to the other groups, they found for "psychogenic" pain patients significantly increased parental abuse, deflected aggression and an elevated family history of pain symptoms/illnesses. More recently Gamsa & Vikis-Freibergs (1991), tested in a controlled study the "pain prone" profile, questioning the assumptions that pain patients are a psychologically homogeneous group and that a relationship exists between pain and life events predating pain onset. A chronic pain group in multiple settings and control subjects were tested on 20 psychological variables. Only "less emotional repression" and greater "ergomania" (excessive work) were consistently associated with pain. Pain patients however, were found again to be more likely to have had a relative with chronic pain.
1.3.4 Learning Theories

1.3.4.1 Early Learning

One of the main theoretical accounts in the subject has emerged from the learning approach. The fact that parents and children share the same language extends to the language for illness and pain (Campbell, 1978). Craig (1980) noted that in a child, words for pain are amongst the first learned, although young children have few words available to describe personal emotional states. In cases where a lack of differentiation between bodily sensations and emotional feelings occurs in parents, particularly where there is a confusion between pain and suffering, then it is very likely that they will teach their children this misnaming, who will in turn be unable to differentiate between emotional and physical problems (Violon, 1985). No direct testing of this theory appears to have been carried out, however.

Animal studies have shown that early learning may influence subsequent pain perception. Melzack and Scott (1957) reported that Scottish Terriers raised in isolation cages were remarkably insensitive to painful stimuli, whilst monkeys raised in isolation showed an inability to learn from painful experiences such as fighting with older monkeys (Lichstein and Sackett, 1971). Similarly in humans, studies deriving from psychodynamic theory (Engels, 1959; Blumer and Heilbronn, 1982) report high levels of abuse and deprivation in families of pain patients, indicating a plausible relation between early experiences of this sort and the development either of a "pain-prone" personality or of hypersensitivity to nociceptive stimuli in later life. More specifically, a study of kittens that were exposed to pain stimuli (Morpurgo et al. 1983) provided evidence that the brain of these kittens showed much larger representations of the affected body part in the thalamus and cortex, which may suggest a physiological account for the previous observations in humans.

1.3.4.2 Social Modelling

Craig (1978, 1980; Craig and Prkachin, 1980) offers another explanation for the high incidence of chronic pain occurring within some families, advocating the social modelling perspective (i.e. learning occurs through imitation). In a number of laboratory studies, Craig and collaborators showed the importance of observational factors in the perception of, and coping with, painful stimulation. Compared to those exposed to intolerant models, experimental subjects exposed to tolerant models reported lower levels of pain and displayed higher pain tolerance in experimental pain induction studies using electric shock stimulation assessed by verbal reports as well as psychophysiological indices. Supporting predictions derived from social modelling theory, Christensen and Mortensen (1975) compared children whose parents suffered from abdominal symptoms as adults...
with children whose parents had no abdominal complaints. They found that the former were very likely to have the same pain symptoms as those currently being reported by their parents, but were less likely to have the same pain symptoms their parents had as children. In addition, abdominal pain was significantly more frequent in children whose parents had abdominal complaints than in the control group.

1.3.4.3 Operant Conditioning

An alternative approach to pain occurrence in families comes from a behavioural perspective via an operant conditioning model. According to this model, an emphasis is placed in the role of contingent reinforcement in the development of a chronic pain problem. The main assumption of this account is that pain behaviours (e.g., moaning, limping, sighing) like other behaviours solicit attention from the environment and can be strengthened or extinguished depending upon the environmental response (Fordyce, 1976, 1978). These pain behaviours may be maintained by sympathetic responses from the spouse and significant others and can lead to avoidance of undesirable activities such as work and household duties. They may function as a major source of reinforcement if there is a lack of reinforcement from other sources. Fordyce et al. (1973) showed that "well behaviour" (e.g., physical activity) increased, and pain behaviour (e.g., medication use) decreased when attention was withdrawn from pain behaviours and "well behaviours" were reinforced. Block, Kremer and Gaylor (1980) demonstrated that the spouse may not only be an important reinforcer but also an important discriminative stimulus for pain behaviour in the patient. They showed that if the observers were solicitous spouses the pain patients reported higher pain levels as compared to a neutral observer condition (ward clerks). Conversely, the pain patients with nonsolicitous spouses reported higher pain levels when the ward clerks were present than when observed by their spouses. Flor, Kerns & Turk (1987) showed that patients' perception of spouses responses significantly predicted pain intensity and activity levels, with patients having solicitous spouses reporting greater pain and reduced activity levels. They also noted a positive correlation between reports of pain intensity and marital satisfaction of pain patients, which was to a large extent explained by the positive association between spouse solicitousness and marital satisfaction.

This approach to chronic pain fails to account for the reciprocal relationship that exists between behaviour and important cognitive components such as life events, goals, expectations of family members about family functioning and roles. In addition, the inclusion only of the spouse might not be adequate as all family members can function as significant others. Also, there might be a difference between objective behavioural observation and its cognitive interpretation. Flor, Kerns & Turk (1987) found that it is
the patients' perception of solicitous or punishing responses rather than what the spouses say or they actually do, that is more closely related to the patient's self-reported pain and activity levels. On the other hand, the operationalization of the relevant constructs such as reinforcement of pain behaviours is a considerable strength of this perspective.

Some recent research has addressed the impact of pain on the health and psychological adjustment of spouses of chronic pain patients. The pain patient's behaviour can equally be seen to act as a reinforcer for particular behaviours from the spouse, and to cause particular emotional reactions. Rowat and Knafl (1985) examined spouses' perception of patients' pain and its impact on their own health using an exploratory descriptive design. They assessed 40 spouses of pain patients via semi-structured interviews and the McGill Pain Questionnaire (Hopelessness Scale) and studied the relationship between patients' and spouses' own pain ratings using the McGill Pain rating index. They found that 69% of spouses complained about the negative impact of their partner's pain in their own emotional status (sadness, nervousness, irritability), 23% of them had physical complaints and 8% complained also about deterioration in their social health (homebound, feeling alone). There was also a significant positive although moderate correlation between patients' and spouses' perception of patient's pain ($r = 0.32, p < 0.05$).

Flor, Turk & Scholz (1987) investigated effects of chronic pain on marital satisfaction and spouses' emotional and physical health by comparing 58 chronic pain patients and their spouses to diabetic patients and their spouses. Spouses of chronic pain patients reported significantly more pain symptoms than spouses of diabetics, and this was also related to higher depression levels. Spouses' negative mood was associated with patients' dysphoria about the pain, their own perception of lack of life control and marital dissatisfaction. Changes in marital and sexual satisfaction due to pain were also found, and higher pain levels were reported by patients who had more solicitous and maritally satisfied spouses.

Flor, Turk & Rudy (1989) viewed significant others of pain patients as reinforcing agents of pain behaviour and investigated the roles of marital satisfaction, marital status and gender in pain impact. They studied 185 male and female patients and their significant others using the Multidimensional Pain Inventory (MPI) and the Locke-Wallace Marital Adjustment Scale (MAS). They found that there was a gender difference in the impact of pain in that a moderately strong association between pain impact and positive responses by spouses was observed only for the married sample of the male patients. The opposite pattern was found for female patients where there was a positive association between pain impact and solicitousness only for the unmarried sample. Marital satisfaction was
associated with higher significant-other responses and pain impact levels irrespective of patients' gender.

Ahern, Adams & Follick (1985) investigated emotional and marital disturbance in 117 couples of chronic low-back pain patients using the Multiphasic Personality Inventory, and the MAS. They found that 20% of spouses were clinically depressed and 35% of marriages were maladjusted. Again, spouses' emotional distress was related to patients' emotional distress and spouses' marital adjustment was related to patients' levels of social interaction deficits.

Mohamed, Weisz & Waring (1978) performed one of the first studies investigating the relationship between chronic pain, depression, marital adjustment and family dynamics. They compared a group of depressed chronic-pain patients to a matched group of depressed patients and found a previous history of pain symptoms for the pain patients and their spouses, as well as a consistency among patients, spouses and their families on pain locations.

Therefore, negative psychological effects have been observed for both patients and their spouses in relation to pain. Some research investigating the effects of pain in childhood in children in pain and their families will be reviewed in Chapter 6, and evidence on what the effects of chronic pain in a parent are in children's psychological adjustment will be presented in Chapter 7 since the aims in those studies of the thesis are to investigate cognitive and familial factors in childhood pain experience.

1.3.4.4 Learning Theories and Pain Management

From the above it is evident that different theoretical emphasis is placed in the significance of early learning or social modelling in shaping pain experience, and on the effects of reinforcement of pain behaviour in the aetiology and maintenance of pain conditions. In practice however, all learning theory based approaches have a common thread when management of chronic pain is required: Non-pain behaviour is rewarded while pain behaviour is ignored, and more adaptive coping responses to pain are learned to replace the unhelpful ones (Pearce & Erskine, 1989). In addition, the involvement of significant others, especially the spouse, in the patients' pain management has been reported recently to produce encouraging results (Keefe, 1996).

1.3.5 Family Systems Theory

While the behavioural approaches focus on the individual with the problem and take into account mainly the spouse's contribution to the problem, family systems theories view
the family as a system of relationships with the functioning of each member depending on
the functioning of the other members (Jackson, 1957). This system has a tendency
toward homeostasis and any symptom that develops in the family context is considered
as serving a stabilising role in the familial system (for a detailed review see Gurman and
Kniskern, 1981). Symptoms are thus viewed with regard to their functional role in the
family system. Many of the relevant models emphasise the unresolved childhood
problems of individual family members and claim that these problems are resolved by
engaging another family member in the sick role. The most prominent theorists (Bowen,
1966; Framo, 1970; Grolnick, 1972; Jackson, 1957; Meissner, 1966 and Reiss, 1982)
refer to a number of constructs, such as, "undifferentiated self", "object-related needs",
"undesirable mutuality", and "projective identification", that are difficult to
operationalize, making empirical evaluation of these models very hard. Overall, despite
the extensive theorising, there have been few attempts to test these concepts empirically.
Usually no control groups are used, small sample sizes are tested, and most evidence is
based on anecdotal reports. It is, therefore, difficult to draw definite conclusions, though
some insight can be gained from the relevant literature.

Minuchin et al. (1975, 1978), for example, in a controlled trial, described family
interaction patterns comparing families of well, and poorly controlled diabetic children.
As expected from his model of "psychosomatic families", the families of the poorly
controlled children showed more enmeshment (excessive "togetherness" in the family),
rigidity (a resistance in the family towards change), and less parental conflict. The
interpretation being that the presence of an uncontrolled diabetic child serves to increase
family cohesion and reduce or divert parental conflict. They also measured three fatty
acids as an indication of stress and found that when the ill child was present throughout a
parental conflict, an increase in the release of the fatty acids occurred for both parties.
However, when the child was brought from outside into a similar conflict situation, the
parents became relaxed but the child's fatty acids increased further. The authors
emphasize the paradox that the apparent resolution of the conflict by the arrival of the
child may increase the child's health risk. Similar but anecdotal data were presented by
Liebman et al. (1976) in children suffering from chronic pain.

Patterson and McCubbin (1983) tested whether family stressors (e.g., important
decisions, family finances) contribute to the exacerbation of symptoms in children with
cystic fibrosis. They suggested that this relationship exists, but as they assessed the
presence of these symptoms only at one point in time, and their assessment instrument
included a health category (a possible overlap may exist between dependent and
independent variables) they can not infer causal mechanisms. Feuerstein et al. (1985),
tested the impact of family and work environment stressors on pain experience
comparing a group of low back pain patients and a matched control group. They found
greater family conflict, family control and social stress for the patients group. However, greater numbers of family conflicts were associated with higher affective pain ratings, and increased family organisation was related to higher evaluative pain ratings. These findings contradict predictions derived from the family systems models (e.g., Minuchin, 1978). If the symptom actually served as a stabilising factor for the family, acting as a conflict avoidance agent, we would expect that there should be less conflict in pain patients' families, less depressed mood and anxiety, and more satisfaction with the present status.

1.3.6 A Psychosocial Model of Pain Experience

Recently, Skevington (1995) has presented a hierarchical model of psychosocial processes and social factors in the generation and maintenance of chronic pain which usefully draws together most of the socio-cultural factors discussed above. It emphasises the view that the individual's own perceptions, behaviours and beliefs regarding pain and illness, and those deriving from the social context, interact to produce a personal pain experience. The model involves four levels. The lowest level specifies how individual behaviours are affected by social processes (e.g., pain tolerance, lifetime personal and social schemata about pain, illness and disability). The second level refers to the role of interpersonal behaviours, and of communication about pain with people in the immediate family and social environment, (e.g., the seeking and use of social support, the development of beliefs about the nature and causation of pain, self-efficacy and pain control, and the seeking of treatment). The third level refers to group and intergroup behaviour (e.g., social representations of pain, illness and coping, group beliefs, experience and influence). The fourth level includes higher order factors which affect sociopsychological processing (e.g., health culture, economic beliefs about pain). Emphasis is placed on the ways in which the different levels in the hierarchy interact within a social environment to determine and shape pain experience. In that respect it could also be said to adopt a systemic view, as the different systems are seen in relationship to each other. Personal pain experience is placed within the context of different levels of the social environment, starting from the immediate family, but also addressing its social, cultural and political dimensions.
1.4 Cognitive Factors Influencing Pain Experience

In order to obtain a complete understanding of the pain phenomenon, this section investigates the cognitive processes that help the individual to perceive and construct representations of the external and internal world. Individuals internalise experience and knowledge originating from the family or the broader social environment, form attitudes, produce reactions and sense their bodies, via complex, structured cognitive systems which receive, interpret and integrate input from somesthetic systems. The information provided by the multiple pain systems is included in the different stimuli and signals that the cognitive system processes.

The recent development of a body of psychological work on the application of cognitive psychology and the information processing paradigm to the investigation and understanding of emotional disorders, has stimulated research on pain alongside the general increase in interest in the connection between emotion and cognition. The relevant depression and anxiety literature will be discussed later. The reasoning behind the adoption of this approach is that pain experience possesses a large negative affective component and, as indicated above, the cognitive system processes pain related information. Researchers in this area have used a number of models in order to clarify the specific role and mode of action of cognitive functions such as memory and attention in the perception of pain in general, and more specifically in chronic pain conditions.

The existence of conclusive and replicated evidence for the influence of memory and attention on selective processing of information related to mood disorders raises the question whether analogous evidence can also be found for chronic pain disorders. In depression particularly, a consistent memory bias for negative self-related information has been reported and this is usually interpreted as a causal factor in the persistence of this emotional dysfunction (Beck, 1976). In anxiety, selective attention to threatening information has been observed (Mathews & MacLeod, 1985; 1986; MacLeod & Mathews, 1988), therefore, it has been suggested that cognitive biases might also play a dominant role in the emergence, development and maintenance of pathological conditions like chronic pain.

Lately, experimental investigation of selective processing of pain related information in chronic pain patients has been attempted and some preliminary but consistent findings have been obtained (Pearce et al. 1990; Edwards et al. 1992a; Pincus et al. 1993; Koutantji and Pearce, 1992). It seems that chronic pain patients also present a memory bias towards pain related information, an effect similar to the one observed in depression. These results and the methodology of the above studies will be discussed later in further detail. First though, it is important to present the theoretical accounts and principal assumptions upon which research on the relationship between emotional disorders and
cognitive functions is based, as these also form the theoretical basis for much of current research in pain and the experimental work of this thesis.

1.4.1 Theoretical Accounts

1.4.1.1 The Information Processing Paradigm

Much of the research in this area has emerged from investigations based on cognitive psychology and the theoretical framework of information processing. This work was carried out initially on normal individuals and was followed by studies on emotionally disturbed subjects (anxious and depressed). According to Williams et al. (1988) in their review, such models upon this work was based are defined by seven basic characteristics:

i) There is a constraint in the capacity available for each of the information processing functions.

ii) Due to competition within the cognitive system, differential processing of simultaneous sources of information occurs, defined as "selective attention".

iii) Operations takes place by means of a number of serial, component processes.

iv) Parallel processing can also occur (where a number of processes can take place simultaneously).

v) Top-down, in contrast to bottom-up processing, results in the execution of complex cognitive activities. Low-level operations (data driven, involving bottom-up processing) may be influenced by the results of higher level operations (top-down) in the accomplishment of a complex task.

vi) The processing of information is thought to occur through hierarchical systems (e.g. Leventhal, 1979), the operation of lower level hierarchies being controlled by higher levels. Bottom up and top-down processing is conceived of as occurring within each hierarchy, with hierarchies working independently.

vii) Some forms of processing both innate and learned are thought to be automatic. They are fixed and can occur in parallel. On the other hand, the strategic (controlled) processes are flexible. They can be modified, are essential in dealing with novel situations and are largely serial in execution.

A number of theoretical approaches sharing the above characteristics have been proposed and relevant predictions derived from them have been empirically tested, mainly in the fields of anxiety and depression. The dominant approaches in this area are the Associative Network Model (Bower, 1981) the Self-Schema Theory (Beck, 1976) and the Integrative Model (Williams et al. 1988). These models will be discussed in some
detail, and relevant empirical evidence from the emotional disorders and pain literature will be presented.

1.4.1.2 Associative Network Models

Associative network theory has been used to generate predictions relating to affective disorders. According to Bower's (1981) version of the model, each distinct emotional state has a "node" in memory which brings together aspects of the emotion in question. Each node is in turn linked with representations of events from the past in which that emotion was aroused. These emotion nodes are considered to be activated by a range of stimuli, both physiological and verbal. When activated above a certain point the node transmits excitation throughout the memory structure to which it is associated. Hence, for example excitation of the "sadness" node will create subthreshold excitation at connected event nodes making them more likely to be recalled. The basic tested hypotheses based on this model are i) state dependence and ii) mood congruity.

State dependence refers to the tendency for material to be recalled best when there is a close match between the mood in which the material was learnt and the mood in which it is recalled. Bower et al. (1978) showed that words learnt in a depressed mood are more easily recalled when a depressed mood is induced.

Mood congruity refers to the fact that material is more likely to be learnt or recalled if it is consistent with the subject's prevailing mood. Teasdale et al. (1980) for example showed that subjects in an elated mood recalled more pleasant autobiographical memories whilst those in a depressed mood recalled more unpleasant ones.

1.4.1.3 Self-Schema Theory

According to this theory, the self is represented in the form of a schema, the content of which is a hierarchical body of knowledge, incorporating a "list" of general and specific terms that characterise the individual. This schema is a result of past experiences and their interpretation, which evolves and changes. It functions in an interactive mode with the incoming information, choosing to process selectively features which are congruent with its own content, creating structure for ambiguous or missing information, and guiding in general the interpretation of every new input based on the existing knowledge base (Derry & Kuiper, 1981; Beck et al. 1979; Williams et al. 1988).

Evidence supporting this concept was obtained when the phenomenon of self-referential bias in recall was demonstrated for normal individuals by Rogers et al. (1977). The term memory (response) bias is used to refer to factors which affect the likelihood that an
individual will decide to respond in a particular way on a memory test, independent of
the actual encoding, storage or retrieval of material. The researchers examined the
degree to which the self is implicated in processing personal information using a depth of
processing paradigm in two experimental trials. This paradigm was based on the concept
that the depth of processing is reflected in the strength of the memory trace which refers
to greater degrees of semantic involvement (Craik and Tulving, 1975). Judgements of
whether adjectives described oneself (self-reference), meant the same as another word
(semantic) or were presented in large or small letters (structural), were compared for
their capacity to facilitate incidental recall. The incidental recall of the previously judged
(rated) words indicated that adjectives from the self-reference task were recalled the best
and followed by the semantic task words which in turn were better recalled than
structural task words. These results were interpreted as an indication that in order for the
self-reference condition to produce such effective encoding, the self must be a uniform,
well structured schema. It was further hypothesised that during the recall phase of the
study, subjects used the self as a retrieval cue. The superiority for self-referenced
material for normal subjects in recall is now a well established finding which has been
replicated by many other researchers, as has the tendency to recall more positive words
encoded both in relation to oneself and to unfamiliar others (Bower & Gilligan, 1979;
These findings have stimulated the development and testing of hypotheses based on the
self-schema theory in emotional disorders and in pain, and relevant studies will be
presented in the following sections since much of the experimental work of the thesis had
been drawn from them.

1.4.2 Biased Cognitive Functions in Depression

1.4.2.1 Memory Processes

The evidence accumulated on the relationship between memory and depression can be
broadly categorised by the nature of the experimental tasks used. The frequent use of
recall tasks has provided consistent evidence of a memory bias towards negative
information in depressive states.

Studies using autobiographical memory and prose recall tasks have provided additional
information about memory function during a depressive state. Lloyd and Lishman (1975)
using personal memories recall found a significant negative association between severity
of depression and time taken to retrieve unpleasant memories. One criticism of their
work is that they failed to control for the number of actual negative events experienced
by the depressed subjects. In particular, it is possible that depressed subjects were more
likely than normals to have categorised events as negative and remembered them as such, making their retrieval more probable because of the greater number available. In order to control for these shortcomings, Teasdale and Fogarty (1979) used a mood induction paradigm with random allocation of the subjects to conditions, and found a slowed recall of material in depressed mood. Clark and Teasdale (1982) testing depressed patients with diurnal variations in mood found that positive memories were less probable in their depressed phase and more likely in their elated phase, using independent judges rating of the affective tone of the memories.

Among the researchers who used mood-related recall of stories with mixed affective content, Breslow, Kocsis and Belkin (1981) compared depressed patients and matched controls in their recall of positive, negative and neutral aspects of a narrative. They found that the depressed group showed a decrement in the recall of the positive components of the story. Bower, Gilligan and Monteiro (1981) using a hypnotic mood induction procedure, found that subjects who heard the story in a sad mood recalled more sad facts in comparison to the ones that heard the same story in a happy mood.

Overall, there is enough evidence to suggest that depressed emotional state is associated with decreased recall of positive autobiographical memories, and increased recall of negative material.

1.4.2.2 Attention Processes

In contrast with the consistent findings on the effect of memory bias in depression, no congruous findings have been reported concerning attention and depression. The main experimental task involved in the few studies which have been reported is various forms of the Stroop test using emotional words. Gotlib & McCann (1984) compared two groups of depressed and non depressed students (as screened by the Beck Depression Inventory) using depressive, neutral or manic self-descriptive adjectives. A significant interference effect in the mean colour naming latencies emerged only for the depressed subjects and the depressive adjectives, whilst this effect was not present when depressed mood was induced in subjects. This suggests that this bias is related to trait rather than state patterns of processing. It is possible of course that the conclusions of this study may only hold when non clinical populations are concerned. Williams and Nulty (1986) however, found similar Stroop interference effects to those found by Gotlib & McCann (1984), when they tested stable depressed, stable non-depressed, and "unstable" depressed groups as defined after a one year follow up. In both of these studies subjects' anxiety status was not assessed, and this can be a confounding factor as depression is commonly associated with elevated levels of anxiety. Williams and Broadbent (1986) in another Stroop trial, controlled for tension/anxiety and found that the interference effect
was observed only in a hospitalised suicidal group when compared to normal controls and another group of hospital patients, and it was clearly predicted by self-rated depression.

When a visual dot-probe task using anxiety related stimuli was employed by MacLeod, Mathews and Tata (1986), no evidence of an attentional bias specifically related to depression was found. Gotlib, McLachlan and Katz (1988) using the emotional Stroop task found no differences in attention to depressed, manic and neutral-content words in their depressed subjects. Similarly, Mogg et al. (1991), using the same task did not find any evidence of attention bias in depression.

1.4.3 Biased Cognitive Functions in Anxiety

1.4.3.1 Attention Processes

Recent research has demonstrated that clinically anxious individuals selectively attend to threatening information. Mathews and MacLeod (1985) using a modified Stroop color-naming task found that anxious patients were relatively slower than normal controls in naming the ink colour of threatening words as compared with nonthreat words, and the degree of slowing was correlated with subject's state anxiety scores. A replication of this study confirmed this selective interference effect of threat cues on the performance of anxious patients, but this time the interference effect was significantly correlated with trait anxiety but not state anxiety scores (Mogg, Mathews & Weinman, 1989). In order to further investigate this specificity of disruption, Watts, McKenna, Sharrock and Trezise (1986) demonstrated that the performance of spider phobics was greatly impaired in comparison to a control group only when spider words such as "hairy" and "crawl" were presented, while it was little affected when general emotional words such as "death" and "grief" were presented.

In addition, the effect of incidental threat stimuli on the direction of attentional responses was investigated by MacLeod, Mathews and Tata (1986). They used an attention deployment task in which pairs of words were presented on a computer monitor. On critical trials, one of the two words was threatening. The subjects attentional responses were measured by a secondary test that required them to detect a small dot probe, which could appear in the location of either word after its presentation. They found that anxious patients were particularly fast at detecting probes that replaced threat rather than nonthreat words, whereas nonanxious controls were relatively slower to detect probes replacing threat words. Anxious patients shifted their attention towards threat stimuli, while nonanxious subjects shifted their attention away from threat.
In order to clarify whether attentional bias is a function of current mood state or some more enduring cognitive vulnerability associated with high trait anxiety, MacLeod and Mathews (1988) tested a nonclinical population of high and low trait anxious students on the attention deployment task, when state anxiety was low (12 weeks before a major examination) and again when state anxiety was high (1 week before the examination). High trait anxious subjects alone shifted attention toward generally threatening stimuli on both test occasions. For examination-relevant threat words (e.g., failure, test), high trait subjects shifted attention toward such threat stimuli just before the examination, while low trait subjects showed a shift of attention away from such stimuli. This bias was interpreted as a factor that could further increase state anxiety, thus maintaining the attentional bias and so on, resulting in a feed forward cycle in which both attentional bias and state anxiety spiral in intensity. Anxious subjects have been consistently found to be characterised by their tendency to process selectively, stimuli related to threat, and they do so even when such stimuli are presented outside of awareness.

1.4.3.2 Memory Processes

Despite the fact that anxious subjects tend to select the more threatening of two meanings implicit in ambiguous material (Mathews et al. 1989), they do not present the bias in memory favouring negative material, which is found in depressed subjects.

Mogg et al. (1987) tested predictions derived from a cognitive schema model of anxiety by comparing generally anxious patients and normal controls on their incidental recall of positive and negative, threatening and non-threatening, self and other-referenced words. They found no evidence of a self-referential recall bias favouring negative or threatening words in anxiety. In contrast, relatively poorer memory for threatening material was found for anxious patients. It was suggested that the cognitive schema model could not adequately account for information-processing biases in anxiety. Similar findings were reported by Foa, McNally and Murdock (1989), who failed to provide evidence for an anxiety related mood congruity effect at either encoding or retrieval stages of processing. Mathews and MacLeod (1987), reviewing evidence in the anxiety literature, argued that memory bias is not a characteristic of anxiety states. They further proposed that anxiety and depression are associated with cognitive biases at different stages of processing, such that acquisition of threat-related information is facilitated in anxiety, while the recall of negative memories is more a characteristic of depression.
1.4.4 The "Integrative Model"

With the dissociation between anxiety and depression evident in the different cognitive effects that they manifest in the form of information processing biases, Williams, MacLeod, Watts and Mathews (1988) proposed a new model in order to adequately account for the observations. A central feature of this model, which is based on Graf and Mandler (1984), is that they differentiate between two processes, integration (priming) and elaboration, that operate upon mental representations.

Integration is a form of automatic processing involving activation of the multiple components involved in the representation, of a specific stimulus (word). The result of this process is the strengthening of the representation making the word more accessible with an increased likelihood that the word will come to mind when only some of its features are presented. This specific process can explain why anxious patients show an attentional bias towards threatening stimuli in visual dot-probe tasks, as anxiety acts to bias the extent to which threat words are primed.

Elaboration is a more strategic process which consists of the activation of the representation in relation to other associated representations to form new relations between them, and to activate old relationships, rendering the representation more retrievable. The authors suggest that depth of processing tasks such as recall of negative material encoded in depressed mood, may reflect the extent to which negative material has been elaborated at encoding. While the previous models could account either for the attentional biases in anxiety (Bower, 1981, Network Theory of Affect) or for the memory biases in depression (Self-Schema models), the Integrative Model provides an adequate framework for both phenomena to be accommodated.

In the relevant literature therefore, recall and recognition tasks are used as measures of explicit memory, as they require from participants conscious processing of the stimuli. In contrast, implicit memory is defined as memory for stored information without awareness of the learning event (e.g., evidence obtained from amnesic patients where they showed learning without awareness, Warrington & Weiskrantz, 1970; Verfaellie et al. 1991) and it is a non-intentional, automatic, data driven, process. It results from activation of a mental representation, or schema, that strengthens the internal structure of that representation (integration) and renders it more accessible, but not necessarily more retrievable. Completion of word stems, interpretation of ambiguous cues or even sentences are among the tasks used to study possible evidence of implicit memory bias in emotional and chronic pain disorders.
1.4.5 Biased Cognitive Functions in Pain

Because the techniques and materials used in the depression and anxiety literature were felt to be inappropriate for the examination of possible cognitive biases relevant to chronic pain conditions, researchers were led to explore new ones, though still drawing upon the existing theoretical and methodological paradigms for emotional disorders.

Lefebvre (1981) for example, assessed cognitive distortions in low back pain patients using methods based on Beck's (1976) cognitive model of depression which suggests that depressed patients systematically distort the meaning of events in order to perceive themselves and their experiences in a consistently negative fashion. Accordingly, Lefebvre, developed two questionnaires which measure negative cognitive distortions concerning general life experiences and low back pain. It was shown that cognitive distortions are common among depressed low pain patients, particularly with regard to pain-related situations, but no specific investigation of their attention or memory functions was attempted.

1.4.5.1 Attention Processes

Pearce and Morley (1989) investigated attention in relation to pain related information in a group of chronic pain patients compared to a control group. They employed a variation of the Stroop task presenting negative, sensory and affective words and observed a greater interference on both sensory and affective stimuli in the chronic pain patients group. They did not find any systematic pattern of correlations between interference scores and ratings of fatigue, tension, vigour, despondency, confusion and anger. There is still a possibility that the observed effect could be attributed to anxiety or depression rather than pain per se as standard measures of anxiety or depression were not used.

Eccleston (1994) in two experiments studied possible interference effects of pain intensity levels on attention, employing a low and a high attention demanding numerical interference task. Performance on the tasks was compared among a high intensity chronic pain group, a low intensity one and a control no pain group. The results showed that performance deteriorated (was slower), for the high pain intensity group only when performing the high attention demanding task when compared to performance of the other groups. This effect suggests that for pain to have a negative effect on attention it should exceed a certain intensity level, and even then it affects only performance on complex and difficult tasks.

Eccleston (1995) carried out another two experiments investigating further the impact of low and high pain intensity on attention using a similar design but a more difficult high attention demanding numerical interference task than the one used in the 1994 study. The
intention was to investigate whether the unimpaired performance of the low intensity group was due to distractional psychoanalgesia achieved by the execution of the task or due to fast switching of attention from the pain to the task. He replicated the results of his previous study in that only the high pain intensity subjects showed a performance deficit on the task, whereas the low intensity group seemed not to be processing the pain when fully engaged in the competing attentional task.

Although there is no strong evidence supporting the existence of pain specific attentional biases, it seems that high pain intensity interferes with attentional resources leading to lower performance in complex attention demanding tasks.

1.4.5.2 Memory Processes

A number of investigations have attempted to address effects of pain on processing and recall of pain related information using explicit and implicit memory tasks. Autobiographical memory for pain has also been investigated, as well as the effects of current pain in recall of past pain levels, revealing interesting effects for chronic pain patients.

Pearce et al. (1990) investigated memory for pain, testing predictions derived from the associative network theory of memory (Bower, 1981), in two experimental trials. The basic phenomena under investigation were state dependence and mood congruity. In the first experiment they compared chronic pain patients and normal controls on a test involving both immediate and delayed recall of a mixed list of pain related, negative and neutral words. The pain related words were derived from the McGill Pain Questionnaire (MPQ), while the negative and neutral ones were the ones used by Clarke & Teasdale (1982) and Teasdale & Russel (1983) respectively. They found no significant group differences in overall rates of immediate recall but pain patients recalled more pain-related words than controls, an effect which was also detected on delayed recall, although the controls recalled significantly more words overall. Therefore, some evidence for a mood congruity effect were obtained from this trial. The second experiment tested mood congruity effects in experimentally induced pain with the same word list as in the previous experiment, using healthy volunteers who were tested in one of four conditions either after a cold-pressor or a warm water condition. A recall test was performed immediately following further exposure to the stimulus conditions which were congruent or non-congruent with the original stimulus. No significant main effects for group or word type were found but a significant interaction emerged between state at encoding and at recall, leading to the observation that mood congruity effects in memory for pain may be more related to the status of being a chronic pain patient that to the state of being in pain.
Seltzer & Yarczower (1991) investigated the effects of experimental (cold-pressor) pain in encoding and retrieval of affective words in a female student sample. They found that pain experience significantly decreased the encoding of positive words and significantly increased the retrieval of negative words previously seen, irrespective of whether they were encoded during exposure to pain or not.

The possible effects of depression and chronic pain in recall patterns was studied by Edwards et al. (1992a). They investigated selective memory for sensory and affective pain related information in depressed and non-depressed chronic pain patients, depressed psychiatric patients and normal controls. They used a recall test comprising of sensory and affective adjectives from the MPQ and neutral adjectives matched for frequency. A recognition test was also administered after the recall phase which included all the words of the recall test, randomised with an equal number of new adjectives matched for wordtype and frequency. The analysis of the recall data revealed that non-depressed chronic pain patients showed a recall bias associated with sensory adjectives alone, while the depressed chronic pain patients displayed higher, although not significant recall for both sensory and affective material. Similarly, the depressed psychiatric patients showed a recall bias only for the sensory words despite the fact that in most of the previous studies depressed subjects were found to selectively recall negative material. Depressed subjects could be employing a cognitive avoidance mechanism in relation to recall of affective words. The recognition data analysis showed that the clinical groups presented poorer overall “true memory” than normal controls, and this result was discussed in terms of memory biases in these groups partially being due to differences in true memory ability.

Koutantji & Pearce (1992) using a similar methodology compared a group of atypical facial pain patients to a control group on their recall and recognition of pain related and neutral material encoded in a "self", and an "other-person" reference conditions, measuring also the processing times for the words on the recall lists (using a similar task to the one used by Edwards et al. (1992a)). They replicated the results of the previous studies where pain patients were found to recall selectively more sensory words when encoded in the self-reference, condition whilst controls showed an enhanced recall for neutral words in the same condition. Neutral words required greater processing times regardless of group and reference condition. The recognition test results showed that selective memory in chronic pain may to some extent be accounted for by differences in "true memory" as measured by d' scores, the contribution of response bias remaining less clear (beta scores).

A few studies have also used word completion tasks and interpretation of ambiguous homophones for investigating implicit memory biases (Edwards & Pearce 1994; Pincus
et al. 1994; Griffith et al. 1996). As a word completion task was used for the study presented in Chapter 4 the relevant literature will be reviewed there.

Little evidence regarding autobiographical memory for pain experiences has been reported. Eich, Rachman and Lopatka (1990), using an autobiographical memory task in female students, compared retrieval of real-life events when the subjects were experiencing menstrual pain and when they were pain free. They found that pain promoted recall of unpleasant events only if it was accompanied by negative affect, suggesting that the impact of pain on autobiographical memory is mediated by its influence on mood.

Morley (1993) investigated the effects of memories for pain events and non-pain events in medical students using methodology commonly used to study autobiographical memory. Pain event memories were rated as more surprising, inducing more negative emotional change and provoking greater change in ongoing activity than no-pain event memories. Ratings of intensity and sensory quality were associated with the reported vividness of the pain event memory. Nobody reported sensory re-experiencing of pain, and 41% of the sample were unable to recall the sensory quality of the pain event. Distress was associated with frequency of rehearsal of the pain event and with ratings of emotional and activity change due to the pain event. Based on these findings it was suggested that the memory for a pain event is easily accessible, whereas the elements of the pain experience, such as its sensory and affective qualities, and its somatosensory component, are separated either at encoding and / or retrieval.

Wright & Morley (1995) investigated the influence of chronic pain on the recall of autobiographical memories to neutral and pain-related cue words comparing a chronic pain group (n = 11) to a matched control group. They found that chronic pain patients recalled more memories involving elements of physical pain, and content analysis of them showed that they also retrieved more memories of themselves in chronic pain than the control group. Overall pain memories were retrieved significantly faster than non-pain memories, and there was no between groups difference on the number of memories recalled.

The above studies mainly investigated the impact of chronic pain on attention and memory processes. A further area of research has focused on examining the effect of pain on accuracy of memory for past pain intensity and affect, an area of significant interest for clinicians, as self-report of pain in clinical consultations with chronic and acute pain patients determines to a large extent the prescribed analgesia and subsequent interventions. Possible biases therefore in report of past pain could influence important treatment decisions.
Eich et al. (1985) compared hourly pain diaries to ratings of minimum, maximum and usual levels of prior pain completed by headache patients. They found that patients overestimated their prior pain levels when their current pain intensity was high and vice versa, presenting evidence that pain distorts current self-report measures in a similar way that depressed mood increases retrieval of negative material. Similar effects were observed by Smith and Safer (1993) when they compared pain ratings and medication use recorded on an electronic diary to self-report pain ratings, for the previous day and week, obtained by a group of chronic pain patients before receiving physical therapy (PT), and another group who gave their ratings post physical treatment. Current pain intensity influenced chronic pain patients' recall for both pain levels and medication use. Patients' ratings obtained before PT significantly overestimated pain levels and medication, and patients' ratings received after PT significantly underestimated them. Further confirmation of a pain report bias effect due to current pain levels was reported by Bryant (1993) who studied chronic pain patients before and after a pain management programme. It was found that patients who reported increased pain or depression over the duration of the programme overestimated their pre-treatment levels of pain and depression.

In summary, there is no evidence available to date supporting an attention bias towards selective processing of pain related information for chronic pain patients. Some preliminary evidence exists however, supporting an interference effect of high intensity chronic pain in the performance of highly demanding attentional tasks. Memory biases regarding recall of pain related material have consistently been found in chronic pain patients. Chronic pain status is also associated with increased recall of autobiographical memories involving chronic pain. Current pain intensity levels distort systematically past pain report with low intensity resulting in underestimation of past pain levels and high pain intensity in overestimation of them.
1.5 Scope and Objectives of the Thesis

This thesis sets out to study pain processing taking into account the multiplicity of systems that affect it and are affected by it. Sensory, schematic, conceptual and family (social) aspects of pain processing will be investigated, combining methodologies based on information processing principles and subjective, self-report measures. The investigations were guided by the parallel processing model of pain distress as presented earlier (Leventhal and Everhart, 1979). Some of the subsequent studies will also assess the relationship between familial factors and pain experience taking account of the social context within which pain is experienced.

The thesis therefore, employs a range of methodologies to address questions about the experience of pain at each of the specified levels. Morphine was used as a vehicle to study physiological pain mechanisms following a double blind placebo controlled methodology in order to investigate perceptual motor processing in acute and chronic pain conditions. Research paradigms from cognitive psychology as applied in the study of emotional disorders and pain are used in the study of the schematic level of pain processing with different pain and age groups. A self-report questionnaire, the Pain Beliefs Questionnaire (PBQ, Edwards et al. 1992b) is used to assess conceptual processing, evaluating specific beliefs about causes, consequences and control of pain. Additional self-report questionnaires are used to assess aspects of current pain experience, family history of pain, gender differences, family function, psychological adjustment and accuracy of perception of pain in others.

Specifically the following questions will be addressed in the empirical work\(^1\) of the thesis:

The first study investigates whether:

a) there are any differences in the perceptual-motor processing of pain between chronic idiopathic chronic pain patients and acute pain patients,

b) a pharmacological, analgesic manipulation can alter schematic processing of pain related material in chronic and acute pain conditions (assessing stability of pain-specific biases),

c) there are differences in beliefs about causes and consequences of pain between chronic and acute pain patients (assessing the conceptual level of pain processing).

The second study investigates the role of gender and family history of pain in pain experience and report.

\(^1\)The clinical studies of the thesis (studies 1,5 & 6) were approved by the Ethics Committee of the Eastman Dental Institute.
The third and fourth studies investigate:

a) whether pain-specific cognitive biases are a consequence of long-term pain, or are responsible for its onset, constituting vulnerability factors,

b) the time course of pain specific cognitive biases,

c) whether frequent current pain experience is associated with a specific family environment,

d) whether there are differences in beliefs about causes and consequences of pain between people with high and low frequency of pain.

The fifth and sixth studies investigate whether

a) pain specific cognitive biases are present in children suffering from chronic pain or whether they are only present in adults,

b) exposure to people in pain can lead to pain specific cognitive biases or is it pain per se that is associated with cognitive biases,

c) chronic pain is associated with a specific family environment,

d) chronic pain in one family member affects other family members and in what way if at all,

e) parental perception of children's pain experience is accurate,

f) beliefs about causes and consequences of pain are different between people with and without a relative in pain.
CHAPTER 2

The Effects of Morphine on Pain Perception and Pain Related Cognition in Chronic and Acute Pain Patients

2.1 Introduction

Much research has been conducted on the use of opioid analgesics but little is known about their mode of action. Two major areas of morphine's use are for the relief of long term pain, especially cancer pain, and for the relief of acute post-operative pain. Considerable debate surrounds its use in the relief of chronic, non-malignant pain (Brena and Sanders 1991; Glynn et al. 1991; Gourlay and David, 1991). In addition, proposals for the underlying mechanisms that mediate its action are far from conclusive.

