INCONGRUOUS PAIN DISPLAY AS A SOURCE OF SELF-DECEPTION

by

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Abstract

In some cases of chronic pain, the complaints seem out of proportion to pathophysiological findings. Several models of pain have been forwarded to account for such cases, but no one explanation can account for the underlying processes involved in the genesis of chronic pain in all cases. The present analysis offers the additional factor of self-deception, defined as a contradiction between one's words or attitude and behavior. By attempting to demonstrate subjective pain to observers, a pain patient convinces him- or herself of the displayed painfulness through a process of self-deception. Several psychological phenomena are included in the model of self-deception, including coping strategies, cognitive dissonance, self-perception, impression management, and attentional and memory biases.

To explore the self-deception model of chronic pain, a laboratory analogue study was devised using female student volunteers who rated the painfulness of shock-induced stimuli under conditions designed to foster self-deception. Painfulness was measured 1) verbally by means of two visual analogue scales which reflected the pain intensity and affective unpleasantness and 2) nonverbally by means of quantified facial muscle movements. For each subject, individual pain threshold and tolerance levels were established. She then underwent a pretest comprising five random shocks from her threshold to tolerance range. Next, in the manipulation phase the subject was asked to display more, less or the same degree of pain while undergoing another random series of shocks. A final posttest was identical
to the pretest and provided a measure of the durability of the altered pain display effect. In the first of two studies, the altered pain display was nonverbal: subjects exaggerated, diminished or did not change their facial expressiveness while undergoing the pain stimuli. In the second study, the altered pain display was verbal: subjects were told that at the end of the series they would be required to tell a fellow student (via videotape) that the shocks hurt more, less or about the same as what they had expected. Half of all subjects were further told that their deceptive communication would have negative consequences for viewers.

Misleading fellow students about the pain experienced was expected to make the subjects feel badly, motivating them to change their attitude or beliefs about the pain experienced. They were expected to change their pain reports in keeping with the deceptive communication. That is, other deception was expected to foster self-deception. This effect was expected to endure and it was expected to be greatest for those in the negative consequences condition.

The first study showed that exaggerated facial expressions of pain appear to be an amplification of normal pain expression. However, changes in facial expression did not bring about changes in verbal report of pain perceived, calling into question the facial feedback hypothesis.

The results of the second study suggested that pain was altered only for subjects who prepared to state that their pain fell less painful than expected. This effect reached
significance on the pain intensity visual analogue scale for low intensity shocks. This effect did not carry over into the posttest phase, nor were negative consequences effective in amplifying the manipulation, leaving the theoretical mechanism underlying the change in pain unclear. Moreover, the effect did not vary amongst subjects who scored differently on questionnaires measuring self-deception as a trait, present anxiety, or adaptive coping strategies.

The self-report measure of self-deception was related to factors found to predict adaptive coping or good functioning in chronic pain patients, namely a sense of control over pain and the absence of catastrophizing thoughts.

One particular facial movement (brow lowerer) was consistently related to the verbal pain reports, attesting to the validity of facial expression as a measure of pain.

The results are discussed with implications and suggestions for future research. One major problem with research involving subject deception is that subjects may appear to comply with experimental instructions to deceive others while avoiding personal responsibility through a variety of mechanisms yet to be determined.
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Introduction

Pain is a private experience that is difficult to define, explain, and measure. The biomedical disease model suggests to both lay persons and physicians that pain results from underlying trauma or disease, and so patients seek appropriate diagnoses and pain cures from their doctors (White, 1990). In fact, it constitutes the primary reason for visiting a physician in North America (White, 1990). In the words of Proust, "Illness is the most heeded of doctors: to goodness and wisdom we only make promises; pain we obey" (cited in Auden & Kronenberger, 1966). Unfortunately, health professionals can offer few effective treatments for many kinds of pain and a sizeable proportion of the population at large (about 11%) remains dogged by chronic pain complaints (Crook et al., 1986).

Despite its prevalence, pain is poorly understood, especially when it lasts beyond the normal healing time or when it strikes individuals who appear to have no underlying physiological pathology (Reesor & Craig, 1988). The term chronic pain syndrome has been reserved to classify patients whose complaints of pain are out of proportion with objective pathophysiological damage either in intensity and/or in duration (most definitions specify a minimum duration of six months). The biomedical disease model fails to explain how pain can persist beyond the normal healing time. In such cases, psychosocial variables help to explain the appearance and maintenance of pain complaints. For example, cognitions, emotions, and behavioral contingencies can lead to pain complaints that are
disproportionate to bodily injury (Eisenberg, 1977; Reesor & Craig, 1987). General biopsychosocial models of pain have emerged which embrace physiological and psychosocial factors (Engel, 1977) largely as a result of Melzack & Wall's (1982) gate control theory of pain which demonstrated how psychological processes might enhance or dampen incoming pain signals.

Because many psychological factors have merit in explaining the etiology of chronic pain, they were included in Flor & Turk's (1984) comprehensive "diathesis-stress model" which integrates "physical, psychological and social factors...to explain the development of chronic back pain" (p. 215). The diathesis or predisposition to increased muscle tension in the back may result from genetic influences, past injury and/or past learning history. Coupled with a stressful environment, low pain tolerance, and/or poor coping responses, repeated episodes of pain and tension may cause ischemia, release of pain chemicals, muscle spasm, and hence more pain. This constitutes the pain-tension cycle that has long been used to explain the genesis of chronic pain in psychophysiological terms (Livingstone, 1943; Turk, Meichenbaum & Genest, 1983). Fear of increasing the pain by physical activity leads to conditioned fear responses whereby the patient learns to avoid activity and thereby suffers more from muscle tension and pain (Fordyce, 1989; Philips, 1987). But although pain patients may have areas of increased muscle tension, higher muscle tension is not correlated with higher pain intensity (Arena et al., 1991). Therefore other constructs are
needed in comprehensive models that fully explain the origins of chronic pain.