Leventhal and Everhart's (1979) three level parallel processing model of pain distress distinguishes among perceptual motor processing, schematic processing and conceptual processing, and can be used to account for the evidence obtained from opioid analgesia research. Perceptual motor processing is of particular interest for the study to be reported here as it has been reported that opioids are active at that level (Snyder, 1977). It is the lowest, innate level and is composed of three types of pathway: two are information pathways which generate outputs related to features like location, duration and sensory attributes of the noxious stimulation, and the third is responsible for a generalised arousal state and a specific emotional response, such as distress.

Price et al. (1985) tested normal subjects exposed to nociceptive temperature stimuli, each of five seconds duration, using intravenous administration of different morphine dosages. They found that morphine administration reduced visual analogue scale (VAS) ratings of sensory intensity and unpleasantness in a dose-dependent manner. The lower doses resulted in reductions in the affective but not sensory intensity ratings. The highest dose tested reduced both sensory and affective VAS responses to graded nociceptive stimuli, as well as
VAS sensory responses to first and second components of pain evoked by brief heat impulses.

Arner and Meyerson (1988) assessed the responsiveness of nociceptive, neuropathic and "idiopathic" chronic pain to opioids given intravenously. They found that nociceptive pain was effectively alleviated, while neuropathic differentiation pain was not significantly influenced by morphine or equivalent doses of other opioids. Idiopathic chronic pain, with little or no demonstrable pathology, also failed to respond.

The interpretation of these results have been challenged by Portenoy et al. (1990), who suggested that opioid responsiveness should be judged in relation to the specific pain syndrome, patient characteristics, drug selective effects, dosage and side effects. They argue that generalised conclusions, such as that neuropathic pains are not responsive to opioid treatment, need further and more rigorous investigation. The same principle could be extended in relation to chronic idiopathic forms of pain where very little evidence from controlled trials exists on the effect of opioids, and far fewer explanations on pain specific mechanisms have been proposed.

Kupers et al. (1991), in a double blind placebo controlled crossover study, investigated the effect of morphine on affective and sensory pain ratings in three groups of chronic pain patients suffering from central and peripheral neurogenic pain, and from various types of idiopathic pain. They administered intravenous (IV) morphine and placebo (saline) gradually in bolus injections, and assessed the affective and sensory dimensions of pain using 101 point rating scales, including in their sample both opiate naive and opiate non-naive subjects. They found that morphine reduced the affective but not the sensory dimension of pain sensation for the two groups of neurogenic patients, whilst in the idiopathic group neither the affective nor the sensory dimension of pain were altered.

Moulin et al. (1996) evaluated the effectiveness of oral morphine in 46 patients suffering from treatment-resistant chronic regional pain of soft tissue or musculoskeletal origin, in a randomised double-blind crossover study where an active placebo was used. They found that oral morphine given over a period of 9 weeks was effective in reducing pain intensity but not pain relief measures.

Jadad et al. (1992), using a dose titration principle, investigated morphine responsiveness of chronic neuropathic pain and nociceptive pain in a double blind crossover study with patient controlled analgesia (PCA). High and low concentrations of morphine were compared in different types of neuropathic pain and different types of nociceptive pain. A good response to morphine was achieved for half the neuropathic patients, and was found to be a more reliable pain relief for nociceptive pains. On the basis of their data, they argued that changes in mood, reflected changes in pain intensity and relief, as no patient had a change in mood in
the absence of a change in pain intensity or pain relief. The design of the study did not control for the placebo effect.

In contrast to this, Gracely (1979) had shown that the short acting opioid fentanyl when administered to subjects after tooth pulp stimulation resulted in reductions of the sensory and not the affective pain ratings, whilst Price et al. (1985) found reductions for both sensory and affective ratings under similar conditions, but employing a more rigorous methodology. Based on the above findings it seems that morphine can be used as a vehicle to study pain perception (intensity and affect) in chronic and acute forms of pain, with the aim of gaining more insight into the specific mechanisms involved in opioid analgesia at the perceptual motor level of pain processing as suggested in Leventhal and Everhart's (1979) model of pain distress.

It is also of interest to investigate effects of morphine on pain related cognitions in chronic and acute pain. Previously relevant investigations have been carried out with anxious subjects by Golombok et al. (1990) & Golombok et al. (1991). They investigated the effects of diazepam on anxiety related cognition in two placebo controlled trials. They found a bias towards the processing of threatening information (using a modified version of a Stroop colour-naming task for threatening and nonthreatening words) in relation to anxiety, but they failed to find any effects of diazepam on the processing of threatening words, providing some evidence that the anxiolytic effect of diazepam relates to the alleviation of anxious mood and not of cognitive manifestations of anxiety.

As reviewed in the previous chapter, evidence from studies on information processing in adults suffering from depression have shown that they present a consistent memory bias towards negative self-related information. This effect is usually interpreted as a causal factor in the persistence of this emotional dysfunction (Beck et al. 1979). In addition, patients suffering from anxiety present an attentional bias towards threatening information (Mathews & MacLeod, 1985; 1986; MacLeod & Mathews, 1988). Some work on the impact of pain in cognitive processing has been carried out addressing the question whether cognitive activities might also play a dominant role in the emergence, development and maintenance of pathological conditions like chronic pain. The main effect found was that of a memory bias towards pain related information for the chronic pain patients (Pearce et al. 1990; Edwards et al. 1992a).

Findings of this sort support the existence of the schematic level proposed in Leventhal and Everhart's model where a pain schema is a representation of the visual, auditory and somesthetic events associated with the stimulus. Schemata of past pain events constitute memory structures which can influence the processing of current events, and can be activated automatically. Based on the above findings and on the assumption that morphine
acts differentially upon the different aspects of pain experience, we investigated whether morphine administration could alter the pattern of recall of pain related and neutral stimuli for the acute and chronic pain groups in comparison to a placebo condition.

Aims of the study

The primary aims of the study are:

a) to compare the effects of morphine and a placebo on pain perception in an atypical facial pain group (a homogenous group of chronic idiopathic pain patients), and a post-operative pain group, comprising of subjects who had impacted wisdom teeth removed, in order to test the belief that centrally acting opioids are of greater value in controlling organic acute pain (Seymour, 1984) and neurogenic pain (Kupers et al. 1991) than idiopathic forms of pain.

b) to clarify the effect of morphine on the sensory and affective components of pain. Previous studies (Price, 1985), would predict reductions in both pain affect and intensity ratings for the post-operative group. Under the hypothesis that a similar underlying mechanism operates in the idiopathic (AFP) group as in other chronic pain conditions (e.g., neuropathic), reductions only in pain affect ratings should occur.

c) to test the effect of morphine on pain related cognition in both groups, employing Edwards et al.'s (1992a) procedure adapted to the clinical limitations of the trial. Possible memory biases were investigated before the administration of morphine for the chronic pain group, as well as the effects of acute pain on the processing of pain related information in a non chronic pain population. Furthermore, the effect of morphine on recall after the administration of morphine would provide a further test of the independence of sensory and affective processing in pain.
2.2 Method

2.2.1 Design

A mixed design was employed. The between subjects factors were group (atypical facial pain group (AFP), post-operative group) and the drug administered (morphine vs placebo). When pain dimensions (sensory, affective) were used as dependent variables, the within subjects factor was time (pre-drug administration (time 0 & time 1), during (time 2 to time 5), and post-drug (time 6)). When recall scores were the dependent variable, time of testing (pre, post-drug administration) and wordtype (sensory, affective and neutral) were the within subjects factors. The memory testing involved the audiotaped presentation of two recall lists; one before and one after the drug trial. The presentation of lists was randomised and each list presentation was followed by an immediate recall period of 2 minutes duration. The dependent variables for the recall lists were the percentage recall of each wordtype pre and post treatment. The dependent variables for the pain dimensions (sensory, affective) were ratings taken for each dimension separately using 101 point verbal analogue scales (VAS) which were taken before, during (every 10 minutes) and after the drug administration.

2.2.2 Subjects

The 11 subjects for the atypical facial pain group were recruited during their medical examination from the Pain Clinics of the Eastman Dental Hospital. Their mean age was 43.5 (sd = 11.5), age range 27 to 59, and 8 of them were female. All had suffered from chronic idiopathic facial pain for at least 12 months (mean = 4.1 years, range 1-10 years) and none suffered from any kind of mental illness or presented any kind of cognitive dysfunction. The mean score for the pain intensity at the time of completing the experiment was 54.2 (max of 100),(sd = 33) and of the pain affect was 42 (sd = 37). Most of the patients (88%) were on antidepressant medication. The control group consisted of 20 patients suffering from acute post-operative pain due to surgical removal of impacted wisdom teeth who volunteered to participate in the study (mean age of 28.9, sd = 8.9, range 20 - 50). In this group 15 were female. Only subjects who were native english speakers participated in the memory tests (N = 26).

2.2.3 Apparatus

The experiment was conducted using a tape recorder to present the word lists, and pen and paper materials. The instructions were given by the experimenter before every test. A stopwatch was used to measure: a) the two minutes duration of the recall phases and b) the
10 minutes intervals between the administration of each bolus injection and the recording of
the pain ratings. A pulse oximeter was used to monitor patients' respiratory and pulse levels.

2.2.4 Materials

The memory task consisted of two word lists. Each list consisted of 26 words, of which six
were neutral, six sensory, and six affective adjectives. To these words were added four
neutral words at the beginning and four at the end of each list, acting as fillers in order to
control for any primacy or recency effects. The words in the sensory and affective categories
consisted of pain adjectives chosen from the McGill Pain Questionnaire (MPQ) (Melzack,
1975) which were first used by Edwards et al. (1992a) as a memory task addressed to
chronic pain populations. To these words were added neutral adjectives, matched as closely
as possible for frequency and number of syllables (Carroll et al. 1971). One word list was
administered before and one after the end of the substance administration, and their
presentation followed a prefixed random order. The recall lists are presented in Table 2.1.
The presentation of each list was followed by an immediate 2 minutes recall phase during
which subjects were asked to remember as many adjectives as they could. The recall
responses were recorded by the experimenter. Pen and paper were used to record the pain
ratings and complete the questionnaires.

Questionnaires used were:

i) The State Anxiety Inventory (STAI) where the A-State form measures a transitory
emotional state in response to situational stress, and the A-Trait form measures relatively
stable individual differences in anxiety proneness (Spielberger et al. 1973)(see appendix 2.1).

ii) The Beck Depression Inventory (BDI), (Beck et al. 1961) which is used to assess subjects
levels of depression assessing cognitive and somatic complaints (see appendix 2.2).

iii) The Pain Beliefs Questionnaire (Edwards et al. 1992b), which assesses peoples attitudes
to the origin, nature and causes (psychological and organic) of pain (see appendix 2.3).

iv) An alteration of Kupers et al. (1991) "Pain Story", accompanied by the 101 point Verbal
Analogue Scales (VAS), were used to assess patients pain intensity and pain affect levels.
The extremes were respectively, 0 no pain, and 100 the most intense pain imaginable / the
most unpleasant pain imaginable. The "Pain story" was especially constructed to meet the
needs of the present and future studies where there is a need to help patients to reliably
differentiate between the two distinct aspects of pain experience. Previous work has shown
that it is effective in helping patients to differentiate between pain dimensions (Koutantji &
Pearce, 1992) (see appendix 2.4).
Table 2.1 Recall lists I and II.

<table>
<thead>
<tr>
<th>RECALL LISTS</th>
<th>List I</th>
<th>List II</th>
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<tbody>
<tr>
<td><strong>FILLERS</strong></td>
<td>round</td>
<td>useful</td>
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<tr>
<td></td>
<td>common</td>
<td>wooden</td>
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<td>straight</td>
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<td>fresh</td>
<td>short</td>
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<td><strong>NEUTRAL</strong></td>
<td>windswept</td>
<td>selective</td>
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<td></td>
<td>imprecise</td>
<td>legal</td>
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<td>flexible</td>
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</tr>
<tr>
<td></td>
<td>educated</td>
<td>nimble</td>
</tr>
<tr>
<td></td>
<td>polished</td>
<td>angular</td>
</tr>
<tr>
<td><strong>SENSORY</strong></td>
<td>scalding</td>
<td>tingling</td>
</tr>
<tr>
<td></td>
<td>stabbing</td>
<td>flashing</td>
</tr>
<tr>
<td></td>
<td>pressing</td>
<td>throbbing</td>
</tr>
<tr>
<td></td>
<td>boring</td>
<td>crushing</td>
</tr>
<tr>
<td></td>
<td>pounding</td>
<td>tugging</td>
</tr>
<tr>
<td></td>
<td>tender</td>
<td>hurting</td>
</tr>
<tr>
<td><strong>AFFECTIVE</strong></td>
<td>unbearable</td>
<td>gruelling</td>
</tr>
<tr>
<td></td>
<td>discomforting</td>
<td>miserable</td>
</tr>
<tr>
<td></td>
<td>mild</td>
<td>distressing</td>
</tr>
<tr>
<td></td>
<td>horrible</td>
<td>troublesome</td>
</tr>
<tr>
<td></td>
<td>fearful</td>
<td>terrifying</td>
</tr>
<tr>
<td></td>
<td>cruel</td>
<td>vicious</td>
</tr>
</tbody>
</table>

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2.2.5 Procedure

The study proposal was approved by the Ethics Committee of the Eastman Dental Hospital. The subjects were informed that the study concerned the administration of morphine or placebo following a double blind procedure, and the completion of questionnaires before and after the drug trial. After being informed about the procedure if they agreed to take part they were asked to sign a consent form.

i) Medication and observations

Patients for the post-operative group were withheld from opioid analgesics, and the AFP patients were asked to stop taking any relevant medication such as antidepressants and/or analgesics for about one week prior to the trial. Their respiratory and cardiovascular functions were monitored via a pulse oximeter and they were under close medical attention during and after the trial. Antiemetic medication and additional analgesics/antagonist drugs were available if needed in the event of side effects and dropout. Patients received either placebo or morphine intravenously following a double blind procedure. Each patient allocated to the morphine condition received a total dose of morphine of 0.15 mg/kg bodyweight. Every 10 minutes the patient received a bolus injection of one fifth of the total dose via an intravenous catheter. In total, 5 doses were administered. Assessments took place 10 min after the first injection and were repeated every 10 min up to 60 min. In order to maximise blindness and eliminate as many primacy effects as possible, the first intravenous administration was always saline in the placebo and in the morphine conditions. This is presented schematically in figure 2.1.

ii) Measurements

In order to ensure that all patients were in pain at the start of testing, patients pain levels in the post-operative group were required to be equal to or above 30 on a 101 point intensity scale. Both post-operative and chronic pain patients rated their nausea, drowsiness and depression status using 101 point VAS (where for e.g., 0 represented no nausea at all, and 100 represented as nauseous as one can be). The cognitive tests started by the administration of the recall task. Subjects were asked to listen to the word list presented using a tape-recorder. They were asked to pay attention and attempt to learn the words because they would be asked to recall as many as they could afterwards. The inter-stimulus interval was 2 seconds. Two minutes were allowed for the immediate recall phase, during which the experimenter was recording the responses. Then, the subjects were informed of the differences in sensory and affective aspects of pain, after which they were asked to read the "Pain story" with the aim of making clearer the distinction between pain dimensions.
**Figure 2.1** Protocol for Morphine and Placebo administration.

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6-Post Drug</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 min</td>
<td></td>
<td>10 min</td>
<td>20 min</td>
<td>30 min</td>
<td>40 min</td>
<td>50 min</td>
<td>60 min</td>
</tr>
<tr>
<td>Morphine</td>
<td>Saline</td>
<td>Morph</td>
<td>Morph</td>
<td>Morph</td>
<td>Morph</td>
<td>Morph</td>
<td>-</td>
</tr>
<tr>
<td>Placebo</td>
<td>Saline</td>
<td>Saline</td>
<td>Saline</td>
<td>Saline</td>
<td>Saline</td>
<td>Saline</td>
<td>-</td>
</tr>
</tbody>
</table>

The A-State form of the STAI questionnaire was administered (it was completed twice, once before and once after the drug trial, to obtain accurate state anxiety measurements), baseline measurements of pain intensity and affect were taken and then the drug/placebo administration began. After the completion of the drug trial, the memory tests were repeated in the same order, following the same procedure, and measurements on 101 point rating scales for nausea, drowsiness and depression were recorded. Finally, all subjects were administered the STAI (A-State and A-Trait), BDI and BBQ. After the completion of the questionnaires subjects were thanked for their participation and they were given information about the purpose of the study. The whole procedure lasted approximately 2 to 3 hours.
2.3 Results

2.3.1 Pain Ratings Analysis

The distributions of pain intensity and pain affect scores were tested for normality using the Box-Cox diagnostic procedure (Box and Cox, 1964). Both distributions were found to be positively skewed and a square root transformation was made to satisfy the normality assumption and stabilise the variances.

The transformed scores for pain intensity and pain affect were analysed for the two groups (Post-operative, Atypical facial pain (AFP)) by means of three-way analysis of variance, examining jointly group and drug treatment (morphine, placebo) as the between subjects factors, and the time of measurement (T2 to T6) as the repeated measure. As the two groups differed significantly in age, and there were also differences in baseline pain ratings (on measurements T0 and T1, which were taken before the administration of active substance to either group), those variables were entered as covariates in the subsequent analyses, following recommendations for statistical analysis of this type of repeated measures designs by Everitt (1996). All subsequent analyses were performed using the transformed scores as the dependent variables.

An analysis of covariance (ANCOVA) was performed on the pain affect ratings with age, baseline affect and T1 affect ratings as covariates. The analysis showed that only T1 affect ratings was a significant covariate ($t = 2.12, p < 0.05$). In the subsequent analysis the main effect of group was not significant ($F(1,22) < 1$). The main effect of drug ($F(1,22) = 5.07, p < 0.05$) was significant with subjects receiving morphine showing reduced pain affect ratings (morphine $\bar{X} = 8.61$, placebo $\bar{X} = 12.00$). The interaction group by drug was not significant ($F(1,22) < 1$). The main effect of time was significant ($F(4,100) = 4.38, p < 0.01$). A priori contrasts (polynomial) showed that there was a significant linear effect ($t = -2.22, p < 0.05$) and a significant quadratic effect ($t = 2.54, p < 0.05$) of time on the pain affect ratings reductions. The interaction group by time was not significant ($F(4,100) < 1$), but the interaction drug by time was significant ($F(4,100) = 3.71, p < 0.01$). Simple effects analysis of the interaction showed there was a significant interaction of drug with the linear effect of time ($t = -2.35, p < 0.05$). As it can be seen in figure 2.2 the rate of reduction for the pain affect ratings was significantly higher for morphine than placebo in both groups. The interaction group by drug by time was not significant ($F(4,100) < 1$). Therefore, both the acute and the chronic idiopathic pain group show a similar response to morphine regarding the reductions of their affective scores.
The same model of ANCOVA was used for the pain intensity ratings. Age, baseline intensity ratings and T1 intensity ratings were used as covariates. This time age approached significance (t = 1.84, exact p = 0.08) as a covariate, and T1 intensity ratings was a significant covariate (t = 2.89, p < 0.01). The main effect of group was not significant (F(1,22) = 2.53, p > 0.05). The main effect of drug approached significance (F(1,22) = 3.63, exact p = 0.07). The interaction group by drug was not significant (F(1,22) < 1). The main effect of time though was significant (F(4,100) = 6.58, p < 0.001), and when polynomial contrasts were performed a significant linear effect of time (t = -3.57, p < 0.01) was found on the intensity ratings. The group by time interaction was not significant (F(4,100) < 1). The interaction drug by time was significant (F(4,100) = 4.40, p < 0.01). Simple effects analysis of the interaction showed that there was a significant effect of drug on the linear effect of time (t = -2.71, p < 0.05). The group by drug by time interaction was significant (F(4,100) = 4.46, p < 0.01). Simple effects analysis of contrasts showed that there was a significant effect of drug on the linear effect of time only for the post-operative group (F(1,25) = 19.87, p < 0.001), with morphine producing significant reductions in intensity ratings only for this group. These effects are depicted graphically in figure 2.3. Although the graph suggests there might be an effect of morphine on pain intensity ratings for the AFP group, this did not even approach significance statistically, however, it has to be taken also
into account that a small number of AFP patients received morphine. The graph also suggests that there is a different response to placebo in the two groups. The intensity ratings of the post-operative group receiving placebo increase slightly over time, whilst the AFP groups intensity ratings decrease a little over time.

**Figure 2.3** Intensity pain ratings (raw data) for the Post-operative and Atypical Facial Pain Groups in Morphine and Placebo conditions.

Mean pain ratings (raw data) for the AFP group in placebo and morphine conditions are presented in Table 2.2 and for the Post-operative group are presented in Table 2.3.
Table 2.2  Affective and Intensity pain ratings (raw data) of the Atypical Facial Pain Group in Morphine (n = 5) and Placebo conditions (n = 6) (\( \bar{X}, \text{Sd} \)).

<table>
<thead>
<tr>
<th></th>
<th>AFFECTIVE-PLACEBO</th>
<th>AFFECTIVE MORPHINE</th>
<th>INTENSITY-PLACEBO</th>
<th>INTENSITY-MORPHINE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \bar{X} )</td>
<td>( \text{Sd} )</td>
<td>( \bar{X} )</td>
<td>( \text{Sd} )</td>
</tr>
<tr>
<td>Baseline Ratings (T0)</td>
<td>41.7</td>
<td>37</td>
<td>58.0</td>
<td>29</td>
</tr>
<tr>
<td>T1</td>
<td>44.2</td>
<td>34</td>
<td>40.0</td>
<td>35</td>
</tr>
<tr>
<td>T2</td>
<td>42.8</td>
<td>35</td>
<td>39.0</td>
<td>19</td>
</tr>
<tr>
<td>T3</td>
<td>35.3</td>
<td>32</td>
<td>32.0</td>
<td>22</td>
</tr>
<tr>
<td>T4</td>
<td>41.2</td>
<td>40</td>
<td>19.6</td>
<td>19</td>
</tr>
<tr>
<td>T5</td>
<td>36.7</td>
<td>34</td>
<td>19.8</td>
<td>23</td>
</tr>
<tr>
<td>T6 POST-TRIAL</td>
<td>40.8</td>
<td>29</td>
<td>19.0</td>
<td>22</td>
</tr>
</tbody>
</table>

Table 2.3  Affective and Intensity pain ratings of the Post-Operative Group in Morphine (n = 10) and Placebo (n = 10) conditions (\( \bar{X}, \text{Sd} \)).

<table>
<thead>
<tr>
<th></th>
<th>AFFECTIVE-PLACEBO</th>
<th>AFFECTIVE MORPHINE</th>
<th>INTENSITY-PLACEBO</th>
<th>INTENSITY-MORPHINE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \bar{X} )</td>
<td>( \text{Sd} )</td>
<td>( \bar{X} )</td>
<td>( \text{Sd} )</td>
</tr>
<tr>
<td>Baseline Ratings (t0)</td>
<td>48.0</td>
<td>25</td>
<td>39.0</td>
<td>21</td>
</tr>
<tr>
<td>T1</td>
<td>42.4</td>
<td>30</td>
<td>29.2</td>
<td>20</td>
</tr>
<tr>
<td>T2</td>
<td>36.0</td>
<td>30</td>
<td>20.3</td>
<td>14</td>
</tr>
<tr>
<td>T3</td>
<td>34.5</td>
<td>30</td>
<td>15.5</td>
<td>12</td>
</tr>
<tr>
<td>T4</td>
<td>33.5</td>
<td>30</td>
<td>11.9</td>
<td>13</td>
</tr>
<tr>
<td>T5</td>
<td>37.0</td>
<td>29</td>
<td>10.7</td>
<td>18</td>
</tr>
<tr>
<td>T6 POST-TRIAL</td>
<td>36.5</td>
<td>31</td>
<td>13.3</td>
<td>19</td>
</tr>
</tbody>
</table>
2.3.2. Questionnaires Analysis

The questionnaire data was analysed using independent t-test comparisons. They revealed significant differences between the two groups in relation to Trait Anxiety \( (t = 2.47, p < 0.05) \), BDI somatic scores \( (t = 2.74, p < 0.05) \) and PBQ organic beliefs \( (t = 2.77, p = 0.01) \). The AFP patients showed elevated scores in each measure. The means and sds of the questionnaire scores for each sample are presented in Table 2.4.

Table 2.4 Beck Depression Inventory, Spielberger Anxiety Inventory and Pain Beliefs Questionnaire scores for Atypical Facial Pain group and Post-operative Pain group \( (\bar{X}, \text{Sd}) \).

<table>
<thead>
<tr>
<th></th>
<th>Atypical Facial Pain group ( (n = 11) )</th>
<th>Post-operative group ( (n = 20) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEPRESSION STATUS</td>
<td>( \bar{X} ), Sd</td>
<td>( \bar{X} ), Sd</td>
</tr>
<tr>
<td>BDI Score</td>
<td>12.2, 7.6</td>
<td>6.92, 7.8</td>
</tr>
<tr>
<td>BDI (Somatic)</td>
<td>5.7, 3.9</td>
<td>2.6*, 2.0</td>
</tr>
<tr>
<td>BDI (Cognitive)</td>
<td>6.5, 4.0</td>
<td>5.2, 6.5</td>
</tr>
</tbody>
</table>

ANXIETY STATUS (STAI)

<table>
<thead>
<tr>
<th></th>
<th>( \bar{X} ), Sd</th>
<th>( \bar{X} ), Sd</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Anxiety PRE DRUG</td>
<td>41.6, 15.5</td>
<td>37.8, 9.5</td>
</tr>
<tr>
<td>State Anxiety POST DRUG</td>
<td>33.7, 11.6</td>
<td>33.7, 10.5</td>
</tr>
<tr>
<td>Trait Anxiety</td>
<td>49.1, 10.5</td>
<td>37.7*, 12.5</td>
</tr>
</tbody>
</table>

Pain Beliefs Questionnaire

<table>
<thead>
<tr>
<th></th>
<th>( \bar{X} ), Sd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic</td>
<td>4.00, 0.81</td>
</tr>
<tr>
<td>Psychological</td>
<td>4.35, 1.61</td>
</tr>
</tbody>
</table>

\( *p < 0.05 \) (independent Student t-test)
2.3.3 Recall Scores Analysis

The percentage recall for each wordtype (neutral, sensory, affective) was calculated. These recall scores were positively skewed, and a square root transformation was performed which resulted in adequate degrees of normality. The fillers were excluded from the analysis as they were included to control for primary and recency effects. In all subsequent analyses the transformed (sqrt) recall scores were used as the dependent measures and percentage recall scores are presented in tables and graphs.

Two subjects of the AFP group and 3 acute pain patients were not native english speakers and they did not do the memory test. In order to test the effect of drug on recall of each wordtype for the two groups, the post-drug recall scores were used as the dependent variable. The age of participants was entered in the analysis as a covariate to eliminate any differences occurring between groups on recall due to the age difference between groups. The pre-drug recall scores for each wordtype were used as covariates. A 2x2x3 analysis of covariance was carried out with group (Post-operative, AFP) and drug (morphine, placebo) as the between subjects factors, and the wordtype (neutral, sensory, affective) as the within subjects factor. The analysis showed that the main effects of group (F(1,16) = 1.17, p > 0.05) and drug (F(1,16) = 1.31, p > 0.05) were not significant. The interaction group by drug was also nonsignificant (F(1,16) = 2.62, p > 0.05). The main effect of wordtype (F(2,40) < 1), the interaction group by wordtype (F(2,40) < 1), and the interaction drug by wordtype (F(2,40) = 1.68, p > 0.05) were not significant. The three way interaction group by drug by wordtype (F(2,40) = 1.69, p > 0.05) was not significant either. The same pattern of results was observed when an ANOVA without the covariates was carried out. The above results suggest that morphine has no effect on processing of pain related material in either acute or chronic pain conditions. Mean percentage recall scores and sds for the Post-Operative group according to drug condition and time of testing are presented in Table 2.5 and illustrated in figure 2.4, and for the AFP group the same data is presented in Table 2.6 and figure 2.5.
**Figure 2.4** Post-operative Pain group percentage recall scores for each wordtype before and after the drug administration.

**Post-Operative Pain Group Recall Scores**

![Graph showing recall scores for different word types before and after drug administration.](image)

**Table 2.5** Mean percentage recall scores for the Post-Operative group in morphine and placebo conditions.

<table>
<thead>
<tr>
<th>Drug</th>
<th>Wordtype</th>
<th>Post-Operative group</th>
<th>Post-Operative group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Pre-Drug</td>
<td>Post-Drug</td>
</tr>
<tr>
<td></td>
<td></td>
<td>X</td>
<td>Sd</td>
</tr>
<tr>
<td>Morphine</td>
<td>Sensory</td>
<td>0.33</td>
<td>0.13</td>
</tr>
<tr>
<td>n = 8</td>
<td>Affective</td>
<td>0.31</td>
<td>0.18</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>0.31</td>
<td>0.19</td>
</tr>
<tr>
<td>Placebo</td>
<td>Sensory</td>
<td>0.30</td>
<td>0.18</td>
</tr>
<tr>
<td>n = 9</td>
<td>Affective</td>
<td>0.24</td>
<td>0.12</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>0.24</td>
<td>0.15</td>
</tr>
</tbody>
</table>
Table 2.6 Mean percentage recall scores for the Atypical Facial Pain Group in morphine and placebo conditions.

<table>
<thead>
<tr>
<th>Drug</th>
<th>Wordtype</th>
<th>Atypical Facial Pain Group</th>
<th>Atypical Facial Pain Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Pre-Drug</td>
<td>Sd</td>
</tr>
<tr>
<td>Morphine</td>
<td>Sensory</td>
<td>0.29</td>
<td>0.25</td>
</tr>
<tr>
<td>n = 4</td>
<td>Affective</td>
<td>0.17</td>
<td>0.14</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>0.04</td>
<td>0.08</td>
</tr>
<tr>
<td>Placebo</td>
<td>Sensory</td>
<td>0.27</td>
<td>0.09</td>
</tr>
<tr>
<td>n = 5</td>
<td>Affective</td>
<td>0.13</td>
<td>0.14</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>0.20</td>
<td>0.18</td>
</tr>
</tbody>
</table>

Figure 2.5 Atypical Facial Pain group percentage recall scores for each wordtype before and after the drug administration.

Atypical Facial Pain Group Recall Scores

A further mixed model analysis of variance with group as the between subjects factor was carried out on the pre-drug recall scores to investigate whether a significant group by wordtype interaction would emerge for the pre-treatment phase using again age as a covariate. The ANCOVA was carried out with groups as the between subjects factor, and
wordtype as the within subjects measurement. In this case the dependent variable was the recall scores of subjects before the drug administration. The main effect of group approached significance \( (F(1,21) = 3.28, p < 0.08) \), with the acute group showing greater recall. The main effect of wordtype also approached significance \( (F(1,21) = 2.69, \text{exact } p = 0.079) \). Given that it was of theoretical interest to investigate processing of each wordtype, a priori orthogonal contrasts were performed to analyse the wordtype main effect. It was found that there was no significant difference between the recall of neutral and affective words \( (F(1,22) < 1) \). Despite that, there was a significant superior recall of sensory words when compared to recall of neutral and affective words \( (F(1,22) = 7.94, p < 0.05) \), (neutral words \( \bar{X} = 0.40, \text{sd} = 0.25 \), sensory words \( \bar{X} = 0.52, \text{sd} = 0.19 \), affective words \( \bar{X} = 0.43, \text{sd} = 0.23 \)). The interaction group by wordtype was not significant \( (F(2,44) < 1) \). As can be seen from the raw means of the pre-treatment scores for the two groups in Table 2.7, it seems that the major difference found when sensory is compared to neutral and affective wordtypes, can be attributed to the superior recall of sensory words from the AFP group when compared to recall of the other two wordtypes, which is in line with previous findings (Koutantji & Pearce, 1992). Statistically though, this effect cannot be shown due to the small sample size of the AFP group. Means and sds for pre-drug recall scores for each group are presented in Table 2.7.

**Table 2.7** Means and Sds for pre-drug percentage recall scores for Post-Operative Pain group and Atypical Facial Pain group.

<table>
<thead>
<tr>
<th>Wordtype</th>
<th>Atypical Facial Pain Group</th>
<th>Post-Operative Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Drug, n = 9</td>
<td>Pre-Drug, n = 17</td>
</tr>
<tr>
<td>Sensory</td>
<td>0.28, Sd 0.17</td>
<td>0.31, Sd 0.15</td>
</tr>
<tr>
<td>Affective</td>
<td>0.15, Sd 0.13</td>
<td>0.27, Sd 0.15</td>
</tr>
<tr>
<td>Neutral</td>
<td>0.13, Sd 0.16</td>
<td>0.27, Sd 0.17</td>
</tr>
</tbody>
</table>
2.4 Discussion

This study was an investigation of the effect of morphine on pain perception and pain related cognition in chronic and acute pain conditions.

In the light of previous studies (e.g., Price 1985, though see Gracely, 1979) it was expected that in response to morphine administration the post-operative group would show significant reductions in both pain intensity and affect ratings, while the AFP group would show a response in pain affect only. As anticipated, morphine produced significant reductions for both intensity and affective ratings for the post-operative group. The pattern of reduction in affective ratings was time dependent, with the rate of reduction being stable over time (as the linear effect of time was significant), which can most simply be explained in terms of dosage escalation, as the subjects were receiving one fifth of the total dose every ten minutes. The intensity ratings were also influenced by morphine for this group. The significant effect of time for both pain intensity and affective ratings indicates that both are dose dependent within the range of morphine levels administered in this study.

However, morphine had no significant effect on pain intensity ratings for the AFP group, which is consistent with results from previous studies on chronic idiopathic pain (Kupers et al. 1991; Arner and Meyerson, 1988). Evidence from a number of basic animal studies (Dickenson, 1994) provides a framework for a discussion of the mechanisms that may underlie reduced or poor opioid responsiveness of different pain states. Independently of pathological changes in opioid receptors, a number of pharmacological systems have been identified which may be overactive in the AFP group, and could reduce opioid sensitivity. In the studies in question, which have used pain intensity as an endpoint, both peptides and excitatory aminoacid mechanisms have been implicated. Importantly, all available evidence points to an interference with spinal opioid analgesic mechanisms. Presumably, the same would be true for idiopathic facial pain where the sensory trigeminal nuclei can be affected at a spinal cord level. In contrast to pain intensity, there was evidence of morphine influencing the affective pain ratings in the AFP group. This finding could be explained by the observation that lower doses of morphine, which are likely to be active supraspinally in man, reduce the unpleasant nature of pain without much alteration in its intensity (Price et al. 1985). This interpretation is reinforced by evidence from animal studies (Dickenson, 1991), showing that low doses of morphine acting supraspinally can reduce the unpleasant nature of the stimulus in conditions where intensity would be unaltered. It could therefore be proposed that the intensity of pain is altered by spinally acting opioids, whereas the affective component is especially sensitive to supraspinal opioid modulation. In the AFP group it may be that spinal morphine analgesia is reduced by one or another of the proposed mechanisms (Dickenson, 1994), so explaining the lack of effect on intensity. By contrast, supraspinal...
opioid analgesia is still operative so that affect can still be reduced. The same physiological mechanism as in acute pain sufferers could thus be hypothesised to be active in atypical facial pain where morphine blurs the perception of pain (Diffuse Noxious Inhibitory Controls theory) (Le Bars and Villaneuva, 1988). In this case the differential effects for pain intensity ratings found in the present study could be attributed to the low total dose of morphine administered. The use of a higher dose in a future study could help to clarify whether there is a qualitative difference in morphine's impact in pain intensity ratings between chronic idiopathic and acute forms of pain, or whether it is just a dose dependent difference between them due to altered opioid responsiveness of the chronic pain patients. A future attempt to match subjects receiving each drug based on their baseline pain ratings could also help to clarify the issue.

In contrast to previous work, the present study used a homogenous group of idiopathic pain patients, which strengthens the conclusions drawn from the results. Findings from animal behavioural studies suggests that exposure of animals to novel and stressful situations enhanced morphine responsiveness (Wiertelak et al. 1992). This might explain the effect of morphine on AFP patients' affective ratings due to the unfamiliar environmental factors, but this is unlikely since there was no difference between the two groups in their state anxiety levels.

In Leventhal and Everhart's (1979) model the lowest level of perceptual motor processing is underspecified in terms of the location and the specific mechanisms involved in the sensory processing of pain. It seems as if the sensory pathway is particularly active at the spinal cord level, where morphine administration produces differential effects for acute pain and chronic idiopathic pain.

The investigation of the morphine effect at the schematic level of pain processing via the memory task, suggested that morphine has no effect on recall of pain related material for either groups. Similar results were obtained from Saddler et al. (1985), who assessed the effect of morphine on immediate recall in healthy volunteers and found no impairment relative to predrug baseline measures. The group by drug by time by wordtype interaction was not significant, therefore it seems likely that morphine does not have a specific effect on the processing of pain related information either in acute pain or chronic idiopathic pain. Since acute pain patients did not show any preference towards pain related information before the drug administration, it seems likely that cognitive processing of pain is not influenced by the state of acute pain in non chronic pain populations.

The small sample size of the AFP group is also likely to be responsible for the lack of direct evidence of a memory bias favouring pain related information, given that a memory bias effect towards sensory information has been observed in a previous trial with the same
ch. chronic pain population (Koutantji & Pearce, 1992). When a between groups comparison was performed for the pre-treatment recall scores it was found that sensory words were better recalled than neutral and affective ones irrespective of group. A more careful examination of the data showed that it was the chronic pain patients' scores for recall of sensory words which heavily influenced the main effect of wordtype, but this difference was not statistically significant, again possibly due to the small sample size of the AFP group. Whether morphine might have an effect at the cognitive (schematic) level of pain processing in the AFP group is currently the object of a further investigation as this study cannot provide unequivocal results on this issue.

The results from the questionnaires analysis showed that AFP patients are characterised by significantly higher trait anxiety when compared to the acute pain group. A chronic pain condition can be a cause of stress, and at the same time high stress and tension levels can aggravate a chronic pain condition. It is important also that AFP patients reported higher organic pain beliefs regarding causes and consequences of pain, as measured by the PBQ. Atypical facial pain patients in clinical consultations are usually very keen in establishing an organic defect as the cause of their pain, probably reflecting their beliefs about the origins and causes of pain and indicating differences at the conceptual level of pain processing (Leventhal and Everhart, 1979) between the acute pain and the AFP group. This finding is also in line with evidence from studies with other types of chronic pain patients (Edwards et al. 1992b). AFP patients also showed elevated scores on the somatic items of the BDI which could reflect the effects of pain on their sleep, appetite and libido rather than being solely evidence of permanent mood disturbance.

The question why "idiopathic" forms of pain might present different responses to morphine administration than other forms of chronic pain (e.g. neuropathic) implied from previous studies, should be reconstrued as how morphine acts in such states, examining specific chronic pain conditions. Currently we are undertaking further research in an attempt to replicate the morphine effects observed on the affective pain ratings of the AFP group, and study further possible effects of morphine on pain intensity and cognitive processing of pain in chronic pain conditions. The state of acute pain does not seem to affect processing of pain related information in volunteers without chronic pain, suggesting that memory biases observed in chronic pain populations are not likely to be state dependent, but that they occur as the result of prolonged suffering from pain.

The current study attempted to examine perceptual, schematic and conceptual levels of pain experience in chronic and acute pain patients. The next study sets out to explore aspects of the social dimension of pain experience at the early stages of the development of a pain
condition, focusing on the relationships among family history of pain, gender and current pain experience in non-chronic pain populations and using a self-report questionnaire.
CHAPTER 3

An Investigation of the Relationship of Family History of Pain, Gender, and Current Pain Symptomatology

3.1 Introduction

A series of investigations based on the observational vicarious learning hypothesis, have assessed the relationship between pain models within the family and an individual's current pain experience, and have suggested a direct aetiological mechanism. In this context, a familial pain model is defined as a family member who experiences and expresses frequent and persistent pain. It is generally assumed that observation from an early age of people in the immediate family environment suffering from persistent pain and/or illness can act as a modelling factor, shaping future pain and illness behaviour in the observer and possibly also influencing the experience of pain itself.

In a study of chronic pain patients, Violon and Giurgea (1984) compared a group of chronic pain patients to a matched pain-free chronic patient group on the occurrence of chronic pain in their families. The chronic pain group reported significantly more pain models in their families, suggesting that this may have led to a greater sensitivity to pain and/or a greater tendency towards pain behaviour in themselves.

In another study of chronic pain patients Turkat et al. (1984) employing sensitivity, specificity and efficiency analyses, compared a group of headache sufferers to a control group on the number of immediate family members reported to suffer from headaches. They found that headache sufferers reported significantly more headache models, and concluded that knowledge of family headache history has predictive value, although they did not suggest any mechanisms by which that effect might operate.
Turkat & Guise (1983) and Turkat, Guise & Carter (1983), in a series of experiments using students as subjects, investigated whether prior exposure to a high-avoidant or a low-avoidant model's reaction to pain could affect an individual's subsequent reaction to an experimentally induced finger pressure pain. They found that subjects exposed to the high-avoidant model showed a lowered pain tolerance, and completed less work when compared to the low-avoidant model group, giving further evidence of the contribution of vicarious learning processes to the development of reactions to painful stimuli. These findings are in line with evidence from similar previous studies (Craig 1978; Craig and Prkachin, 1978; Craig and Weiss, 1971), but they cannot directly answer to what extent this relationship is short-term or can produce long-lasting effects in the acquisition and/or development of certain pain behaviours.

Further research has investigated the relationship between parental modelling and vicarious observational learning in childhood with reference to current adult pain symptomatology and pain experience, in both student populations and specific chronic pain patient groups.

Edwards, Zeichner, Kuczmierczyk & Boczkowski (1985a), investigated the relationship between family history of pain and current pain experience in male and female college students via the "Parameters of Pain Questionnaire" (PPQ), a questionnaire designed to assess current frequency, duration and intensity of 10 common pain symptoms. They found a significant positive correlation between the frequency of subjects' current pain reports and familial pain models. In addition, pain models were found to have a greater effect on female subjects by predicting more of their current pain symptoms. Mechanisms of vicarious reinforcement associated with secondary gains, external health locus of control beliefs, and genetic predisposition were proposed as plausible explanations for the above findings, although there was no direct investigation of any of them.

Edwards, O'Neil, Zeichner & Kuczmierczyk (1985b), tested possible effects of pain models on pain behaviour and on coping with pain in student subjects, dividing them into a high and a low pain models group on the basis of the number of family members reported suffering from pain symptoms. They found that the high pain models group reported significantly higher pain frequencies than the control group, and their parents were perceived as being less able to work due to pain than those of the low pain models group. Women students also reported higher pain frequencies than men. The authors suggested that the number of pain models was related to the perception of pertinent secondary gains such as work avoidance. There were no differences between high and low pain models students in terms of pain medication use, pain-mediating activities (e.g., distraction), or cognitive coping strategies (attempts to change painful sensations).
Kuczmierczyk and Edwards (1989) explored the role of familial pain models in premenstrual symptomatology (PMS). They used the PPQ, testing 11 women suffering from PMS and 10 pain free women. They replicated the main finding of their previous study (Edwards et al. 1985a). Significant positive relationships existed between the number of pain models and the frequency of current pain reports for subjects with PMS, but not for the controls. Furthermore, specific pain models were found to have a greater impact to the PMS group although there was no significant difference on mean frequency of current pains, and specific and total family models between the two groups. These findings might be attributed to the specific symptom under investigation (PMS) and/or the small sample size tested.

Ehde, Holm & Metzger (1991), compared pain modelling in tension headache and migraine sufferers with headache free subjects, and found that headache sufferers reported more family members displaying pain and illness behaviour. However, when headache pain modelling was specifically examined tension headache sufferers reported a greater number of headache models and more intense headache models than either migraine or control groups.

Lester, Lefebvre & Keefe (1994), investigated the relationship of pain to gender, and family pain history in students. They found using body maps that women reported a greater number of pain sites, and subjects with a family history of pain problems reported a greater number of pain sites, and higher levels of pain-related interference in their daily activities.

The work to date on familial pain models has been carried out primarily in American populations (Edwards et al. 1985 a,b; Lester et al. 1994). The present study was designed to assess the effect of familial influences on current pain experience in a British student population via the completion of the Family Health Questionnaire which was designed for use in this study and was based on the PPQ (Edwards et al. 1985a). The present study also investigated gender specific symptomatology and, indirectly, gender differences in health awareness, since there is current concern about men's health in relation to their style of life, health awareness and illness preventive behaviours. In addition, the contribution of particular pain models to the specific pattern of symptom presentation was studied in the same sample.
Aims of the study

This was the first of three related studies. It set out to examine environmental effects on pain perception and experience, focusing on the influence of the immediate family environment. Its aims were to explore:

i) the incidence of pain symptomatology in male and female students,

ii) the effect of family history of pain on current pain experience and specificity of symptom presentation, and

iii) the predictive value of familial pain models in current symptom presentation.

Specifically it was predicted that:

a) the availability of pain models would be positively correlated with pain frequencies and/or pain symptoms,

b) females would report more pain models and more pain frequencies and/or symptoms than males, and,

c) subjects would be influenced more by pain models of the same sex in symptom presentation.
3.2 Method

3.2.1 Subjects

The sample consisted of 130 first and second year psychology students and 50 medical students in their first year of clinical training. Their mean age was 22.12 (sd = 4.61), age range 18 to 51, and 114 of them were female. All 180 subjects completed the Family Health Questionnaire.

3.2.2 Apparatus and Materials

The Family Health Questionnaire (FHQ) is based closely on Edwards et al. (1985a), "Parameters of Pain Questionnaire" and is a paper and pencil test constructed to assess: a) students experience of current pain symptoms; their kind, frequency, intensity and duration in the previous month, b) current and past pain complaints and/or illnesses of immediate relatives and "significant others". The symptom categories included in the questionnaire were headache, neck pain, back pain, joint pain, muscle pain, chest pain, abdominal pain, menstrual pain, internal pain, tooth/ear pain and other pain. A copy of the FHQ can be found in appendix 3.2.

3.2.3 Procedure

The data were collected from 4 groups of subjects on different occasions. On each occasion the researcher administered the FHQ to students at the beginning of a teaching session. Instructions were given both verbally and on the questionnaire and any additional questions were answered. Questionnaire completion lasted approximately 10 to 15 minutes. At the end the students were thanked for their participation and informed that some of them would be contacted in future to take part in another, related study.
3.3 Results

3.3.1 Pain Models
The completed questionnaires (N = 180) were coded and analysed using the SPSS for Windows program. Each "significant other" person who was reported as suffering from at least one pain symptom counted as one pain model even in cases where he or she was reported as suffering from more than one pain symptom / health problem. The mean number of pain models for the whole sample, calculated by dividing the sum of all the pain models reported by the number of subjects in the study, was 1.94 (sd = 1.68, range 0 to 7 pain models). Female subjects differed significantly from male subjects in the number of pain models reported when an independent t-test comparison was performed (females $\bar{X} = 2.26$, sd = 1.71, males $\bar{X} = 1.39$, sd = 1.48, t = 3.44, p = 0.001).

3.3.2 Incidence of pain symptomatology
The mean number of pain symptoms for the whole sample was 2.53 (sd = 1.76, range 0 to 9). An independent t-test comparison between sexes revealed that females were reporting significantly more pain symptoms than males (females $\bar{X} = 2.75$, sd = 1.78, males $\bar{X} = 2.15$, sd = 1.67, t = 2.21, p < 0.05). The percentage of subjects reporting each individual pain symptom is presented for the whole sample and each sex separately in Table 3.1.

The sum of the pain frequencies reported by the subjects for each pain symptom for the previous month was divided by the number of subjects, to produce the mean frequency of pain which was for the whole sample during the past month 8.69 (sd = 11.37). Despite the greater number of symptoms reported by women students there was no significant difference between the sexes as far as frequency of pain is concerned (females $\bar{X} = 9.66$, sd = 12.99, males $\bar{X} = 7.04$, sd = 7.72, t = 1.49, p > 0.05), in contrast to findings from previous studies (Edwards et al. 1985a,b). Despite that, pain frequencies and pain symptoms were significantly correlated (Pearson r (178) = 0.52, p < 0.001), indicating that greater pain frequencies are associated with more pain symptoms.
Table 3.1 Percentages of participants presenting each pain symptom for the whole sample and each sex separately.

<table>
<thead>
<tr>
<th>Pain Symptoms</th>
<th>Percentage % of ALL sample (N = 180) with symptom</th>
<th>Percentage % of WOMEN (N = 114) with symptom</th>
<th>Percentage % of MEN (N = 66) with symptom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache</td>
<td>72 %</td>
<td>76 %</td>
<td>64 %</td>
</tr>
<tr>
<td>Neck pain</td>
<td>26 %</td>
<td>25 %</td>
<td>27 %</td>
</tr>
<tr>
<td>Back pain</td>
<td>33 %</td>
<td>34 %</td>
<td>30 %</td>
</tr>
<tr>
<td>Joint pain</td>
<td>19 %</td>
<td>19 %</td>
<td>20 %</td>
</tr>
<tr>
<td>Muscle pain</td>
<td>21 %</td>
<td>23 %</td>
<td>18 %</td>
</tr>
<tr>
<td>Chest pain</td>
<td>7 %</td>
<td>5 %</td>
<td>11 %</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>21 %</td>
<td>25 %</td>
<td>15 %</td>
</tr>
<tr>
<td>Menstrual pain</td>
<td>-</td>
<td>48 %</td>
<td>-</td>
</tr>
<tr>
<td>Tooth/ear pain</td>
<td>14 %</td>
<td>14 %</td>
<td>15 %</td>
</tr>
<tr>
<td>Internal pain</td>
<td>4 %</td>
<td>1 %</td>
<td>9 %</td>
</tr>
<tr>
<td>Other pain</td>
<td>5 %</td>
<td>4 %</td>
<td>6 %</td>
</tr>
</tbody>
</table>

3.3.3 The relationship between familial pain models and current pain symptoms

The relationship between pain models and pain symptoms was assessed using Pearson Product-Moment Correlation coefficient. The correlation was significant for the whole sample, Pearson r (180) = 0.35, p < 0.001, as well as when it was computed for each gender separately: Females, Pearson r (114) = 0.29, p < 0.05, Males Pearson r (66) = 0.41, p = 0.001). The significant positive correlation between these variables suggests that students who report a greater number of available pain models also tend to report more pain symptoms overall irrespective of their gender. A regression analysis was performed between age, sex, and number of available pain models as predictor variables, and number of total pain symptoms as the response variable, to assess the extent to which each of these variables could predict the symptoms reported by the participants (Table 3.2). The beta weights represent the contribution of each variable to the current number of symptoms reported.
Table 3.2. R square and β regression values between group, age, sex, and number of available pain models with number of total pain symptoms reported by the participants.

<table>
<thead>
<tr>
<th>Predictor Variables</th>
<th>β(beta)weights $^2$</th>
<th>t value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-0.15</td>
<td>-2.21 *</td>
</tr>
<tr>
<td>Sex</td>
<td>-0.78</td>
<td>-1.01</td>
</tr>
<tr>
<td>Pain Models</td>
<td>0.34</td>
<td>4.7 **</td>
</tr>
</tbody>
</table>

* p < 0.05, ** p < 0.001, R square = 0.154, F(3,176) = 10.7, p < 0.001.

Number of pain models and age, predicted significantly the pain symptoms currently reported by the subjects. The significant contribution of age was not expected, and it was further examined. It was found that the small number of older subjects included in the study (N = 5, age ≥ 35 years) reported significantly fewer pain symptoms than the rest of the sample, which had a great effect in the overall analysis. When they were excluded from the analysis the contribution of age was no longer significant ($β = -0.050$, $t = -0.69$, $p > 0.05$), whilst the pain models still predicted significantly pain symptoms ($β = 0.33$, $t = 4.51$, $p < 0.001$). Sex was not a significant variable in this analysis ($β = -0.089$, $t = -1.18$, $p > 0.05$). R square was 0.134, (F(3,171) = 9.02, p < 0.001).

The lack of an effect of sex in the regression analysis suggests further examination of the measures in the analysis, since it was shown above that women report significantly more pain symptoms than men. As menstrual pain is gender specific, it was decided to exclude menstrual pain from the pain symptoms and the pain frequencies, as well as to exclude pain models of menstrual pain from the pain models, and to repeat the between-sex comparisons for the rest of pain symptoms, pain frequencies and reported pain models. When this was done, there was no significant difference between male and female subjects either when the response variable was pain symptoms (independent $t = 0.44$, $p > 0.05$), or when it was pain frequencies (independent $t = 0.29$, $p > 0.05$). It seems that the sex difference noted above in current pain symptom report was mainly based on the inclusion of menstrual pain in the analysis. However, when the remaining pain models was the dependent measure women were still reporting significantly more pain models than men (independent $t = 3.08$, $p < 0.05$).

When a regression analysis with age, sex and the remaining pain models was performed on the rest of pain symptoms, only pain models emerged as a significant predictor ($β =

$^2$ Standardised regression coefficients.
0.30, t = 3.94, p < 0.0001). Again R square was 0.09, (F(3,171) = 5.43, p = 0.0014). It can thus be assumed that there is an important effect of pain models on current pain report, and this effect is independent of menstrual pain and specific menstrual pain models.

3.3.4 Sex differences in pain models / pain symptoms relationship.

The following analysis was performed to examine this relationship further, with all pain symptoms and all pain models included in the analysis. Based on the number of available pain models the whole sample was divided into two groups. One group reported no pain models (N = 42), and the other group reported at least 1 pain model (N = 138). A one-way ANOVA with pain model group (No pain model group, at least 1 pain model group) as the between subjects factor, and total number of symptoms as the dependent measure, showed that there was a significant difference between the two groups (F(1,178) = 15.801, p < 0.001). Subjects in the pain models group reported significantly more pain symptoms than subjects in the no pain model group. In a further analysis chi square tests were employed to assess differences on specific pain symptoms between subjects with and without pain models for each sex as presented in Table 3.3. The analysis was performed for all subjects in the two groups, and then for women and men separately for the two groups.

In reference to the two pain model groups when data for both sexes were included, headache, joint pain and muscle pain were significantly more prevalent in the pain models group in comparison to the no pain model group. When gender was added as another independent variable, the results revealed different patterns for men and women. Headache, menstrual and tooth/ear pains were significantly more prevalent for women in the pain models group than in the no pain model group. Men in the pain models group presented significantly more joint, and chest pains than men in the no pain model group.
### Table 3.3 Chi square tests for differences between the Pain Model groups in their specific symptom presentation.

<table>
<thead>
<tr>
<th>Pain Symptoms</th>
<th>Pain Model Groups (0, ≥1) (both sexes)</th>
<th>Pain Model Groups (0, ≥1) Women only</th>
<th>Pain Model Groups (0, ≥1) Men only</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \chi^2(1) )</td>
<td>( \chi^2(1) )</td>
<td>( \chi^2(1) )</td>
</tr>
<tr>
<td>Headache</td>
<td>5.69 **</td>
<td>3.57 *</td>
<td>1.18</td>
</tr>
<tr>
<td>Neck pain</td>
<td>1.22</td>
<td>1.20</td>
<td>0.34</td>
</tr>
<tr>
<td>Back pain</td>
<td>1.99</td>
<td>0.91</td>
<td>0.89</td>
</tr>
<tr>
<td>Joint pain</td>
<td>5.29 **</td>
<td>0.29</td>
<td>8.09 **</td>
</tr>
<tr>
<td>Muscle pain</td>
<td>2.79 *</td>
<td>0.83</td>
<td>1.83</td>
</tr>
<tr>
<td>Chest pain</td>
<td>1.91</td>
<td>0.00</td>
<td>3.92 **</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>0.00</td>
<td>0.38</td>
<td>0.06</td>
</tr>
<tr>
<td>Menstrual pain</td>
<td></td>
<td>14.21 ***</td>
<td></td>
</tr>
<tr>
<td>Tooth/ear pain</td>
<td>2.36</td>
<td>3.96 **</td>
<td>0.06</td>
</tr>
<tr>
<td>Internal pain</td>
<td>0.33</td>
<td>0.21</td>
<td>0.83</td>
</tr>
<tr>
<td>Other pain</td>
<td>0.00</td>
<td>0.02</td>
<td>0.13</td>
</tr>
</tbody>
</table>

* \( p > 0.1 \), ** \( p > 0.05 \), *** \( p > 0.001 \)

### 3.3.5. Specificity of symptom presentation

In order to assess whether a direct relationship existed between the type of pain symptom presented by the subjects and those reported by their relatives, chi square analyses were performed for each gender separately for those symptoms where there were enough subjects in each cell of the contingency table (\( N > 5 \)). In cases where less than 5 subjects were reported in at least 1 cell of the contingency table, the Fisher's exact probability statistic was calculated (Coolican, 1990).

In the case of back pain a significant association was found between the women subjects' and their fathers' back pain (\( \chi^2(1) = 4.02, p < 0.05 \)). When women reported joint pain, a significant association between this pain and their mothers' (Fisher exact \( p = 0.028 \)) and sisters' joint pain emerged (Fisher exact \( p = 0.036 \)). Women's abdominal pain was significantly associated with their sisters report of abdominal pain (Fisher exact \( p = \))
0.059), and the report of menstrual pain was significantly associated with menstrual pain in both their mothers (Fisher exact p = 0.005) and their sisters (Fisher exact p = 0.088).

In contrast, when specificity of symptom presentation was examined in the male subjects, the only significant association was between the subjects "other pain" and their fathers' "other pain" report (Fisher exact p = 0.06) which is not really any specific association since the "other pain" category is by definition non specific.
3.4 Discussion

In this study the incidence of pain symptoms during the previous month was investigated in male and female students in relation to their familial pain models and their gender.

The percentages of students presenting some of the pain symptoms (e.g., headache 72%, back pain 33%, neck pain 26%) are higher than one might have expected on the basis of anecdotal evidence from such a young non-clinical population but are comparable to results from other studies (Edwards et al. 1985 a,b; Lester et al. 1994; Sternbach, 1986). Additional research on the pain experience of young adults in different occupational settings and from varying socioeconomic backgrounds, could offer a broader perspective on the generalisability of this finding. Taken at its face value, the high incidence of pain symptoms at such an early age may indicate the need for primary prevention, possibly in the form of pain counselling. In particular, given that for some individuals the symptoms may persist and even worsen unless appropriate action is taken early, an investment in education about pain could prove cost-effective.

The findings also show a significant gender difference in reference to the number of pain symptoms, with women reporting significantly more pain symptoms than men. This finding is in line with previous research (Edwards et al. 1985a,b; Lester et al. 1994). When menstrual symptoms are excluded from the comparison in this study however, the significant difference disappeared. The previously reported differences in the literature between men's and women's current pain report could thus be due to the inclusion of one additional female specific symptom category in the between sexes comparisons (in this study 48% of women reported menstrual pain), rather than any other gender related reason in young adults. This suggestion is strengthened by the fact that menstrual pain was included in Edwards et al. (1985a,b) and the Lester et al. (1994) studies.

In contrast, females reported significantly more pain models than males even when the menstrual pain models were excluded from the comparisons. The fact that women still reported more pain models may reflect a greater tendency to be attentive and aware of other people's pain. Being more aware of pain, and paying more attention to medical problems, may lead to an increased probability of preventing the development of life threatening conditions. It may equally mirror the physiological morbidity of women to chronic pain illnesses, as attention has been drawn recently to possible gender-specific physiological mechanisms in the experience of chronic pain (Unruh, 1996). Preliminary evidence primarily from the United States suggests this could be the case, in that women present higher rates of drug consumption and illness associated with both acute and non-fatal chronic diseases such as arthritis, and headaches (Verbrugge, 1985). Furthermore, women use more medical services than men, even when physician visits for pregnancy
and childbirth are excluded (Cleary, Mechanic & Greenley, 1982; Verbrugge, 1985). The socially approved role of women as primary caregivers, and their traditional choice of occupations as teachers and nurses (Crook, 1982) suggest the operation of plausible, socially determined, learning mechanisms and conformity to sex-role stereotypes, that could account for the observed gender differences in reporting pain models. Violon (1985) proposed a gender specific mechanism for pain, based on "conformity to socio-familial rules", through which pain and suffering in females is viewed by society as inherent to their condition.

Different social roles are attributed to men, in that a caring role is commonly not seen as a vital component of their expected social functions, and health-related complaints are not encouraged. The latter in particular could have an effect on men's own health and might partially account for men's increased suffering from fatal chronic diseases, and lower life expectancy in comparison to women (Verbrugge, 1980). Future research on men's and women's learning history in relation to pain paying particular attention to the associated processes, may lead to a more detailed account of this phenomenon. In addition, an investigation of whether men and women in professional caring roles (e.g., doctors, nurses) tend to observe patients' pain behaviour, or attend to their complaints in different ways, might give a useful insight into other gender-related factors influencing patient care. Some preliminary evidence from research in primary care settings does suggest that gender plays an important role in patient/doctor communication. Hall et al. (1994) found that female physicians conducted longer visits and engaged in more verbal and nonverbal communication with their patients, whilst Bensing et al. (1993) in a study of Dutch general practitioners (GPs) also reported that female GPs spent more time with their patients and had a stronger tendency to provide continuity care.

The importance of pain models as a predictor of current pain report was confirmed by the present study, even though the number of pain models was counted as the number of relatives reported suffering from pain problems and not, as in Edwards et al. (1985a,b) studies, on the number of different pain complaints each relative was reported to suffer from. The latter could inflate the apparent number of pain models, and undermine the significance of the relative as a person in relation to the subject. When subjects were divided in terms of whether or not they reported having pain models, they differed significantly on current symptom presentation. The pain models group presented significantly more pain symptoms than the no pain models group. In relation to the pain symptoms as the response variable, it can be suggested that the number of pain symptoms experienced is less likely to be influenced by memory biases than the report of pain frequencies. A more detailed analysis for each specific symptom revealed that headache, joint and muscle pain were significantly associated with the pain models
group. When gender was taken also into account, headache, menstrual and tooth/ear pains were significantly associated with women in the pain models group, in accordance with evidence that suggests that headaches and orofacial pains are generally more prevalent in women than men (Unrue, 1996), whilst menstrual pain by definition exclusively affects women. Only joint and chest pains were significantly associated with men in the pain models group. A similar effect of gender can be seen when specificity of symptom presentation between relatives' and subjects' currently reported symptoms was studied. The results suggest that there is a specificity of modelling, as women's joint, abdominal and menstrual pain were found to be associated with their female pain models' (mothers and sisters) pain symptoms. This is in contrast to women's male pain models, where only the report of back pain was associated with their fathers' back pain. Men on the other hand, did not identify female relatives as pain models and had their father as a pain model only in respect to the general "other pain" symptom category. These results are similar to Edward's et al. (1985a) findings, but the small number of cases presenting some of the symptoms should be taken into account in evaluating the validity of the findings for those symptoms. As willingness to report pain symptoms could be different between sexes, it would be helpful in future studies to incorporate an additional measure of social desirability to help to clarify this issue.

The reliability of the FES was not tested on this occasion. It was, however, based on the PBQ, and the evidence obtained to a large extent replicated previous findings. A second administration of the FES on a small group of participants, to be reported on Chapter 5, indicated that it can distinguish between high and low pain frequency subjects on two occasions, a year apart. The validity of the instrument, which is basically a self-report measure, is difficult to ascertain. It measures type, frequency and duration of pain experience, which is highly subjective, and no other measures can be used to validate it against, apart from detailed daily diaries which were not possible to administer on this occasion, and can also be subject to inaccuracies.

The retrospective nature of the collected data and possible memory biases means we do not have an objective account of the actual pain experienced by the subjects and/or their family members, a problem inherent in this kind of observational research. On the other hand, one could argue that what matters is people's perception of the events and its effect on their own behaviour. At this stage it is difficult to isolate and suggest a specific mechanism responsible for the observed differences in reported pain models. Future research might usefully employ qualitative methods (e.g., in-depth interviews) to study factors affecting the learning process arising from experiencing one's own, and observing other people's pain symptoms with the ultimate aim perhaps of identifying and reinforcing positive influences and attitudes. Longitudinal studies with young adults
presenting pain symptoms would allow us to determine factors influencing the development of chronic conditions for each gender, and specifically design health protective interventions and promote health related activities accordingly.

The FHQ was used in the following two studies as a screening device to identify groups of subjects with high or low pain frequency, and to investigate cognitive, familial and psychological adjustment factors, possibly affecting the transitional period between frequent experience of pain and the development of chronic pain.
CHAPTER 4

An Investigation of Cognitive Vulnerability towards Pain Information in Non-Clinical Subjects

4.1 Introduction

Various experimental methodologies have been used to investigate information processing biases in emotional disorders and in chronic pain. As reviewed earlier, negative biases in relation to current chronic pain conditions have been detected mainly in memory processes, via the use of incidental and delayed recall tasks and recognition tasks. Implicit memory tasks have recently been shown to produce evidence of an implicit memory bias in emotional disorders and in chronic pain. These studies have used spontaneous report of associations to word stems, examining the wordstem completions as well as interpretation of ambiguous cues to access implicit memory. The role of cognitive biases in the development of a chronic pain condition, however, has not been addressed to date.

Several investigations have studied whether implicit memory effects can be identified in anxious and depressed patients, and have contrasted this with their performance on explicit memory tasks. Mathews et al. (1989) compared clinically anxious subjects to controls on a word completion task and a cued recall task involving neutral, positive, and threatening words investigating implicit and explicit memory processes respectively. They found no effect for an explicit memory bias towards threatening information for the anxious patients, but there was evidence for an implicit memory effect, where anxious patients produced significantly more threatening word completions than the controls, although only for words that they had been recently exposed to. The authors suggested on this evidence, that in anxiety states the internal representations of threat words are more activated rather than better elaborated.
Zeitlin & McNally (1991) in a study of post-traumatic stress disorder (PTSD) investigated implicit and explicit memory for combat, social threat, positive and neutral words in a group of Vietnam combat veterans suffering from PTSD, and a control group of veterans not suffering from PTSD. They replicated the findings of the Mathews et al. (1989) study with respect to the implicit memory test, where PTSD patients produced significantly more word completions for combat words. In contrast to the results of the previous study, however, they also showed a relative explicit memory bias for combat words in that they showed poor memory for everything but combat words. It seems that memory processes are affected in PTSD rather than attentional ones as in anxiety.

Eysenck et al. (1991) examined bias in interpretation of ambiguous sentences related to threat in two experiments with clinically anxious, recovered anxious, recovered clinically anxious and control subjects. They found that currently anxious subjects were more likely than the other groups to interpret the ambiguity in a threatening way, which reflected their anxious mood state, and was not due to response bias.

Nugent & Mineka (1994) investigated implicit and explicit memory biases for threatening material in two studies comparing high and low trait anxious college students. They did not find any implicit memory effects in either of the experiments, although they observed a recall bias for threat words on their first study that they were unable to replicate in the second.

In contrast to findings from the anxiety literature, evidence for an implicit memory bias towards negatively valenced information has not been reported in depression research. Watkins et al. (1992), compared a group of depressed patients to a control group on cued recall and word completion tests with positive, neutral, depression and physical threat words. They found a mood congruent memory bias in the cued recall task for the depressed patients for the words related to depression, but not for the physical threat ones. There was no implicit memory bias effect for the word completion task. They interpreted the explicit memory bias as evidence for the important role that elaboration plays in depression.

Elliot & Greene (1992) studied performance on implicit and explicit memory tasks in a group of 10 subjects suffering from major depression and a matched control group. They used word stem completion and homophone spelling as tests of implicit memory, and cued recall and free recall as explicit memory tests. They found poorer memory in both explicit and implicit memory tasks for the depressed group.

Denny & Hunt (1992) in their investigation of implicit and explicit memory for positive and negative words compared a group of depressed subjects to a nondepressed one using free recall and fragment completion tasks. Depressed subjects showed evidence only for
explicit memory bias towards negative information, where no bias was found in relation
to their performance on the implicit task, a finding which is in line with Watkins et al.

Bradley et al. (1994) examined students by testing a group high in both depression and
anxiety (high negative affect group), and a group low in depression and anxiety (low
negative affect group). The investigators used a primed lexical decision task comprising
neutral, anxiety and depression related words in subliminal and supraliminal priming
conditions. They also examined explicit memory for a self-referent encoding task,
measuring incidental free recall. They found that the high negative affect group
demonstrated a significantly greater subliminal priming of depression-relevant words than
to neutral words in comparison to the low negative affect group. This effect was shown
to be more associated with depression than anxiety measures. These results could be
specific to the groups studied as both anxiety and depression levels were elevated in the
high negative affect group. There were no significant effects on the supraliminal priming
condition or the free recall tasks. The authors concluded that non-clinical depression is
associated with a mood-congruent bias in automatic aspects of implicit memory.

Some attempts to investigate aspects of activation of pain related representations using
implicit memory methodologies have been recently carried out. Pincus et al. (1994) in
two related trials employed an association task where groups of chronic pain patients,
physiotherapists and control subjects were asked to produce relevant associations when
presented with ambiguous and neutral cues, where pain related and neutral associations
were possible. The results showed that pain patients produced significantly more pain
related associations when compared to the other groups, and that this effect was not
related either to anxiety or depression status.

Edwards & Pearce (1994) further investigated the existence of a pain schema when they
compared a chronic pain patients group to a health professionals group and a control
group in their responses to a word association task. The subjects were presented with
twelve word stems which could be completed with four sensory words, four affective
and four illness or pain related words, as well as at least three other non-pain words
each, and were asked to produce spontaneously two words for each stem. The chronic
pain patient group produced significantly more pain related completions compared to the
other groups, indicating the existence of a pain schema specific to the pain patients
group, with differentiated content and higher levels of activation.

Griffith et al. (1996) used a variant of the word completion task from Edwards & Pearce
(1994) study which also included a category of "life-threat" words comparing arthritis,
back pain and cancer pain patients. They found that arthritis patients produced
significantly more pain and illness words, whilst the back pain patients produced significantly more illness related words than the cancer patients. Cancer patients' completions, surprisingly, did not differ from those of the control group, even for the life-threatening words, suggesting possible cognitive avoidance as a coping mechanism in dealing with the disease. The above findings raise the possibility that different pain groups might exhibit different patterns in implicit memory biases, specific to predominant features of the chronic pain syndrome under investigation, such as its meaning, aetiology and consequences for patients' self-schemata.

These studies provide evidence for the existence of a pain schema with different content and or activation level for the chronic pain patients in comparison to the no-pain patient groups. Their results suggest that biased memory processes play an active role in chronic pain groups in the presentation and possibly maintenance of their health problems, in a similar way that negative self-appraisals have been implicated in the maintenance of depression.

The aim of the current study is to investigate whether a similar pattern of pain related word completions is found in non clinical populations when an operationally defined high risk group (a group with significantly higher pain frequencies) is compared to a low pain frequencies control group on the Edwards and Pearce's (1994) word association task. If this is found to be the case, then it could plausibly be argued that the existence of a pain schema and/or its differential activation is evidence of a cognitive vulnerability factor which could be implicated in the development of a chronic pain condition.
4.2 Method

4.2.1 Design

A 2x3 mixed model design was used for the analysis of the word association data where the between subjects factor was group (high pain frequency vs low pain frequency) and the within subjects factor was wordtype (sensory, affective, illness-related).

4.2.2 Subjects

The FHQ was administered to a sample of 141 first year psychology students after they completed the word association task. Subjects who reported up to four episodes of pain during the past month were allocated to the low pain frequency group, while subjects who reported eight or more episodes in the past month were allocated to the high pain frequency group. Thirty six subjects reported between four and seven episodes of pain in the past month and they were excluded from the analysis. This screening procedure resulted in two subsamples of 105 subjects in total. A further four subjects were excluded as they were not native English speakers, and data from the remaining 101 subjects were analysed. In the high frequency group there were 52 subjects, 43 of whom were females ($\bar{X}$ age = 21.48, sd = 0.81), and in the low frequency group there were 49, 28 of them females, ($\bar{X}$ age = 22.14, sd = 0.98). There were no significant differences between groups regarding age (ind $t(1, 97)$ = -0.53, $p > 0.05$).

4.2.3 Materials

The word completion task used by Edwards & Pearce (1994), a pen and paper task, was administered to the subjects, and comprised of two parts. In the first part subjects were presented with twelve word endings (e.g., -ing, -ed), and were asked to write the first two English words that came to their minds for each of the target endings. These words were not used as responses and were only included to train the subjects, as well as give them the impression that the task investigated language. In the second part they were given twelve word stems and were asked again to produce two English words as completions of each word stem. Four word stems were chosen from the sensory and four from the affective categories of the McGill Pain questionnaire (e.g., ten- for tender, hor- for horrible), whereas the remaining four were chosen to be stems of illness-related words (e.g., dis- for disease). For this second part of the task, at least one pain or illness related word completion was possible for each word stem according to the word category it was chosen from, and a minimum of three non-category related completions
of the same or greater frequency of occurrence in the English language were possible (Carroll, Davies and Richman, 1971). The whole list of target words is presented in Table 4.1.

Table 4.1 Target pain and illness related words.

<table>
<thead>
<tr>
<th>Sensory words</th>
<th>Affective words</th>
<th>Illness words</th>
</tr>
</thead>
<tbody>
<tr>
<td>tender</td>
<td>horrible</td>
<td>ambulance</td>
</tr>
<tr>
<td>hurting</td>
<td>miserable</td>
<td>disease</td>
</tr>
<tr>
<td>burning</td>
<td>fearful</td>
<td>healthy</td>
</tr>
<tr>
<td>sharp</td>
<td>cruel</td>
<td>accident</td>
</tr>
</tbody>
</table>

4.2.4 Procedure

The word association task was administered to all subjects at the end of one of their lectures, with instructions to complete the task as part of an investigation into the use of language. They were asked to complete the word stems with the first two English words that came to their mind. Subjects who were not native English speakers were asked not to complete the word association task form. After that, subjects had to complete the FHQ which was later used by the experimenter as a screening device to allocate subjects into two groups based on their report of current pain frequencies prior to the coding and analysis of the word association task data. This presentation order was chosen so as the word association task data would not be biased by the explicit reference to pain experiences included in the FHQ. The whole procedure lasted about 15 minutes and the subjects were thanked for their participation.
4.3 Results and Discussion

The word completions were scored by calculating for each subject the total number of target words and their variants produced for each wordtype category (pain related and illness related). All variants of the target words were accepted (e.g., horrible, horrendous). Plots of means against standard deviations showed that no transformations were necessary.

A mixed model analysis of variance was performed, with group (high pain frequency, low pain frequency) as the between subjects factor, and wordtype (sensory, affective, illness related) as the repeated measure. The main effect of group was not significant ($F(1,99) < 1$). In addition, neither the main effect of wordtype ($F(2,198) = 1.14$, $p > 0.05$), nor the interaction group by wordtype ($F(2,198) < 1$) were significant. A between groups comparison was also performed on the total of pain word completions (computed as the sum of pain related word completions from the sensory and affective categories) and this also was not significant ($ind \, t(1,99) = 1.05$, $p > 0.05$).

Table 4.2 Means and Sds for Wordtype completions for High pain frequency Group and Low pain frequency Group.

<table>
<thead>
<tr>
<th>Wordtype</th>
<th>High pain frequency Group N = 52</th>
<th>Low pain frequency Group N = 49</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\bar{X}$</td>
<td>Sd</td>
</tr>
<tr>
<td>Sensory</td>
<td>0.92</td>
<td>0.71</td>
</tr>
<tr>
<td>Affective</td>
<td>1.13</td>
<td>0.86</td>
</tr>
<tr>
<td>Pain Words Total</td>
<td>2.06</td>
<td>1.02</td>
</tr>
<tr>
<td>Illness related</td>
<td>0.90</td>
<td>0.82</td>
</tr>
</tbody>
</table>

In this investigation of high and low pain frequency subjects there were no significant differences between groups regarding their fragment completions of sensory and affective pain related words and illness related words. It would appear from this that there are no differences in either the content or the activation of a pain schema in normal populations. As there is evidence of selective processing of pain related material in studies of chronic pain patients, it may be that the increased activation of constructs related to pain experience results or develops as the pain condition progresses and...
becomes chronic (clinical). It might be that individuals have to explicitly identify themselves as pain sufferers before information processing biases regarding pain material occur. This identification might facilitate the formation of a pathological-content pain schema, and/or mediate an increased activation of pain related representations possibly as part of their self-schema. Relevant research has shown that the accessibility of negative content constructs is dependent on a state of depression, with depressed patients exhibiting an interference effect to depression-related words on a Stroop task during hospitalisation but not on discharge (Gotlib & Cane, 1987). Dobson & Show (1987) using a self-referent encoding task also found that depressed patients who recovered, presented a pattern in recall which was similar to control groups, but dissimilar to their initial performance on the task when they were depressed. It might be the case therefore, that such an activation is also more state dependent for pain related material, and closely related to current concerns and attitudes. Identifying and following up subjects who would go on to develop a chronic condition in a longitudinal design could give more insight into the nature, the time of occurrence, levels of activation and stability of a pain schema.

In order to further investigate implicit memory functions in people who have a high risk of developing chronic pain in the future, we have to devise more specific tests where subjects are exposed to pain relevant stimuli (priming) prior to the administration of implicit tests such as word completion or word decision ones. However, in research comparing students who are vulnerable to depression or anxiety with control groups of students, such as the Nugent & Mineka (1994) and Bradley et al. (1994) studies, there was no consistent evidence for implicit memory biases. Additional control for the verbal fluency of subjects might be beneficial, although in this study we could assume there are no significant differences on verbal ability since the subjects were university students, and such a control was not included in other similar studies. Based on the above findings we could suggest that there are no differences in pain schema activation at the extreme ends of the distribution of pain frequencies for normal populations. Of course it could be the case that the task used was not sensitive enough to detect any differences, which is unlikely, since the same task has yielded different responses when used with chronic pain populations (Edwards & Pearce, 1994; Griffith et al. 1996). Furthermore, the categorisation criterion used might not be valid, in the sense that allocating subjects to high and low current pain frequency groups was not actually differentiating between high and low risk subjects, although in other studies similar group selection criteria were used (e.g., Bradley et al. 1994). In the study described in the next chapter, however, a subgroup of the initial sample was subjected to further investigations, which included a 12 month follow-up testing phase, and it was found that
there were still significant differences between subjects allocated to the two groups regarding both pain frequencies and pain symptoms (see Chapter 5).

As there was a lack of support in this study for an implicit memory bias in high pain frequency subjects, and given the dissociation between implicit and explicit memory functions, it was decided to use tests of explicit memory to further explore the relationship of pain specific cognitive biases in the development of chronic pain.

In the next study therefore, explicit memory and processing time for pain related and neutral material was examined using recall and recognition tests in processing tasks employing self and other reference encoding conditions, with high and low pain frequency students. In addition, the role of the family in pain development was further investigated by examining whether specific patterns of family function were associated with high and low pain reporting.
CHAPTER 5

An Investigation of Memory for Pain and Family Function in High and Low Pain Frequency Subjects

5.1 Introduction

A considerable amount of evidence from research on emotional disorders points to the differential processing of disorder-specific material which can be demonstrated either at the attentional, or the memory stages of information processing. The importance of identifying whether a cognitive bias constitutes a vulnerability factor affecting future development of a disorder, or is simply a consequence of current experience, is that it might provide us with ways of screening for that disorder, and possibly intervening before its onset. The question of where a cognitive bias comes from and how it develops also requires attention if a fuller understanding of the interplay between environmental and cognitive factors in physical and/or emotional disorders is to be achieved. The social environment, epitomised by the immediate family, plays an important role in shaping an individual's frame of mind, personality, attitudes and beliefs; but does it also affect modes of information-schematic processing regarding pain?

In the previous study no evidence of an implicit memory bias for pain related words in high and low pain frequency subjects was found. Given the dissociation between implicit and explicit memory processes (Parkin, 1993) a further study was designed to investigate recall for pain related and neutral material, examining also the effects of self and other reference encoding, in high and low pain frequency subjects.

The formulation of hypotheses derived from the schema theories in the study of emotional disorders has led to a number of studies investigating the effects of self-reference encoding in the fields of depression, anxiety and, recently, in chronic pain.
Derry & Kuiper (1981) for example, studied differences in self-schema content in a female population among a clinical group of depressives, a non depressed psychiatric control group, and a normal non depressive group. They tested the hypothesis that there would be selective processing of negative material in depressed patients, using a depth of processing manipulation where subjects were asked to make structural, semantic and self-reference ratings on personal adjectives, with "depressed" or "non-depressed" content followed by an incidental recall test. They found that depressed patients showed a recall bias towards depression related adjectives when they were encoded in the self-referential condition, while both normal and nondepressed psychiatric control groups displayed superior recall for the self-referenced, non-depressed content adjectives. It was suggested that the findings are consistent with Beck's proposal that an efficient negative self schema exists, specific to the disorder of depression. According to this argument, depressed subjects tend to criticise themselves as responsible for life events, assuming responsibility for them and exacerbating their meaning. Their negative self schema tends to process congruent information selectively, ignoring or inhibiting processing of positive incongruent material (Pincus et al. 1993). It should also be mentioned that demonstration of a self-reference recall advantage in depression depends crucially on the use of negative mood congruent words (Williams et al. 1988).

The stability of the negative self-reference bias in recall in relation to depression was studied by Mathews & Bradley (1983) in an experimental mood induction study, where normal students were tested using a brief version of the Self-Referent Adjective Recall Task. They were asked to make ratings on the adjectives in a self-reference and in an other-person reference condition. A follow up trial was also carried out for the subjects scoring at the extreme ends of the distribution in bias four months later. Their results indicated that the extent of self-related recall bias varied considerably across the two occasions, though significant correlations were still found between negative recall bias and self reported frequency and severity of depression. These findings give equivocal support for the negative self schema model. Similar results were obtained from Hammen et al. (1986) where the extent of reported past depression contributed to current recall bias in depressed students, but when their mood improved all evidence of enhanced recall for negative words disappeared.