Other approaches that have been utilized to explain the etiology of the chronic pain syndrome include the medically-based psychoanalytic viewpoint; the family systems approach; and psychological approaches derived from social-learning, behavioral and cognitive-behavioral theories. A model is proposed in this thesis which focuses upon a self-deception process to account for persisting reports of pain. Investigations are presented that examine self-deception as a mechanism involved in the persistence of reports of high levels of pain in the absence of adequate noxious stimulation. As well, controls are included to examine alternatives to self-deceptive processes, which could alter one's attitudes about pain and/or the experience of pain, including facial feedback mechanisms, cognitive dissonance, self-perception, and impression management. As a conceptual model, it is contended that self-deception may encompass components from all of these competing theories. Moreover, self-deception might represent an adaptive coping mechanism for dealing with pain.
Literature Review

Embracing the medical disease model, psychoanalytic theorists conceptualize persistent and unexplained pain as a symptom of disease—not physical, but mental. Pain is construed as signifying psychiatric illness such as "conversion neurosis, depressive equivalent, or hypochondriacal reaction" (Turk & Flor, 1984, p. 210). The several editions of the medically-based *Diagnostic and Statistical Manual for Mental Disorders* have only recently dropped the term "psychogenic pain disorder" and have replaced it with the term "somatoform pain disorder" (American Psychiatric Association, 1987). This still differs from the predominant term in current use by researchers and clinicians--"chronic pain syndrome"--and testifies to the reluctance that some authorities have in moving beyond psychoanalytic / psychiatric nomenclature and beliefs about pain. Research evidence supporting this approach has been characterized as riddled with logical and methodological flaws (Turk & Flor, 1984), not the least of which is a heavy reliance upon correlational methods that fail to determine causal direction.

For example, to treat pain as a symptom of depression is now considered simplistic (Blumer & Heilbronn, 1981; Large, 1986; Romano & Turner, 1985). Depression often accompanies pain (Craig, 1989; Romano & Turner, 1985), but it is reasonable to contend that depression results from pain, especially prolonged pain that prohibits normal work and leisure activities (Fordyce, 1976). Younger patients are more likely to suffer from depression than older patients (Keefe, Dunsmore & Burnett, in
press) perhaps because it interferes more with their high expectations of long-lasting health, work and leisure satisfaction. Moreover, pain intensity has been shown to predict level of depression in one longitudinal study of arthritic patients (Brown, 1990). Part of the problem in differentiating depression from pain might be a measurement issue: many questionnaires that purport to measure depression include items related to reduced physical functioning which taps symptoms of chronic pain (Wesley et al., 1990). Moreover, definitions of depression vary from study to study (Haythornthwaite, Sieber & Kerns, 1991). Anxiety also accompanies chronic pain in many cases (Jamison, Rock & Parris, 1988; Smith, 1986; Wade et al., 1990). It can be safely concluded that psychological distress is often correlated with pain, but the relationship between these variables needs further longitudinal study to determine the direction of causality.

Chronic pain generally has an impact upon all aspects of an afflicted individual's life, including family relations. In some instances, family members have been said to promote chronic pain complaints. For example, family systems theorists who examined the sick role in its familial context suggested that a family may avoid conflict by focussing upon one member's illness (Flor & Turk, 1984). Illness may take the form of pain if that is the most common physical complaint in the family's history (Craig, 1978, 1983; Turk, Rudy & Flor, 1985). Emotional pain might receive a somatic label in chronic pain families (Violon, 1985). Like the psychoanalytic approach to pain, this model is highly
speculative and relies upon correlational and case-study evidence. Some of the constructs used to explain family dynamics are difficult to measure or refute (e.g., enmeshment) and are therefore not easily researched (Turk et al., 1985). Nonetheless, chronic pain patients usually have pain sufferers in their families, more so than comparable medical patient controls (Violon, 1985). Thus, there is some link between family and chronic pain that deserves further study.

The social learning / modelling approach suggests that in the family and other social settings, we learn vicariously how to behave when injured and suffering (Craig, 1978; 1983). This formulation helps to understand why an individual's pain behaviors seem to correlate with the family's history of pain complaints (Violon, 1985). It also provides an account of how pain behaviors may be patterned within a specific culture through observational learning (Craig, 1978; Mechanic, 1961; Escobar et al., 1987).

The behavioral approach (Fordyce, 1976) involves contingencies provided by family members (and others) for pain behaviors. This formulation has been indirectly supported by repeated research findings that behavioral treatment of pain reduces disability and improves physical and emotional functioning (Flor & Turk, 1984; Fordyce, Roberts & Sternbach 1985). A central biopsychological assumption here has been that a cycle is established whereby pain leads to heightened muscular tension which leads to avoidance of activity and further pain (Ross, Keefe & Gil, 1988; Turk, Meichenbaum & Genest, 1983).
Physical deconditioning occurs as the patient avoids activity formerly associated with pain (Fordyce, 1989; Philips, 1987). Fear of pain, anxiety and depression feed the cycle.

Through the use of operant reinforcement, Fordyce (e.g., 1976) has successfully designed treatment programs to reduce "pain behaviors" but not necessarily pain ratings (Kerns et al., 1986; Prkachin & Cameron, 1990). Fordyce, Roberts & Sternbach (1985) defend their position by pointing out that their aim has been to reduce disability not pain. Increased activity is shaped and rewarded thus extinguishing avoidance of activity based on fear of pain.

**Facial feedback in chronic pain**

It is yet to be determined whether pain perception can be altered by changing its social contingencies (Fordyce, Roberts & Sternbach, 1985). Altering one specific pain behavior—facial grimaces—might cause changes in pain per se. The facial feedback hypothesis (Adelman & Zajonc, 1989) holds that changes in facial expression cause neurocirculatory changes from the skin/muscles of the face to trigger neurochemical alterations in the brain. That is, facial expression might be a cause rather than a result of emotional experience (Adelmann & Zajonc, 1989; Izard, 1990; Kraut, 1982; Laird, 1984). Ongoing emotional tone may be amplified or diminished by feedback systems from the face to underlying systems. What seems to follow from this hypothesis is that if someone fakes more or less of an emotion, he/she may actually come to experience an amplification or diminution of that emotion. A second corollary of the facial feedback
hypothesis would be that the system is dynamic, changing over the course of time, and therefore fluctuations in emotional tone would be expected to quickly follow changes in facial movements.

If applied to pain, this facial feedback model suggests that a change in facial expression causes a change in the pain experience. While this view is controversial (Buck, 1980; Izard, 1990), it can be supported or refuted. One group of studies in the pain literature supports some of its assumptions (Colby, Lanzetta & Kleck, 1977; Kleck et al., 1976; Lanzetta, Cartwright-Smith & Kleck, 1976): male subjects exposed to shock-induced pain when observed by others exhibited less facial expressiveness and reported less pain while their skin conductance responses also were attenuated. It is uncertain whether the facial expression preceded the pain experience, making causal direction unclear. Moreover, there has been some difficulty replicating these results (Kleck, personal communication). Even more controversy exists in attempts to define facial cues of deceptive communication (Cody & O'Hair, 1983), especially when gender differences are examined. Part of the problem is methodological: studies abound in which a detailed analysis of facial movements was not used to define facial features (Matsumoto, 1987).

Cognitive-behavioral models of chronic pain

Perhaps altering verbal behaviors and/or cognitions can alter one's pain (Bayer, 1985). The cognitive-behavioral approach to pain includes an "underlying assumption that affect and behavior are largely determined by the way in which the individual construes the world" (Turk, Meichenbaum & Genest,
Coping is a primary topic of concern to cognitive-behavioral therapists who wish to determine how coping affects patients' adaptation to chronic pain.

Coping refers to a process whereby an individual appraises a situation as a stressor and then mobilizes thoughts and/or behaviors to manage the impact of the stressor (Lazarus & Folkman, 1984). Lazarus and Folkman have divided the construct into problem-focused and emotion-focused coping strategies. But it may also include the apparent absence of strategies such as the use of "denial" to cope with a situation (Tunks & Bellissimo, 1988). Coping thoughts and acts vary across time and contexts, thus are best construed as processes rather than as styles or traits (Lazarus & Folkman, 1984).

Much research has sought the identification of adaptive coping mechanisms. Some researchers have noted few differences in coping strategies used across a variety of chronic diseases such as hypertension, diabetes mellitus, cancer, and rheumatoid arthritis (Felton, Revenson, & Hinrichsen, 1984). But coping strategy use interacts with factors within a situation. For example, appraisal of the situation and its meaning may determine the type of cognitive strategy selected and its effectiveness (Lerman, 1987; McCrae, 1984). Or a more generally adaptive disposition such as "optimism" may color subjects' responses on coping questionnaires making some people appear to use a wide variety of coping mechanisms when they really have a general response bias such as an optimistic outlook (Scheier & Carver, 1985, 1987).
Strategies used specifically for coping with pain have been identified with the Coping Strategies Questionnaire (Rosenstiel & Keefe, 1983)—a 44-item questionnaire with 7 subscales and two rating scale. Three major factors and two single-subscale factors have emerged from the scale (Lawsen, Reesor, Keefe & Turner, 1990). The first factor refers to active cognitive coping strategies (e.g., ignoring, coping self-statements, reinterpreting the pain). The second factor refers to a self-evaluation of the patient's ability to control their pain. The third factor refers to passive strategies of coping (e.g., praying, hoping, diverting attention). The subscales of behavioral coping and catastrophizing weighted heavily on the fourth and fifth factors, respectively.

Prior research involving medically incongruent chronic low back pain (Reesor & Craig, 1988) and osteoarthritic knee pain (Keefe et al., 1987a & 1987b) indicated that a poor sense of control over the pain and catastrophizing thoughts were related to greater pain. Improvement in perceived control over pain has been shown to predict six-month follow-up measures of pain report in chronic low back pain patients (Spinhoven & Linssen, 1991). This finding underscores the usefulness of treatments designed to improve patients' sense of control over pain.

In a recent review of coping with chronic pain, Turner (1990) concluded that useful techniques emphasize active coping and avoidance of catastrophizing, while promoting a sense of control over pain. Attention diversion seems ineffective for such patients. Furthermore, flexibility of coping strategies
used across different settings or circumstances may be useful (Tunks & Bellissimo, 1988; Turner, 1990). One such circumstance may be the pain severity (Blew, Patterson & Quested, 1989). Given the finding that a perception of control is useful, perceived coping self-efficacy may be a key ingredient to adaptiveness (Bandura et al., 1985; Dolce, 1987). For example, Devine and Spanos (1990) found that a variety of coping strategies attenuated pain response, especially if the subject became absorbed in their use as a result of positive self-efficacy expectations.

As Turner (1990) noted, strategy usefulness may further vary as a function of time. In a meta-analysis of coping strategies used over time for a variety of stressors (such as pain, stress, and anxiety), Suls and Fletcher (1985) concluded that 1) either avoiding (e.g., distraction) or attending to sensations (e.g., monitoring sensations) was a good short-term strategy; and 2) the whole class of attentional strategies (such as focusing on the source of stress and physiological reactions) was associated with better long-term adjustment. Again, the use of any strategy was superior to using no systematic strategy.

Attempts have been made to match treatment modes with preferred coping style. Pain was reduced in oral surgery patients who were given strategies consistent with their style of coping (Martelli et al., 1987) as measured by a modified version of the Ways of Coping Scale (Folkman & Lazarus, 1980). Subjects who preferred a high level of surgery information responded best to a problem-focused strategy, while those who preferred a low
level of information responded best to an emotion-focused strategy (although this latter result was only marginally significant, \( p < .10 \)). Laboratory subjects trained in coping with cold pressor pain have also been shown to benefit from the use of a wide range of coping strategies such as diverting attention, reinterpreting the pain sensation, engaging in fantasy incompatible with the pain context, and avoiding catastrophizing thoughts (Devine & Spanos, 1990; Miller & Bowers, 1986).