Bradley & Mathews (1988) studied memory bias comparing people who had recovered from clinical depression, depressed patients and nonpsychiatric controls using the same task as in their 1983 study, and a self or unfamiliar-other referent encoding condition. Their findings indicated with current depression showed a negative self-referent bias in recall, while the recovered group and the controls recalled more positive than negative self-referent material. In the other-person referent condition, recovered depressives
recalled fewer positive than negative adjectives, suggesting that retrieval operations in recovery are not completely normal. Therefore, it was concluded that negative self-referent recall bias is a function of both mood and more enduring cognitive structures, such as a self-schema.

Evidence from relevant research with other conditions suggests that there are different patterns of negative bias. As reviewed in Chapter 4, research with various groups of anxious patients did not provide consistent evidence for a memory bias towards threatening or negative information (Mathews et al. 1989; Mogg, Mathews & Weinmann, 1987). One partial exception to these negative findings is Nugent & Mineka's (1994) study of memory biases for threatening material with high and low trait anxious college students. They found a recall bias for threat words on the first trial, though they were unable to replicate it on the second.

When disorder-specific stimuli have been used with various types of anxiety related disorders, some positive results were obtained regarding memory biases. Watts et al. (1986), showed that spider phobics had poor recognition memory for spiders suggesting the operation of a cognitive avoidance mechanism. In a further study, Watts & Dalgleish (1991) used recall and recognition tests for spider phobia and baby related words. They showed that spider phobics in comparison to controls presented impaired free recall (incidental and delayed) and recognition of spider related words. Zeitlin & McNally (1991) when tested PTSD patients in comparison to controls, found that PTSD patients presented poorer memory for everything but combat words.

As Mathews & MacLeod report in their 1994 review of the area, "the weight of empirical evidence suggests strongly that facilitated ability to recall emotionally negative information is a characteristic of elevated depression, but not of elevated anxiety". Despite the lack of a facilitated recall for threatening information for anxious patients, however, some disorder (content) specific memory biases have been demonstrated for anxiety related disorders.

Current evidence from the pain literature indicates that pain patients present information processing biases favouring pain-related information similar to those of the depressed patients (demonstrated mainly as memory biases) rather than the anxious ones (attentional biases). As reviewed in Chapter 1, an increased recall for pain related words when compared to controls is found for pain patients (Pearce et al. 1990; Edwards et al. 1992a), and a self-reference effect favouring pain related information is also present (Pincus et al. 1993; Koutantji & Pearce, 1992) suggesting that a pain schema is incorporated in the self concept of chronic pain patients.
In a recent study, Pincus et al. (1995) investigated endorsement and memory bias of self-referential stimuli in depressed and non-depressed pain patients and non-pain control subjects. Subjects were presented with positively and negatively valenced depression-related, pain-related and neutral control adjectives and were asked i) to make a judgement on whether the adjectives described themselves and their best friends and ii) to recall the processed words. The investigators used endorsement and recall scores as dependent variables. They found that depressed pain patients showed self-referential bias towards negative pain-related words but not towards negative depression-related words, for both endorsement and recall data. These findings suggested a content-specific processing bias for chronic pain patients similar to the one observed for the PTSD patients in the Zietlin & McNally’s (1990) study.

Along with research on the effects of pain in information processing, some research has been carried out investigating familial factors in chronic pain patient groups. Evidence from relevant studies suggests that families of chronic pain patients differ from control families in patterns of specific family functions such as organisation, control, and conflict. Feuerstein et al. (1985) using the Family Environment Scale (FES, Moos & Moos, 1981), an inventory that assesses different dimensions of family function, found that chronic low-back pain patient families presented with increased family conflict and family control, and were less recreationally oriented in comparison to control families. High family conflict in these patients was associated with increased distress and pain, whereas independence was related to less distress but more pain. Waring & Russel (1980) investigated family structure and marital adjustment in patients with chronic physical symptoms of obscure aetiology and in normal controls. They administered the FES and found patients' families to be significantly less cohesive and expressive, less oriented towards intellectual interests, and higher on organisation and control than the families of the control subjects.

As shown in Chapter 3, student subjects with pain models reported significantly more pain symptoms when compared to students with no pain models. It is of theoretical and clinical interest to study further this phenomenon by examining the relationship between patterns of family function and pain experience. If certain family characteristics co-exist with the experience of high pain frequency and are different from the characteristics of the families of low pain frequency subjects, then they might play a predisposing or even mediating role in the development of a chronic pain condition. One way of exploring this would be to investigate the family environments of high and low pain frequency subjects using the FES.
Taking the above consideration into account, the current study was designed to investigate whether students with high pain frequencies would exhibit selective memory for pain-related information encoded in relation to themselves when compared to a low pain frequencies control group. Under the assumption that the high pain frequency group is at high risk of developing a chronic pain condition in the future, the study looks particularly at:

i) whether memory bias towards pain-related information precedes the establishment of chronic pain, and therefore could be partially implicated in causing its development/transition, and

ii) whether environmental, in this case familial factors, are associated with the development of a pain-specific schema incorporated within the self representation of vulnerable individuals.

Recall and recognition memory tasks for pain related and neutral material encoded in a "self" and "other" person reference conditions were administered. It was predicted that high pain frequency subjects would present a memory bias favouring pain-related information only for the self-reference condition, and possible processing-time biases were also explored.

In addition, patterns of family function were assessed using the FES. Evidence from studies of chronic pain patients (Feuerstein et al. 1985; Waring & Russel 1980) suggests that a specific pattern of family functions is associated with the presence of painful conditions. In the light of this evidence the hypothesis under investigation was that high pain frequency subjects would come from families scoring high in conflict, control and organisation, and low in expressiveness and support dimensions as measured by the FES subscales when compared to low pain frequency subjects. If this was found to be the case, it would suggest that this pattern of family function may contribute to the development of chronic pain.

A follow up phase was carried out approximately 1 year (13.3 months) after the initial assessment. The experiment was repeated to look at the development of pain, and possible differences arising in the processing of pain related material over time. It was hypothesised that a greater proportion of those subjects in the high pain frequency group with a bias in the first trial would present a self-referential bias favouring pain related information in the follow up.
5.2 Phase One

5.2.1 Method

5.2.1.1 Design

A mixed design was employed, with one between groups factor (high pain frequency group, low pain frequency group), and regarding the processing memory task, two within group factors, reference (self-reference, other-reference) and wordtype (sensory, affective and neutral). The response variables for the recall lists were the percentage recall for each wordtype. The recognition task dependent variables were the d' scores used as a measure of discriminability, and beta scores used as a measure of response bias; d' and beta scores were calculated on the basis of the number of words correctly recognised, "hits", and the number of words incorrectly recognised as previously presented, "false alarms", following principles of signal detection theory. The processing times for each wordtype in the recall lists were also used as a dependent measure.

Between groups comparison were made regarding subjects scores in the Family Environment Scale (FES, Moos & Moos, 1981), Beck Depression Inventory (BDI, Beck et al. 1961) & State Trait Anxiety Inventory (STAI, Spielberger et al. 1973).

5.2.1.2 Subjects

Two groups of subjects were selected from the student population who participated in the studies presented in Chapters 3 & 4 based on their report of current pain frequency as reflected in the FHQ. The low current pain frequency group comprised of 18 student subjects (14 females, \( \bar{X} \text{age} = 20.66, \text{sd} = 2.87 \)) who reported no more than 4 episodes of pain during the past month. The high pain frequency group subjects \((N = 18, 11 \text{ females}, \ \bar{X} \text{age} = 24.66, \ \text{sd} = 9.21)\) reported at least 8 episodes of pain in the past month. The choice of twice the number of reported frequencies as an operational criterion to allocate subjects into the high frequency group instead of using the dichotomy was made with the aim of maximising the likelihood of detecting any differences between the groups (similar methodology was used by Mathews & Bradley, 1983), and it was applied as a result of a preliminary analysis on the FHQ data for 88 subjects, carried out for the study presented in Chapter 3. This showed that pain frequency was the significant variable that distinguished between high and low pain models groups in that study. All subjects were native English speakers.
5.2.1.3 Apparatus

The processing memory task was presented on an IBM compatible Personal Computer. The instructions and the verbal material were displayed in white on a black field on a monitor with VGA screen. The response buttons were the 1, 2, 3, 4 and 5 keys on the computer keyboard which was at desk level while the monitor was at eye level. A stopwatch was used to measure: a) the two-minute intervals between the end of the presentation of the recall list and the beginning of the recall phase and b) the three-minute duration of the recall phases.

5.2.1.4 Materials

Processing memory Task

The two recall lists used in the audiotaped presentation in the study presented in Chapter 2 were used again, but this time all test material were presented visually on the computer screen. In the recall stage subjects were asked to remember as many adjectives as they could in each referential condition, while the order of the reference conditions (self, friend), as well as the presentation of the lists (I, II) was randomised across subjects. Each recall test was followed by the visual presentation of a corresponding 52 word recognition list, which included all the words of the recall list previously presented (26), plus an equal number of matched new adjectives of each wordtype presented in random order. During the recognition test subjects were asked to identify which of the words were part of the recall list previously presented and which were not. The recall and recognition word lists are presented in Tables 5.1 and 5.2 respectively. A computer programme written in QBasic computer language was used in order to present the lists of the words to the subjects and to record the responses.

Questionnaires

Three questionnaires were administered after the completion of the second memory test in order to assess subjects' general psychological state. These were the STAI, BDI and the FES which was used to assess different dimensions of family function, and was described in the introduction section of this chapter (see appendix 5.1). The other two questionnaires were described earlier in the thesis (see Chapter 2).
Table 5.1 Recall lists I and II.

**RECALL LISTS**

<table>
<thead>
<tr>
<th></th>
<th>List I</th>
<th>List II</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FILLERS</strong></td>
<td>round</td>
<td>useful</td>
</tr>
<tr>
<td></td>
<td>common</td>
<td>wooden</td>
</tr>
<tr>
<td></td>
<td>straight</td>
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<tr>
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<td>quiet</td>
</tr>
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<td>original</td>
</tr>
<tr>
<td></td>
<td>difficult</td>
<td>marked</td>
</tr>
<tr>
<td></td>
<td>fresh</td>
<td>short</td>
</tr>
<tr>
<td><strong>NEUTRAL</strong></td>
<td>windswept</td>
<td>selective</td>
</tr>
<tr>
<td></td>
<td>imprecise</td>
<td>legal</td>
</tr>
<tr>
<td></td>
<td>amazing</td>
<td>leaking</td>
</tr>
<tr>
<td></td>
<td>flexible</td>
<td>promising</td>
</tr>
<tr>
<td></td>
<td>educated</td>
<td>nimble</td>
</tr>
<tr>
<td></td>
<td>polished</td>
<td>angular</td>
</tr>
<tr>
<td><strong>SENSORY</strong></td>
<td>scalding</td>
<td>tingling</td>
</tr>
<tr>
<td></td>
<td>stabbing</td>
<td>flashing</td>
</tr>
<tr>
<td></td>
<td>pressing</td>
<td>throbbing</td>
</tr>
<tr>
<td></td>
<td>boring</td>
<td>crushing</td>
</tr>
<tr>
<td></td>
<td>pounding</td>
<td>tugging</td>
</tr>
<tr>
<td></td>
<td>tender</td>
<td>hurting</td>
</tr>
<tr>
<td><strong>AFFECTIVE</strong></td>
<td>unbearable</td>
<td>gruelling</td>
</tr>
<tr>
<td></td>
<td>discomforting</td>
<td>miserable</td>
</tr>
<tr>
<td></td>
<td>mild</td>
<td>distressing</td>
</tr>
<tr>
<td></td>
<td>horrible</td>
<td>troublesome</td>
</tr>
<tr>
<td></td>
<td>fearful</td>
<td>terrifying</td>
</tr>
<tr>
<td></td>
<td>cruel</td>
<td>vicious</td>
</tr>
</tbody>
</table>
Table 5.2 Recognition lists I and II.

<table>
<thead>
<tr>
<th></th>
<th>Recognition List I</th>
<th>Recognition List II</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SENSORY</strong></td>
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<td></td>
</tr>
<tr>
<td>scalding</td>
<td>tingling</td>
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</tr>
<tr>
<td>stabbing</td>
<td>flashing</td>
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<tr>
<td>pressing</td>
<td>throbbing</td>
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<tr>
<td>boring</td>
<td>crushing</td>
<td></td>
</tr>
<tr>
<td>pounding</td>
<td>tugging</td>
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<tr>
<td>tender</td>
<td>hurting</td>
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<td>searing</td>
<td></td>
</tr>
<tr>
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<td>itchy</td>
<td></td>
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<tr>
<td>beating</td>
<td>pricking</td>
<td></td>
</tr>
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<td>drilling</td>
<td></td>
</tr>
<tr>
<td>cutting</td>
<td>gnawing</td>
<td></td>
</tr>
<tr>
<td>shooting</td>
<td>splitting</td>
<td></td>
</tr>
<tr>
<td><strong>AFFECTIVE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>unbearable</td>
<td>gruelling</td>
<td></td>
</tr>
<tr>
<td>discomforting</td>
<td>miserable</td>
<td></td>
</tr>
<tr>
<td>mild</td>
<td>distressing</td>
<td></td>
</tr>
<tr>
<td>horrible</td>
<td>troublesome</td>
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<tr>
<td>fearful</td>
<td>terrifying</td>
<td></td>
</tr>
<tr>
<td>cruel</td>
<td>vicious</td>
<td></td>
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<tr>
<td>punishing</td>
<td>exhausting</td>
<td></td>
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<td>excruciating</td>
<td></td>
</tr>
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<td>sickening</td>
<td></td>
</tr>
<tr>
<td>blinding</td>
<td>annoying</td>
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<td>frightful</td>
<td></td>
</tr>
<tr>
<td>killing</td>
<td>tiring</td>
<td></td>
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<tr>
<td><strong>NEUTRAL</strong></td>
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<td>windswept</td>
<td>selective</td>
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<tr>
<td>imprecise</td>
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<td>amazing</td>
<td>leaking</td>
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<td>educated</td>
<td>nimble</td>
<td></td>
</tr>
<tr>
<td>polished</td>
<td>angular</td>
<td></td>
</tr>
<tr>
<td>knotty</td>
<td>protruding</td>
<td></td>
</tr>
<tr>
<td>reputable</td>
<td>prime</td>
<td></td>
</tr>
<tr>
<td>grand</td>
<td>resounding</td>
<td></td>
</tr>
<tr>
<td>informal</td>
<td>swaying</td>
<td></td>
</tr>
<tr>
<td>transient</td>
<td>youthful</td>
<td></td>
</tr>
<tr>
<td>spreading</td>
<td>stony</td>
<td></td>
</tr>
</tbody>
</table>
5.2.1.5 Procedure

Subjects from studies presented in Chapters 3 & 4 meeting the selection criteria were contacted through the university's internal post, and informed about the next part of the study concerning health and language, and were invited to participate. Each volunteer was tested individually in an office or a university cubicle.

The processing memory task was carried out in two phases each involving the presentation of a recall list followed by a recognition list. The subject sat in front of a computer screen and was asked to read from a sheet of paper the instructions for the appropriate condition, and ask any questions if there was anything they had not clearly understood. The same instructions were then also presented on the computer screen. The instructions for the self-reference condition were:

'You will be asked to imagine YOURSELF in situations involving certain words. For example, a situation where something or someone is obedient. Then you will be asked how likely this is to happen. There are no right or wrong answers. You do not have to write anything down, just strike the appropriate key (1-5) that says how likely it is that this situation would happen in real life. (The example was cued with the instruction) Imagine YOURSELF in a situation in which something or someone is: obedient

(The following scale was used by the subjects to rate the likelihood of the imagined situation happening in real life)

1 represents that this WILL NOT HAPPEN

2 represents that this is UNLIKELY TO HAPPEN

3 represents that this is POSSIBLE TO HAPPEN

4 represents that this is LIKELY TO HAPPEN

5 represents that this is CERTAIN TO HAPPEN

Make sure that you have a good picture in your mind of every word and that you include yourself in each situation'.

In addition, subjects were trained with the adjectives: inconstant, incredible, and morbid before the beginning of the actual trial. Further explanations and examples were given by the experimenter at this point when necessary. In cases were subjects pressed a key other than 1-5, a buzz was heard and the next word did not appear on the screen until an appropriate key had been struck. For the other-reference condition, instead of imagining themselves, subjects were instructed to select and imagine a friend who does not suffer from pain, in conditions irrelevant to themselves (the subject). The rest of the
instructions were identical to the self-reference condition. After the training, subjects were again presented with the instructions relevant to the referential condition in which they had to perform on the specific trial. As soon as they read the instructions, presentation of the words on the recall list was initiated. One word at a time was presented on the screen preceded by the instruction "Imagine YOURSELF in a situation in which something or someone is: ........" or "Imagine your FRIEND in a situation in which something or someone is: ........". The subject then responded as soon as the word was processed by pressing one of the 5 designated keys as appropriate. Processing time (time lapsed between presentation of the word on the screen and the pressing of the appropriate button) was recorded automatically along with the subjects rating. When all the words on the first recall list had been presented and responded to, the subjects were asked to count backwards from 1000 in threes and write down the numbers for two minutes in order to clear short term memory before starting the recall test (this interference task was used in similar studies by Mathews et al. 1983). Then, they were asked to recall as many words as they could from those previously presented for a period of three minutes. Those responses were recorded by the experimenter. On completion of the recall test the corresponding recognition list was presented one word at a time on the computer screen. Each presented word on the screen was cued with the phrase "Do you recognise this word as belonging to the previously presented list? Yes or No Press Y for Yes, N for No. They were further instructed to guess in instances where they were not sure. These responses were recorded automatically.

Finally, all subjects were administered with the STAI, BDI and FES. After the completion of the questionnaires subjects were thanked for their participation and were informed about the follow-up phase of the study which was scheduled for the following year. The whole procedure took from 45 to 60 min.
5.3 Results

5.3.1 Recall Scores Analysis

From the raw scores the proportion of words correctly recalled for each wordtype (neutral, sensory, affective) in each referential condition (self, other) was calculated for each subject. The recall data were subjected to a 2x2x3 analysis of variance with group (high pain frequency group, low pain frequency group) as the between subjects factor, and reference condition (self, other) and wordtype (sensory, affective, neutral) as the two within group factors. The SPSS for Windows program was used for the analyses. Means and sds for the recall scores are presented in Table 5.4.

Table 5.4 Means and Sds for recall scores.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Wordtype</th>
<th>High pain frequency Group</th>
<th>Low pain frequency Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N = 18</td>
<td>N = 18</td>
</tr>
<tr>
<td>Self</td>
<td>Neutral</td>
<td>0.23 0.16</td>
<td>0.20 0.13</td>
</tr>
<tr>
<td></td>
<td>Sensory</td>
<td>0.41 0.26</td>
<td>0.27 0.18</td>
</tr>
<tr>
<td></td>
<td>Affective</td>
<td>0.38 0.20</td>
<td>0.31 0.28</td>
</tr>
<tr>
<td>Other</td>
<td>Neutral</td>
<td>0.27 0.15</td>
<td>0.28 0.20</td>
</tr>
<tr>
<td></td>
<td>Sensory</td>
<td>0.34 0.25</td>
<td>0.27 0.14</td>
</tr>
<tr>
<td></td>
<td>Affective</td>
<td>0.19 0.16</td>
<td>0.24 0.16</td>
</tr>
</tbody>
</table>

In the analysis of variance the main effect of group was not significant (F(1,34) = 2.28, p > 0.05), but the main effect of wordtype approached significance (F(2,68) = 2.55, p = 0.086), (neutral words $\bar{X} = 0.25$, sd = 0.12, sensory words $\bar{X} = 0.32$, sd = 0.17, affective words $\bar{X} = 0.28$, sd = 0.14). A priori contrasts on the wordtype effect showed that there was no significant difference on the recall between sensory and affective words (F(1,34) = 1.22, p > 0.05), but both sensory and affective words were better recalled than neutral words (F(1,34) = 4.74, p < 0.05). The interaction group by wordtype was not significant (F(2,68) = 1.44, p > 0.05). The main effect of reference was also non significant F(1,34) = 2.43, p > 0.05), as well as the interaction group by reference F(1,34) = 2.43, p > 0.05). In contrast, the interaction of wordtype with reference was significant (F(2,68) = 4.05, p < 0.05). Simple effects analysis of the wordtype by
reference interaction revealed that there was a significant effect of reference on the recall of the affective words. The affective words encoded in the self-reference condition were significantly better recalled in comparison to the ones encoded in the other-reference condition (F(1,34) = 7.16, p < 0.05). Since it was of theoretical interest for the present study whether there was also a within groups difference in the processing of affective words for each reference, the relevant simple interaction effects were calculated for each group (see Howell, 1987, pg. 405). It was found that recall for the affective words encoded in the self-reference condition was significantly better only for the high pain frequency group (F(1,34) = 7.51, p < 0.05). Following the same line of analysis, between groups differences were also investigated. The simple interaction effects of sensory words encoded in the self-reference condition between groups were calculated. It was found that there was an almost significant difference on recall of sensory words encoded in the self-reference condition (F(1,33) = 4.02, exact p = 0.053), with the high pain frequency group presenting increased recall of sensory words in self-reference, as it is graphically illustrated in figure 5.1. The overall three way interaction group by wordtype by reference was not significant (F (2,68) < 1).

Since the increased recall of affective words could be attributed to the higher depression levels of the high pain frequency group (they had higher BDI scores but not significantly different from those of the low pain frequency group, see Questionnaires analysis), the BDI was entered as a covariate and the analysis was repeated. The covariate was not significant (t = -1.36, p > 0.05) and its use did not alter the pattern of the results in the main analysis.
Figure 5.1 High and Low Pain Frequency groups percentage recall scores for each wordtype in each referential condition.

Recall Scores
High Pain Freq Group vs Low Pain Freq Group

5.3.2 Processing Time Analysis

In the examination of the raw processing time data, one case was identified as an outlier and eliminated from the analysis. When the Box-Cox (1964) diagnostic procedure was applied on the raw data, a square root transformation was performed to reduce positive skewness. The processing time data were analysed using the same mixed model of analysis of variance as in the recall and recognition analyses, with group as the between subjects factor and reference and wordtype as the repeated measures. Since the pattern of the results on the transformed processing time scores did not differ from that of the raw data analysis, the latter will be presented.

The main effect of group was not significant (F(1,32) = 1.28, p > 0.05). The main effect of wordtype approached significance (F(2,64) = 2.54, exact p = 0.087). The interaction group by wordtype was not significant (F(2,64) < 1). The main effect of reference was significant (F(1,32) = 4.78, p < 0.05). The self-reference encoding required significantly more time in comparison to the other reference condition (self-reference $\bar{X} = 6.19$, sd = 2.88, other reference $\bar{X} = 5.55$, sd = 2.20). The interaction group by reference was not significant F(1,32) = 1.92, p > 0.05). The interaction wordtype by reference approached
significance \( F(2,64) = 2.60, \) exact \( p = 0.082 \), and the interaction group by wordtype by reference \( F(2,64) = 4.85, \) \( p < 0.05 \) was significant. Simple effects analysis of the interaction revealed that subjects in the high pain frequency group allocated more time in the processing of neutral words in the self-reference condition \( F(1,32) = 4.20, \) \( p < 0.05 \) than in the other reference condition. Furthermore, the same group allocated significantly more time for the processing of affective words in the self-reference condition in comparison to the other reference condition \( F(1,32) = 9.75, \) \( p < 0.01 \). Means and sds for processing time (raw data) are presented in Table 5.5. and represented graphically in figure 5.2.

**Table 5.5** High and Low Pain Frequency groups Means and Sds for processing time in seconds.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Wordtype</th>
<th>High pain frequency Group</th>
<th>Low pain frequency Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \bar{X} )</td>
<td>Sd</td>
<td>( \bar{X} )</td>
</tr>
<tr>
<td>Self</td>
<td>Sensory</td>
<td>6.18</td>
<td>2.52</td>
</tr>
<tr>
<td></td>
<td>Affective</td>
<td>7.50</td>
<td>3.40</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>6.92</td>
<td>3.09</td>
</tr>
<tr>
<td>Other</td>
<td>Sensory</td>
<td>6.05</td>
<td>2.46</td>
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<tr>
<td></td>
<td>Affective</td>
<td>5.62</td>
<td>2.30</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>5.76</td>
<td>2.36</td>
</tr>
</tbody>
</table>
5.3.3 Recognition Scores Analysis

Signal detection analysis of the recognition data was performed to obtain measurements of true memory and response bias (Banks, 1970). The measures d' (sensitivity) and β (beta, bias) were calculated from the "hit rate" and "false alarm rate" respectively, using tables from Hochhaus (1972), for each subject and wordtype. A three way analysis of variance with group as the between subjects factor, and reference and wordtype as the within subjects factors was employed for both d' and β scores.

\[ d' \text{ Scores} \]

When d' data were examined using the Box-Cox (1964) diagnostic procedure a reciprocal transformation was proposed, but the subsequent results of the transformed data analysis did not differ from the analysis of the original data. Therefore, the original data analysis will be presented. The main effect of group was not significant (F(1,33) = 1.71, p > 0.05), but the main effect of wordtype was significant F(2,66) = 10.23, p < 0.001). A priori (Helmert) contrasts revealed that neutral words were better discriminated than sensory and affective (F(1,33) = 7.85, p < 0.05), and that sensory words were better discriminated than affective (F(1,33) = 12.13, p = 0.001), (neutral
words \( \bar{X} = 3.76, \text{sd} = 0.87 \), sensory words \( \bar{X} = 3.68, \text{sd} = 0.78 \), affective words \( \bar{X} = 3.07, \text{sd} = 1.05 \). The interaction group by wordtype was not significant \( F(2,66) < 1 \).

The main effect of reference was significant \( (F(1,33) = 5.35, p < 0.05) \), with the self-reference condition presenting significantly greater d' scores (self-reference \( \bar{X} = 3.70, \text{sd} = 0.76 \), other reference \( \bar{X} = 3.31, \text{sd} = 1.00 \)), but the interaction group by reference was not \( (F(1,33) = 1.49, p > 0.05) \).

The interaction wordtype by reference was not significant \( (F(2,66) < 1) \), although the interaction group by wordtype by reference approached significance \( (F(2,66) = 2.70, \text{exact} p = 0.075) \). Simple effects analysis of the interaction revealed that there was a significant group by reference effect regarding the discriminability of neutral words where the low pain frequency group showed significantly lower d' scores for neutral words encoded in the other reference condition \( (F(1,33) = 5.02, p < 0.05) \).

There were also significant reference effects within groups. The low pain frequency group had significantly higher d' scores for neutral words encoded in the self-reference condition \( (F(1,33) = 6.36, p < 0.05) \), and a similar nonsignificant trend for the sensory words \( (F(1,33) = 3.15, \text{exact} p = 0.08) \).

The high pain frequency group on the other hand presented higher d' scores for affective words encoded in the self-reference condition. Means and sds for the d' scores are presented in Table 5.6 and illustrated in figure 5.3.

**Table 5.6** High and Low Pain Frequency groups Means and Sds for d' scores

<table>
<thead>
<tr>
<th>Reference</th>
<th>Wordtype</th>
<th>High pain frequency Group, N = 17</th>
<th>Low pain frequency Group, N = 18</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \bar{X} )</td>
<td>Sd</td>
<td>( \bar{X} )</td>
</tr>
<tr>
<td>Self</td>
<td>Sensory</td>
<td>3.92</td>
<td>0.94</td>
</tr>
<tr>
<td></td>
<td>Affective</td>
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<td>1.34</td>
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<td>Neutral</td>
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<td>1.16</td>
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</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>4.09</td>
<td>0.94</td>
</tr>
</tbody>
</table>
**Figure 5.3** High and Low Pain Frequency groups d’ scores for each wordtype in each referential condition.

![d' Scores Graph](image)

**Beta Scores**

The β scores distribution was positively skewed when examined using the Box-Cox (1964) diagnostic procedure, and a square root transformation was performed to satisfy the normality assumption. On the transformed scores analysis the main effect of group was significant (F(1,33) = 6.05, p < 0.05) with the low pain frequency group presenting significantly higher transformed β scores (high pain frequency group $X = 1.31$, $sd = 0.47$, low pain frequency group $X = 1.75$, $sd = 0.60$). In other words, subjects in this group applied a stricter criterion, they were more cautious in accepting new items as old. The main effect of wordtype was not significant (F(2,66) < 1), neither was the interaction group by wordtype (F(2,66) < 1). The main effect of reference was not significant (F(1,33) < 1) and also the interaction group by reference was not significant (F(1,33) < 1). Neither the interaction wordtype by reference (F(2,66) < 1), nor the interaction group by wordtype by reference (F(2,66) < 1) were significant. Means and sds for raw β scores are presented in Table 5.7 and the transformed β scores (sqr) are represented graphically in figure 5.4.
Table 5.7 High and Low Pain Frequency groups Means and Sds for raw β scores.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Wordtype</th>
<th>High pain frequency Group</th>
<th>N = 17</th>
<th>Low pain frequency Group</th>
<th>N = 18</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>X</td>
<td>Sd</td>
<td>X</td>
<td>Sd</td>
</tr>
<tr>
<td>Self</td>
<td>Sensory</td>
<td>2.50</td>
<td>3.92</td>
<td>4.94</td>
<td>4.94</td>
</tr>
<tr>
<td></td>
<td>Affective</td>
<td>2.34</td>
<td>3.20</td>
<td>5.40</td>
<td>5.14</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>3.01</td>
<td>4.85</td>
<td>3.65</td>
<td>4.69</td>
</tr>
<tr>
<td>Other</td>
<td>Sensory</td>
<td>2.83</td>
<td>4.46</td>
<td>4.05</td>
<td>4.84</td>
</tr>
<tr>
<td></td>
<td>Affective</td>
<td>2.62</td>
<td>4.56</td>
<td>4.31</td>
<td>5.91</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>2.40</td>
<td>3.15</td>
<td>4.52</td>
<td>4.90</td>
</tr>
</tbody>
</table>

Figure 5.4 High and Low Pain Frequency groups transformed β scores (sqr) for each wordtype in each referential condition.

Transformed Beta Scores
High Pain Freq Group vs Low Pain Freq Group
5.3.4 Questionnaire Scores Analysis

The data from the STAI, BDI and FES were scored according to the appropriate inventory's instructions and subjected to independent t-test comparisons with group as the between subjects factor. No significant differences emerged in any of the comparisons. There was no difference between groups in state anxiety (t(34) = 0.28, p > 0.05) or trait anxiety (t(34) = 0.98, p > 0.05) as measured by the two forms of STAI questionnaire. The difference between groups on depression as measured by the BDI was not significant either (t(34) = 1.73, exact p > 0.05). The questionnaire mean scores and sds are presented in Table 5.8.

Table 5.8  High and Low Pain Frequency groups Means and Sds for STAI & BDI questionnaires.

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>High pain frequency Group N = 18</th>
<th>Low pain frequency Group N = 18</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \bar{X} ) Sd</td>
<td>( \bar{X} ) Sd</td>
</tr>
<tr>
<td>STAI State</td>
<td>38.78 12.98</td>
<td>37.72 9.44</td>
</tr>
<tr>
<td>STAI Trait</td>
<td>40.28 10.33</td>
<td>36.94 10.06</td>
</tr>
<tr>
<td>BDI</td>
<td>10.78 11.98</td>
<td>5.50 4.96</td>
</tr>
</tbody>
</table>

There were no significant differences between groups on their scores on the subscales of the Family Environment Scale, the mean scores, sds and t-values of which are presented in Table 5.9.
Table 5.9  High and Low Pain Frequency groups Means, Sds & t-values for FES subscales scores.

<table>
<thead>
<tr>
<th>Family Environment Scale</th>
<th>Subscales Scores</th>
<th>High pain frequency Group N = 18</th>
<th>Low pain frequency Group N = 17</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\bar{x}$</td>
<td>Sd</td>
<td>$\bar{x}$</td>
</tr>
<tr>
<td>Cohesion</td>
<td>6.50</td>
<td>2.28</td>
<td>6.41</td>
</tr>
<tr>
<td>Expressiveness</td>
<td>5.33</td>
<td>2.66</td>
<td>4.59</td>
</tr>
<tr>
<td>Conflict</td>
<td>2.78</td>
<td>1.90</td>
<td>3.94</td>
</tr>
<tr>
<td>Independence</td>
<td>7.22</td>
<td>1.40</td>
<td>6.35</td>
</tr>
<tr>
<td>Achievement-Orientation</td>
<td>4.94</td>
<td>2.10</td>
<td>6.00</td>
</tr>
<tr>
<td>Intellectual-Cultural Orientation</td>
<td>6.61</td>
<td>2.38</td>
<td>6.06</td>
</tr>
<tr>
<td>Active-Recreational Orientation</td>
<td>5.72</td>
<td>2.87</td>
<td>5.71</td>
</tr>
<tr>
<td>Moral religious Emphasis</td>
<td>3.44</td>
<td>2.55</td>
<td>3.53</td>
</tr>
<tr>
<td>Organisation</td>
<td>4.72</td>
<td>2.19</td>
<td>4.59</td>
</tr>
<tr>
<td>Control</td>
<td>2.94</td>
<td>2.18</td>
<td>4.35</td>
</tr>
<tr>
<td>Family Relationship Index (Average of Cohesion, expressiveness &amp; Conflict)</td>
<td>4.87</td>
<td>1.41</td>
<td>4.98</td>
</tr>
</tbody>
</table>

* ns = non significant, p > 0.05
5.4 Discussion

Recall Scores

In this study selective memory for pain related material was investigated in a high pain frequency group of students and a low pain frequency group, using self and other-reference encoding tasks.

Contrary to the predictions, there was not an overall significant group by reference by wordtype interaction regarding the recall scores. A lack of overall significant results was also observed by Bradley et al. (1994) when student groups were investigated for information processing biases related to depression and anxiety using a self-referent encoding task. Similarly, Nugent & Mineka (1994) investigated anxious students without finding robust memory bias effects for threat words in recall tasks. In addition, Hammen et al. (1986) reported that when depressed students recovered, previous evidence of enhanced recall for negative words disappeared.

Nevertheless, there were differences in the present data in the recall of the wordtypes overall. Sensory and affective words were better recalled than neutral, a finding that suggests that emotionally charged words might be better elaborated at encoding due to their prominent content, which results in improved recall. Furthermore, the interaction of wordtype by reference was significant. Affective words encoded in the self-reference condition were better recalled than the ones encoded in the other-reference condition. The superiority of the "self" as a retrieval cue is well documented in the literature (Rogers, Kuiper & Kirker, 1977; Klein & Kihlstrom, 1986), and this effect is replicated in the current recall scores analysis, although in this case, it does not explain why it does not enhance recall for neutral and sensory words as well. A similar effect was obtained with the recognition task.

When the wordtype by reference effect was further investigated because of its relevance to the aims of the current study, a statistically significant difference was found between self- and other- encoding conditions for the recall of affective words, but only for the high pain frequency group. This result could indicate that it is possible to detect differences in cognitive processing regarding material related to the emotional aspects of pain in the early stages of a pain condition. It also seems that this effect is independent of depression levels at the time of testing, since the use of BDI scores as a covariate did not alter the pattern of the results. Previous findings though from studies with chronic pain patients show that chronic pain is associated with enhanced recall of sensory rather than...

There was also a between-groups difference on the recall of sensory words encoded in the self-reference condition, with the high pain frequency group again showing an increased recall of sensory words compared to the low pain frequency group, which was in line with the predictions. The high pain frequency group thus, presents a similar recall pattern to that previously demonstrated for chronic pain patients regarding sensory words. The fact that between-groups differences were not evident in the form of a significant overall group by reference by wordtype interaction, probably indicates that the effects at that stage are not big enough to be detectable as overall between-groups differences, though they became apparent in the subsequent simple effects analysis undertaken to test in detail the hypotheses under investigation. It is important though to note that these findings are tentative and in need of further replication.

One could speculate about possible changes in information processing patterns with regard to individuals' representations of their own pain experience based on findings from previous and the current studies. These changes might be thought to occur alongside the development of a chronic pain condition. Frequent experience of pain episodes could lead to an initial schematic representation of pain, containing elements both of the distressing aspects of pain experience and of its sensory qualities, both as a part of that information which is important enough to be closely linked and organised within the individual's self-schema. When pain becomes chronic, and unless depression becomes also a problem, the pain schema may become specified in more detail by focusing on the sensory qualities of pain as experienced by each individual, which could be a closer reflection of their subjective sensory experience. If this is true, it might lead to specific information processing biases relevant to each type of chronic pain problem and patient group. Findings from the Griffith et al. (1996) study where back pain patients presented a different information processing bias to that of arthritis patients, could be seen to support the argument of specialisation (plasticity) of information processing biases in chronic pain.

*Processing times*

The processing times analysis revealed that self-reference encoding required significantly more processing time than that needed for the other-reference encoding. This finding could suggest that the allocation of more processing time mediates and explains i) better discrimination for words encoded in the self-reference condition, as found in the recognition task analysis discussed below ii) better recall for affective words encoded in
the self-reference condition for high pain frequency subjects. The same does not apply, however, to the overall better recall of sensory words for the same group since no between-groups differences in processing time were found, but still the high pain frequency group presented with increased recall.

There was a significant group by wordtype by reference interaction, which after further analysis showed that within the high pain frequency group there was a different pattern regarding the processing of affective and neutral words for each reference condition. Subjects in this group allocated more time to processing neutral and affective words in the self-reference condition than they did in the other-reference condition. This increased processing time resulted in better recall only for the affective words in this group. A possible explanation could be that for the high pain frequency subjects the content of the affective words when encoded in relation to themselves is more salient than the neutral words, which makes the former more retrievable. The sensory words though encoded in the self-reference condition, did not require longer processing to result in superior recall for that group, indicating that the sensory information is associated with faster processing. The above suggests that there is not a one-to-one relationship between processing time and recall, and that longer processing results in better recall for neutral and affective material, but it is not necessary for enhanced recall of sensory material for the high pain frequency subjects. These findings provide further support to the hypothesis that high pain frequency subjects would show differential processing and enhanced recall for sensory and affective pain related words in comparison to low pain frequency subjects.

Recognition
d' Scores

The results from the recognition analysis regarding the d' scores used as a measure of "true memory", showed that words encoded in the self-reference condition were better discriminated than those encoded in the other-reference condition. This outcome provides more evidence of the superiority of self-referential processing, which results in deeper levels of encoding and better discrimination of new items from old ones, when compared to other-person reference processing. The different wordtypes demonstrated different discriminability as well. Neutral words were the ones better discriminated, followed by the sensory and the affective ones, an effect which was also found by Koutantji & Pearce (1992). It is possible that neutral words are easier to discriminate, and/or are possibly less disturbing, as they convey no information of immediate personal
relevance at either the emotional or the physical levels for an individual, in contrast to the content of affective and sensory words.

**Beta Scores**

Regarding the $\beta$ scores results, only a between groups difference was obtained. The subjects in the low pain frequency group presented significantly higher $\beta$ scores irrespective of reference condition and wordtype. The subjects in this group applied a stricter criterion, they were more cautious than subjects in the high pain frequency group in accepting new items as old. The reasons why the high pain frequency subjects are more willing to accept the new items as old, whether they are more distracted, less able to concentrate on the demands of the task, or even possibly less inhibited, are not clear to us at this stage. There was no evidence for differences between groups in true memory as measured by the $d'$ scores, and the nature of the recognition task is not a complex one. In addition, there was no different manipulation regarding the motivation of subjects in each group to perform the task. Although the application of methodology based on signal detection theory allows us to separate true memory from response bias, it is not based on a specific theoretical framework, and it cannot help in the explanation of the current findings. Further studies investigating in more detail patterns of cognitive processing could give more accurate explanations on why this difference occurs.

**Questionnaire Scores**

There were no between-groups differences regarding students' scores on the questionnaires assessing trait and state anxiety, and depression. Despite that, there was a trend for subjects in the high pain frequency group to present higher scores on the questionnaire assessing depressive status (BDI), which does not seem to affect recall patterns at this stage however. Since there was no significant difference between groups in the control, organisation, conflict, or any other subscales of the FES, the hypothesis that the high pain frequency group would come from families scoring higher in those family dimensions was not supported.

The next phase of the study examined the progress of the pain symptoms of a selection of the same subjects, and investigated whether pain-specific cognitive biases change in relation to pain status a year after initial testing.
5.3 Phase Two

The second phase of this study was a replication of phase 1, approximately one year after initial assessment (mean interval = 13.32 months, sd = 2.46), with the addition of the Pain Beliefs Questionnaire (Edwards et al. 1992b). The aim of the second investigation was to look at the development of pain in relation to subjects' performance on the memory tasks and the questionnaire scores over time.