A recent study demonstrated that treating catastrophizing as an individual difference variable helps to predict differential treatment response (Heyneman et al., 1990). Catastrophizers tended to benefit from instructions to alter self-statements (self-instructional training) during a cold-pressor task. Non-catastrophizers tended to benefit most from attention diversion strategies.

To summarize, a variety of psychological approaches have been offered as explanations for the persistence of chronic pain in the absence of adequate pathophysiological explanation. None on its own can fully account for the genesis or maintenance of chronic pain, but before attempting to integrate these into a comprehensive model, the construct of self-deception will be introduced. It, too, provides a partial formulation of the progression towards the chronic pain state (Bayer, 1985).
Self-deception

The concept of self-deception arose in the domain of philosophy in which self-deception has been formally defined as believing a proposition, p, and its opposite, not-p, simultaneously (Bach, 1981, 1985; Demos, 1960). Most definitions suggest further that self-deception must be motivated\(^1\) (Bach, 1981, 1985; Davidson, 1986; Paulhus, Fridhandler & Hayes, in press; Pears, 1986; Sackeim & Gur, 1978); for example, self-deception results in the manipulation of one's emotional state (Silver, Sabini & Miceli, 1989). The construct of motivation is necessary to separate self-deception from akrasia\(^2\), biased thinking, wishful thinking, or mere ignorance. While motivated, self-deception is not thought to be intentional (Bach, 1981; Bok, 1980; Mele, 1987), which further differentiates it from wishful thinking. The definition used in the present study is that self-deception is a process that involves a contradiction between one's words or attitude and behavior and is motivated by the protection of self-esteem.

To think and/or behave in two opposing directions at the same time is a paradox or contradiction which many writers have attempted to resolve. Some philosophical viewpoints challenge

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\(^1\) For a cognitive functionalist view of motivation, see Weiner (1986) who provides empirical evidence supporting his view that emotions, many of which arise out of attributions of causality, precede actions. Thus, we typically think, feel, and then act: emotions provide the motivating force for actions.

\(^2\) Akrasia may be defined as voluntarily and consciously acting against one's better judgement in a particular situation when the preferred course of action is psychologically weak. An akratic action might be that which is more salient, or more habitual, or that which peers are doing. (Rorty, 1980)
the logical possibility of self-deception whereas others blend into psychological explanations. For example, Bok (1980) has argued that self-deception is merely a semantic problem and that better words for the phenomenon might be "bias, rationalization, and denial" (p. 924). Or self-deceivers might be "twisting" the evidence in a way that remains rational, but is self-deceptive (Szabados, 1985). Perhaps what appears to be self-deception is merely behavior being emitted out of habit (Chanowitz & Langer, 1985; Rorty, 1986). Self-deception may occur by repetitive "jamming" of our thoughts until we believe that which we wish to believe (Bach, 1981). Behaviors that vary across time or situations may appear self-deceptive but may still be internally consistent (Ainslie, 1986; Chanowitz & Langer, 1985). Although discussed by philosophers, these latter explanations become acceptable to behavioral psychologists since there seems to be agreement that persons emit habitual, repetitive behaviors which are under the control of situational stimuli. For example, Fordyce (1989) is a behavioral psychologist who has developed a cognitive-behavioral model of chronic pain that emphasizes the role of learning and conditioning in the genesis of pain and suffering behaviors.
Self-deception as a coping style or strategy

Cognitive-behavioral views of coping intuitively seem related to self-deception. Self-deception may be a component underlying some kinds of coping such as the denial/avoidant strategies (Lazarus, 1979; Power, 1984). Self-deception may be viewed as a health-enhancing coping style or strategy if it allows a person to muster up emotional strength before facing a distressing situation. In some cases, self-deception might promote a sense of control, self-efficacy, or optimism about resolution of disease symptoms such as pain. It may allow a patient to feel hopeful in the face of a crisis, especially if the information about the crisis is ambiguous (Lazarus, 1979) as it so often is with pain problems. Catastrophizing would seem to be a special case of self-deception: a process that promotes a worsened state of the self. This is all speculative since the constructs have yet to be compared systematically, although such an undertaking is planned (Paulhus, personal communication).

Thus, descriptively and at a practical level, self-deception may turn out to be a useful coping mechanism in some cases. Whether the self-deception construct proves useful theoretically or to have supportable clinical applications is yet to be determined.

The present review proposes that pain report may be altered by self-deception. Social or clinical circumstances may dictate a pattern of self-representation that leads to self-deception. Exaggerating or diminishing one's display of pain in order to deceive others may also deceive the self. To illustrate, the
patient who believes that his/her pain is diagnostic of serious
disease might exaggerate the pain report to ensure that medical
professionals thoroughly test for all possible causes of the pain
or otherwise provide the best possible care. Such a patient
wants to put his/her "worst fears to rest" and might visit many
specialists (Blackwell & Gutmann, 1986). As the patient repeats
his/her pain story, a cycle of persistent pain report is set in
motion until he/she is assured that cancer, arthritis, or other
serious diseases have been ruled out. By then, he/she may have
become fully convinced about the persistence of the pain
experienced. The complaints of pain have become habitual.

An extreme conflict between the beliefs of patient and
physician may also entrench a patient's pain complaints. A
variety of scenarios is plausible. Physicians or others might
suggest that a patient has a psychiatric disorder--Chronic Pain
Syndrome (or "somatoform pain disorder" in the DSM-III-R)--when
there are no or insufficient organic signs of underlying physical
trauma to account for the pain complaints. The patient who
senses that this label means that the physician views the pain as
"all in the head" might desperately attempt to find a specialist
who can correctly find the cause of very real pain. Moreover,
the chronic pain patient often searches for the "correct"
diagnosis that will lead to subsequent cure of pain (Kotarba,
1983). Thus, complaints of pain might become firmly entrenched:
to stop complaining might cause a "loss of face" when one's
physical and/or mental health is questioned.
The opposite scenario is equally plausible: hiding one's pain might come to decrease it in the long run. For example, blue collar workers and professional athletes fear losing their jobs if they take sick time or complain of inability to carry out physically taxing activities (Kotarba, 1983). Others may hide their pain from family members in order to decrease their worry and to preserve the family system with roles kept intact (Kotarba, 1983; Tunks & Roy, 1990). Perhaps these people become experts at hiding pain from others and thus from themselves.

Either extreme of pain reporting can have deleterious effects on a patient's functioning. Exaggerated pain complaints go hand in hand with decreased physical activity and avoidance of work activities that ordinarily build self-esteem, fuelling a cycle that can lead to chronic pain (Ross, Gil, & Keefe, 1988). The patient's pain may worsen as a result of weakened muscles and weakened spirits. Increased medication use may lead to abuse or dependency, and subsequent attempts at reducing self-medicating can trigger increased pain complaints. At the opposite extreme, the patient who inappropriately avoids accepting the sick role may prolong recovery from acute trauma. Work efficiency may suffer along with increased stress and irritability.

If we could pinpoint the underlying psychological and physiological processes involved in such self-deception, we might better understand some cases in which pain seems out of keeping with medical findings. Moreover, we might bolster discoveries that some pain patients can be treated by having them reduce their pain complaints. This would be consistent with and support
the Fordyce (1976; 1989) behavioral approach to pain management which has been accused of treating the symptoms but not the underlying pain (Prkachin & Cameron, 1990). If changing pain behaviors does alter the underlying pain, then patients could clearly benefit from treatment aimed at reducing displays of pain. In short, the better we understand pain behavior, the better equipped we should be to change it and/or its psychological concomitants.

Other psychological viewpoints of self-deceptive phenomena to be discussed next include cognitive dissonance, self-perception, impression management, and attentional and memory biases (Bayer, 1985). It is contended that a combination of these processes brings about self-deception. These will be incorporated into a model accounting for some kinds of chronic pain complaints.

**Cognitive dissonance**

Cognitive dissonance provides an avenue for understanding self-deception. If a person is induced to publicly engage in a "behavior that is inconsistent with their private attitude and if they have insufficient justification for the inconsistent behavior, dissonance will occur" (Penner, 1986, p. 427). This fosters a state in which discrepant cognitions (beliefs, attitudes, ideas or thoughts) are smoothed out, made more consistent. "Dissonance is like a negative drive; people are motivated to reduce or eliminate it" (Penner, 1986, p. 427).

For example, cognitive dissonance might occur if a person who believes that he/she is good performs a bad act such as
telling a lie to others (Gilbert & Cooper, 1985; Snyder, 1985). There is a discrepancy or dissonance between these cognitions of good- v. bad-me (Festinger, 1957). The person becomes motivated to reframe the act as less negative or to decrease his/her sense of responsibility for the act. In other words, the person would engage in "excuse-making" while filtering out discrepant data, thereby enhancing the self-esteem (Snyder, 1985) and bringing about self-deception.

Older versions of cognitive dissonance theory held that simply doing or saying something discrepant with one's beliefs, with low justification for doing so, would arouse dissonance which could lead to attitude change. In the forced compliance manipulation, subjects who performed a boring task were asked to tell the next subject (actually a confederate) that the task was interesting. Subjects given a small reward ($1) for engaging in attitude-discrepant behavior came to rate the task as more interesting than subjects in a large reward condition (paid $20) or in a control condition.

Recent versions of cognitive dissonance theory add that the necessary triggers of change in attitude are: 1) that the subject freely chooses to deceive others and so cannot attribute responsibility to another person or to circumstances beyond his/her control; and 2) that there are foreseeable, negative consequences of this deception (Cooper & Fazio, 1984; Scher & Cooper, 1989; Schlenker, 1982). Whether these are indeed necessary is debatable. They may exacerbate dissonance
(Berkowitz & Devine, 1989) or they may increase the unpleasant threat to self-esteem (Hilgard, 1949; Steele, 1988).

Fazio (1986) further contends that the consistency between attitudes and resultant behavior should improve if one's attitudes are developed through direct experience and/or if the attitude is made salient (due to "priming" or other means of focusing attention on attitudinal issues). From this it follows that if one develops a negative attitude about pain (e.g., fear of chronic pain and disability), any sensation that seems somewhat painful might become more salient, especially if one actually vocalizes one's complaints to family members or the physician. In Fazio's (1986) model, such a salient (and negative) attitude developed through past pain experiences should make a patient's behaviors consistent with the attitude: fear of pain should consistently lead to behaviors indicative of avoidance of pain (e.g., guarding, physical inactivity).

Zimbardo et al (1969) have examined cognitive dissonance and pain tolerance. Subjects agreed to accept further electric shocks for a questionable purpose, after already completing an experimental protocol. This was expected to arouse dissonance and thereby alter subjects' pain tolerance. That is, "agreeing to be shocked is not so irrational if one expects that the 'shocks will not hurt as much this time'" (p. 109). The researchers found only tentative support for this.

Competing theories that offer explanations of forced compliance phenomena include self-perception and impression management (Cooper & Fazio, 1984; Paulhus, 1982).
Self-perception

By self-perception is meant more than observing one's own past behaviors such as in the case of self-modelling where past experiences with painful stimuli are said to predict future reactions (Craig, 1980). Instead, self-perception refers to instances of observing and subsequently making inferences from one's own behavior when that behavior is out of character (Bandler, Madaras & Bem, 1968; Bem, 1972). If internal cues about one's internal state are "weak, ambiguous, or uninterpretable", then the person relies on external cues to infer the internal state, in the same manner that an outside observer makes inferences (Bem, 1972). Add motivation to weight the observations in one direction and the result is self-deception.

In a test of the self-perception model (Bandler, Madaras & Bem, 1968), subjects undergoing shock-induced pain trials observed themselves either escaping or not escaping the shocks. Subjects were instructed that they should press a button to end the shock when the red light came on, constituting the escape condition. In the no-escape condition signalled by a green light, subjects were told that they should not end the shock by pressing the button. The researchers found support for the hypothesis that the perception of painfulness is partially determined by one's inferences regarding his/her own behavior: Those subjects who saw themselves escape from the shocks rated the felt discomfort higher than subjects in the "no-escape" condition, although the shock intensities were the same in both
conditions. It seems that subjects deceived themselves about the amount of pain perceived, since subjects should have rated the shocks as equally intense in the two experimental conditions (Bayer, 1985). The "no-escape" subjects observed themselves taking more shocks and presumably concluded that the shocks were less severe, otherwise they would have appeared odd indeed for agreeing to suffer.