5.3.1 Method

5.3.1.1 Design

The experiment had a (2x3x2x2) mixed model design with group (low pain frequency group, high pain frequency group) as the between subjects factor and wordtype (neutral, sensory, affective), reference (self, other) and time of testing (1st, 2nd phase) as the within subjects factors. The response variables used for the recall tasks were percentage recall for each wordtype, processing time for each wordtype, whilst for the recognition tasks the dependent variables used were d' and β scores calculated on the basis of their "hit" and "false alarm" rates as in the first phase.

5.3.1.2 Subjects

Although every effort was made by the experimenter for a higher response, only 9 out of the initial 18 subjects of the high pain frequency group, (8 women, X age = 28.89, sd = 3.76), and 11 out of the initial 18 subjects of the low pain frequency group (7 women, X age = 26.36, sd = 11.39) finally participated in the second phase. The mean interval between phases one and two for the high pain frequency group was 12.78 months (sd = 2.95) whilst for the low pain frequency group was 13.8 months (sd = 1.77). An independent t-test comparison showed that there was no significant between groups difference on the time interval (t = 0.90, p > 0.05) between first and second testing.

5.3.1.3 Apparatus and Materials

The same word lists for the memory tasks were used in this follow-up phase, with the only constraint being that the word lists that were used in the first phase for the self-reference encoding condition were used for the other reference in the follow-up. The reason for the use of the same word lists in the second phase, is that the restricted number of available pain related words made it impossible to construct matching novel
recall and recognition lists. The STAI, BDI, FES, & FHQ questionnaires, as well as the Pain Beliefs Questionnaire (PBQ, Edwards et al. 1992b), a questionnaire measuring beliefs about psychological and organic causes of pain, were also administered.

5.3.1.4 Procedure

The same procedure was followed as in phase 1. Subjects encoded pain related and neutral material in a "self" and "other person" reference condition. The completion of each encoding condition followed a 2 minutes distraction period during which subjects were asked to perform the same interference task as in phase 1 which entailed counting backwards from 1000 in threes. This was followed by a 3 minutes free recall test, and the corresponding recognition test. After subjects completed the memory tests they were asked to complete the questionnaires. The session lasted approximately 1 hour, and at the end subjects were given information on the purpose of the experiment and thanked for their participation.
5.3.2 Results

5.3.2.1 Recall Scores Analysis

The proportion of recall for each wordtype from phase 2 was calculated and entered in a group by reference by wordtype by time of testing (2x2x3x2) mixed model of analysis of variance. Recall data from phase 1 for the subjects with available follow up data were also included in the analysis to investigate possible differences in the processing of pain related and neutral material occurring over time. Subjects allocated in the high pain frequency group in the first phase still reported significantly more pain symptoms, pain frequencies and pain models than subjects allocated to the low pain frequency group (a detailed presentation of the findings is given in the questionnaires analysis section in this chapter). Means and sds for the recall scores for the first and second phase are presented in Table 5.10 and illustrated in figures 5.5 & 5.6.

In the analysis of variance the main effect of group was not significant (F(1,18) < 1). The main effect of time of testing was significant (F(1,18) = 17.32, p = 0.001). Subjects performance on the recall tests in the second phase was significantly better than on the first one (overall recall $\bar{X} = 0.254$ for Phase 1, $\bar{X} = 0.352$ for Phase 2). The interaction group by time was not significant (F(1,18) = 1.36, p > 0.05). The main effect of reference was significant (F(1,18) = 5.91, p < 0.05). Recall for information encoded in the self-reference condition was again superior to recall in the other-reference condition (self-reference $\bar{X} = 0.33$, sd = 0.09, other reference $\bar{X} = 0.27$, sd = 0.08). The interaction group by reference was not significant (F(1,18) < 1). The main effect of wordtype was not significant either (F(2,36) = 1.39, p > 0.05). The interaction group by wordtype was not significant (F(2,36) < 1) and the interaction time by reference was also not significant (F(1,18) < 1). The three way interaction group by time by reference was not significant (F(1,18) = 2.01, p > 0.05). The interaction time by wordtype was not significant (F(2,36) = 1.21, p > 0.05), neither was the interaction group by time by wordtype (F(2,36) < 1). The interaction reference by wordtype was not significant (F(2,36) = 1.16, p > 0.05). The interactions group by reference by wordtype (F(2,36) < 1), time by reference by wordtype (F(2,36) < 1) and group by time by reference by wordtype (F(2,36) < 1) were also not significant.
Table 5.10 High and Low Pain Frequency groups Means and Sds for percentage recall scores by wordtype and reference in Phases 1 and 2.

1st Phase

<table>
<thead>
<tr>
<th>Reference</th>
<th>Wordtype</th>
<th>High pain frequency Group N = 9</th>
<th>Low pain frequency Group N = 11</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>X</td>
<td>Sd</td>
</tr>
<tr>
<td>Self</td>
<td>Sensory</td>
<td>0.33</td>
<td>0.29</td>
</tr>
<tr>
<td></td>
<td>Affective</td>
<td>0.35</td>
<td>0.21</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>0.22</td>
<td>0.19</td>
</tr>
<tr>
<td>Other</td>
<td>Sensory</td>
<td>0.22</td>
<td>0.20</td>
</tr>
<tr>
<td></td>
<td>Affective</td>
<td>0.17</td>
<td>0.17</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>0.26</td>
<td>0.12</td>
</tr>
</tbody>
</table>

2nd Phase

<table>
<thead>
<tr>
<th>Reference</th>
<th>Wordtype</th>
<th>High pain frequency Group N = 9</th>
<th>Low pain frequency Group N = 11</th>
</tr>
</thead>
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<tr>
<td></td>
<td></td>
<td>X</td>
<td>Sd</td>
</tr>
<tr>
<td>Self</td>
<td>Sensory</td>
<td>0.44</td>
<td>0.20</td>
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<tr>
<td></td>
<td>Affective</td>
<td>0.35</td>
<td>0.24</td>
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<td>Neutral</td>
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<td>0.08</td>
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<tr>
<td>Other</td>
<td>Sensory</td>
<td>0.39</td>
<td>0.26</td>
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<tr>
<td></td>
<td>Affective</td>
<td>0.24</td>
<td>0.19</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>0.28</td>
<td>0.24</td>
</tr>
</tbody>
</table>
Figures 5.5. & 5.6  High and Low Pain Frequency groups percentage recall scores for each wordtype in each referential condition in phase 1 & 2.

Phase 1: Recall Scores
High Pain Freq Group vs Low Pain Freq Group

Phase 2: Recall Scores
High Pain Freq Group vs Low Pain Freq Group
5.3.2.2 Recognition Scores Analysis

d' scores

When the Box-Cox (1964) diagnostic procedure was applied to the d' scores it was found that there was no need to transform the data. In the analysis of variance the main effect of group was not significant (F(1,17) < 1). The main effect of time of testing approached significance (F(1,17) = 4.32, exact p = 0.053), with subjects performing better in the second phase (overall d' scores on the first trial $\bar{X} = 4.05$, sd = 1.17, second trial $\bar{X} = 4.58$, sd = 1.09). The main effect of reference was significant (F(1,17) = 6.56, p < 0.05). Subjects discriminated much better items that were encoded in the self-reference condition than in the other reference (self-reference $\bar{X} = 4.60$, sd = 1.10, other reference $\bar{X} = 4.04$, sd = 1.11). The interaction group by reference was not significant (F(1,17) = 3.55, exact p = 0.077). The main effect of wordtype was significant (F(2,34) = 6.32, p < 0.05). A priori contrasts (Helmert) revealed that neutral words were not significantly better discriminated than sensory and affective words (F(1,16) = 2.48, p > 0.05), although sensory words were discriminated significantly better than affective (F(1,16) = 5.48, p < 0.05), (neutral words $\bar{X} = 4.56$, sd = 1.04, sensory words $\bar{X} = 4.51$, sd = 0.89, affective words $\bar{X} = 3.88$, sd = 1.38). Other interactions which proved non-significant were: group by wordtype (F(2,34) < 1), time of testing by reference (F(1,17) < 1), group by time by reference (F(1,17) < 1), time by wordtype (F(2,34) = 1.26, p > 0.05), group by time by wordtype (F(2,34) < 1), reference by wordtype (F(2,34) < 1), group by reference by wordtype (F(2,34) < 1), time by reference by wordtype (F(2,34) = 1.53, p > 0.05), and the four way interaction group by time by reference by wordtype (F(2,34) < 1). These effects for subjects participating both in the first and second phase are presented in Table 5.11 and illustrated in figures 5.6 & 5.7.
Table 5.11  High and Low Pain Frequency groups Means and Sds for d' scores for the first and second phase.

1st Phase

<table>
<thead>
<tr>
<th>Reference</th>
<th>Wordtype</th>
<th>High pain frequency Group</th>
<th>Low pain frequency Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N = 9</td>
<td>N = 10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$\bar{X}$    Sd</td>
<td>$\bar{X}$    Sd</td>
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<td>Self</td>
<td>Sensory</td>
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<td>Affective</td>
<td>3.92    2.21</td>
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<td>4.49    1.92</td>
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<td>Sensory</td>
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<td></td>
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<td>3.54    1.92</td>
<td>2.85    1.54</td>
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<tr>
<td></td>
<td>Neutral</td>
<td>4.66    1.74</td>
<td>3.24    2.05</td>
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2nd Phase

<table>
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<tr>
<th>Reference</th>
<th>Wordtype</th>
<th>High pain frequency Group</th>
<th>Low pain frequency Group</th>
</tr>
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<td></td>
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<td>N = 10</td>
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<td></td>
<td>$\bar{X}$    Sd</td>
<td>$\bar{X}$    Sd</td>
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<tr>
<td>Self</td>
<td>Sensory</td>
<td>4.60    1.46</td>
<td>4.94    1.13</td>
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<td></td>
<td>Affective</td>
<td>4.78    1.99</td>
<td>5.00    1.70</td>
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<td>Neutral</td>
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<td></td>
<td>Neutral</td>
<td>5.05    1.61</td>
<td>4.63    1.61</td>
</tr>
</tbody>
</table>
Figures 5.7. & 5.8 High and Low Pain Frequency groups d' scores for each wordtype in each referential condition in Phases 1 & 2.

Phase 1: d' Scores
High Pain Freq Group vs Low Pain Freq Group

Phase 2: d' Scores
High Pain Freq Group vs Low Pain Freq Group
Beta Scores

When the Box-Cox (1964) diagnostic procedure was applied, the β scores were found to be positively skewed and so were subjected to a square root transformation. When the transformed β scores were analysed, the pattern of the results did not differ from that of the raw data analysis, and so the latter will be presented. The main effect of group approached significance (F(1,17) = 3.94, exact p = 0.064). The low pain frequency group had higher β scores than the high pain frequency group (high pain frequency group $X = 5.88$, sd = 3.57, low pain frequency group $X = 9.75$, sd = 4.76). This finding is consistent with the effect observed in the first phase. The analysis did not yield any other significant differences.

The main effects of time (F(1,17) <1), wordtype (F(2,34) < 1), and reference (F(1,17) <1) were not significant. Other interactions which proved non-significant were: group by time (F(1,17) < 1), group by reference (F(1,17) < 1), group by wordtype (F(2,34) < 1), time by reference (F(1,17) < 1), group by time by reference (F(1,17) < 1), time by wordtype (F(2,34) = 1.84, p > 0.05), group by time by wordtype (F(2,34) < 1), reference by wordtype (F(2,34) < 1), group by reference by wordtype (F(2,34) = 1.84, p > 0.05), time by reference by wordtype (F(2,34) = 1.29, p > 0.05), and group by time by reference by wordtype (F(2,34) < 1). The means and sds of the β scores are presented in Table 5.12 and depicted graphically in figure 5.9.
Table 5.12  High and Low Pain Frequency groups Means and Sds for β scores for the first and second phase.

1st Phase

<table>
<thead>
<tr>
<th>Reference</th>
<th>Wordtype</th>
<th>High pain frequency Group</th>
<th>Low pain frequency Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N = 9</td>
<td>N = 10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>X</td>
<td>Sd</td>
</tr>
<tr>
<td>Self</td>
<td>Sensory</td>
<td>5.56</td>
<td>11.08</td>
</tr>
<tr>
<td></td>
<td>Affective</td>
<td>5.04</td>
<td>9.21</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>6.87</td>
<td>13.66</td>
</tr>
<tr>
<td>Other</td>
<td>Sensory</td>
<td>6.40</td>
<td>12.58</td>
</tr>
<tr>
<td></td>
<td>Affective</td>
<td>6.18</td>
<td>12.68</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>5.12</td>
<td>9.17</td>
</tr>
</tbody>
</table>

2nd Phase

| Self      | Sensory  | 3.27 | 7.91  | 9.00  | 13.71 |
|           | Affective | 3.55 | 7.79  | 3.33  | 7.38  |
|           | Neutral  | 8.72 | 11.71 | 11.42 | 14.09 |
| Other     | Sensory  | 7.29 | 13.37 | 3.19  | 7.44  |
|           | Affective | 8.74 | 15.58 | 12.57 | 18.86 |
|           | Neutral  | 6.15 | 10.31 | 12.76 | 15.59 |
Figure 5.9  High and Low Pain Frequency groups β scores for each wordtype in each referential condition in Phases 1 & 2.

5.3.2.3 Processing Times Analysis

Plots of means against standard deviations showed that the processing time data were normally distributed and there was no need for transformation. Nineteen cases were included in the analysis, due to missing data for one case. In the subsequent analysis of variance, the main effects of group (F(1,17) < 1), and time of testing (F(1,17) < 1) were not significant, neither was the interaction group by time of testing (F(1,17) < 1). The main effect of reference however approached significance (F(1,17) = 4.31, exact p = 0.053), with subjects allocating more time to process the words in the self-reference condition compared to the other-reference condition (self-reference $\overline{X} = 5.99$, sd = 2.00, other reference $\overline{X} = 5.09$, sd = 3.12). The interaction group by reference was not significant (F(1,17) < 1). The main effect of wordtype was significant (F(2,34) = 6.39, p < 0.05). A priori contrasts (Helmert) revealed that when neutral words were compared to sensory and affective ones there was no statistically significant difference (F(1,17) = 3.94, exact p = 0.063), although sensory words were processed for significantly less time than affective words (F(1,17) = 8.58, p < 0.05), (neutral words $\overline{X} = 6.03$, sd = 2.05, sensory words $\overline{X} = 5.49$, sd = 2.09, affective words $\overline{X} = 6.00$, sd = 2.68). Other non significant interactions were: group by wordtype (F(2,34) < 1), time of testing by
reference \(F(1,17) < 1\), group by time by reference \(F(1,17) = 1.24, p > 0.05\), time by wordtype \(F(2,34) < 1\), and group by time by wordtype \(F(2,34) = 1.36, p > 0.05\). The interaction reference by wordtype, however, was significant \(F(2,34) = 3.44, p < 0.05\). Simple effects analysis of this interaction revealed that neutral words processed in the self-reference encoding condition required significantly more time in comparison to the other-reference condition \(F(1,17) = 6.24, p < 0.05\). The same pattern was also observed regarding the processing of the affective words, which required significantly more processing time to be processed in the self-reference condition than in the other-reference condition \(F(1,17) = 5.63, p < 0.05\). Related 3 and 4 way interactions which were not significant were: group by reference by wordtype \(F(2,34) = 2.26, p > 0.05\), time by reference by wordtype \(F(2,34) = 2.01, p > 0.05\), and, group by time by reference by wordtype \(F(2,34) < 1\). The means and sds of these effects are presented in Table 5.13 and depicted graphically in figures 5.10 & 5.11.
Table 5.12  High and Low Pain Frequency groups Means and Sds for processing time scores for the first and second Phases.

1st Phase

<table>
<thead>
<tr>
<th>Reference</th>
<th>Wordtype</th>
<th>High pain frequency Group</th>
<th>Low pain frequency Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N = 9</td>
<td>N = 10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( \bar{X} ) Sd</td>
<td>( \bar{X} ) Sd</td>
</tr>
<tr>
<td>Self</td>
<td>Sensory</td>
<td>5.85 2.39</td>
<td>4.87 2.60</td>
</tr>
<tr>
<td></td>
<td>Affective</td>
<td>7.24 3.12</td>
<td>4.90 3.26</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>7.01 3.71</td>
<td>6.25 4.48</td>
</tr>
<tr>
<td>Other</td>
<td>Sensory</td>
<td>5.53 1.84</td>
<td>4.76 2.14</td>
</tr>
<tr>
<td></td>
<td>Affective</td>
<td>5.33 1.60</td>
<td>4.85 2.92</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>5.40 2.03</td>
<td>4.74 1.99</td>
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</tbody>
</table>

2nd Phase

<table>
<thead>
<tr>
<th>Reference</th>
<th>Wordtype</th>
<th>High pain frequency Group</th>
<th>Low pain frequency Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N = 9</td>
<td>N = 10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( \bar{X} ) Sd</td>
<td>( \bar{X} ) Sd</td>
</tr>
<tr>
<td>Self</td>
<td>Sensory</td>
<td>5.67 1.20</td>
<td>5.96 4.42</td>
</tr>
<tr>
<td></td>
<td>Affective</td>
<td>6.57 1.73</td>
<td>7.09 5.44</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>6.14 1.17</td>
<td>6.58 4.27</td>
</tr>
<tr>
<td>Other</td>
<td>Sensory</td>
<td>6.03 2.63</td>
<td>5.38 2.65</td>
</tr>
<tr>
<td></td>
<td>Affective</td>
<td>5.86 2.50</td>
<td>6.26 4.31</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>6.18 3.07</td>
<td>6.04 3.70</td>
</tr>
</tbody>
</table>
Figures 5.10 & 5.11 High and Low Pain Frequency groups processing times for each wordtype in each referential condition in Phases 1 & 2.

Phase 1: Processing Times
High Pain Freq Group vs Low Pain Freq Group

Phase 2: Processing Times
High Pain Freq Group vs Low Pain Freq Group
5.3.2.4 Questionnaire Scores Analysis

The STAI, BDI & FHQ scores for subjects who participated in both phases were subjected to a 2x2 mixed model of analysis of variance with group as the between-subjects factor and time of testing as the repeated measure. There were not enough degrees of freedom to yield multivariate Fs when a multivariate analysis of variance was attempted. Instead the analysis resulted in the same univariate F values and associated probability levels for each dependent variable as the repeated measures ANOVA.

There were no significant differences between groups in their scores on the above questionnaires for either phases. The results regarding STAI-State showed no significant main effect for group (F(1,18) < 1), time of testing (F(1,18) < 1) or the interaction group by time (F(1,18) < 1). The same happened when STAI-Trait was used as a dependent variable, where the main effects of group (F(1,18) = 2.17, p > 0.05) and time (F(1,18) < 1) were not significant, and neither was the group by time interaction (F(1,18) < 1). Similar results were obtained for the BDI scores where neither the main effect of group (F(1,18) = 1.25, p > 0.05) nor that of time (F(1,18) < 1) were significant. The interaction group by time was also nonsignificant (F(1,18) = 1.86, p > 0.05).

All subjects participating in the second phase were administered the PBQ, an inventory which measures beliefs about causes of pain and distinguishes between psychological and organic ones. A one-way analysis of variance with group as the between subjects variable was performed on the PBQ scores for organic and psychological pain beliefs (used as the dependent variables). Though the main effect of group for the organic beliefs scores was not significant (F(1,18) = 2.84, exact p = 1.11), the high pain frequencies group presented slightly lower organic scores (high pain frequency group $\bar{X} = 3.11$, low pain frequencies group $\bar{X} = 3.44$). There was no between groups difference regarding the psychological scores of the PBQ (F(1,18) < 1). Means and sds for the STAI, BDI & PBQ are presented in Table 5.14.
Table 5.14 High and Low Pain Frequency groups Means and Sds for STAI, BDI & PBQ scores.

<table>
<thead>
<tr>
<th>1st Phase</th>
<th>Questionnaire</th>
<th>High pain frequency Group</th>
<th>Low pain frequency Group</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td>N = 9</td>
<td>N = 11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$\bar{X}$</td>
<td>Sd</td>
</tr>
<tr>
<td>STAI State</td>
<td>39.22</td>
<td>12.95</td>
<td>37.73</td>
</tr>
<tr>
<td>STAI Trait</td>
<td>41.22</td>
<td>13.20</td>
<td>36.09</td>
</tr>
<tr>
<td>BDI</td>
<td>11.56</td>
<td>15.85</td>
<td>5.00</td>
</tr>
<tr>
<td>2nd Phase</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAI State</td>
<td>37.67</td>
<td>15.42</td>
<td>37.36</td>
</tr>
<tr>
<td>STAI Trait</td>
<td>41.89</td>
<td>9.32</td>
<td>35.18</td>
</tr>
<tr>
<td>BDI</td>
<td>8.11</td>
<td>9.44</td>
<td>5.73</td>
</tr>
<tr>
<td>PBQOrganic</td>
<td>3.11</td>
<td>0.46</td>
<td>3.44</td>
</tr>
<tr>
<td>PBQPsychol</td>
<td>4.36</td>
<td>0.92</td>
<td>4.30</td>
</tr>
</tbody>
</table>

Family Health Questionnaire

For each subject the number of pain symptoms, pain frequencies and pain models was calculated for both times the questionnaire was completed, based on subjects' responses on the FHQ forms administered i) during the student studies presented in Chapters 3 & 4, and ii) on the second phase of this study. The above variables were used as dependent variables when a 2x2 mixed model of analysis of variance was performed with group (high vs low pain frequency group) as the between subjects factor, and time of completion (1st vs 2nd completion) as the repeated measure.

The analysis for the pain symptoms revealed that there was a significant effect of group ($F(1,18) = 38.90$, $p < 0.001$). The high pain frequency group reported significantly more pain symptoms overall (high pain frequency group $\bar{X} = 4.06$, $sd = 0.85$, low pain frequencies group $\bar{X} = 1.09$, $sd = 1.20$). The main effect of time of completion was not significant ($F(1,18) < 1$), whilst the interaction group by time of completion approached significance ($F(1,18) = 3.03$, exact $p = 0.09$).

When the pain frequencies data were examined, positive skeweness was evident and a square root transformation was performed to reduce it. The analysis of the transformed
pain frequencies data produced the same pattern of results as the raw data analysis and so the latter will be presented. One case from the low pain frequencies group was omitted because of missing data. The main effect of group was significant \((F(1,17) = 15.55, p = 0.001)\). The high pain frequencies group, which was composed of those subjects that reported an elevated number of pain episodes during the month before the first administration of the FHQ (at least 8 episodes of pain), also reported significantly more pain episodes in the second FHQ completion than subjects initially allocated to the low pain frequencies group (high pain frequency group \(\bar{X} = 24.88, sd = 15.71\), low pain frequencies group \(\bar{X} = 4.39, sd = 6.34\)). Neither the main effect of time of completion \((F(1,17) < 1)\) nor the interaction group by time were significant \((F(1,17) < 1)\).

When the number of pain models were used as the dependent variable, it was found that the main effect of group approached significance \((F(1,18) = 4.06, exact p = 0.059)\), with the high pain frequencies group reporting more pain models (high pain frequency group \(\bar{X} = 4.60, sd = 1.67\), low pain frequencies group \(\bar{X} = 0.99, sd = 1.52\)). The main effect of time of completion was not significant \((F(1,18) < 1)\), and the interaction group by time \((F(1,18) < 1)\) was not significant either. The means and sds for pain symptoms, pain frequencies and pain models for each group for the first and the second FHQ completions are presented in Table 5.15.

**Table 5.15** Means and Sds for pain symptoms, pain frequencies and pain models for 1st and 2nd FHQ completions. Digits 1 and 2 are used to indicate scores in first and second completion respectively.

<table>
<thead>
<tr>
<th>FHQ Scores</th>
<th>High pain frequency Group</th>
<th>Low pain frequency Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N = 9</td>
<td>N = 11</td>
</tr>
<tr>
<td>Pain Symptoms 1</td>
<td>(\bar{X} = 4.33) (sd = 1.22)</td>
<td>(\bar{X} = 0.73) (sd = 1.10)</td>
</tr>
<tr>
<td>Pain Symptoms 2</td>
<td>(\bar{X} = 3.78) (sd = 1.64)</td>
<td>(\bar{X} = 1.45) (sd = 1.37)</td>
</tr>
<tr>
<td>Pain Frequencies 1</td>
<td>(\bar{X} = 23.63) (sd = 18.01)</td>
<td>(\bar{X} = 3.09) (sd = 5.61)</td>
</tr>
<tr>
<td>Pain Frequencies 2</td>
<td>(\bar{X} = 26.00) (sd = 21.20)</td>
<td>(\bar{X} = 5.68) (sd = 8.66)</td>
</tr>
<tr>
<td>Pain Models 1</td>
<td>(\bar{X} = 2.89) (sd = 2.26)</td>
<td>(\bar{X} = 2.00) (sd = 1.79)</td>
</tr>
<tr>
<td>Pain Models 2</td>
<td>(\bar{X} = 3.89) (sd = 2.71)</td>
<td>(\bar{X} = 2.09) (sd = 0.94)</td>
</tr>
</tbody>
</table>
Family Environment Scale

The same 2x2 mixed model of analysis of variance was used to analyse scores from each subscale of the FES. The between-subjects factor was the group, and the time of testing (first, second completion) was the repeated measure. There were significant effects for the cohesion, expression, independence, achievement-orientation, and intellectual-cultural orientation subscales and for the Family Relationship Index (FRI, average of Cohesion, Expressiveness & Conflict subscales) of the FES.

When scores on the cohesion subscale were examined there was no significant main effect of group (F(1,17) < 1). The main effect of time of testing, however, was significant, (F(1,17) = 4.75, p < 0.05) with all subjects reporting significantly higher scores on the cohesion subscale on the second time of testing (cohesion, 1st phase $\bar{X} = 6.26$, sd = 2.92, 2nd phase $\bar{X} = 7.20$, sd = 2.48). The interaction group by time was not significant (F(1,17) < 1).

The analysis of the expressiveness scores revealed that the main effect of group was not significant (F(1,17) < 1), but the main effect of time of testing was significant (F(1,17) = 6.45, p < 0.05). Again subjects obtained higher scores on the second completion. The interaction group by time of testing approached significance (F(1,17) = 3.29, exact p = 0.087), and when simple effects analysis was performed to examine further the interaction, it was found that subjects in the low pain frequency group were the ones that scored significantly higher the second time on expressiveness (F(1,170 = 10.00, p < 0.05).

The analysis of the subjects' scores on the conflict subscale of the FES, for which a between groups difference was predicted, did not reveal any significant effects. The main effects of group (F(1,17) < 1) and of time (F(1,17) < 1), and the interaction group by time (F(1,17) < 1) were also not significant.

In contrast, when scores on the independence subscale were analysed, although there was no significant main effect for either group (F(1,17) < 1) or time (F(1,17) < 1), there was a significant group by time interaction (F(1,17) = 5.14, p < 0.05). Simple effects analysis on the interaction showed that independence scores for the low pain frequency group were higher on the second completion (F(1,17) = 3.43, exact p = 0.081).

There was no significant main effect of group (F(1,17) < 1) or time (F(1,17) < 1) for the achievement-orientation subscale scores, but the group by time interaction was again significant (F(1,17) = 5.46, p < 0.05). Further simple effects analysis on the interaction revealed that there was a significant decrease on the achievement-orientation scores for the low pain frequency group over time (F(1,17) = 4.76, p < 0.05).
The intellectual-cultural orientation subscale scores showed no significant main effect of group (F(1,17) < 1). The main effect of time however, was significant (F(1,17) = 8.51, p < 0.05), with all subjects reporting higher scores on the second time. The interaction group by time was not significant (F(1,17) = 1.07, p > 0.05).

There were no significant differences with the active-recreational orientation subscale of the FES (main effect of group (F(1,17) = 1.10, p > 0.05); main effect of time (F(1,17) < 1); group by time interaction (F(1,17) = 1.30, p > 0.05)).

Similar results were obtained from the moral/religious emphasis subscale scores. There was no significant main effect for either group (F(1,17) < 1) or time (F(1,17) < 1), and the interaction group by time was also non significant (F(1,17) = 1.30, p > 0.05).

The analysis of the organisation subscale scores also did not yield any significant results. The main effect of group (F(1,17) < 1), the main effect of time (F(1,17) = 2.00, p > 0.05), and the interaction group by time (F(1,17) = 2.00, p > 0.05) were all non-significant.

Similarly for the control subscale scores, the main effects of group (F(1,17) = 1.00, p > 0.05) and time (F(1,17) < 1), and the interaction group by time (F(1,17) < 1) were not significant.

Finally, the analysis of the FRI showed no significant main effect of group (F(1,17) < 1), although there was a significant main effect of time (F(1,17) = 5.60, p < 0.05). All subjects had significantly higher FRI scores on the second completion. Means and sds for all FES subscales scores are presented in Table 5.16.
Table 5.16  FES subscales Means and Sds for subjects participating in both phases. Digits 1 and 2 are used to indicate subscale scores in first and second trial respectively.

<table>
<thead>
<tr>
<th>Family Environment Scale</th>
<th>High pain frequency Group N = 9</th>
<th>Low pain frequency Group N = 10</th>
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</thead>
<tbody>
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<td></td>
<td>( \bar{X} )</td>
<td>Sd</td>
</tr>
<tr>
<td>Cohesion 1</td>
<td>6.78</td>
<td>2.59</td>
</tr>
<tr>
<td>Cohesion 2</td>
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</tr>
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<td>1.69</td>
</tr>
<tr>
<td>Independence 2</td>
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<td>Achievement-Orient 1</td>
<td>5.56</td>
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</tr>
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<td>2.00</td>
</tr>
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<td>6.67</td>
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</tr>
<tr>
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<td>1.66</td>
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</tr>
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<td>Family Relationship Ind 2</td>
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</tr>
</tbody>
</table>

(Average of Cohesion, Expressiveness & Conflict)
5.3.3 Discussion

The data for subjects who participated in the first phase of this study and also in the follow-up phase were analysed together to explore changes in pain specific cognitive biases, family functions and pain experience as a function of time and pain status. Unfortunately in the follow-up far fewer subjects were tested, which affects the power of the study and allows differences to be detected only when effect sizes are big.

Recall Scores

In the recall scores analysis it was found that all subjects showed a better performance in the second phase irrespective of group. This could be explained by the fact that subjects had to perform the same task a year later, and although many of them could not remember the procedure, it seems the replication had an enhanced effect on their performance on the recall task. It is worth noting that a reversal of reference encoding conditions for the word lists was made in the second phase. The list encoded in self-reference in the first phase was encoded in the other-reference for the second phase and vice versa.

In addition it was found that recall of material encoded in the self-reference condition was recalled significantly better than material encoded in other-reference, replicating previous findings. There were no pain-specific memory biases evident. This might be due to the small number of subjects participating in the second phase and the smaller size of the memory bias effect which was not directly evident even in the first part of this study.

Processing Times

The processing times analysis showed that the reference effect approached significance. Self-reference processing required more time than other-reference processing, replicating the results obtained from the first phase of the experiment.

The sensory words overall, required significantly less processing time than neutral and affective ones, which is consistent with findings from the first phase, and indicates that sensory information is processed faster. This time though, there was no between-groups difference in the processing time of sensory information, again possibly due to the small sample size. Furthermore, there was a significant reference by wordtype interaction for which further analysis showed that neutral and affective words required more processing time in the self-reference than in the other-reference condition.
Recognition Scores

d' Scores

Results of the d' scores analysis showed that in the second phase of this study subjects were better able to discriminate new from old items, showing enhanced performance on the second recognition, presumably due to familiarity with the material and the procedure, repeating the pattern seen on the recall task. In addition, the words encoded in the self-reference condition were better discriminated than the ones encoded in the other-reference condition; an effect also shown on the first experiment. There was a significant wordtype effect, where neutral and sensory words were better discriminated than affective words, as observed in the first experiment.

Beta Scores

Beta scores analysis showed that there was an almost significant difference between groups. The high pain frequency group had lower β scores than the low pain frequency group, irrespective of wordtype. Subjects in the low pain frequency group were more cautious than the high pain frequency group in accepting new items as old, an effect also observed in the first phase of the study.

Questionnaires

There were no between groups differences on state or trait anxiety or depression scores for subjects participating on both phases of the study, indicating that despite frequent pain experience, subjects with high pain frequency do not present evidence of increased psychopathology in comparison to their peers. The high pain frequency group had lower scores, though not statistically significant on the PBQ assessing beliefs about organic causes of pain, in contrast to findings from previous studies with chronic pain patients (i.e., Edwards et al. 1992b). At this stage it is difficult to say whether this is due to the small sample size of the groups, or is a result of frequent pain experience.

The analysis of data from the FHQ showed that the high pain frequencies group on the second completion again had significantly higher pain symptoms, pain frequencies, and pain models than those of the low pain frequency group. It seems the operational criterion used to differentiate between subjects with high and low current pain experience is reliable over time even in such a small sample and one could speculate about its potential to assess vulnerability in relation to developing a chronic pain condition.

On the analysis of the FES subscale scores some interesting findings emerged. All subjects irrespective of group reported significantly higher scores for the cohesion, intellectual-cultural orientation and family relationship index on the second completion of the FES. These effects could be interpreted in the light of the changes occurring either to
the actual family functions, or to the students' perception of them as a result of their newly independent lifestyle, which would allow strengthening or even redefining of family relationships. There was a significant increase in scores on the expressiveness and independence subscales for the second completion time in the low pain frequency group. The same group presented significantly lower scores on the achievement-orientation subscale on the second phase. There was no evidence from the FES for increased control, conflict and organisation or low expressiveness and support in high pain frequency subjects. This finding is in line with results from a study comparing a group of students seeking counselling to a control group on their perceptions of family environment using the FES where there was no evidence of dysfunctional family patterns for the students receiving counselling (May & Sowa, 1994).
5.4 General Summary and Conclusions

Some evidence for a pain specific memory bias favouring sensory and affective information encoded in self-reference for the high pain frequency group was observed in the first phase of the study which was not replicated in the second phase, possibly because of the small sample size tested.

Processing of sensory information was found to be faster than that for neutral and affective information. Longer processing time for neutral and affective words when they are encoded in self-reference appears to result in better recall.

In the recognition task, the high pain frequency group was consistently more willing to accept newly presented words as old and, irrespective of group, neutral and sensory words were better discriminated than affective.

Further longitudinal investigations with larger samples with more complete follow-up would allow for replication of the weak recall bias effect in vulnerable individuals obtained in the first experiment, and the acquisition of a firmer picture of the development of cognitive biases through time alongside the pain condition. The small sample size in the current study, especially on the follow up phase, did not allow for clear conclusions to be drawn regarding the progress of recall bias over time.

In addition, the construction of different tasks for each phase of the study would help clarify the findings. Measuring pain levels at the time of testing could also be helpful as this factor could possibly affect performance on recall and recognition tasks. The limited number of available pain related words could be problematic though for the former suggested improvement if both recall and recognition tasks are to be employed. Equally the taking of pain intensity measurements would possibly reveal the purpose of the experiment and could influence task performance, unless it is embedded in the collection of other types of information.

The results of this study, despite its limitations, has provided an initial idea of the types of processing of pain related material and family characteristics to be found in non-clinical young populations.

The next study was designed to investigate cognitive processing of pain-related information and family function in children who suffer from chronic pain in comparison to pain-free children. In particular it was of interest to discover if children with chronic pain present similar cognitive biases in relation to pain to those observed in adult chronic pain patients, or whether these are age-dependent phenomena. A further important aim is to explore family environment when there is a young member who suffers from chronic pain.
CHAPTER 6

Children in pain: an investigation of family environment and memory for pain

6.1 Introduction

Recent evidence from studies on adult chronic pain patients has shown that these patients present specific memory and interpretation biases for pain-related material (Pearce et al. 1990; Edwards et al. 1992a; Pincus et al. 1995). Furthermore, these memory biases are evident only for pain words processed in relation to the self (Pincus et al. 1993; Koutantji & Pearce, 1992). There is very little evidence concerning cognitive activities and mood in relation to recurrent or chronic pain in children and adolescents (Johnson & Spence, 1993; Johnson et al. 1993). Most studies investigating cognitive biases with adult chronic pain patients depend on the use of word tasks, which require advanced skills in language understanding and use. When the target population is children, it is more difficult to study cognitive functions such as attention or memory and pain, as there is a need to construct appropriate tests for children's stage of language development. On the other hand, a considerable amount of information is available on psychological status and family interactions of these children which rely solely on self-report measures. Further study of the processing of pain-related material in children suffering from chronic pain is important in order to identify whether a similar memory bias is present as in adult chronic pain patients, and simultaneously to investigate how their family is perceived by these children. It would be helpful to understand better the interaction between chronic pain, cognitive activities, psychological health and family adjustment in childhood, so as to inform theory and clinical practice accordingly. A brief review follows, covering evidence
on family characteristics of children with chronic pain, and the interaction of cognitive processes with emotional disorders and pain in childhood.

It seems that there is a difference in findings between studies of organic pain (such as pain due to arthritis) and functional pain (such as recurrent abdominal pain or headaches with no identifiable physical origin) in relation to family characteristics and parental psychopathology. Evidence from arthritis studies indicates that there is better family adjustment to this disease (Myones et al. 1988; Daltroy et al. 1992). In the course of an educational needs assessment of 50 children suffering from juvenile arthritis (JA) and their families Konkol et al. (1989) found diverging views of family members regarding perceptions and impact of JA. Children with JA, and almost half of their siblings, were concerned about physical limitations generally, while parents were concerned about the impact of those limitations at school only. In addition, siblings and parents were concerned about understanding the patient and the additional demands the illness placed on the family.

In contrast, evidence from studies with children suffering from abdominal pain of no identifiable organic pathology or headaches, points generally to a family history of concern about health issues (Ruth & Ernst, 1984; Wasserman et al. 1988), and more specifically to a family history of abdominal pain or headaches, with some evidence of decreased expressiveness and high expectations in the family in the case of abdominal pain (Wasserman et al. 1988).

Kopp et al. (1995) investigated family environment using the FES in a group of 12 families where the mother suffered from chronic headache, a second group where the mother had lower back pain, and a control group of pain-free families. They found a significant reduction in expressiveness only for the headache families, whilst both types of pain families reported a lower degree of activity in their leisure time in comparison to pain-free families. Interestingly, children of the headache group rated their families significantly lower on expressiveness, cohesion, independence and active recreational orientation than the other two groups, providing some evidence on the specific communication patterns that these families employ. Since we have no information on the communication style of these families prior to the onset of the chronic pain condition, no causal inference can be drawn, equally though the possible contribution of this kind of communication in initiating and/or maintaining the pain problem cannot be ruled out.

Garralda (1994) reviewing the area of chronic physical illness and emotional disorders in childhood, acknowledges the potential risk that physical illness carries for generating maladaptive family and social changes, (e.g., mood disorders in parents, overprotection). Despite this, it is more likely that these children will present some emotional symptoms
and eating anomalies rather than antisocial behaviour, probably because of the protective role of the observed increased family support, empathy and sympathy that they receive (Reynolds et al. 1988).

Limited evidence is currently available on the effects of emotional disorders on cognitive functions in childhood. Lauer et al. (1994) for example, investigated the effects of depression on memory performance and metamemory in a group of unmedicated depressed children and a matched undepressed control group. They found that those subjects in the depressed group with high depression scores, demonstrated performance deficits on an immediate recall trial when compared to those with lower depression scores, and to nondepressed subjects. Both the high and the low depression subjects overestimated their memory ability on the metamemory tests compared to non-depressed subjects. These effects are similar to the ones observed in depressed adults where comparatively poorer memory performance has been reported (Weingartner & Silberman, 1984; Hasher & Zacks, 1979).

The amount of research conducted on cognitive and psychological processes, and acute or chronic pain in childhood is also quite limited. Landen et al. (1992) using a cross-sectional design, investigated expected pain, recalled pain and anxiety in children undergoing venipuncture. In the two month follow-up, they found that children's recall of pain was generally good, although better for affective than sensory pain, and that anxiety was related to overestimation of expected pain, but not to greater experienced pain.