**Impression management**

There is an alternative explanation for the above finding that subjects rated the pain as higher in the escape condition than in the no-escape condition: The report of reduced pain might have been motivated by a desire to protect the outward appearance of consistency in the presence of a respected experimenter—impression management.

Some researchers have postulated that social anxiety might mediate the forced compliance effect (Tedeschi & Rosenfeld, 1981). But this "assertion that an individual is aroused as a consequence of having freely brought about an aversive event makes it very difficult to find many lingering points of contrast between impression management and dissonance" (Cooper & Fazio, 1984, p. 252). Schlenker (1982) emphasizes the importance of protecting one's self-identity as a motivating force in impression management which makes impression management seem much like self-deception.

Questionnaires designed to measure impression management should elicit different responses in public versus private disclosure settings (Paulhus, 1984). That is, the construct of
impression management represents deception of others much more than self-deception (which is not expected to vary considerably across settings).

**Complementary processes**

Cognitive dissonance has been differentiated from self-perception (Bem, 1972) in that the former is thought to occur when behaviors are clearly discrepant with one's attitude, while the latter occurs when behaviors are more congruent with one's attitude (Cooper & Fazio, 1984; Fazio, Zanna & Cooper, 1977). Impression management is a similar construct whose boundaries overlap with various so-called intrapsychic phenomena (Tetlock & Manstead, 1985) including cognitive dissonance and self-perception. Paulhus (1982) has suggested that a combination of cognitive dissonance and impression management leads to attitude change in forced-compliance situations. This underscores the suggestion made by Tetlock and Manstead (1985) that the area needs an all-encompassing theoretical framework which captures the range of findings related to cognitive dissonance, self-perception, and impression management. The contention in the current thesis is that one such unifying construct that underlies these concepts is self-deception.

Self-perception, impression management, and cognitive dissonance all protect self-esteem (and thus are motivational) and all imply some contradiction between one's words or attitude and behavior. Therefore, they fit the general definition of self-deception. These cognitive-behavioral perspectives suggest that the self-deceiver "weights the data" in favor of proposition
p (Mele, 1987). Our beliefs of p and not-p are probabilistic rather than dichotomous; there is really no paradox to resolve (Mele, 1987). The manner in which we process information makes this possible.

**Attentional and memory biases**

In situations that are ambiguous and allow for various interpretations, we might bias our beliefs in such a way as to promote a positive self-image or to protect self-esteem (Demos, 1960; Gilbert & Cooper, 1985; Rorty, 1986; Silver et al., 1989; Szabados, 1985; Weiner, 1986). We may engage in "selective attention" that confirms our positive self-image (Gilbert & Cooper, 1985; Rorty, 1986; Snyder, 1985). Memory studies have revealed that simpler events are recalled better than complex events (including feeling states) under high arousal (Paulhus & Suedfeld, 1988). What this means for self-deception is that memory processes may serve to bias recall, especially in ambiguous, complex, and emotionally-arousing situations (Paulhus & Suedfeld, 1988; Schelling, 1986; Wilson, 1985).

One such complex situation might occur when uncomfortable and/or distressing physical sensations remind someone of the last time he/she suffered from pain. Physical sensations are often ambiguous and their labelling may be shaped by modelling and learning in childhood (Craig, 1980). They may be misinterpreted as painful if past experience has led to reinforcement for acting out one's suffering (Fordyce, 1989) or if alternative perspectives are unavailable (Turk, Meichenbaum & Genest, 1983). Moreover, the greater one's distress, the greater the likelihood
of "mislabeled ambiguous signals as indicators of threat or harm" (Fordyce, 1989, p. 58). Chronic patients have been shown to blur the distinctions between painful and nonpainful situations, and may interpret a wide variety of experiences, especially affective distress, in pain terms (Clark & Yang, 1983; Pennebaker, 1982; Pennebaker & Skelton, 1978; Yang et al., 1983). Medical professionals fuel the fear of pain by directing patients to exercise to the point of pain; this leads to a "failure to distinguish hurt from harm" (Fordyce, 1989, p. 58; Philips, 1987). And so one's fears and/or emotional distress cause one to cautiously respond to ambiguous sensations by labelling them as pain, in order to avoid harming oneself. The cognitive-behavioral treatment approach to pain aims to change patients' misperceptions and misconceptions about pain (Turk, Meichenbaum & Genest, 1983) which further attests to the centrality of psychological processes involved in altering chronic pain.

**Self-deception in pain: Previous studies**

At least two previous laboratory studies have examined the effect of self-deception on pain expression. In the first, Quattrone & Tversky (1984) told subjects that a diagnosis of longevity was associated with either increased or decreased pain tolerance after physical exercise. Their tolerance to cold pressor pain was measured before and after exercising on a stationary bicycle. Most subjects tolerated more or less pain, in keeping with their self-diagnosis about their longevity. This was likely a self-deceptive process because most of the subjects denied altering their pain tolerance. In the authors' terms,
self-deception was defined as choosing an action that is diagnostic of a positive outcome without realizing that they "purposefully selected the action in order to make the diagnosis [of longevity]" (p. 240).

In a different study (Jamner & Schwartz, 1986), pain tolerance was positively correlated with the degree to which subjects generally deceived themselves, as measured by the Lie Scale of the Edwards Personality Inventory. In addition, subjects who scored high on self-deception required greater shock intensity levels before reaching the same self-reported discomfort and pain levels as subjects who scored low on self-deception. Further, pain sensation threshold was not affected by self-deception; only affective qualities of pain were. However, further study is necessary before conclusions can be drawn about the role of self-deception in pain tolerance and self-report. For example, the conclusions of the latter study are unclear given Paulhus's (1986) finding that the EPI Lie Scale measures impression management rather than self-deception.
An Integrated Model of Self-deception in The Genesis of Chronic Pain

Given the wide array of definitions and theoretical formulations of self-deception, it is not surprising that no one account of how or why self-deception comes about has been generally accepted. No doubt several variables bring about self-deception, including biological, cognitive, and social psychological processes (Hyman, 1989). The model of self-deception in chronic pain proposed here (depicted in Figure 1) emphasizes cognitive-behavioral psychological processes and integrates several of the key positions discussed earlier. It is an elaboration of a model originally formulated by Bayer (1985).

If the situation at hand is ambiguous so that the ground is fertile for misinterpretation, then the first phase of the self-deception model can take place. First, the subject engages in deceitful behavior by stating an untruth. For example, unusual physical sensations are often ambiguous and threatening, so the patient may complain of pain while unsure whether the sensations constitute pain or just fatigue, tightness, stiffness, warmth, etc. Many pain patients have no idea about what their diagnosis is, nor do they understand the underlying processes involved in pain perception (Rowat & Jeans, 1989), and so unusual sensations become feared as signs of impending disease or suffering (Fordyce, 1989). If repeated complaints are seen by the patient to be of questionable accuracy or to be selfish pleas for attention, he/she becomes aroused and uncomfortable with this negative view of the self. Cynical or displeased medical personnel may feed this negative view, especially when medical
interventions fail to achieve a cure (Kotarba, 1983) and the attending physician overtly or covertly suggests psychological causes for the chronic condition (Blumer & Heilbronn, 1981).

Next, arousal and discomfort arise upon the discovery of information about the self that is discrepant with one's positive view of the self (Festinger, 1957; Higgins, 1989). Such out-of-character information would result from engaging in contemptible behaviors that society has taught us are socially undesirable or have aversive consequences to others. This information threatens self-esteem which provides motivation to decrease the aversive arousal (Higgins, 1989). This heightened emotional arousal is associated with reduced cognitive complexity (Paulhus & Suedfeld, 1988; Schelling, 1986; Wilson, 1985) and memory and perceptual biases which aid in the filtering process whereby the individual focuses upon self-confirmatory information (Lockard & Paulhus, 1988). In the pain example, heightened emotional arousal triggers a decrease in cognitive complexity so that the evaluative dimension of pain becomes most salient (e.g., "This pain is awful; it's really bad"). Fleeting weak and ambiguous sensations are specifically attended to and interpreted as confirmations of the pain complaint. The lack of a physical diagnosis feeds the cycle of increasing emotional distress, pain, and catastrophizing thoughts (Flor & Turk, 1984; Kotarba, 1983).

Finally, we have a situation whereby unintentionally biased interpretation of the events has served to preserve self-esteem. The pain patient protects his/her self-esteem through a self-deceptive process: "this pain is very serious". He/she
continues to seek a definitive diagnosis by visiting more and more specialists, hopeful that the "right one" will diagnose and treat the formidable pain (Kotarba, 1983). And thus the complaints become chronic, entrenched beliefs that the pain is very real and indicative of undiagnosed disease.

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Figure 1.
Model of the self-deception cycle in chronic pain.

1.) Ambiguous, threatening sensations come to be labelled as "pain"

Tell an untruth = contemptible behavior
"I have this terrible pain again. Comfort me."

2.) Arousal & emotional discomfort
Reduced cognitive complexity
Memory & perception help one to attend to self-confirmatory information

3.) Biased interpretation of events such that self-esteem is preserved
"I am not a liar; my pain is very real and not in my head."

= Self-Deception
As will be seen in the next section, affective qualities of pain are generally more amenable to psychosocial interventions than sensory qualities. Thus, under conditions of affective arousal, it is reasonable to predict greater possible alterations in the evaluative and/or affective dimensions of pain than in the sensory dimension.

To explore this model of self-deception, a laboratory analogue of pain with healthy volunteers was used in the present study. While such a population may not provide direct generalizations to chronic pain patients, it would be inappropriate to ask pain patients to deceive others (and themselves) about the amount of pain that they were experiencing. Furthermore, precise control over the repeated pain stimuli allows for a direct analysis of effects over time resulting from the independent variables of interest. As well, it becomes possible to determine if social conditions produce and maintain either an extraordinary or a diminished pattern of pain response if there is already available a baseline assessment of the patterns of response to controlled stimuli. These conditions are not available in the clinical environment. Shock stimuli provide a means of inducing pain that is similar to chronic pain in at least one major fashion: both kinds of pain induce distress (Gracely, 1989) which will be quantified using a standard measure of state anxiety--the State-Trait Anxiety Inventory (Spielberger, Gorsuch & Lushene, 1970).

Moreover, deliberate dissimulation of pain expression in the laboratory might provide clues to the diagnosis and underlying
processes of such behavior in pain patients. The issue of how best to measure pain has been a major topic of interest to pain researchers and so deliberate dissimulation affords insight into this important measurement issue.
Pain Measurement

The first step to the study of pain is to define and measure it. The International Association for the Study of Pain (1986) has defined pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (p. S217). This definition indicates that at least two major dimensions to pain can be differentiated: a sensory/intensity dimension and an affective or unpleasantness dimension. Also documented in the literature is an evaluative dimension whereby the individual attaches meaning to pain (Melzack, 1984). For example, labour pain is evaluated more positively than pain resulting from accidental injuries. Measurement strategies have included primarily verbal questionnaires and visual analogue scales while nonverbal measures have been less frequently utilized, especially in laboratory studies of pain (Philips, 1983).

Verbal pain measurement

Sensory and affective qualities of pain can be quantified using two sets of ratio-scaled adjectives developed by Gracely, McGrath, and Dubner (1978a). An alternative method of measuring these two pain dimensions is to use visual analogue scales that are highly correlated to the two 15-word rating scales (Price et al., 1983).