Two other studies which are relevant to the relationship between other psychological processes and pain in children will be presented in more detail as their methodology and findings are important in the design of the current investigation. Johnson et al. (1993) studied the influence of affective state on pain in 8 to 12 years old children suffering from post-operative pain after undergoing minor surgery (tonsillectomy and/or adenoidectomy). The children's mood was effectively manipulated via the use of appropriately valenced video clips after obtaining baseline ratings of pain and affect. One group of children watched a happy video, a second group watched a sad video, and a third group watched a neutral one. The results showed that both negative and positive mood manipulations were successful in altering mood ratings in the expected direction, whilst no significant changes were observed for the neutral group. Children's pain ratings were also altered, with the negative group presenting significantly higher pain ratings after watching the video clip whilst the group watching the happy video, presented with significantly lower pain ratings and the neutral group's pain ratings, did not change. The authors concluded that the relationship between negative affect and pain is bi-directional and that changes in affect may produce alterations in intensity of perceived pain.
Johnson & Spence (1993) in a further study investigated the effect of a clinical (hospital) environment and pain state a) on attention using a dichotic listening task (personal communication) and b) on immediate and delayed recall of pain related words in comparing 4 groups of children suffering from i) acute postoperative pain, ii) juvenile arthritis pain, iii) no-pain but in hospital and iv) no-pain and not in hospital. The pain descriptive words used were derived from the sensory adjectives of the MPQ, the pain related words were salient within the hospital environment (e.g., x-ray, nurse). Affectively negative words and neutral words were also used in the tasks. The memory task results showed that both the acute and the chronic pain group recalled significantly more pain-descriptor words than the other two groups. The acute pain group and the no-pain hospital group recalled significantly more pain-related words, followed by the chronic pain group. There were no significant differences observed for the recall of negative words. Subjects suffering from higher pain recalled significantly more pain descriptors. The pain-related words used in this study were actually hospital description words which might be unrelated to pain experience per se, and this might explain the lack of an effect for the chronic pain group. In addition, there were no words in the task describing the affective dimension of pain, and although negative words were used these were not pain-specific. There was no evidence in the analysis of the dichotic listening task data for an attention bias towards pain words for either of the pain groups. The lack of a pain effect on attentional processing is similar to evidence from adult chronic pain patients studies. A possible criticism on the above methodology is that the words used for both attention and memory tasks were the same, and if the memory tasks were performed second, as seems likely from the authors' description of their methods, then the stimuli were previously rehearsed, which could have contaminated the results. In addition, although the words used were matched for frequency of usage and length, no specific attempt was made to address the issue of children's vocabulary to describe pain. There is however, evidence available elsewhere on children's vocabulary in describing pain. Gaffney (1988) studied in detail 5 to 14 years old children's ability to use words and analogies to describe pain in a sample of Irish school children. This study used age groupings based on Piaget's model of children's stages of cognitive development, and found developmental differences in the use of both pain descriptors and analogies when comparing 5-6 year olds to 8-10 year olds and 11-14 year olds. Sensory and evaluative words (e.g., hurting, bad) were used by the younger children, these were complemented by some affective descriptions by the older children (e.g., annoying, irritating), and further use of qualitative words (throbbing), complex evaluative words (e.g., unbearable) and affective words (e.g., upsetting) was observed for the oldest children. A gender effect was also present with girls using more pain descriptors and more advanced words.
earlier than boys. Based on these findings it seems necessary to control for developmental differences in language skills when constructing word-tasks.

In addition, to the best of this author's knowledge, there has been no previous investigation into whether older children present superior recall for information encoded in a self-reference condition as adults do. Similarly, the relationship between recall and processing time of pain-related words, for which equivocal findings are available for adults, has not yet been studied in children. For example, in adults, Wright & Morley (1995) investigated the relationship between autobiographical memories of pain and non-pain events in chronic pain and no-pain subjects. They found that chronic pain patients retrieved more memories of themselves in chronic pain, and that irrespective of group, the memories for pain were recalled significantly faster than non-pain memories. They explained the latter effect as evidence for the organismic value for survival of pain-related material. Also of relevance to the present study are the findings presented in Chapter 5 which suggest that sensory information is associated with faster processing than neutral and affective information in young non-clinical adults.

Outline of the study and its aims

This study investigated memory for pain-related and neutral material encoded in self-reference and other-reference conditions, in a group of children suffering from juvenile arthritis and a no-pain control group. All subjects were assessed in a hospital environment. Recall and processing time for each wordtype were used as dependent measures. The main experimental hypotheses under investigation were:

a) that children suffering from arthritis would present selective memory for pain-related material encoded in the self-reference condition when compared to children in the no-pain control group,

b) that there would be a differential relationship between recall of pain-related words and processing time, with faster processing of sensory words for the arthritis group.

Family function, anxiety and depression levels were also examined in an attempt to explore psychological and family adjustment of children who suffer from chronic pain.
6.2 Method

6.2.1 Design

A mixed model design was employed with group as the between-subjects factor (arthritis group, control group). For the processing memory task, the within-subjects factors were reference (self-reference, other-reference) and wordtype (neutral, sensory and affective). The percentage recall and processing time for each wordtype were used as the dependent variables for the processing memory task. Between groups comparisons were also performed for the children's scores on three questionnaires assessing depression, anxiety and family environment.

6.2.2 Subjects

The experimental group comprised of 18 children ($\bar{X}$ age = 13.42, sd = 1.86, ranging from 10.5 to 16 years old, 13 were females) suffering for at least 6 months from various forms of juvenile arthritis (disease duration $\bar{X}$ = 6.28 years, sd = 3.92, ranging from 1.5 to 13 years), who were recruited from relevant clinics at Northwick Park Hospital, London. In the control group 18 children participated ($\bar{X}$ age = 13.28, sd = 1.63 range 10.5-16 years old, 11 were females). They were recruited on their first diagnostic visit to the orthodontic clinics held at the Eastman Dental Hospital, London, before they had started any treatment so that they would be pain free.

6.2.3 Apparatus

The processing memory task was carried out with the aid of an IBM compatible portable Personal Computer. The words were presented in white on a black field on the computer screen. The response buttons were the 1,2, & 3 keys on the keyboard. The computer was placed at desk level, and when opened the screen was almost at eye level.

The word association task was a pen and paper test. A stopwatch was used to time the 2-minute interval between the word presentation phase and the recall phase for each word list of the memory task.

6.2.4 Materials

6.2.4.1 Questionnaires

i) The Children Depression Inventory (CDI) (Kovacs et al. 1981) was used to assess childhood depression. CDI is a self-report questionnaire with 27 items and three
response categories for each one, assessing symptoms of depression adapted for children from the BDI (see appendix 6.1).

ii) The State-Trait Anxiety Inventory for Children (STAIC) (Spielberger, Edwards, Lushene, Montuori & Platzek, 1973) was used to assess children's trait and state anxiety levels. STAIC is based on the STAI and has been adapted for children. It has 20 items for each scale (Trait, State) evaluating symptoms of anxiety in children with three response categories for each item (see appendix 6.2).

iii) The FES was also administered to assess children's perception of family function.

6.2.4.2 Processing Memory Task

The processing memory task involved the presentation of two word lists presented in Table 6.1. In each list, 26 words were included, six of which were words used to describe the sensory dimension of pain, six the affective dimension of pain, six neutral words, and an additional eight neutral words used as fillers (four presented at the beginning and four at the end of each word list). The order of word list presentation was randomised and the words in each list were presented in a pre-fixed pseudorandom order. The words in each list were matched as closely as possible for frequency and number of syllables (based on K. Hofland & S. Johansson (1982) "Word frequencies in British and American English" NAVE). Eight of the 12 sensory words and all the affective words used were obtained from a study on words and analogies used by 5-14 year old children to describe pain (Gaffney, 1988). The remaining four words for the sensory category were obtained from the MPQ. It was considered important to take into account the developmental stage of the children in their knowledge and use of the language in relation to their ability to describe pain, so as to construct an appropriate task to measure possible effects of long-term pain on children's self-schema.
Table 6.1 Recall lists I and II.

<table>
<thead>
<tr>
<th>RECALL LISTS</th>
<th>List I</th>
<th>List II</th>
</tr>
</thead>
<tbody>
<tr>
<td>FILLERS</td>
<td>round</td>
<td>useful</td>
</tr>
<tr>
<td></td>
<td>common</td>
<td>wooden</td>
</tr>
<tr>
<td></td>
<td>straight</td>
<td>regular</td>
</tr>
<tr>
<td></td>
<td>modern</td>
<td>scientific</td>
</tr>
<tr>
<td></td>
<td>interesting</td>
<td>quiet</td>
</tr>
<tr>
<td></td>
<td>careful</td>
<td>original</td>
</tr>
<tr>
<td></td>
<td>difficult</td>
<td>marked</td>
</tr>
<tr>
<td></td>
<td>small</td>
<td>short</td>
</tr>
<tr>
<td>NEUTRAL</td>
<td>slow</td>
<td>knitting</td>
</tr>
<tr>
<td></td>
<td>merging</td>
<td>halting</td>
</tr>
<tr>
<td></td>
<td>cleared</td>
<td>clean</td>
</tr>
<tr>
<td></td>
<td>steaming</td>
<td>knocking</td>
</tr>
<tr>
<td></td>
<td>curling</td>
<td>pushing</td>
</tr>
<tr>
<td></td>
<td>stormy</td>
<td>pounced</td>
</tr>
<tr>
<td>SENSORY</td>
<td>sharp</td>
<td>numbing</td>
</tr>
<tr>
<td></td>
<td>ticklish</td>
<td>aching</td>
</tr>
<tr>
<td></td>
<td>tender</td>
<td>strong</td>
</tr>
<tr>
<td></td>
<td>acute</td>
<td>hurting</td>
</tr>
<tr>
<td></td>
<td>throbbing</td>
<td>beating</td>
</tr>
<tr>
<td></td>
<td>flashing</td>
<td>twinging</td>
</tr>
<tr>
<td>AFFECTIVE</td>
<td>dangerous</td>
<td>troublesome</td>
</tr>
<tr>
<td></td>
<td>excruciating</td>
<td>damaging</td>
</tr>
<tr>
<td></td>
<td>fierce</td>
<td>fatal</td>
</tr>
<tr>
<td></td>
<td>worrying</td>
<td>sickening</td>
</tr>
<tr>
<td></td>
<td>horrifying</td>
<td>frightening</td>
</tr>
<tr>
<td></td>
<td>nasty</td>
<td>agonizing</td>
</tr>
</tbody>
</table>
6.2.5 Procedure

Approval from the hospital's ethics committee was obtained before the start of the trial. The families of children suffering from arthritis were contacted by mail before their respective visit to the hospital for a clinic appointment. They were sent information about the study and invited to participate. The experimenter contacted them by phone in the following days to discuss any queries, and arrange an appointment on the day of their hospital visit. Ninety five percent of the families contacted gave their consent for their child to participate on the study. Time constraints on the day of their hospital visit were given as reasons of not wanting to take part for the remaining 5% of the families. The children and parents of the control group were recruited by the experimenter who attended the orthodontic clinics of the hospital, on the date of their hospital appointment. Each child and the accompanying parent were seen by the experimenter in a hospital room where they carried out the trial.

The recall task was similar to the one administered to the students described in Chapter 5, but made simpler to be easily understood by the children. The instructions were presented first on a sheet of paper and then on the computer screen. The instructions for the self-reference condition were:

"In order to do this task you will have to use your imagination. You will be asked to imagine YOURSELF in situations involving certain words. For example, a situation where something or someone is FRESH. What you have to do is to try and imagine a situation in relation to this specific word and YOURSELF.

Then, choose a number from 1 to 3 representing whether it was easy or not to imagine each scene. There are no right or wrong answers. You do not have to write anything down, just press the appropriate number from 1 to 3.

For example,

Imagine YOURSELF in a situation in which

something or someone is : FRESH

and then choose the appropriate number.

(The following scale was given for the children to rate the difficulty of imagining each situation).

1 represents that it was NOT AT ALL EASY to imagine the situation
2 represents that it was EASY to imagine the situation
3 represents that it was VERY EASY to imagine the situation
The children were specifically asked in this condition to "Make sure that you have a good picture in your mind for every word and you include YOURSELF in each situation". Then the children were asked to imagine a situation, and further examples were carried out using the words golden and grand to ensure that they had understood the task requirements.

Similar instructions were given for the other-reference condition with these differences:

"You will be asked to imagine A GOOD FRIEND OF YOURS (who is a healthy person, in conditions that are irrelevant to you) in situations involving certain words. For example, a situation where something or someone is OBEDIENT. What you have to do is to try and imagine a situation in relation to this specific word and YOUR FRIEND.

After the training phase the children were presented again with the instructions and the trial initiated. Once they had processed the allocated word list they were asked to count backwards from 1000 in threes for two minutes and write down the numbers, in order to clear their short-term memory. On completion of the interference task they were asked to recall as many words as possible from the ones on the processed list for a period of three minutes. After completion of their first test, they were presented with the relevant instructions for the next processing condition. Examples were carried out and the task was executed following the same procedure.

The processing memory task was followed by the administration of the questionnaires. The children were instructed on how to complete the STAIC followed by the CDI and the FES. Once the children had completed all the questionnaires they and their parents were debriefed and thanked for their participation. The session lasted approximately one hour.
6.3 Results

6.3.1 Recall Scores Analysis

The proportion of correct recall for each wordtype (neutral, sensory, affective) in each referential condition (self, other) for each child, was calculated from the raw recall scores. The recall data were subjected to a 2x2x3 analysis of variance with group (arthritis group, control group) as the between-subjects factor, and reference condition (self, other) and wordtype (sensory, affective, neutral) as the two-within group factors. Again, the SPSS for Windows program was used for the analyses. Means and sd for the recall scores are presented in Table 6.2 and illustrated in figure 6.1.

Table 6.2 Means and Sds for recall scores for the Arthritis and Control Groups.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Wordtype</th>
<th>Arthritis Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N = 18</td>
<td></td>
<td>N = 18</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>Sd</td>
<td>X</td>
</tr>
<tr>
<td>Self</td>
<td>Sensory</td>
<td>0.42</td>
<td>0.19</td>
</tr>
<tr>
<td></td>
<td>Affective</td>
<td>0.23</td>
<td>0.20</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>0.28</td>
<td>0.21</td>
</tr>
<tr>
<td>Other</td>
<td>Sensory</td>
<td>0.26</td>
<td>0.20</td>
</tr>
<tr>
<td></td>
<td>Affective</td>
<td>0.25</td>
<td>0.17</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>0.19</td>
<td>0.17</td>
</tr>
</tbody>
</table>
Figures 6.1 & 6.2 Recall scores for the Arthritis and Control Groups.

Recall Scores
Arthritis Group

Control Group
The plot of means against sds showed that the data was normally distributed and there was no need for transformations. The children's rating of the difficulty involved in imagining each situation was entered as a covariate in the mixed model analysis of variance, in an attempt to partial out any effects of the difficulty of the task on subjects' recall. The covariate was not significant ($t(1,33) = -2.00$, $p > 0.05$), and its use did not alter the pattern of the results. Therefore, the original 2x2x3 analysis of variance will be presented. In this analysis the main effect of group was not significant ($F(1,34) < 1$), whereas the main effect of wordtype was significant ($F(2,68) = 3.63$, $p < 0.05$). A priori orthogonal (Helmert) contrasts revealed that there was no significant difference between the recall of neutral words when compared to recall of sensory and affective words ($F(1,34) = 2.20$, $p > 0.05$), however, there was a significant difference on recall of sensory words when compared to recall of the affective ones with an increased recall of sensory words ($F(1,34) = 3.63$, $p < 0.05$), (neutral words $\bar{X} = 0.24$, sd = 0.14, sensory words $\bar{X} = 0.31$, sd = 0.13, affective words $\bar{X} = 0.25$, sd = 0.14). The interaction group by wordtype ($F(1,34) < 1$) and the main effect of reference ($F(1,34) < 1$) were not significant. The interaction group by reference however, was significant ($F(1,34) = 3.42$, $p < 0.05$). Simple effects analysis showed that there was a difference on recall between groups only for words encoded in the self-reference condition ($F(1,34) = 3.75$, exact $p = 0.061$), with the arthritis group recalling more information encoded in the self reference condition when compared to the control group (arthritis group $\bar{X} = 0.31$, sd = 0.14, control group $\bar{X} = 0.23$, sd = 0.12). The interaction wordtype by reference was not significant ($F(2,68) < 1$), but the three way interaction group by wordtype by reference was significant ($F(2,68) = 3.42$, $p < 0.05$). Further analyses were performed to clarify the latter interaction. First, the simple interaction effects of reference by wordtype were calculated for each group separately. This revealed that there was no significant difference between the self-reference and other-reference condition on the recall of neutral and affective words for either group (arthritis group, reference condition within neutral words ($F(1,34) = 2.10$, $p > 0.05$), control group, reference condition within neutral words ($F(1,34) = 2.10$, $p > 0.05$), (arthritis group, reference condition within affective words ($F(1,34) < 1$), control group, reference condition within neutral words ($F(1,34) < 1$)). There was however, a significant effect of reference condition for the arthritis group, but not for the control group, on the recall of sensory words (arthritis group, reference condition within sensory words ($F(1,34) = 6.71$, $p < 0.05$), control group, reference condition within sensory words ($F(1,34) = 2.32$, $p > 0.05$)). The sensory words encoded in the self-reference condition in the arthritis group were better recalled when compared to other-reference encoding (self-reference $\bar{X} = 0.42$, sd = 0.19, other-reference $\bar{X} = 0.26$, sd = 0.20). This result could indicate that the arthritis
group self-schema is more elaborated, incorporating more elements of sensory pain representations.

The between groups comparisons on the effect of reference condition within each level of wordtype were also computed. Significant differences were found between groups for reference condition on the recall of neutral (F(1,34) = 4.19, p < 0.05) and sensory words (F(1,34) = 8.46, p < 0.05), but not for affective words (F(1,34) < 1). As is evident from the means presented in Table 6.2 and figures 6.1 & 6.2, the arthritis group recalled more neutral and sensory words when encoded in relation to themselves, whilst the control group showed the opposite pattern by recalling more neutral and sensory words when encoded in the other reference condition. There was no significant effect of gender on recall (F(1,34) < 1), and no overall between groups difference on recall (F(1,34) < 1).

6.3.2 Processing Time Analysis

The same mixed-model of analysis of variance as in the recall scores analysis was applied to the processing time scores. Group (arthritis vs control) was the between-subjects factor, and reference (self-reference, other-reference) and wordtype (neutral, sensory, affective) were used as the repeated measures. The raw processing time scores as seen in Table 6.3 and figures 6.3 and 6.4 were not normally distributed, and a logarithmic transformation resulted in adequate degrees of normality. The transformed (log) processing time scores were used as the dependent variable in the subsequent analyses. Subjects' ratings of difficulty in imagining a situation was again entered as a covariate in the mixed-model of analysis of variance and again was not significant. Therefore the initial analysis of the transformed processing times scores will be presented. The main effects of group (F(1,34) < 1) and reference (F(1,34) < 1) were not significant, nor was the interaction group by reference (F(1,34) = 2.67, p > 0.05). The main effect of wordtype (F(2,68) = 1.43, p > 0.05), and the interaction group by wordtype (F(2,68) < 1) were not significant, although the interaction reference by wordtype was significant (F(2,68) = 3.93, p < 0.05). Simple effects analysis of the interaction showed that although there was not a significant effect of reference condition for any of the wordtypes, there was a group by reference interaction effect for sensory words which approached significance (F(1,34) = 3.65, exact p = 0.064). The arthritis group spent less time in processing sensory words in the self-reference condition (F(1,35) = 3.60, exact p = 0.066). There was no significant effect of reference condition on the processing of sensory words for the control group (F(1,35) < 1). The three-way interaction group by reference by wordtype was not significant (F(2,68) < 1).
Table 6.3 Means and Sds for raw processing time scores for the Arthritis and Control Groups.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Wordtype</th>
<th>Arthritis Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N = 18</td>
<td>N = 18</td>
</tr>
<tr>
<td></td>
<td>( \bar{X} )</td>
<td>Sd</td>
<td>( \bar{X} )</td>
</tr>
<tr>
<td>Self</td>
<td>Sensory</td>
<td>6.04</td>
<td>2.56</td>
</tr>
<tr>
<td></td>
<td>Affective</td>
<td>6.55</td>
<td>2.58</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>6.41</td>
<td>2.14</td>
</tr>
<tr>
<td>Other</td>
<td>Sensory</td>
<td>7.95</td>
<td>4.90</td>
</tr>
<tr>
<td></td>
<td>Affective</td>
<td>6.47</td>
<td>2.43</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>8.07</td>
<td>3.70</td>
</tr>
</tbody>
</table>
Figures 6.3 & 6.4 Raw processing time scores for the Arthritis and Control Groups.

**Processing Times**

**Arthritis Group**

- **Self-reference**
- **Other-reference**

**Control Group**

- **Control-Self**
- **Control-Other**
6.3.3 Questionnaires Scores Analysis

The questionnaires were scored according to the relevant instructions for each inventory. Due to concerns expressed by the Eastman Hospital’s Ethical Committee the question assessing suicidal thoughts of the CDI form was omitted, and the total of the remaining 26 questions was calculated and used as the response variable. In some cases when the participants were judged not to have enough time to fill in all the questionnaires at the time of the experiment they were given the FES to complete at home and return in a stamped addressed envelope. Unfortunately 11 FES forms were not returned. The STAIC Trait and State scores and CDI scores were subjected to independent t-tests with group as the between subjects factor. There was no significant difference between groups in trait anxiety (t(1,33) = -0.95, p > 0.05), state anxiety (t(1,33) = -1.88, exact p = 0.07) or depression status (t(1,33) = -1.67, p > 0.05). The CDI scores for the control group were very similar to the ones reported by Kovacs (1981), with $\bar{X} = 9.3$, and Spence & Kennedy (1989), with $\bar{X} = 9.5$, both studies testing general school populations. The same was true for the STAIC scores where Spielberger et al. (1973) report for State anxiety $\bar{X} = 30.5$ and Trait anxiety $\bar{X} = 37.7$. The arthritis group presented lower scores in all above measures, though the differences are not statistically significant. Means and sds for the two groups on the above questionnaires are presented in Table 6.4. and depicted in figure 6.5.
Figure 6.5 Questionnaires scores for the Arthritis and Control Groups.

Table 6.4 Means and Sds for questionnaires scores for the Arthritis and Control Groups.

<table>
<thead>
<tr>
<th>Questionnaires</th>
<th>Arthritis Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N = 17</td>
<td>N = 18</td>
</tr>
<tr>
<td>STAI Trait</td>
<td>35.41 7.69</td>
<td>37.50 5.18</td>
</tr>
<tr>
<td>STAI State</td>
<td>31.06 5.36</td>
<td>34.67 5.95</td>
</tr>
<tr>
<td>CDI</td>
<td>6.65 5.31</td>
<td>9.61 5.17</td>
</tr>
</tbody>
</table>

Comparisons of the children’s scores on the subscales of the FES were also performed using independent t-tests, where group was the independent variable. There were no significant differences between-groups on any of the subscales of the FES, although the FRI approached significance (t (1,24) = 2.01, exact p = 0.056) with higher scores for the arthritis group. FES Subscales mean scores, sds and t-values are presented in Table 6.5.
Table 6.5 Means and Sds for FES subscales scores.

<table>
<thead>
<tr>
<th>Family Environment Scale Subscales Scores</th>
<th>Arthritis Group (N = 11)</th>
<th>Control Group (N = 15)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(\bar{x})</td>
<td>Sd</td>
</tr>
<tr>
<td>Cohesion</td>
<td>6.82</td>
<td>1.78</td>
</tr>
<tr>
<td>Expressiveness</td>
<td>5.09</td>
<td>2.12</td>
</tr>
<tr>
<td>Conflict</td>
<td>3.73</td>
<td>2.00</td>
</tr>
<tr>
<td>Independence</td>
<td>6.55</td>
<td>1.44</td>
</tr>
<tr>
<td>Achievement-Orientation</td>
<td>5.73</td>
<td>2.00</td>
</tr>
<tr>
<td>Intellectual-Cultural Orientation</td>
<td>5.45</td>
<td>2.11</td>
</tr>
<tr>
<td>Active-Recreational Orientation</td>
<td>5.64</td>
<td>2.20</td>
</tr>
<tr>
<td>Moral religious Emphasis</td>
<td>3.55</td>
<td>1.92</td>
</tr>
<tr>
<td>Organisation</td>
<td>4.64</td>
<td>1.91</td>
</tr>
<tr>
<td>Control</td>
<td>3.73</td>
<td>2.24</td>
</tr>
<tr>
<td>Family Relationship Index</td>
<td>5.21</td>
<td>0.91</td>
</tr>
</tbody>
</table>

(Average of Cohesion, Expressiveness & Conflict)

*p = 0.056*
6.2.4 Discussion

In this study, possible information processing biases for pain-related information encoded in a self-reference and other-reference condition, were investigated in children suffering from arthritis pain, and were compared to a group of pain free children. Psychological adjustment and perception of family functions were also assessed.

Recall Scores

The recall scores analysis showed that sensory words were better recalled than affective and neutral ones irrespective of group. It seems that the content of these words is more prominent than neutral or affective ones, which might explain their increased recall. As suggested by Wright and Morley (1995), pain related information has an important biological significance for an organism, as it is closely associated with its survival, thus explaining enhanced recall of sensory information in this study.

There was a trend for the arthritis group to recall more information encoded in the self-reference condition, providing some evidence for a self-reference effect in children, although this was found only for the arthritis group.

When recall of each wordtype was investigated for each group separately, the only significant effect observed was that for the arthritis group, which recalled significantly more sensory words in the self-reference condition than in the other-reference condition. This effect indicates that for this group sensory information is important only when it relates to themselves.

When between-groups comparisons were made, it became evident that the arthritis group recalled significantly more neutral and sensory words when they were encoded in self-reference condition. The control group showed the opposite pattern by recalling more sensory and neutral words when encoding was in the other-person reference condition, although there was no difference overall on the amount of information each group retrieved.

The between-groups difference on recall of sensory information is similar to findings of studies with adult chronic pain patients, but superior recall of neutral material associated with the chronic pain group is a novel finding. A possible explanation might be an earlier developed self-schema for this group, though this is made less likely by the fact that the control group showed increased recall of neutral information in the other-reference condition. A more plausible explanation of this effect might be that it is a methodological artifact due to the illness/pain related content of some of the words used in the neutral category. Words such as "slow", "steaming", "knocking", and "pushing" might be associated with physical limitations of suffering from arthritis, and could explain why
they are better recalled from the arthritis group when encoded in self-reference condition. This could have biased the results and increased recall for the neutral category. It would be useful to repeat the study and improve the memory task by using disease irrelevant words in the neutral category, so as to replicate the findings for sensory information, and clarify whether the self-reference effect for neutral words is an artifact of the specific word lists used.

These results suggest that children in pain have a more elaborated self-schema than no-pain children, and that this incorporates information related specifically to the sensory qualities of pain, as seems to be the case in adult chronic pain patients. The control group showed the opposite pattern by avoiding sensory information encoded in the self-reference condition but retrieving it in the other-reference condition, a result which replicates findings from similar tasks on adult no-pain groups.

Processing Times

There was a significant difference between groups in the speed of processing for sensory words. The arthritis group processed sensory words faster in the self-reference condition than the control group. This effect shows that although children in pain recall more sensory information in relation to themselves, they spent less time elaborating it. It possibly indicates that it is much easier for them to process sensory words in relation to themselves than it is for the control group, and the time spent processing the words does not affect recall for children with arthritis. This finding is similar to the effect observed for the high pain frequency students in the previous study (Chapter 5), and suggests that pain-related biases can also be detected when processing time is used as the dependent measure, opening a new area of investigation in the field of information processing biases in pain. When faster encoding is viewed in combination with the self-referential memory bias effect for sensory information, it provides some additional evidence on facilitated retrievability of this kind of information, possibly due to its saliency for chronic pain children's self-schema.

The above findings provide some preliminary evidence for self-referential memory and processing time biases towards sensory information for children with chronic pain. Changes in information processing thus seem to occur as a result of suffering from long term pain in children in the same way as in adults. Once such information processing biases are in operation they could exacerbate the pain experience. If children for example, do define themselves as being pain sufferers at the expense of their other characteristics, this could lead to increased sensory awareness and enhanced pain perception. In view of the above and in the light of previous findings, it seems that chronic pain patients, irrespective of age, define themselves as persons in pain and that
this is an important element of their self-schema. Clinical interventions aimed at modifying pain-related contents of the chronic pain children's self-percepts by focusing on the development and reinforcement of alternative characteristics and increased pain control, might facilitate coping and increase self-efficacy, leading to better pain management and better quality of life.

Questionnaires

It is important to note that the children with arthritis did not present evidence of psychological disturbance when compared to the control group on either the anxiety or the depression measures. Although the differences were not statistically significant, the children with arthritis pain tended to have lower scores overall than control children on these measures, which in itself may be an indication of increased levels of coping in the pain group. This suggests that suffering from pain per se might not be the only factor predisposing children to being psychologically vulnerable, and that an interaction of other environmental factors, such as family relationships, with pain intensity and disease severity, might determine the extent of the effect that suffering from pain might have on children's psychological wellbeing. Indeed in this study, although there were no significant differences between groups on any of the FES subscales, there was an almost significant difference (at exact p = 0.056) on the family relationship index scale, which represents the average of cohesion, expressiveness and conflict subscales. The pain group reported higher scores, although only a subsample completed this questionnaire. It seems that high cohesion, and expressiveness without suppression of conflict in the families of children with arthritis does have a beneficial supportive effect on children's psychological adjustment. It would be worth replicating and examining this effect in more detail in order to understand specifically how this relationship pattern can be adaptive in relation to children's pain, possibly by increasing coping, feelings of support and security. In addition, the lack of any indication for psychological maladjustment for the pain group could also be explained by the relatively mild disease activity and severity present in most subjects (N = 16, 89%) in this group, along with the early onset of the disease for most of them.

Further studies investigating possible information processing biases, psychological adjustment, and family functions in children suffering from various types of chronic or recurrent pain, would allow us to explore further how cognitive, psychological and family functions change and adapt under the strain of pain in childhood. It is likely that the impact of pain in childhood will prove to be far from uniform across conditions of varying aetiology and intensity. The use of implicit as well as recognition memory tasks could add to our understanding of cognitive functions in relation to processing of pain-
related information. In addition, treatment outcome studies designed to evaluate specific interventions aimed at changing and improving children's self perception are needed. In connection with the latter, pre- and post-intervention assessment of selective memory for sensory information may prove to be a useful indicator of recovery.

In summary, children with arthritis pain showed selective memory for sensory words encoded in self-reference condition. A similar bias was found for neutral words, but this might be due to an experimental artifact, and a replication of the study could clarify the issue. Facilitated processing for sensory information encoded in self-reference was again observed only for the pain group, as in the students study. Increased family support, mild disease severity, and long disease duration characterised the arthritis group which was found to be psychologically well adjusted. This finding is in line with conclusions by Garralda (1994) in her review of the effects of physical illness in childhood.

The next study investigates further the impact of children's chronic pain on the family by assessing psychological adjustment, information processing of pain related material, current pain experience, and perception of family functions in parents of children with arthritis pain and parents of control group children. The relationship between children's and parents' perceptions of children's pain is also investigated.
CHAPTER 7

The family impact of children's chronic pain

7.1 Introduction

The investigation of information processing in children with chronic pain undertaken in the previous chapter, gave some evidence of cognitive biases (in recall and processing time) regarding pain-related sensory information. This finding replicates research findings obtained from studies of adult chronic pain patients, but no research to date has investigated whether similar information processing biases occur in relatives, or significant others of chronic pain patients. The question whether being exposed to verbal and non-verbal pain and illness behaviour from a member of the family has an effect on the way immediate relatives of chronic pain patients process pain and illness related information, has not been addressed directly. There have however, been studies of situations where professionals (physiotherapists, nurses) have frequent encounters with pain patients, but in these no effect on information processing of pain material has been apparent (Pincus et al. 1994; Edwards & Pearce, 1994, see also Chapter 4). Pain and illness related biases in information processing might, nevertheless, be evident in immediate relatives of pain patients in view of their greater emotional attachment to the pain patients, than that of the health professionals. The study described in Chapter 3, found that the number of pain models was a significant predictor of current pain in students and it seems probable that living in the same family with a pain patient would be particularly likely to influence the processing of pain and illness related material by other family members.

Significant others can also play a role in decisions regarding the management of patients' chronic pain, especially when the patients cannot communicate their pain experience to clinicians very well. In children, pain reports may be constrained by their limited ability to verbalise their pain, and special measurement instruments have been developed to aid them.
Frequently though, parents are asked to assist in providing more information to clinicians regarding their child's pain experience. There has been very little research however on the relationship between the child's own pain report and the parents' perception of their child's pain.

Research conducted on the effects of chronic pain in the family has focused mainly on the effect of chronic pain on patients' spouses, examining their psychological adjustment and well being. Even fewer studies have assessed the effect of chronic pain on the whole family, examining the children as well as the spouses of pain patients. As reviewed in Chapter 6 it seems that pain in childhood due to well defined organic illnesses, is associated with better family adjustment (Garralda, 1994; Reynolds et al. 1988; Myones et al. 1988; Daltroy et al. 1992; Konkol et al. 1989) when compared to pain due to functional symptoms (Ruth & Ernst, 1984; Wasserman et al. 1988).

In addition, there is enough evidence indicating that a chronic painful condition in the family has a negative effect on the psychological wellbeing of the patient and their spouses, and that specific conditions place different demands on the patients and their families, based on research findings reviewed in Chapter 1 (Rowat & Knafl, 1985; Flor, Turk & Scholz, 1987; Flor, Turk & Rudy, 1989; Ahern, Adams & Follick, 1985; Mohamed, Weisz & Waring, 1978).

Roy (1988) investigated from a systems perspective (using the McMaster model of family functioning) a clinical sample of 32 patients with head or back pain and their spouses. They found that these patients' families were characterised by low problem solving abilities, ineffective communication styles, and ineffective functioning in the areas of nurturing and support of each other. Headache patients were much more efficient than back pain patients in fulfilling their occupational and household roles, and all subjects reported lack of sexual gratification in their marriage. Most families demonstrated unhealthy (rigid or chaotic) behaviour control. Although this study does not include a control group, and there is no information on the family function before the onset of pain, it provides a detailed picture of family functioning when a spouse suffers from chronic pain, and these observations could be used as a basis to generate more specific controlled investigations.

Some research has been conducted into the effect that chronic pain in a parent, mostly in mothers, has on children's physical and psychological health. Dura & Beck (1988) compared family functioning, depression and anxiety levels in families where mothers had chronic pain, families where the mother suffered from diabetes, and chronic illness-free, control families. They employed self-report measures including the FES and a family interaction task. They found higher levels of depression and anxiety in chronic pain patients' families. Both the pain and diabetic families showed higher conflict and lower cohesion when compared to the
control families. There was also a consistent but not statistically significant trend for children of the pain families to have lower social skills and more behavioural problems, to complain more about poor health, and to be absent from school more days when compared to the control group, whilst the scores on these measures for children from diabetic families fell in between the scores of the other two groups.

Jamison & Walker (1992) conducted two studies examining the perceptions which adult chronic pain patients had of their own children's health and the children's self-report of pain. They compared these observations to the pain and illness behaviour of children of no-pain parents. They found that where parental emotional distress and disability, as well as pain behaviour were high, the parent reported more pain in the child. Furthermore, children of pain patients reported significantly more abdominal pains and used more medication than children of control group parents.

Chun, Turner & Romano (1993), assessed the psychological adjustment of adult chronic pain patients, their spouses and their children and compared them to pain-free families, obtaining measures on the children's adjustment also from their teachers. Pain patients and their spouses were significantly more depressed and more disabled than controls. The children with a pain patient parent were rated by their teachers as having more behaviour problems and lower social competence than control children. A significant patient gender effect emerged regarding children's perceived social competence, with children of male pain patients being rated as less competent by their parents.

Faucett & Levine (1991) compared a group of arthritis patients to a group of patients suffering from myofascial disorders, on social support and interpersonal conflict measures, including the FES. They found that the myofascial group reported more pain, experienced more interpersonal conflict, experienced less support from others and was significantly more depressed than the arthritis group. In the arthritis group, patients with lower pain experienced more family conflict, and lower pain intensity was associated with more punishing responses from significant others. It seems likely that different pain syndromes are associated with different responses from the social environment, since in Kopp et al. (1995), and Roy (1988) pain disorder specific differences were found in family functions. It might be that the type of diagnosis has an effect, and whether or not an organic cause is attributed to the chronic pain condition, moderates the patient's as well as the social environment's reaction to the condition. It is likely that suffering from pain caused by an identified organic condition is regarded as more "justifiable" and generates more social support, whereas pain with a less well defined origin could be faced more with suspicion than sympathy.

As noted earlier, the relationship between children's own pain report and parents perception of children's pain, especially where the child is the pain patient, has not been adequately
researched. The issue of pain measurement in children though has been the object of extensive research for some years now, and valid and reliable measures have been constructed to assess pain intensity and affect in children of different ages. McGrath & Unruh (1992), presented an extensive review of the area, and Barr (1994) gave a detailed account of the current understanding of the developmental changes occurring in pain perception in children.

Manne, Jacobsen & Redd (1992) studied factors associated with measures of acute paediatric pain and distress due to venipuncture, obtaining ratings from 95 children (3-10 years old), parents and nurses. Additional behavioural ratings were recorded by trained raters. Regression analyses showed that nurses' ratings of the child's pain were based upon overt behavioural distress, parents ratings were based upon their own anxiety before the procedure and their estimate of the child's pain, whilst children's pain self-report was negatively associated with the child's age (younger children gave higher ratings).

Varni, Thomson & Hanson (1987) used Visual Analogue Scales as part of their Pediatric Pain Questionnaire to assess pain levels with children suffering from juvenile rheumatoid arthritis. They found no significant differences in present pain intensity and worst pain ratings between the children and their parents. They concluded that VAS is an appropriate method to assess pediatric pain, providing that it is appropriately modified for the developmental stage of the children population under investigation.

To the best of the author's knowledge, no study has yet investigated cognitive biases in the relatives of depressed, anxious or pain patients. Research of this sort could provide more evidence on the role of environmental factors on the cognitive processing of relevant material, by investigating the effect on non-patients of exposure to the behaviour of people with emotional or pain disorders.

The current study was designed to:

i) assess whether living in a family environment where a child is suffering from a chronic pain condition, has an effect on parents' processing of pain-related and illness-related words,

ii) compare psychological adjustment, family health and family function of parents of children with chronic pain to parents of pain-free children, hypothesising that parents of children with chronic pain will present poorer psychological adjustment than parents of the control group children,

iii) to investigate the relationship between the parents' perception of their children's pain and the children's self report of their pain, with the prediction that there will be a good correlation between parental perception and children's pain report.
7.2 Method

7.2.1 Design

A between-subjects design was employed with group as the between-subjects factor (arthritis group parents, control group parents) on questionnaires assessing depression, anxiety, family environment, family health and pain beliefs. A word association task was also used, and a mixed model analysis of variance was used with the above groups as the between subjects factor, and wordtype (sensory, affective, illness related) as the repeated measure. In addition correlations between arthritis children's own pain reports and their parents perception of the children's pain levels were computed.

7.2.3 Subjects

The arthritis parents group comprised of 20 parents of children who had suffered for at least 6 months from various forms of juvenile arthritis (17 mothers, $\bar{X}$ age = 41.45, sd = 5.41, ranging from 28 to 50 years old, 14 of the children were girls, children's age $\bar{X}$ = 13.43, sd = 1.93). They were recruited from children's arthritis clinics at Northwick Park Hospital, London. In the control parents group, 18 parents participated ($\bar{X}$ age = 42.18, sd = 5.21, ranging from 33 to 50 years old, 11 mothers). They were recruited from the orthodontic clinics held at the Eastman Dental Hospital, London, on a first diagnostic visit for their children. The children of both parental groups participated in the trial presented in Chapter 6.

7.2.4 Apparatus

The word association task was a pen and paper test as were all of the other measures (questionnaires) used.

7.2.5 Materials

7.2.5.1 Word Association Task

The same word association task (Edwards & Pearce, 1994) was employed in this study as in the study presented in Chapter 4, and is used here to investigate cognitive biases for pain related and illness related words, between parents of children with arthritis and parents of the control group.
7.2.5.2 Questionnaires

The same questionnaires as in previous studies with adults were used. These were:

i) The STAI (Spielberger et al. 1973) which measures state and trait anxiety levels.

ii) The BDI, (Beck et al. 1961) which assesses subjects levels of depression addressing both cognitive and somatic depressive symptoms.

iii) The PBQ (Edwards & Pearce, 1992) which assesses peoples attitudes to the origin, nature and causes (psychological and organic) of pain.

iv) The FES (Moos and Moos, 1981) which is used to assess different dimensions of family function.

v) The FHQ based on Edwards et al. (1985a), "Parameters of Pain Questionnaire" which was used to assess: a) parents experience of current pain symptoms, and their frequency in the previous month, b) number of immediate relatives and "significant others" reported suffering from current and past pain complaints and/or illnesses (pain models).

Two additional tests constructed for the needs of this study were:

a) The Arthritis Group Parents Information Form on Children's Health Status, and

b) The Arthritis Children's Information Form on Children's Health Status.

A specially constructed form was administered to the arthritis group parents assessing their perception of their child's health status. Visual Analogue Scale (VAS) measures of parents perceptions of their child's pain intensity and affect levels during the previous week including the day of testing, and the previous month were obtained. Information on disease severity, duration and children's mobility was also collected (see appendix 7.1). A similar form was administered to the arthritis children group assessing the children's own pain intensity and affect levels, mobility and disease perception (see appendix 7.2).

The children's pain measures employed in this study consisted of Visual Analogue Scales (VASs), assessing Pain Intensity and Pain Affect based on recommendations by Savedra & Tesler (1989). The validity and reliability of the VASs in assessing children's pain has been well supported by relevant research (O'Hara et al. 1987; Varni et al. 1987; Savedra & Tesler, 1989). Examples of the VAS used with children are presented in figure 7.1.
Figure 7.1 Examples of VAS used to measure children's' pain intensity and affect.

1) Pain Intensity VAS

![Pain Intensity VAS]

No Pain Little Medium Large as it could be

2) Pain Affect VAS

![Pain Affect VAS]

Not upset Little Medium Very upset as I could be due to Pain

7.2.6 Procedure

The arthritis group parents were sent a letter by the experimenter with information about the study approximately 2 weeks before their hospital visit. Then they were contacted via telephone to discuss the study and arrange an appointment on the day of their hospital visit. The control group parents were recruited on the day of their children's hospital visit. All parents signed a consent form in which they agreed to participate in this study, and also allowed their children to take part in the project already reported in Chapter 6. In a hospital room, parents were given to complete a set of questionnaires starting with the word association task, while their children were performing their tasks as described in the previous study. They were instructed to complete first the word endings, and then the word stems, with the first two English words that came to their minds. This task was administered only to native English speakers. The rest of the questionnaires followed in the subsequent order: STAI, BDI, FES, FHQ, PBQ. The arthritis group parents and their children were also asked to complete the Information on Child's Health Status form. Once the children had finished the memory task and the remainder of the questionnaires, they filled in the Child's Health
Status form. The session lasted approximately 1 hour. In some cases, parents could not complete all of the questionnaires in the available time, and they were given the FES to complete at home and return it by post to the experimenter in a stamped addressed envelope. At the end of the trial parents were debriefed and thanked for their participation.
7.3 Results

7.3.1 Word Association Task Analysis

For the word stems part of the word association task, arthritis group and control group parents' completions were scored following the same criteria used in the study presented in Chapter 4. Overall, 6 parents were not native English speakers and did not complete this task. Plots of log means against logs of sds showed that there was no need for transformations. Mean number of word completions and sds for each wordtype of the task for both parental groups are presented in Table 7.1.

Table 7.1 Means and Sds for word completions for each wordtype of the word association task for both parental groups.

<table>
<thead>
<tr>
<th>Wordtype</th>
<th>Arthritis Group Parents</th>
<th>Control Group Parents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N = 19</td>
<td>N = 15</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>Sd</td>
</tr>
<tr>
<td>Sensory</td>
<td>1.47</td>
<td>1.02</td>
</tr>
<tr>
<td>Affective</td>
<td>1.05</td>
<td>1.03</td>
</tr>
<tr>
<td>Pain Words Total</td>
<td>2.53</td>
<td>1.74</td>
</tr>
<tr>
<td>Illness related</td>
<td>1.26</td>
<td>0.81</td>
</tr>
</tbody>
</table>

A mixed model analysis of variance was performed with group (arthritis group parents, control group parents) as the between subjects factor and wordtype (sensory, affective, illness related) as the repeated measure. The main effect of group was not significant (F(1,32) < 1). In addition, neither the main effect of wordtype (F(2,64) < 1), nor the interaction group by wordtype (F(2,64) < 1) were significant. Although there was no statistically significant difference between groups for the sensory or the illness related words, the arthritis group parents had higher scores on both wordtypes as can be seen from the means. Looking at the total of pain related completions using an independent t-test comparison (t(1,32) = 0.83, p > 0.05) also revealed no between-groups significant difference.

7.3.2 Questionnaires Analysis

The questionnaires were scored according to the instructions contained in the relevant manual, and between groups comparisons were performed on each measure using
independent t-tests. Means and sds on each questionnaire scores for both groups are presented in Table 7.2.

Table 7.2  Means and Sds on STAI, BDI and PBQ questionnaires for each parental group.

<table>
<thead>
<tr>
<th>Questionnaires</th>
<th>Arthritis Group Parents</th>
<th>Control Group Parents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N = 20</td>
<td>N = 20</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>Sd</td>
</tr>
<tr>
<td>STAI Trait</td>
<td>37.90</td>
<td>8.48</td>
</tr>
<tr>
<td>STAI State</td>
<td>40.60</td>
<td>6.84</td>
</tr>
<tr>
<td>BDI</td>
<td>5.55</td>
<td>5.62</td>
</tr>
<tr>
<td>PBQ Organic</td>
<td>3.14</td>
<td>0.43</td>
</tr>
<tr>
<td>PBQ Psych</td>
<td>3.95</td>
<td>0.87</td>
</tr>
</tbody>
</table>

* p < 0.05

Trait Anxiety scores were significantly different between groups (t (1,37) = -2.22, p < 0.05), with the control group parents presenting a higher score. There was no difference between groups on state anxiety scores (t (1,37) = -0.40, p > 0.05). A trend for higher BDI scores for the control group (t (1,37) = -1.93, exact p = 0.062) was evident, although not statistically significant. No differences were found regarding either the psychological scale (t = -1.07, p > 0.05) or the organic scale (t = 1.44, p > 0.05) of the PBQ.

FHQ Analysis

The FHQ was scored for all parents and the following were used as dependent variables for the between-groups comparisons:

a) the number of pain symptoms the parents reported suffering from during the previous month,

b) frequency of all pain symptoms (calculated as the sum of frequencies for each reported pain symptom) and

c) number of pain models (calculated as the sum of relatives and significant others reported suffering from pain).

Means and sds of the above measures for each group are presented in Table 7.3.
Table 7.3 Means and Sds on Pain Symptoms, Pain Frequencies and Pain Models of arthritis and control parental groups.

<table>
<thead>
<tr>
<th>Family Health Questionnaire</th>
<th>Arthritis Group Parents N = 20</th>
<th>Control Group Parents N = 20</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X</td>
<td>Sd</td>
</tr>
<tr>
<td>Pain Symptoms</td>
<td>2.30</td>
<td>1.08</td>
</tr>
<tr>
<td>Pain Frequency</td>
<td>6.30</td>
<td>5.02</td>
</tr>
<tr>
<td>Pain Models</td>
<td>2.95</td>
<td>1.67</td>
</tr>
</tbody>
</table>

Independent t-test comparisons showed that there was no significant between groups difference in the pain symptoms (t = 0.37, p > 0.05), pain frequencies (t = -1.88, p > 0.05) or pain models (t = 0.81, p > 0.05).

FES Analysis

The FES subscale scores were computed and subjected to independent t-test comparisons. Means, sds and t-values for each subscale are presented in Table 7.4. Higher scores on the conflict subscale (t = -1.70, exact p = 0.09) and on the control subscale (t = -1.99, exact p = 0.056), were observed for the control group parents when compared to the arthritis group parents scores, although these differences were not statistically significant.
Table 7.4 Means and Sds for FES subscales scores for each parental group.

<table>
<thead>
<tr>
<th></th>
<th>Arthritis Group Parents</th>
<th>Control Group Parents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N = 16</td>
<td>N = 16</td>
</tr>
<tr>
<td></td>
<td>$\bar{X}$</td>
<td>Sd</td>
</tr>
<tr>
<td><strong>Cohesion</strong></td>
<td>7.31</td>
<td>1.45</td>
</tr>
<tr>
<td><strong>Expressiveness</strong></td>
<td>5.19</td>
<td>1.87</td>
</tr>
<tr>
<td><strong>Conflict</strong></td>
<td>2.56</td>
<td>2.31</td>
</tr>
<tr>
<td><strong>Independence</strong></td>
<td>6.50</td>
<td>1.37</td>
</tr>
<tr>
<td><strong>Achievement-Orientation</strong></td>
<td>4.63</td>
<td>2.13</td>
</tr>
<tr>
<td><strong>Intellectual-Cultural Orientation</strong></td>
<td>5.94</td>
<td>2.21</td>
</tr>
<tr>
<td><strong>Active-Recreational Orientation</strong></td>
<td>5.50</td>
<td>2.25</td>
</tr>
<tr>
<td><strong>Moral religious Emphasis</strong></td>
<td>3.94</td>
<td>1.91</td>
</tr>
<tr>
<td><strong>Organisation</strong></td>
<td>5.25</td>
<td>2.46</td>
</tr>
<tr>
<td><strong>Control</strong></td>
<td>3.56</td>
<td>1.90</td>
</tr>
<tr>
<td><strong>Family Relationship Index</strong></td>
<td>(Average of Cohesion, Expressiveness &amp; Conflict)</td>
<td>5.02</td>
</tr>
</tbody>
</table>

* p < 0.1
7.3.3 The relationship between parents' perception of children's pain and children's self-report of pain

The use of the Information on Child's Health Status forms assessed a number of pain related variables, such as pain intensity and affect during the previous week and month, disease duration, mobility, frequency of pain episodes and average duration of a pain episode. Information on these variables was gathered from both parents and children. Means and sds of the children's and their parents pain report measures are presented in Table 7.5. The relationship between them was investigated via correlations which are presented in Table 7.6. There were significant positive correlations between children's self-report pain measures and their parents estimation on them for most of the above variables except average duration of a pain episode and average pain intensity per month.

Table 7.5 Means & Sds for the children with arthritis and their parents estimates of children's pain report measures.

<table>
<thead>
<tr>
<th>Pain Measurements</th>
<th>Children with Arthritis</th>
<th>Arthritis Group Parents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N = 20</td>
<td>N = 20</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>Sd</td>
</tr>
<tr>
<td>Intensity/week (VAS)</td>
<td>26.94 21.38</td>
<td>30.55 24.44</td>
</tr>
<tr>
<td>Affect/week (VAS)</td>
<td>11.38 14.49</td>
<td>20.88 18.88</td>
</tr>
<tr>
<td>Intensity/month (VAS)</td>
<td>39.65 20.98</td>
<td>29.45 26.04</td>
</tr>
<tr>
<td>Affect/month (VAS)</td>
<td>24.94 23.26</td>
<td>19.40 18.40</td>
</tr>
<tr>
<td>Frequency/month</td>
<td>2.35 1.22</td>
<td>2.55 1.39</td>
</tr>
<tr>
<td>Episode duration/hrs</td>
<td>3.47 4.45</td>
<td>4.91 5.14</td>
</tr>
<tr>
<td>Disease duration/years</td>
<td>6.23 3.64</td>
<td>6.50 4.16</td>
</tr>
<tr>
<td>Mobility (VAS)</td>
<td>38.29 22.77</td>
<td>30.00 20.00</td>
</tr>
</tbody>
</table>
Table 7.6  Pearson r correlation coefficients between Arthritis group children's measures and their parents estimation of the children's' pain.

<table>
<thead>
<tr>
<th></th>
<th>Intensity/week</th>
<th>Affect/week</th>
<th>Intensity/month</th>
<th>Affect/month</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r(17) = 0.57**</td>
<td>r(17) = 0.62**</td>
<td>r(17) = 0.36 ns</td>
<td>r(17) = 0.41*</td>
</tr>
<tr>
<td>Frequency/month</td>
<td>r(17) = 0.49**</td>
<td>r(13) = 0.07 ns</td>
<td>r(17) = 0.98***</td>
<td>r(17) = 0.45*</td>
</tr>
<tr>
<td>Episode Duration</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disease Duration</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobility</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*  p < 0.1,  **  p < 0.05,  ***  p < 0.001

The above findings indicate that parents have a fairly good idea of their children's pain levels for most pain measures used. The lack of a significant correlation between parents' and children's report of average pain intensity per month might be attributed to a number of possible reasons; it could be due to memory confusion on the children's part, since it is likely that a month's period might not be a very well defined period for them, or due to a memory bias effect with current pain levels influencing their report of last months pain levels (children's intensity over past month $\overline{X} = 39.65$, sd = 20.98, parents intensity over past month $\overline{X} = 29.45$, sd = 26.04), or it could be indicative of a tendency for parents to underestimate children's usual pain intensity levels.

There was no a significant correlation between parents' and children's reports of average pain episode duration either, which merits further consideration. Discrepancy scores of parents' estimate and children's measures of episode duration were calculated by subtracting children's scores of average pain episode duration from the parental scores (children's average pain episode duration in hours $\overline{X} = 3.47$, sd = 4.45, parents estimate of episode duration $\overline{X} = 4.91$, sd = 5.14). A regression analysis was performed in an attempt to identify variables predicting the discrepancy scores. Parental state and trait anxiety scores and depression scores were used as predictors. The regression analysis results showed that neither parental trait anxiety nor depression measures were significant predictors of discrepancy scores, whilst parental state anxiety approached significance as a predictor ($t = 1.94$, exact $p = 0.08$). This regression equation explained 47% of the total variance ($R^2 = 0.47$, $F(3,9) = 2.67$, $p > 0.05$). This result indicates that parents' psychological trait anxiety and depression do not influence their estimate of children's pain episode duration, but possibly their state anxiety does. The beta weights as shown in Table 7.7 represent the contribution of each variable to the discrepancy scores.
Table 7.7  R square and regression coefficient values for trait and state anxiety and depression scores, for average pain episode duration discrepancy scores.

<table>
<thead>
<tr>
<th>Predictor Variables</th>
<th>β (beta)weights $^3$</th>
<th>t value</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAI Trait</td>
<td>-0.22</td>
<td>-0.49</td>
</tr>
<tr>
<td>STAI State</td>
<td>1.11</td>
<td>1.94*</td>
</tr>
<tr>
<td>BDI</td>
<td>-0.81</td>
<td>-1.029</td>
</tr>
</tbody>
</table>

*  p < 0.1

Disease activity levels were obtained also from the doctors who treated the children, based on the results of the medical tests performed on the day of children's hospital visit. They gave ratings using 6 categories, where 0 represented inactive disease, to 5 which represented active disease (the intermediate categories were: minimal activity = 1, moderate activity = 2, mild activity = 3, modest activity = 4). Correlations among disease activity levels, parents report of disease severity and children's report of pain intensity and pain affect on the past month were computed. The only significant association found was between parental report of disease severity and disease activity levels (Spearman Rho = 0.50, p < 0.05). Children's ratings of pain intensity (Spearman Rho = 0.03, p > 0.05) and affect (Spearman Rho = 0.15, p > 0.05) over the last month were not significantly correlated with disease activity levels. When disease activity levels correlations with children's current ratings of pain intensity and affect were computed, no significant associations were found (children current pain intensity, Spearman Rho = 0.35, p > 0.05; children current pain affect, Spearman Rho = 0.09, p > 0.05).

It would have been interesting to construct a model predicting children's pain intensity and affect, evaluating the contribution of psychological and disease related variables in pain ratings. In the same way it would be useful to identify variables that predict parents estimates of children's various pain measures. The small sample of children and parents' examined in this study however, does not give enough data to study the relationship among those variables and arrive at reliable models which would be representative of the populations investigated, since the literature recommends at least 5 times more cases than variables used as predictors (Tabachnick & Fidell, 1989) in order to perform regression analyses.

$^3$ Standardised regression coefficients
7.4 Discussion

This study investigated whether cognitive biases favouring pain and disease-related information, occur in parents of children with chronic pain when compared to parents of pain-free children. The family impact of children's chronic pain, and the relationship between children's and parents' perception of children's pain were also explored.

Analysis of the word association task data showed that parents of children with chronic pain did not produce significantly more pain or illness-related word completions than parents of pain-free children, although their mean scores for the sensory and illness-related words were slightly higher than those of the control group. These results seem to indicate that cognitive biases in pain are a consequence of actual personal pain experience, and that they are less likely to be produced by exposure to pain behaviour from others, even when the pain patient is a child living in the family, and the relative is a parent. Evidence from other studies investigating cognitive biases towards pain-related material, which included samples of nurses and physiotherapists who are frequently exposed to pain behaviour, has shown that those groups also do not present evidence of preferential processing of pain material (Pincus et al. 1994; Edwards & Pearce, 1994). When assessing the present results though, both the type of task used, (an implicit memory task), as well as the small size of the sample tested should be taken into account. A replication of this study with a bigger sample would allow for more robust conclusions, and the inclusion of a recall task would allow us to clarify whether there are any cognitive bias effects evident as a function of explicit memory processes. The tentative findings of Chapter 5, where high pain frequency students presented with some evidence of explicit memory bias towards sensory information encoded in self-reference where no evidence of an implicit memory effect was present in the word association task analysis, could be seen as evidence that such a discrepancy between results from explicit and implicit memory tasks can occur. Although it is possible that there is an explicit and not an implicit memory bias effect in relatives of children in pain, similar to the one observed with the students, one could speculate that this is less likely to exist since the parental groups did not differ on the number of pain symptoms, pain frequencies or pain models they reported. This contrasts with the high pain frequency students who experienced an elevated number of pain episodes both on the first assessment and on the follow-up.

Parental groups differed on trait anxiety scores, with the control group presenting significantly higher scores and also showing a trend towards higher depression scores. The trait anxiety levels of the control group seem to be slightly higher to that expected of the general population (Spielbeger et al. 1973), and it might be representative of the psychological state of the specific group under investigation, although there is no information available in this instance that would explain this difference. There were no
between groups differences on state anxiety and on the organic and psychological scales of the PBQ. The higher scores on anxiety, and depression measures for parents of no-pain children parallels the findings from the previous study that the no-pain children's anxiety and depression measures were higher than those of the pain-children.

There were differences, albeit not significant, between the parental groups only on the conflict and control subscales of the FES. There was a trend for parents of the arthritis children to rate their families lower in conflict and control than the control group parents which may indicate that the former perceive their families as being relatively more relaxed and harmonious. These tentative results however, do not agree with the initial predictions and findings from studies of adult chronic pain patients (Dura & Beck, 1988; Faucett & Levine, 1989), where chronic pain was found to be associated with negative effects in the family. It is possible, if the trends observed in this study can be substantiated, that the role of an adult family member is more disturbed by chronic pain than a child’s role, and this could lead to the differential reaction and adaptation of the family as a system to the pain condition.

The investigation of the relationship between parents' and children's pain ratings showed that there were significant positive correlations between parents' and children's ratings on pain intensity and affect over the past week, pain affect and frequency of pain episodes over the past month, disease duration and mobility. Parents thus seem overall to have a relatively good idea when it comes to estimating their child's pain state supporting the relevant hypothesis. There were discrepancies, however, between parents' and children's estimates of the duration of children's pain episodes and pain intensity over the past month. It seems that parents overestimate children's pain episode duration and this might be partially related to their own levels of state anxiety. A similar effect was observed by Manne et al. (1992) where parents' estimate of children's procedural pain was correlated with parental anxiety levels before the procedure.

Parents ratings of pain intensity over the past month are lower than children's own, which could be explained either as a result of children not complaining about the intensity of pain when in pain, or as an effect of children not having a clear concept of time and not reporting their actual pain intensity over the past month, or this could be explained even as an effect of children's current pain levels, which could bias their report of pain for the past month. Since no daily pain ratings were collected from children over the past month, and no measurements of children's pain behaviour were obtained either, it is not possible to clarify the issue in this study. Further investigations regarding memory for pain intensity and affect in children (adolescents) and collecting data on possible factors influencing children's own pain report and parents perception of children's pain, (e.g., by measuring pain complaints
and pain behaviour from children, parental psychological state) could be carried out following a similar methodology to the one used with adults (Smith & Safer 1993; Eich et al. 1985) reviewed in Chapter 1 (comparing pain diary data to recall of past pain ratings data). Perhaps surprisingly, disease activity as obtained from medical tests was not significantly correlated with the children's own pain reports, but it was significantly correlated with parents report of disease severity and activity. It is possible that parents have more access and better understanding for the doctors' reports, and are more aware of the significance of specific medication levels than children are.

In summary, there was no evidence of an implicit memory bias towards pain or illness related information in parents of children who suffer from arthritis. In addition, parents of arthritis children did not report more pain models, pain symptoms or pain frequencies than parents of pain free children, which indicates that pain modelling is likely to be unidirectional with parents' pain status affecting children (see Chapter 3, Christensen & Mortensen, 1975), but children not influencing parents' pain and illness report. Parents of arthritis children seem to be less anxious than control group parents and they perceive their family as less controlling and lower in conflict. These findings in combination with results from the children's relevant measures presented in the previous study (Chapter 6), seem to support the idea that mild disease (illness) and pain in children can be associated with a positive climate in families. Finally, parents are fairly accurate in their estimation of their child's pain levels, but results of medical tests do not correlate well with children's own pain reports.
CHAPTER 8

General discussion and conclusions

8.1 Introduction

The main aims of this thesis were to investigate the different levels of pain processing according to Leventhal and Everhart's (1979) model of pain. It constitutes a preliminary attempt to explore in parallel the subjective experience of pain and the social context within which it occurs, drawing from information processing theories and research on the role of social factors in pain experience.

In this chapter, a summary will be presented of the main findings obtained in the current series of studies, and an attempt will be made to integrate them with the theoretical frameworks used to design the investigations. The chapter concludes with some thoughts on the implications of the current findings for our understanding of pain processing, for current clinical practice and for future research.

8.2 Summary of the findings

The first study investigated perceptual motor, schematic and conceptual processing of pain. In a double blind placebo controlled design, morphine was used with chronic and acute pain patients to investigate whether different or similar physiological mechanisms are involved in the pain experience in the two conditions. The results indicate that in acute pain patients morphine significantly reduces both sensory and affective ratings of pain, whilst in chronic pain patients only affective ratings are reduced. A memory task with pain related and neutral words to investigate schematic processing pre- and post-drug produced no significant differences between groups, although there was a trend for the chronic pain patients to recall more sensory pain related words before the drug
administration. The chronic pain group had a significantly higher score on organic beliefs about causes and consequences of pain than the acute pain group.

The second study surveyed current pain symptoms and family history of pain and illnesses in a student population (N = 180) using the FHQ. There was a significant difference between males and females on current pain measures, with women reporting more pain symptoms, but only when menstrual pain was included in the comparisons. In contrast, women reported significantly more pain models than men, even when their menstrual pain models were excluded from the analysis. These results suggest that differences observed between sexes in a young student population in relation to current pain symptom reports may be accounted for by the presence of menstrual pain, rather than by differences in family history of pain as had previously been suggested. The higher incidence of pain models reported by females for menstrual as well as non-menstrual pain, suggests a greater awareness of pain in others without implying a greater tendency for the young women as a group to report pain themselves.

The third study used a student sample to test implicit memory for pain. A word completion task with pain/illness related and neutral words was administered to students. High and low pain frequency subjects were identified based on their completions of the FHQ. The word association task analysis showed that the groups did not differ on their pain/illness related and neutral word completions. This negative finding suggests that when implicit memory tasks are used, there is no evidence for a memory bias in favour of pain related material at the early stages of pain development.

The fourth study investigated family function in high and low pain frequency subjects and examined further the schematic level of pain processing. Explicit memory for pain was assessed using recall and recognition memory tasks, and encoding was examined by measuring processing time. Some evidence of self-referential memory bias towards sensory information was found only for the high pain frequency students, suggesting that the memory bias effect reported in chronic pain patients begins to develop at the early stages of the pain condition, but becomes stronger as the condition becomes chronic. There was also evidence of a response bias effect with the high pain frequency group being more willing to accept new items as old. Processing time for sensory words was faster when compared to neutral and affective words in both groups. The high pain frequency group though, processed sensory words encoded in self-reference significantly faster when compared to the control group.

The follow up phase of study four took place a year after initial assessment, and a smaller number of the initial subjects participated. It provided some comparable evidence regarding the response bias findings of the recognition task where high pain frequency
students were again found to be more willing to accept new items as old, but the results of the recall task were not replicated as no memory bias effect towards sensory information was found for the high pain frequency group, possibly due to the small sample size investigated. The groups did not differ on their beliefs on causes and consequences of pain.

The fifth study investigated whether the memory bias and processing time effects for pain related information observed in adult pain patients can be detected in children. The study compared children suffering from arthritis with non pain controls. It also assessed family environment. The results showed that children suffering from arthritis presented a self-referential memory bias towards sensory pain related words and neutral words when compared to the control group. In addition, this group also processed sensory words encoded in self-reference significantly faster than the control group. There was no between groups difference in family environment and the children with arthritis were psychologically well adjusted.

The sixth study investigated whether memory bias for pain related information is a result of changes in processing of pain material due to personal pain experience, or due to frequent exposure to pain behaviour in significant others. The word association task was administered to parents of children with arthritis and to the control group parents. Parents' psychological state, pain experience and perception of family functions were assessed. Finally, the relationship between the perception of pain of children suffering from arthritis was compared to that of their parents' perception of the children's pain. The results showed that there was no evidence of an implicit memory bias effect towards pain/illness related words for parents of children with arthritis who were also found to be psychologically well adjusted and with no evidence of an increased family history of pain. They also had a fairly accurate perception of their children's pain levels. The two parental groups did not differ on their beliefs about causes and consequences of pain.

8.3 Theoretical integration of the findings

Leventhal and Everhart's (1979) model of pain distress was used as a framework for the studies reported in this thesis. Although this model makes suggestions as to the relationships among the different stages of pain processing, it is quite vague and not readily amenable to empirical testing, especially for the schematic and conceptual levels it specifies. It also does not take into account the social context within which pain patients interact, and seek support and derive meaning for their experiences. From the plethora of research evidence and theoretical work in the fields of cognition and emotion, the cognitive schema model (Beck et al. 1979, 1985), and the integrative model (Williams et
al. 1988), along with the relevant methodologies, were adopted as the theoretical basis for the current investigations into the schematic and conceptual levels of pain processing. The social dimension of the pain experience was assessed using mainly learning and family systems theoretical approaches.

**Perceptual/motor processing of pain**

Evidence from the investigation of the perceptual/motor processing of pain in chronic idiopathic and acute pain patients via the use of a pharmacological manipulation in the first study, showed that both groups showed similar effects of morphine on pain affect. The lack of an analgesic effect of morphine on pain intensity for the chronic pain group suggests that compared to pain affect different mechanisms are involved in the processing of pain intensity, which are more affected by the duration of pain. These tentative findings may be interpreted as evidence for central sensitisation in chronic pain conditions resulting in physiological/pharmacological changes, which in turn can play a role in the maintenance of the chronicity of the condition.

**Schematic processing of pain**

The main aims of the investigations on the schematic processing of pain in studies 1, 3, 4, 5 and 6 were to examine onset, specificity, stability, and developmental differences of cognitive biases related to pain.

These studies investigated whether cognitive biases are a result of increased personal pain experience, whether they constitute a consequence of suffering from pain or can be elicited by being exposed to the pain behaviour of others. Evidence from the experiments with students showed that it is more likely that pain specific cognitive biases develop alongside the chronicity of the condition, rather than being vulnerability factors predisposing individuals to developing a chronic pain condition. Their presence though, is likely to be a significant maintenance factor of the chronic pain condition, since recovery is associated with no preferential processing of pain related information (Edwards et al. 1995). There was also no evidence for the cognitive biases being a frequency of exposure effect, since parents of children in pain showed no evidence of increased accessibility of pain and illness related material, despite long-term exposure to their pain-patient child.

The stability of cognitive biases was also examined using the pharmacological manipulation. No memory bias toward pain-related material was evident in acute pain patients, suggesting that acute pain does not influence processing of pain material in
normal individuals. On the other hand, chronic pain patients showed a trend for increased recall for sensory information prior to drug administration. This finding is similar to evidence previously obtained from other chronic pain groups (Edwards et al. 1992a; Koutantji & Pearce, 1992). It seems logical to think that memory bias for sensory information in chronic pain is not solely dependent on current pain levels. Despite evidence showing that current pain levels can result in biases in past pain report (Eich et al. 1985; Smith & Safer, 1993; Bryant, 1993), selective recall for pain material is probably more related to the long term duration of the pain condition, and is possibly not amenable to short term pharmacological manipulations. There might be a parallel with anxiety-conditions, where the processing of anxiety related material was not affected by short-term administration of diazepam (Golombok et al. 1990; Golombok et al. 1991). The small number of subjects in the chronic pain group, however, does not allow for definite conclusions on the issue. For future studies it would be interesting to evaluate the effects of long-term administration of analgesic (opioids) and psychotropic medication prescribed for their pain relieving properties (antidepressants) in pain processing.

The developmental aspect of processing of pain information was investigated by assessing whether cognitive biases observed in adult chronic pain patients would also be evident in children with chronic pain. Children suffering from arthritis showed greater recall and faster processing of sensory information than control children.

Overall, it seems that there is some evidence for plasticity and adaptation of cognitive functions in chronic pain occurring in parallel with changes of physiological and pharmacological mechanisms associated with a chronic pain condition (e.g., wind-up, Dubner, 1991; Woolf & Thomson, 1991). These indicate that it might be possible to conceive both central physiological sensitisation and "cognitive sensitisation" (evidenced as preferential processing of pain material) as different but complementary facets of chronic pain, reflecting the multidimensional nature of pain experience. This conceptualisation could provide a more uniform picture on how chronic pain can affect both physiological and cognitive mechanisms within the same individual, and possibly generate some further research into whether there is an interaction between them, as well as into the course of development of the sensitisations, and provide some ideas about more effective interventions addressed at each specific level.

The following sections provide a more specific discussion of the pain processing patterns and the processes involved as reflected by recall, recognition and processing time measures, along with their implications for the cognitive theory for emotional disorders.
(schema theory) (Beck, 1976; Beck et al. 1987) and the integrative model (Williams et al. 1988).

*Recall*

The weak evidence for a self-referential recall bias towards sensory information obtained from the students with high pain frequency in the first phase of study four, provides some information on how retrieval processes may begin to change as a result of frequent personal pain experience to favour sensory material. This is the first set of information to be obtained on the processing of pain information in people who have not identified themselves as pain patients and presented themselves at a pain clinic, and this tentative finding seems to suggest that greater elaboration of sensory material could start at this early stage. This effect was not found in the second phase of the study however, possibly due to the very small sample size, and we need to question its reliability. It would be necessary to replicate the effect and follow-up the subjects for longer periods to study the development of memory biases further. The use of the same cognitive task in the first phase of the study and at the follow-up could have also affected the results. An additional improvement would be to obtain concurrent information on participants' pain levels at the time of testing, to evaluate the contribution of current versus more general pain levels on memory biases.

As acute pain patients showed no evidence for a recall bias, it seems that retrieval processes are not affected by short-term exposure to pain, suggesting that long-term exposure is a prerequisite for pain-specific recall biases to occur. We do not know the minimum duration of exposure to pain that is necessary for cognitive biases to develop, or whether the duration of exposure needed would be the same or different across pain conditions, levels of pain intensity and disability. It might also be the case that different types of social responses to a pain sufferer can affect pain-related processing patterns. In addition to the above there are a number of other questions that could be addressed in further research. It would be worthwhile for example to investigate whether levels of current pain influence cognitive biases, with higher effects been evident when current pain intensity is high. It would also be interesting to evaluate whether individuals at the early stages of development of a pain condition show these biases only when in a state of pain, and whether this changes, becoming a trait pattern of processing, along with the establishment of chronic pain.

Stronger evidence was obtained for a self-referential recall bias for sensory and neutral information in children with chronic pain and, for sensory information at least, similar effects have been observed in adult chronic pain groups. The elevated recall of neutral
words for children in the current study seems more likely to be the result of a methodological artifact. If this proves to be true, it may be the case that similar cognitive biases specific to chronic pain are present across childhood, adolescence and adulthood indicating that chronic pain has a uniform, reliable effect on cognitive processes, which is dependent more on the developmental stage of the pain condition than on the chronological age of the pain patient.

It has been suggested that enhanced recall in self-reference is possibly a result of retrieval from the same semantic category, due to the better organisation of the related material (Klein & Kihlstrom, 1986; Eysenck & Keane, 1995), and does not constitute evidence of the existence of a self-schema. The differential results though obtained from these studies regarding enhanced recall of sensory words encoded only in self-reference for the pain patients cannot explain why the other types of information (neutral and affective) did not present the same recall pattern, and why retrieval from other-reference category would not be the same across wordtypes for pain and no pain groups.

**Recognition**

The use of recognition tasks showed that self-reference encoding leads reliably to better discrimination of old from new items, thus replicating previous findings using self and other reference manipulations.

The analysis of the response bias data (beta scores) showed that there was a consistent difference between groups, with the high pain frequency students being more willing to accept new items as old (i.e. false positives) across the two student experiments, irrespective of type of information they encoded. At this stage it is difficult to explain this finding since there are no other apparent (measured) differences between the two groups apart from their pain experience over the past month, and there is no information on their pain levels at the time of testing. Further research could address this question by combining cognitive tasks and psychosocial measures, such as assessing problem solving and decision making at varying intensities of pain, the role of chronicity, and social desirability in pain groups which could possibly shed more light into this effect.

**Processing time**

When the experimental work of this thesis started, there was no information available on whether specific processing patterns were involved at the encoding stage of processing of pain related information, and therefore processing time was used as a measurement of encoding in the student and children trials. Results with young adults (see studies four
and six), showed facilitated processing of sensory information. This effect was observed twice in the empirical work of this thesis, and it would be useful if it could be replicated further in order to obtain a better understanding of encoding processes in relation to pain.

The limited available evidence indicates that encoding of sensory information is fast, replicating the effect shown in Wright & Morley's (1995) study, but that it is even more so when chronic pain patients are encoding sensory information in reference to themselves. Children with arthritis also showed evidence of facilitated processing of sensory material in self-reference, possibly indicating congruency of content of previously elaborated pain-related material. This is the opposite processing pattern to that seen in anxious groups, where interference rather than facilitation is evident when processing of threatening material is required (Mathews & MacLeod, 1985; Mogg et al. 1991). Therefore, the importance of actual personal experience of pain for cognitive biases to become evident is demonstrated both with processing time and recall for sensory information encoded in self-reference indicating, that those biases are not a frequency of exposure effect.

**Conceptual processing of pain**

The conceptual processing of pain was investigated across studies 1, 4 and 6 using the Pain Beliefs Questionnaire (PBQ). Evidence obtained from the morphine study showed that chronic pain patients were characterised more by beliefs that stressed organic causes of pain compared to acute pain patients. What is not known is whether these beliefs of the chronic pain group are a result of suffering from pain of non-identifiable organic pathology, whether they existed prior to the onset of the chronic pain condition, or whether they affect coping with it. There were no differences in organic or psychological pain related beliefs between high and low pain frequency students in the follow-up experiment however, which possibly suggests that prior to the onset of the chronic pain condition, conscious beliefs about pain are not a discriminative factor between those individuals who are vulnerable to pain and those who are not. It has to be taken into account that in this instance, relatively small samples were involved and a replication would be necessary to establish the reliability of the results. It seems also that the beliefs in organic causes for pain are not dependent on frequent exposure to a pain patient, since parents of children with arthritis did not differ in their pain beliefs from parents of the control group children on either the psychological or the organic belief scores of the PBQ. This finding might be specific to arthritis which has a well defined organic diagnosis. The observed emphasis on organic beliefs about causes and consequences of
pain for AFP patients might be a consequence of suffering from chronic pain of unexplained aetiology. It could possibly reflect the need of those patients to have a clear diagnosis for their condition, assuming that an organic diagnosis would be associated with a cure and would also be better accepted socially. It would be interesting therefore, to compare conscious beliefs about aetiology and consequences of pain in different pain populations, and to investigate whether psychological and or medical treatment has an effect on those beliefs, including measures of other relevant attitudes and beliefs about control of pain (e.g., via the use of the Beliefs about Pain Control Questionnaire (Skevington, 1990); and the Survey of Pain Attitudes (Jensen et al. 1987)). Evidence from mixed groups of chronic pain patients so far suggests that they have higher organic beliefs than control, no-pain groups (Edwards et al. 1992b).

**Implications of the findings for the cognitive models**

In order to explain why sensory material is associated with faster encoding and greater recall for chronic pain patients, it can be suggested that sensory information is already more elaborated and more activated for those patients. This reduces further its processing time, and since the effect was evident only for self-reference encoding, it could also suggest that sensory information is specifically congruent with the content of the patients' self-schema, an effect which is consistent with predictions from Beck et al.'s (1985) schema theory. Sensory material was also more retrievable when encoded in self-reference by individuals with frequent pain episodes (the high pain frequency students) and children with arthritis, indicating that both encoding and retrieval operations are affected by chronic pain where strategic operations are to be performed. The pain schema therefore seems to be part of the self-schema, since the pain-related cognitive biases observed for pain patients in recall and processing time are self-reference specific rather than constituting an independent pain schema (in which case biases would be shown only as between-groups effects irrespective of reference encoding). Future studies should develop appropriate methodologies to address further the issue of the organisation of pain information as part of the information relevant to self-perception in chronic pain and pain-free individuals.

In contrast, there was no evidence of greater activation for pain and illness related words for high pain frequency students and parents of arthritis children in comparison to control groups when the word association task was used. Pain and illness related words were not found to be more accessible to these groups, although greater activation of pain and illness related words has been documented in chronic pain patients (Edwards et al. 1994; Griffith et al. 1996). On the basis of the findings of the high pain frequency students
study, it seems likely that chronicity of a pain condition results initially in biases in controlled, strategic processes at encoding and retrieval stages of information processing, and that it is at a later stage that biases can also involve automatic processes by enhancing accessibility of relevant constructs. There might be a parallel with depression where it has been reported that “mood-congruent judgements ... become increasingly automated as mood worsens or becomes chronic” (Mathews & MacLeod, 1994). Relevant evidence from parents of arthritis children in the present studies indicates again that priming, accessibility of pain and illness constructs are not being affected simply by living in the same family environment with a chronic pain patient. Results from this study underline the significance of actual personal pain experience even for implicit memory biases to become evident, whilst the studies with students indicate that relevant biases are likely first to be evidenced at encoding (presented as faster processing of sensory material) and retrieval (recall) by influencing elaboration, whereas prolonged duration of pain would result in biases also evident in automatic processes. An additional interesting question for future studies is to investigate what other factors can affect processing time (such as imageability of material) in order to ascertain whether it can be used as a reliable indicator/measurement of prior elaboration and current activation of targeted information.

Evidence to date on the processing of pain related affective words with non-depressed chronic pain groups has not shown any differential processing pattern compared to no-pain groups, and the only differential effect observed in the current studies was a within-group effect for the high pain frequency students who recalled more affective words when encoded in self-reference. This effect might be characteristic of the early stages in the development of a pain condition. It seems that cognitive biases in established chronic pain are specific to sensory rather than affective information, and when processing of affective information is also biased this most likely represents a mood effect, since it has been observed reliably only in depressed chronic pain patients. On the evidence so far, cognitive biases seem to be a consequence of suffering from pain, very likely contributing to the development and maintenance of the chronicity of the pain conditions rather than their onset.

As research evidence on information processing in pain accumulates, it becomes increasingly feasible to develop a specific cognitive model of information processing for pain. Beck's cognitive model of emotional disorders (1976) and Williams et al. (1988) integrative model have provided useful theoretical and methodological resources in investigating information processing in pain, and the integrative model in particular can be extended to account also for findings in pain.
A preliminary formulation based on the available evidence would be that it is mainly encoding and retrieval processes that are affected by chronic pain, resulting in faster encoding and greater recall of sensory information when processed in self-reference condition. Priming occurs at the later stages of a pain condition and it seems that cognitive biases develop alongside the progression of the chronicity of pain, playing a role in the development and maintenance of chronic pain, but seemingly not constituting predisposing, vulnerability factors. This course of progression would fit with principles of parallel information processing models which specify the top-down processes as strategic and the bottom-up as automatic ones. The reiteration of biased functions in strategic processes would result in alterations in automatic patterns of processing of relevant material. Finally, a number of strands of weak evidence show that chronic pain patients' beliefs about causes and consequences of pain are different from those of non chronic pain patient groups (see Edwards et al. 1992b). In non-clinical subjects, however, the present studies found no difference between high and low pain frequency groups in beliefs about the causes and consequences of pain. This raises the possibility that conscious belief do not constitute vulnerability factors for the development of chronic pain but rather are a consequence of it.

**Environmental factors in Pain experience**

The research carried out on information processing in pain has largely ignored the possible relevance of the social context of the pain experience. A clear example of an interaction of physiological with psychosocial factors in the processing of pain experience became evident in this thesis, however, when current pain experience and family history of pain was investigated in young adults. Gender differences in awareness of pain in others were also observed, with women being more aware of the pain status of their significant others than men were. This difference could be interpreted as the result of different social influences, where traditional sex roles require women to take on the caring, nurturing role in the family, and therefore it is assumed that social processes reinforce and reward women's awareness of others' health status. On the other hand men's responsibilities in traditional western societies are less compatible with health concerns, a characteristic possibly affecting their own health behaviour and habits. It would be interesting to compare awareness of pain in others between men and women in societies where gender roles are reversed, in order to separate the social from the biological influences determining awareness of pain in others. Additional information within the same culture could also be obtained from families where men are the main caregivers (e.g., one parent families, families where the father is unemployed and takes...
on household responsibilities). Increased pain experience in young women in this study seems to be associated with gender specific physiological mechanisms (i.e., menstruation), which supports the recent developments in the understanding of sex differences in pain, where greater and differential physiological morbidity to pain has been reported for women (Unrue, 1996) and refutes the traditional psychogenic hypothesis. Men also may benefit by becoming more aware of their own and other people's health status, assuming that this change would lead to better care of themselves.

The report of pain models was the only significant predictor of current pain experience in young adults among the variables investigated. It seems that family history of pain could be a reliable indicator of possible vulnerability to chronic pain, where both biological and environmental effects could interact and affect pain experience and behaviour.

Thus, the role of modelling in shaping pain experience and expression can be seen as fundamental and is most likely uni-directional. The direction of the influence of modelling seems to be from parents to children, with children modelling their pain experience and behaviour on that of their parents. The findings from the current children and parents studies provide some additional information on this, as it was found that although parents lived in the same environment with a child suffering from chronic pain, they did not differ from parents of the control group on reported pain models or their pain experience. On the other hand, evidence from a previous study with children suffering from abdominal pain showed that children's complaints matched those of the parents at the time of testing, and were not related to parents' symptoms when they were at the age of their children (Christensen & Mortensen, 1975), underlining the significance of the learning rather than the biological factors in children's abdominal pain.

Though they did not have greater personal pain experience, parents of children in pain had a fairly accurate perception of their children's pain levels. This finding relates mainly to mothers as they constituted 78% of the parents sample and is in line with the enhanced awareness of pain in significant others observed for young women, indicating that this characteristic is also present in women at a later stage of life.

There was no evidence for specific patterns of family functions being associated with increased pain experience in young adults suffering from frequent pain episodes. This observation is in contrast with approaches in family systems theory which adopt the psychosomatic model, which implies that specific family functions can contribute to the onset of an illness (Minuchin et al. 1975), it is in line though with evidence from a study comparing students receiving short-term counselling in a college counselling center, to students not in counselling, where no differences were found between groups in any of the FES subscales (May & Sowa, 1994).
The lack of evidence for any perceived pathological patterns in family function for children suffering from arthritis, and the evidence of their good psychological adjustment, fits well with the view that the family functions as a primary source of support, helping the patient to cope with the chronic illness and to comply with treatment (Rolland, 1994). The effective adaptation of these families to chronic pain in the child contrasts with evidence on how families react to chronic pain in an adult member. This contrast suggests that a child's role and functioning within the family system are less disrupted by a pain condition which is attributed to an organic illness than are those of an adult pain patient. Difficulties in fulfilling parental roles (e.g., sustaining the family financially by working, being the caretaker) are frequently associated with the observed negative effects of pain in the families of adult chronic pain patients. As reviewed in Chapters 1 and 7, these adverse effects include increased stress in spouses and feelings of helplessness, as well as poor psychological adjustment in their children.

Additional factors possibly mediating adjustment and coping with chronic pain which influence both personal and familial/social responses to chronic pain are the diagnosis of the condition, (especially whether it can be attributed to a well-defined illness or the aetiology is currently obscure), the condition's severity, and its intensity. We might need to develop a specific typology of chronic pain along the lines of Rolland's (1994) typology of illness, which would be useful in the assessment and treatment, both medical and psychological, of each specific chronic pain syndrome, as it would allow for more specific and effective interventions.

As differences are anticipated in treatment needs for different pain conditions there is a clear need for further study of specific pain groups. It is important to understand more fully the psychosocial processes associated with the different stages of development of each pain condition, and to try to address in treatment the relevant individual and family needs. Further research on what constitutes adaptive, effective family and individual function in the context of each chronic pain condition and at particular stages of a family's life cycle can provide invaluable information for health professionals regarding particular difficulties faced at each stage, and provide clear goals for their interventions both at a personal and at a family level. A very interesting anecdotal observation illustrating the above point, was made by the rheumatologist who treats some of the children with arthritis who were studied as part of this thesis work (Dr. M. Rooney, personal communication). She reported that these children usually manage to cope quite well with the condition until their late adolescence, an observation which is in line with the evidence obtained from the study 5, but she noted that some of them when they reach late adolescence face a crisis point. She believes that this happens as children realise their illness-related limitations when comparing themselves with their peers. If we consider
that this developmental stage is when adolescents usually make their first attempts at becoming more independent, suffering from arthritis can be perceived as an impediment in achieving that goal. This could affect psychological adjustment, behaviour, treatment compliance, and become a challenge to be faced by the whole family. The interaction of the change of life cycle stage with the limitations associated with suffering from a chronic painful illness can result in additional strain for the individual and their family (Carter & McGodrick, 1989). It would be helpful therefore, if future research addressed the variability of chronic pain both between different pain states, and in relation to the individual patient and the stage of development which has been reached in the family life cycle.

As a family history of pain seems in the present studies to be a reliable predictor of current pain experience, it might be useful if this was included in the information used in the assessment of vulnerability of individuals to chronic pain. Prospective investigations should attempt to study further the mechanisms responsible for this effect, and develop appropriate strategies to counteract its influence.

Skevington's (1995) psychosocial model of pain experience, provides a framework within which to explore how individual behaviour and the underlying schemata and beliefs about pain are affected by social processes within the immediate social environment, the society and its institutions. This model was not available before the design or during the execution of the empirical work of this thesis, and the studies were not designed specifically to test it. Despite that, the current studies examine some aspects of the first and second levels it specifies, and the work can be extended in future studies.

The first level of Skevington's model refers to individual behaviours affected by social processes, and in that context the gender differences in awareness of pain in significant others can be seen as evidence of distinct social influences in men and women. The pain patients' patterns of processing of pain related information provides evidence for a specific effect of pain on the self-perception of pain patients, the content of which is influenced by social schemata about pain, illness and disability as specified in the model and could be the subject of future research.

The second level refers to "interpersonal behaviours" that affect beliefs about causation, self-efficacy and control of pain, and the context and atmosphere of interpersonal encounters with family members and significant-others, work and health care systems. The current studies examined beliefs about causes and consequences of pain as well as the family environment of children with chronic pain and their parents, and of people with frequent pain experience in comparison to control groups. The evidence so far
suggests that pain patients have different beliefs about the causes and consequences of pain than no chronic pain groups. Also pain might not have a homogenous effect on family functions across pain conditions and developmental stages (e.g., a negative effect has been observed in families where mothers suffered from headache and back pain (Kopp et al. 1995), but not when the children suffered from arthritis in the current study), which stresses the significance of interpersonal and social factors in adapting to and coping with a chronic pain condition.

Future work stemming from the current studies could address the impact of different pain conditions within the third level of the model, that of "group and intergroup behaviour", where beliefs about pain, pain control, illness and disability, and perceptions of family functions could be investigated, assessing "significant-others" of pain patients and health care professionals involved in their care. Cross-cultural comparisons in the social interactions associated with specific pain conditions, could possibly yield interesting information about what type of social responses facilitate coping, management and possibly recovery from pain. Finally, addressing the fourth level of the model which refers to "higher order factors affecting psychosocial processing", future research studying the effects of different health care systems and their policies on pain patients would help to identify what works best to optimise services to these patients. There is though the need to identify existing tests from the current literature, and possibly to develop new instruments that can reliably measure the processes outlined in all four levels of this model.

8.4 Limitations of the investigations and further suggestions for future research

Problems encountered in carrying out the studies described in this thesis are common to most clinical research. The findings for some of the experimental studies could have been more powerful, and the results more conclusive, if it had been possible for larger samples to be tested and the reliability of measures (e.g., FHQ) systematically assessed. Constraints were imposed by difficulties in accessing appropriate clinical and non-clinical subjects and by the limited availability of some relevant materials (e.g., pain-related words).

The need for more longitudinal studies is highlighted in order to study the development of the chronicity of a pain condition and the associated changes at specific levels of pain processing and experience at different stages of pain development. The assessment of beliefs about pain across different pain conditions and diagnoses, and an investigation of
whether changes occur with the development of chronic pain, would clarify whether chronic pain can also produce a bias in beliefs about pain. The relationship between conscious beliefs about causes and consequences of pain and coping, would also be an area worthy of further investigation. The usefulness of information interventions at the early stages of pain could also be evaluated.

An interesting future investigation would be the assessment of the relationship between cognitive biases and coping with chronic pain. It is possible for example, that increased coping could be associated with reduced cognitive biases even when pain is still present. A longitudinal evaluation of individuals who are vulnerable to pain, assessing mood, coping, cognitions (thoughts and beliefs about pain) by collecting measures repeatedly over a period of time using a time series approach, could provide more insight into the processes and stages involved in the transition to a chronic pain condition. If strategic processes such as cognitive restructuring are affecting nonconscious processing of pain information, then in theory it would be possible to develop and evaluate specific treatment techniques which aim to reduce these biases, thereby targeting one of the possible factors affecting maintenance of the condition.

The identification of significant vulnerability factors in relation to chronic pain and the formulation of a model depicting stages in the progression of a pain to a chronic pain condition, could be a very fruitful area for further research. It would lead to better understanding and possibly the development, application and evaluation of appropriate interventions specific to that pain condition and the stage of pain development. Potential vulnerability factors which may be amenable to future longitudinal investigations could be coping style, life events, social support, lifestyle, and health habits.

Along with the use of quantitative methodologies in pain research, the complementary use of qualitative investigations would provide a more detailed picture of the way pain influences peoples life experiences. Effects of pain in the family could be explored in different pain groups, for different family members and in relation to different family roles using in-depth interviews. The content of patients' self-schemata and how much having pain is a dominant feature in their self-perception, could be investigated in detail using qualitative methodology at different pain stages and across different pain conditions, as could gender differences in pain experience.

Evidence from the children's study indicates that psychological interventions intending to change children's self-perception by reinforcing active coping characteristics and focusing on positive, pain-irrelevant ones, might be a useful method in helping children in pain.

Although cognitive tasks are not as convenient to carry out as a self-administered questionnaire, they could be very useful, more objective measures of recovery in addition
to self-report measures, since when appropriately administered, they are far less amenable to response biases. The methodology of cognitive tasks can be improved by the use of disorder specific stimuli whenever possible to match individual patients' and pain groups' pain experiences. As shown in the children's study, words that can be neutral to some people can have a pain related meaning for specific pain groups.

In information processing models (Leventhal & Everhart, 1979) a hierarchical relationship among the different components of pain experience is specified, with specific levels working in parallel and independently of each other. It would be interesting to develop studies that test specifically the independence of those components (conscious, non-conscious, physiological) in order to obtain more information about the relationship among them in relation to changes that occur during the development of a pain condition. Based on available evidence it seems that parallel changes occur in physiological and schematic levels of pain processing, whilst no information is available on whether there is a relationship between them. Similarly, the investigation of a possible relationship between cognitive biases and coping can also prove to be of value.

The multilevel approach adopted in this thesis hopefully suggests that it is feasible to combine research on physiological, cognitive, conceptual and social aspects of pain, allowing for a more encompassing approach analogous to the complexity and diversity of the pain phenomenon itself.
8.5 Epilogue

This thesis represents a preliminary attempt to study pain as a subjective experience occurring within a social context. During the research process the need for a multilevel approach in examining specific components of pain became apparent in order to address the complexity of pain experience. It also became evident that there is a need for a theoretical framework which encompasses the plethora of information, research paradigms and current findings in pain from all disciplines. A useful future endeavour would be to attempt to map all levels of pain experience (biological, and psychosocial) in one meta-model with multiple components. Collaboration of all the different scientific approaches (e.g., anatomy, physiology, pharmacology, psychology, anthropology, sociology) currently active in pain research would provide detail into the function of the specific components, making theoretical formulations of pain more specific and representative. Research in the relevant disciplines would not be curtailed, instead a clearer picture of the pain phenomenon as a result of the continuing synthesis of the current knowledge at all levels, from all disciplines, would emerge. This way relationships between different levels of pain experience would be identified and further hypotheses for future research and interventions would be generated. As pain, and chronic pain in particular, is a complex and still a puzzling phenomenon we need to approach it from a multitude of perspectives, since we still have more to learn in order to manage it better and hopefully to prevent, or at least to ameliorate, the suffering it causes. An effective organisation and use of the existing interdisciplinary knowledge would lead to better co-ordination of future efforts in its understanding, prevention and treatment.
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APPENDICES
Appendix 2.1

SELF-EVALUATION QUESTIONNAIRE
Developed by C. D. Spielberger, R. L. Gorsuch and R. Lushene

STAI FORM X-1

NAME ______________________ DATE ____________

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then blacken in the appropriate circle to the right of the statement to indicate how you feel right now, that is, at this moment. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

1. I feel calm .......................................................... 0 0 0 0
2. I feel secure .......................................................... 0 0 0 0
3. I am tense ........................................................... 0 0 0 0
4. I am regretful ...................................................... 0 0 0 0
5. I feel at ease ....................................................... 0 0 0 0
6. I feel upset .......................................................... 0 0 0 0
7. I am presently worrying over possible misfortunes ........................................ 0 0 0 0
8. I feel rested .......................................................... 0 0 0 0
9. I feel anxious ...................................................... 0 0 0 0
10. I feel comfortable ................................................ 0 0 0 0
11. I feel self-confident ............................................. 0 0 0 0
12. I feel nervous ..................................................... 0 0 0 0
13. I am jittery .......................................................... 0 0 0 0
14. I feel "high strung" .............................................. 0 0 0 0
15. I am relaxed ...................................................... 0 0 0 0
16. I feel content ...................................................... 0 0 0 0
17. I am worried ..................................................... 0 0 0 0
18. I feel over-excited and "rattled" ........................................ 0 0 0 0
19. I feel joyful ....................................................... 0 0 0 0
20. I feel pleasant .................................................... 0 0 0 0

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216
NAME _________________________________________________ DATE__________________

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then blacken in the appropriate circle to the right of so the statement to indicate how you generally feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Circle</th>
</tr>
</thead>
<tbody>
<tr>
<td>21. I feel pleasant</td>
<td></td>
</tr>
<tr>
<td>22. I tire quickly</td>
<td></td>
</tr>
<tr>
<td>23. I feel like crying</td>
<td></td>
</tr>
<tr>
<td>24. I wish I could be as happy as others seem to be</td>
<td></td>
</tr>
<tr>
<td>25. I am losing out on things because I can't make up my mind soon enough</td>
<td></td>
</tr>
<tr>
<td>26. I feel rested</td>
<td></td>
</tr>
<tr>
<td>27. I am &quot;calm, cool, and collected&quot;</td>
<td></td>
</tr>
<tr>
<td>28. I feel that difficulties are piling up so that I cannot overcome them</td>
<td></td>
</tr>
<tr>
<td>29. I worry too much over something that really doesn't matter</td>
<td></td>
</tr>
<tr>
<td>30. I am happy</td>
<td></td>
</tr>
<tr>
<td>31. I am inclined to take things hard</td>
<td></td>
</tr>
<tr>
<td>32. I lack self-confidence</td>
<td></td>
</tr>
<tr>
<td>33. I feel secure</td>
<td></td>
</tr>
<tr>
<td>34. I try to avoid facing a crisis or difficulty</td>
<td></td>
</tr>
<tr>
<td>35. I feel blue</td>
<td></td>
</tr>
<tr>
<td>36. I am content</td>
<td></td>
</tr>
<tr>
<td>37. Some unimportant thought runs through my mind and bothers me</td>
<td></td>
</tr>
<tr>
<td>38. I take disappointments so keenly that I can't put them out of my mind</td>
<td></td>
</tr>
<tr>
<td>39. I am a steady person</td>
<td></td>
</tr>
<tr>
<td>40. I get in a state of tension or turmoil as I think over my recent concerns and interests</td>
<td></td>
</tr>
</tbody>
</table>

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Appendix 2.2

**BDI**

**NAME:_____________________________** **DATE:____**

This questionnaire consists of 21 groups of statements. After reading each group of statements carefully, circle the number (0, 1, 2 or 3) next to the one statement in each group which best describes the way you have been feeling the past week including today. If several statements within a group seem to apply equally well, circle each one.

*Be sure to read all the statements in each group before making your choice.*

1. 0 I do not feel sad
   1 I feel sad
   2 I am sad all the time and I can’t snap out of it
   3 I am so sad or unhappy that I can’t stand it

2. 0 I am not particularly discouraged about the future
   1 I feel discouraged about the future
   2 I feel that I have nothing to look forward to
   3 I feel that the future is hopeless and that things cannot improve

3. 0 I do not feel like a failure
   1 I feel I have failed more than the average person
   2 As I look back on my life all I can see is a lot of failures
   3 I feel I am a complete failure as a person

4. 0 I get as much satisfaction out of things as I used to
   1 I don’t enjoy things the way I used to
   2 I don’t get real satisfaction out of anything anymore
   3 I am dissatisfied or bored with everything
| 5. | 0 | I don't feel particularly guilty |
|    | 1 | I feel guilty a good part of the time |
|    | 2 | I feel quite guilty most of the time |
|    | 3 | I feel guilty all of the time |

| 6. | 0 | I don't feel I am being punished |
|    | 1 | I feel I may be punished |
|    | 2 | I expect to be punished |
|    | 3 | I feel I am being punished |

| 7. | 0 | I don't feel disappointed in myself |
|    | 1 | I am disappointed in myself |
|    | 2 | I am disgusted in myself |
|    | 3 | I hate myself |

| 8. | 0 | I don't feel I am any worse than anybody else |
|    | 1 | I am critical of myself for my weaknesses or mistakes |
|    | 2 | I blame myself all the time for my faults |
|    | 3 | I blame myself for everything bad that happens |

| 9. | 0 | I don't have any thoughts of killing myself |
|    | 1 | I have thoughts of killing myself but I would not carry them out |
|    | 2 | I would like to kill myself |
|    | 3 | I would kill myself if I had the chance |

| 10. | 0 | I don't cry any more than usual |
|     | 1 | I cry more now than I used to |
|     | 2 | I cry all the time now |
|     | 3 | I used to be able to cry but now I can't cry even though I want to |

<p>| 11. | 0 | I am no more irritated now than I ever am |
|     | 1 | I get annoyed or irritated more easily than I used to |
|     | 2 | I feel irritated all the time now |
|     | 3 | I don't get irritated at all by the things that used to irritate me |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.</td>
<td>0</td>
<td>I have not lost interest in other people</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>I am less interested in other people than I used to be</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>I have lost most of my interest in other people</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>I have lost all of my interest in other people</td>
</tr>
<tr>
<td>13.</td>
<td>0</td>
<td>I make decisions about as well as I ever could</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>I put off making decisions more than I used to</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>I have greater difficulty in making decisions than before</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>I can't make decisions at all anymore</td>
</tr>
<tr>
<td>14.</td>
<td>0</td>
<td>I don't feel I look any worse than I used to</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>I am worried that I am looking old or unattractive</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>I feel that there are permanent changes to my appearance that make me look unattractive</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>I believe that I look ugly</td>
</tr>
<tr>
<td>15.</td>
<td>0</td>
<td>I can work about as well as before</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>It takes an extra effort to get started at doing something</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>I have to push myself very hard to do anything</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>I can't do any work at all</td>
</tr>
<tr>
<td>16.</td>
<td>0</td>
<td>I can sleep as well as usual</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>I don't sleep as well as I used to</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>I wake up 1-2 hours earlier than usual and find it hard to get back to sleep</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>I wake up several hours earlier than I used to and cannot get back to sleep</td>
</tr>
<tr>
<td>17.</td>
<td>0</td>
<td>I don't get more tired than usual</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>I get tired more easily than I used to</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>I get tired from doing almost anything</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>I am too tired to do anything</td>
</tr>
<tr>
<td>18.</td>
<td>0</td>
<td>My appetite is no worse than usual</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>My appetite is not as good as it used to be</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>My appetite is much worse now</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>I have no appetite at all anymore</td>
</tr>
</tbody>
</table>
19. 0  I haven’t lost much weight, if any, lately
     1  I have lost more than 5 pounds (2 kilos)
     2  I have lost more than 10 pounds (4 kilos)
     3  I have lost more than 15 pounds (7 kilos)

I am purposely trying to lose weight by eating less
     YES  NO

20. 0  I am no more worried about my health than usual
     1  I am worried about physical problems such as aches and
        pains, or upset stomach, or constipation.
     2  I am very worried about physical problems and it’s hard to
        think of much else
     3  I am so worried about my physical problems that I cannot
        think about anything else

21  0  I have not noticed any recent changes in my interest in sex
     1  I am less interested in sex than I used to be
     2  I am much less interested in sex than I used to be
     3  I have lost interest in sex completely

Somatic items in boxes
Appendix 2.3

PAIN BELIEFS QUESTIONNAIRE

<table>
<thead>
<tr>
<th>Age:</th>
<th>Sex:</th>
<th>Marital Status:</th>
<th>Occupation:</th>
</tr>
</thead>
</table>

For each item please indicate your opinion by underlining one of the following words in each sentence:
- always / almost always / often / sometimes / rarely / never

There are no right or wrong answers; it is important that you respond according to your actual beliefs, not according to how you feel you should believe or how you think we want you to believe.

Please make sure that you answer ALL the questions.

1) Pain is (always/almost always/often/sometimes/rarely/never) the result of damage to the tissues of the body.
2) Physical exercise (always/almost always/often/sometimes/rarely/never) makes pain worse.
3) It is (always/almost always/often/sometimes/rarely/never) impossible to do much for oneself to relieve pain.
4) Being anxious (always/almost always/often/sometimes/rarely/never) makes pain seem worse.
5) Experiencing pain is (always/almost always/often/sometimes/rarely/never) a sign that something is wrong with the body.
6) Being in pain (always/almost always/often/sometimes/rarely/never) prevents you from enjoying hobbies and social activities.
7) When relaxed pain is (always/almost always/often/sometimes/rarely/never) easier to cope with.
8) The amount of pain is (always/almost always/often/sometimes/rarely/never) related to the amount of damage.
9) Thinking about pain (always/almost always/often/sometimes/rarely/never) makes it worse.
10) It is (always/almost always/often/sometimes/rarely/never) impossible to control pain on your own.
11) Pain is (always/almost always/often/sometimes/rarely/never) a sign of illness.
12) Feeling depressed (always/almost always/often/sometimes/rarely/never) makes pain seem worse.
Appendix 2.4

"Pain Story"

"Pain Intensity and Affect"

There are two aspects in pain sensation that we are going to measure, namely the intensity, i.e. how intense the pain is, and the unpleasantness, i.e. how unpleasant or bothering the pain is to you. I will try to make this distinction clear by means of a few examples. First lets consider the sound coming from a radio.

INTENSITY

The intensity of the sound can be adjusted by altering the volume of the radio. In this way, I can control the sound so that it can be inaudible, barely audible, clearly audible, loud, very loud ...

AFFECT

The sound can also evoke a certain affect: we may like it a bit or very much, we can become saddened by it, or we may be indifferent to it.

I am going to ask you how loud the music sounds to you and how pleasant or unpleasant you think it is to listen to it. Both dimensions often change in the same direction: after changing the volume, you may find that the intensity has increased as well as the unpleasantness. However, it is not always like this: both dimensions do not necessarily change in the same direction:

- it may be that the intensity increases but the unpleasantness remains the same,
- it is also possible that the intensity remains the same but that the unpleasantness increases after some time.
It is the same with all sensations. Each has an intensity dimension and an emotional dimension as well. I will try to make this clear by referring to some examples.

a) Tastes can vary in sweetness. The same intensity of sweetness can be very pleasant and welcome if you feel hungry and you desperately need food. On the other hand the same intensity of sweetness can be very unpleasant if you have eaten too much.

b) Smells can also vary in intensity and pleasantness/unpleasantness. An exotic perfume of a particular intensity can provoke a pleasant emotional response at a summer night party by the seaside while the same smell can be extremely unpleasant and disturbing early in the morning on your way to work while sitting next to a lady who wears it, in a crowded carriage in the tube.

c) It is the same thing with PAIN. Pain can vary in intensity or unpleasantness. A medical examination can produce different reactions to a woman hospitalized with uterine cancer and a woman in childbirth even though each may experience the same intensity of feeling during the examination. If they are asked to rate the intensity of this pain on a scale ranging from 0 (no pain) to 100 (most intense pain imaginable) both patients might give approximately the same intensity. On the other hand, their ratings of unpleasantness, on a scale ranging from 0 (no pain) to 100 (most unpleasant pain imaginable) could be very different since the cancer patient may perceive the pain as more frightening while the pregnant woman, in contrast, may feel happy and exhilarated as the same sensations remind her of the impending birth.
As we can see, while the pain intensity remains the same, our emotional reaction to it can be varied depending on factors other than the intensity. We have two distinct scales for measuring both dimensions of pain sensation. We will ask you to rate your pain on both dimensions (intensity and affect) by giving a number on a scale ranging from 0 to 100, with '0' indicating no pain and '100' representing the most intense or the most unpleasant painful experience you can imagine."
Appendix 3.1

FAMILY HEALTH QUESTIONNAIRE

Name ___________________________ Code _____________

Date of Birth ____________________________

Sex ____________________ Marital Status ____________________

Occupation ____________________ Date ____________________

We are conducting a survey on family health and we would be grateful if you could answer the following questions as honestly as possible. The information given will be strictly confidential.

I. In the last month have you experienced any kind of pain? Yes or No

(Please circle the appropriate answer and give if necessary further details as specified below, using numbers)

<table>
<thead>
<tr>
<th></th>
<th>In the last month how often have you had this pain?</th>
<th>How intense was each episode on average, on a scale from 0 = no pain to 10 = extremely painful?</th>
<th>On average how long did the pain last? (Specify either in mins, hrs or days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neck pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Back pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joint pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Muscle pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chest pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abdominal pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Menstrual pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tooth/ear pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(say where)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OTHER pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(please specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
II. Have any of your family members, close relatives, or any other important people in your childhood and current life circumstances evidenced any "persistent pain or illness?"
Please specify the type of pain or what combination of the above common pain symptoms they evidenced or from what kind of illness they suffered.

<table>
<thead>
<tr>
<th>Kinds of symptoms and/or illness</th>
<th>How often was/is the person complaining (specify number of times either per day, week or month)</th>
<th>For how many months or years had the person suffered from these symptoms?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Father</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sister/s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brother/s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grandmother</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grandfather</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spouse</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child/children</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uncle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aunt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Close friend/s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family friend/s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other person/s important to you (please specify)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix 5.1

A SOCIAL CLIMATE SCALE

FAMILY ENVIRONMENT SCALE
FORM R

Rudolf H. Moos

Instructions

There are 90 statements in this booklet. They are statements about families. You are to decide which of these statements are true of your family and which are false. Make all your marks on the separate answer sheet. If you think the statement is True or mostly True of your family, make an X in the box labeled T (true). If you think the statement is False or mostly False of your family, make an X in the box labeled F (false).

You may feel that some of the statements are true for some family members and false for others. Mark T if the statement is true for most members. Mark F if the statement is false for most members. If the members are evenly divided, decide what is the stronger overall impression and answer accordingly.

Remember, we would like to know what your family seems like to you. So do not try to figure out how other members see your family, but give us your general impression of your family for each statement.

Consulting Psychologists Press, Inc.
3803 E. Bayshore Road, Palo Alto, CA 94303

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1. Family members really help and support one another.
2. Family members often keep their feelings to themselves.
3. We fight a lot in our family.
4. We don't do things on our own very often in our family.
5. We feel it is important to be the best at whatever you do.
6. We often talk about political and social problems.
7. We spend most weekends and evenings at home.
8. Family members attend church, synagogue, or Sunday School fairly often.
9. Activities in our family are pretty carefully planned.
10. Family members are rarely ordered around.
11. We often seem to be killing time at home.
12. We say anything we want to around home.
13. Family members rarely become openly angry.
14. In our family, we are strongly encouraged to be independent.
15. Getting ahead in life is very important in our family.
16. We rarely go to lectures, plays or concerts.
17. Friends often come over for dinner or to visit.
18. We don't say prayers in our family.
19. We are generally very neat and orderly.
20. There are very few rules to follow in our family.
21. We put a lot of energy into what we do at home.
22. It's hard to "blow off steam" at home without upsetting somebody.
23. Family members sometimes get so angry they throw things.
24. We think things out for ourselves in our family.
25. How much money a person makes is not very important to us.
26. Learning about new and different things is very important in our family.
27. Nobody in our family is active in sports, Little League, bowling, etc.
28. We often talk about the religious meaning of Christmas, Passover, or other holidays.
29. It's often hard to find things when you need them in our household.
30. There is one family member who makes most of the decisions.
31. There is a feeling of togetherness in our family.
32. We tell each other about our personal problems.
33. Family members hardly ever lose their tempers.
34. We come and go as we want to in our family.
35. We believe in competition and "may the best man win."
36. We are not that interested in cultural activities.
37. We often go to movies, sports events, camping, etc.
38. We don't believe in heaven or hell.
39. Being on time is very important in our family.
40. There are set ways of doing things at home.
41. We rarely volunteer when something has to be done at home.
42. If we feel like doing something on the spur of the moment we often just pick up and go.
43. Family members often criticize each other.
44. There is very little privacy in our family.
45. We always strive to do things just a little better the next time.
46. We rarely have intellectual discussions.
47. Everyone in our family has a hobby or two.
48. Family members have strict ideas about what is right and wrong.
49. People change their minds often in our family.
50. There is a strong emphasis on following rules in our family.
51. Family members really back each other up.
52. Someone usually gets upset if you complain in our family.
53. Family members sometimes hit each other.
54. Family members almost always rely on themselves when a problem comes up.
55. Family members rarely worry about job promotions, school grades, etc.
56. Someone in our family plays a musical instrument.
57. Family members are not very involved in recreational activities outside work or school.
58. We believe there are some things you just have to take on faith.
59. Family members make sure their rooms are neat.
60. Everyone has an equal say in family decisions.
61. There is very little group spirit in our family.
62. Money and paying bills is openly talked about in our family.
63. If there's a disagreement in our family, we try hard to smooth things over and keep the peace.
64. Family members strongly encourage each other to stand up for their rights.
65. In our family, we don't try that hard to succeed.
66. Family members often go to the library.
67. Family members sometimes attend courses or take lessons for some hobby or interest (outside of school).
68. In our family each person has different ideas about what is right and wrong.

69. Each person's duties are clearly defined in our family.

70. We can do whatever we want to in our family.

71. We really get along well with each other.

72. We are usually careful about what we say to each other.

73. Family members often try to one-up or out-do each other.

74. It's hard to be by yourself without hurting someone's feelings in our household.

75. "Work before play" is the rule in our family.

76. Watching T.V. is more important than reading in our family.

77. Family members go out a lot.

78. The Bible is a very important book in our home.

79. Money is not handled very carefully in our family.

80. Rules are pretty inflexible in our household.

81. There is plenty of time and attention for everyone in our family.

82. There are a lot of spontaneous discussions in our family.

83. In our family, we believe you don't ever get anywhere by raising your voice.

84. We are not really encouraged to speak up for ourselves in our family.

85. Family members are often compared with others as to how well they are doing at work or school.

86. Family members really like music, art and literature.

87. Our main form of entertainment is watching T.V. or listening to the radio.

88. Family members believe that if you sin you will be punished.

89. Dishes are usually done immediately after eating.

90. You can't get away with much in our family.
Appendix 6.1

CDI

NAME__________________________
SEX____________________________
DATE OF BIRTH__________________
CLASS__________________________

Kids some times have different feelings and ideas. This form lists the feelings and ideas in Groups. From each group pick one sentence that describes you best for the past two weeks. After you pick a sentence from the first group go on to the next group.

There is no right or wrong answers. Just pick the sentence that best describes the way you have been recently. Put a mark like this ( X ) next to your answer. Put the mark next to the sentence that you pick.

Here is an example of how this form works. Try it... Put a mark next to the sentence that describes you best.

EXAMPLE : ___ I read books all the time
            ___ I read books once in a while
            ___ I never read books

REMEMBER, PICK OUT THE SENTENCES THAT DESCRIBE YOUR FEELINGS AND IDEAS IN THE PAST TWO WEEKS.

1. _____ I am sad once in a while
       _____ I am sad many times
       _____ I am sad all the time

2. _____ Nothing will ever work out for me
       _____ I am not sure if things will work out for me
       _____ Things will work out for me OK.

3. _____ I do most things OK.
       _____ I do many things wrong
       _____ I do everything wrong

4. _____ I have fun in many things
       _____ I have fun in some things
       _____ Nothing is fun at all
5. _____ I am bad all the time
       _____ I am bad many times
       _____ I am bad once in a while

6. _____ I think about bad things happening to me once in a while
       _____ I worry that bad things will happen to me
       _____ I am sure that terrible things will happen to me

7. _____ I hate myself
       _____ I do not like myself
       _____ I like myself

8. _____ All bad things are my fault
       _____ Many bad things are my fault
       _____ Bad things are not usually my fault

9. _____ I do not thing about killing myself
       _____ I think about kill myself but I would no do it
       _____ I want to kill myself

10. _____ I feel like crying everyday
       _____ I feel like crying many days
       _____ I feel like crying once in a while

11. _____ Things bother me all the time
       _____ Things bother me many times
       _____ Things bother me once in a while

12. _____ I like being with people
       _____ I do not like being with people
       _____ I do not want being with people at all

13. _____ I can not make up my mind about things
       _____ It is hard to make up my mind about things
       _____ I make up my mind about things easily

14. _____ I look OK.
       _____ There are some bad things about my looks
       _____ I look ugly

15. _____ I have to push myself all the time to do my schoolwork
       _____ I have to push myself many times to do my schoolwork
       _____ Doing schoolwork is not a big problem
REMEMBER, DESCRIBE HOW YOU HAVE BEEN IN THE PAST TWO WEEKS

16. _____ I have trouble sleeping every night
       _____ I have trouble sleeping many nights
       _____ I sleep pretty well

17. _____ I am tired once in a while
       _____ I am tired many days
       _____ I am tired all the time

18. _____ Most days I do not feel like eating
       _____ Many days I do not feel like eating
       _____ I eat pretty well

19. _____ I do not worry about aches and pains
       _____ I worry about aches and pains many times
       _____ I worry about aches and pains all the time

20. _____ I do not feel alone
       _____ I feel alone many times
       _____ I feel alone all the time

21. _____ I never have fun at school
       _____ I have fun at school only once in a while
       _____ I have fun at school many times

22. _____ I have plenty of friends
       _____ I have some friends but I wish I had more
       _____ I do not have any friends

23. _____ My schoolwork is alright
       _____ My schoolwork is not as good as before
       _____ I do very badly in subjects I used to be good in

24. _____ I can never be as good as other kids
       _____ I can be as good as other kids if I want to
       _____ I am just as good as other kids

25. _____ Nobody really loves me
       _____ I am not sure if anybody loves me
       _____ I am sure that somebody loves me

26. _____ I usually do what I am told
       _____ I do not do what I am told most times
       _____ I never do what I am told
27. ______ I get along with people
      ______ I get into fights many times
      ______ I get into fights all the time
Appendix 6.2

HOW-I-FEEL QUESTIONNAIRE
Developed by C. D. Spielberg, C. D. Edwards, J. Montuori and R. Lushene
STAIC FORM C-1

NAME ____________________ AGE _______ DATE ________

DIRECTIONS: A number of statements which boys and girls use to describe themselves are given below. Read each statement carefully and decide how you feel right now. Then put an X in the box in front of the word or phrase which best describes how you feel. There are no right or wrong answers. Do not spend too much time on any one statement. Remember, find the word or phrase which best describes how you feel right now, at this very moment.

1. I feel .......... □ very calm □ calm □ not calm
2. I feel .......... □ very upset □ upset □ not upset
3. I feel .......... □ very pleasant □ pleasant □ not pleasant
4. I feel .......... □ very nervous □ nervous □ not nervous
5. I feel .......... □ very jittery □ jittery □ not jittery
6. I feel .......... □ very rested □ rested □ not rested
7. I feel .......... □ very scared □ scared □ not scared
8. I feel .......... □ very relaxed □ relaxed □ not relaxed
9. I feel .......... □ very worried □ worried □ not worried
10. I feel .......... □ very satisfied □ satisfied □ not satisfied
11. I feel .......... □ very frightened □ frightened □ not frightened
12. I feel .......... □ very happy □ happy □ not happy
13. I feel .......... □ very sure □ sure □ not sure
14. I feel .......... □ very good □ good □ not good
15. I feel .......... □ very troubled □ troubled □ not troubled
16. I feel .......... □ very bothered □ bothered □ not bothered
17. I feel .......... □ very nice □ nice □ not nice
18. I feel .......... □ very terrified □ terrified □ not terrified
19. I feel .......... □ very mixed-up □ mixed-up □ not mixed-up
20. I feel .......... □ very cheerful □ cheerful □ not cheerful

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HOW-I-FEEL QUESTIONNAIRE
STAIC FORM C-2

NAME ____________________________ AGE ______ DATE ______

DIRECTIONS: A number of statements which boys and girls use to describe themselves are given below. Read each statement and decide if it is hardly-never, or sometimes, or often true for you. Then for each statement, put an X in the box in front of the word that seems to describe you best. There are no right or wrong answers. Do not spend too much time on any one statement. Remember, choose the word which seems to describe how you usually feel.

1. I worry about making mistakes . . . . □ hardly-ever □ sometimes □ often
2. I feel like crying . . . . . . . . . . □ hardly-ever □ sometimes □ often
3. I feel unhappy . . . . . . . . . . □ hardly-ever □ sometimes □ often
4. I have trouble making up my mind . . . □ hardly-ever □ sometimes □ often
5. It is difficult for me to face my problems . □ hardly-ever □ sometimes □ often
6. I worry too much . . . . . . . . . . □ hardly-ever □ sometimes □ often
7. I get upset at home . . . . . . . . . □ hardly-ever □ sometimes □ often
8. I am shy . . . . . . . . . . . . . . □ hardly-ever □ sometimes □ often
9. I feel troubled . . . . . . . . . . □ hardly-ever □ sometimes □ often
10. Unimportant thoughts run through my mind and bother me . . . □ hardly-ever □ sometimes □ often
11. I worry about school . . . . . . . . □ hardly-ever □ sometimes □ often
12. I have trouble deciding what to do . . □ hardly-ever □ sometimes □ often
13. I notice my heart beats fast . . . . □ hardly-ever □ sometimes □ often
14. I am secretly afraid . . . . . . . . □ hardly-ever □ sometimes □ often
15. I worry about my parents . . . . . □ hardly-ever □ sometimes □ often
16. My hands get sweaty . . . . . . . . □ hardly-ever □ sometimes □ often
17. I worry about things that may happen . □ hardly-ever □ sometimes □ often
18. It is hard for me to fall asleep at night . □ hardly-ever □ sometimes □ often
19. I get a funny feeling in my stomach . . □ hardly-ever □ sometimes □ often
20. I worry about what others think of me . □ hardly-ever □ sometimes □ often

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Appendix 7.1

Parent's Information Form about Child's Health status

1. i) What type of arthritis does your child suffer from?
   
   ii) How long has your child suffered from this condition? (in months, years)

   iii) Would you rate the child's disease as: (please, circle the appropriate number)

   0 1 2 3 4
   not severe slightly severe moderately severe severe very severe

   iv) How long does the child suffer from pain due to arthritis? (please specify in months or years)

2. Is pain more of a problem (stronger) for the child at any particular time of the day? (e.g., morning)

3. On average, on a typical day how easy is it for the child to move around?

   0 1 2 3 4
   Very easy Easy moderate difficult Very difficult

4. Has the child ever had surgery due to arthritis? Yes / No

   If yes, when and what kind? (e.g., hip replacement)
5. What kind of drugs is the child on?

NSAIDS

Steroids

Other (please, specify)

6. On a scale from 0 to 100 how strong would you say the child's pain was last week including today? (on average, please put a mark on the line)

0____________________________________100

Pain as strong

No Pain as it could be

7. On a scale from 0 to 100 how upset/sad would you say the child been feeling due to pain last week including today? (on average)

0____________________________________100

Not upset/sad due to Pain

As upset/sad as the child could be due to Pain

8. On a scale from 0 to 100 how strong would you say the child's pain was last month (on average)

0____________________________________100

Pain as strong

No Pain as it could be

9. On a scale from 0 to 100 how upset/sad would you say has the child been feeling due to pain last month (on average)

0____________________________________100

Not upset/sad due to Pain

As upset/sad as the child could be due to Pain
10. How many times has the child had pain last month? (please circle the appropriate number)

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never rarely sometimes often everyday

11. On average each episode how long did it last? (specify in mins, hours)

12. How does your child's condition affect yours and your family's life, if at all?

13. How much school has the child missed per year due to arthritis, if at all?

1. Up to 1 week
2. 1 to 2 weeks
3. More than 2 weeks

14. Are there any other children in the family?

Thank you very much for your cooperation.
Appendix 7.2

*Child's Information form about Health status*

1. i) How long have you suffered from pain due to arthritis? (please specify in months or years)

ii) Are there any other disease related symptoms other than pain? (e.g., fever)
Yes/ No

If yes, what are these symptoms?

How severe are they? (please, put a mark on the line)

0 100
Not severe Very severe

2. Is pain more of a problem (stronger) at any particular time of the day?

3. On average, a typical day how easy is it to move around?

0 100
Very easy Easy medium difficult Very difficult

4. Have you ever had surgery due to arthritis? Yes / No

If yes, when and of what kind? (e.g., hip replacement)

5. What kind of drugs are you taking now? (NSAIDS, steroids)
6. How strong would you say has your pain been last week including today? (on average) please, put a mark on the line.

. 

No Pain Little Medium Large Pain as strong as it could be

7. How upset have you been feeling due to your pain last week including today? (on average)

😊 😞

Not upset Little Medium Very As upset due to Pain upset upset upset as I could be due to Pain

8. How strong would you say has your pain been last month? (on average)

. 

No Pain Little Medium Large Pain as strong as it could be

9. How upset have you been feeling due to your pain last month? (on average)

😊 😞

Not upset Little Medium Very As upset due to Pain upset upset upset as I could be due to Pain
10. How many times have you had pain last month? (please circle the appropriate number)

0 1 2 3 4
never rarely sometimes often everyday

11. On average how long did each episode last? (specify in mins, hours)

12. How does pain affect your life?

Thank you very much for your cooperation.