Affective and sensory qualities of pain are independently altered by various treatments and conditions. The Gracely group's ratio scales differentially reflect pharmacological pain control agents (Gracely et al., 1978b, 1979; Heft, Gracely,
Dubner, & McGrath, 1980) as well as a variety of laboratory manipulations (Craig & Patrick, 1985; Hyde, 1986; Lee, 1985; Patrick et al., 1986). Research evidence further suggests that the affective dimension of pain is affected by one's desire to avoid pain, expectations about whether pain will occur, and how one attends to the pain stimuli (Price, Barrell, & Gracely, 1980). That is, affective ratings of noxious heat stimuli were decreased at low intensity levels if the stimulation was signalled and hence expected. The warning signal did not alter sensory ratings of pain.

Patients with a high degree of threat to health or life—cancer patients and chronic pain patients—rated their pain higher on the affective scale than on the sensory scale (Price, Harkins & Baker, 1987). Patients with low threat to health or life—labour pain patients and experimental pain subjects—rated their sensory pain as higher than their affective pain. A separate study confirmed these findings with chronic pain patients: chronic pain patients and those with rheumatoid arthritis were shown to be similar in rating their sensory pain, but the former group rated their affective pain higher than the latter group (Gaston-Johansson et al., 1985). Hypnotic analgesia also has a greater effect on affective than on sensory pain (Price & Barber, 1987).

Together these studies suggest that the affective qualities of pain are more amenable to psychosocial intervention than sensory qualities. Not surprisingly, for lower-intensity pain stimuli there is more potential for reduction of affective
responses than for higher-intensity stimuli both in the laboratory (Gracely, McGrath, & Dubner, 1978b; Price, 1984; Price, Barrell & Gracely, 1980) and in clinical settings (Melzack & Wall, 1982).

**Facial expression of pain**

Because verbal reports of pain and other mental processes are easily biased (Craig & Prkachin, 1980; Gracely, 1989; Nisbett & Wilson, 1977), confirmatory nonverbal measures have long been sought in the measurement of pain. One promising avenue is the measurement of facial activity in response to pain.

Slow-action feedback of videotaped reaction patterns affords the source data for scientists to study facial movements in a systematic manner. Ekman and Friesen (1978, 1982) developed a "descriptive measurement system" based upon the visible muscle movements of the face. This system, called the Facial Action Coding System (FACS), is objective and has been shown to be a reliable and valid tool in the differentiation of emotions (Ekman, Friesen, & Ellsworth, 1982). With regard to validity, Ekman and Friesen (1982) reported that facial action intensity was "highly correlated with [facial] EMG readings (Pearson R = .85)" (p. 208). Thus, FACS is highly sensitive in discerning subtle movements formerly thought to be quantifiable only by physiological assessment.

FACS has proven valuable in the measurement of clinical and experimental pain (Craig & Patrick, 1985; Craig & Prkachin, 1983; Grunau & Craig, 1987; Grunau, Johnston & Craig, 1990; LeResche & Dworkin, 1988; Patrick, Craig & Prkachin, 1986; Prkachin &
Mercer, 1989; Swalm & Craig, 1991). Facial expression is positively correlated with self-reported affective qualities of pain (LeResche & Dworkin, 1988) as well as with sensory intensity qualities of pain (LeResche & Dworkin, 1988; Swalm & Craig, 1991). Facialy expressed pain was not correlated with self-reports of anxiety and depression (LeResche & Dworkin, 1988); thus facial expression seems to reflect an aspect of pain and not general affective disturbance such as anxiety or depression.

In summary, pain is a multifaceted experience that can be measured verbally (using visual analogue scales for sensory and affective qualities) and nonverbally (using facial activity). The affective dimension of pain seems more amenable to psychosocial interventions than the sensory dimension, more so in clinical pain subjects than in experimental subjects.
Statement of the Problem and Hypotheses

The present study examined the impact that "telling a lie" had on subsequent verbal and nonverbal pain expression. The self-deception model predicts that such behavior should elicit persistently altered pain report, especially if the inducement to lie were poor; the effect should be greatest for subjects who feel responsible for negative consequences of voluntarily agreeing to lie.

The forced compliance paradigm (Festinger, 1957) was used to create a situation conducive to self-deception. Student volunteers received shock-induced pain stimuli which they rated for felt intensity and affective discomfort. An initial ascending series of shocks was administered to determine each subject's pain threshold and tolerance levels. Then five shocks from the threshold to tolerance range were given in a random order, constituting the pretest baseline phase. Next, subjects were randomly assigned and exposed to the experimental conditions and they underwent another series of five shocks. The manipulation was to deceive others about their pain experience either via a nonverbal route in Study 1 (facial expression) or via a verbal route in Study 2. A control group in each study received no instruction to lie. Half were told further that their deceptive behavior would cause negative consequences for others who would view their videotape.

Misleading fellow students about the pain experienced should induce subjects to feel badly; this should motivate them to change their attitude about the pain experienced. Thus, their
subsequent pain experience was expected to change in the
direction of the lie told if self-deception resulted from other-
deception. The durability of this effect was examined in a
posttest phase comprising five more shocks.

Figure 2 outlines the different results predicted by the
different models. The facial feedback hypothesis suggests that
changes in facial expression during the manipulation phase would
cause temporary changes in pain ratings. The self-perception and
impression management models suggest that changes in pain ratings
would occur during the manipulation phase (other deception) with
self-deception taking place over time to induce changes after the
manipulation. The model of forced compliance suggests that the
addition of negative consequences would amplify this effect.

Hypotheses:

1. "Telling a lie" as a result of instructions to
exaggerate or minimize one's pain will lead to increased /
decreased pain expression (verbal and nonverbal) in the
manipulation phase.

2. This increase or decrease will persist through the
posttest phase.

3. The effect will be most marked for subjects told that
their behavior would have negative consequences for others.

4. Because the affective component of pain seems generally
more reflective of psychological manipulations than sensory
features of pain, the affective pain report will reflect the
greatest experimental effects.
5. Facial expression will change significantly when subjects are told to exaggerate or diminish the expression of pain.

6. Altered facial expression will persist during the posttest phase.

7. The self-deception effect will be greater in subjects who score high on questionnaires measuring self-deceptive style, state anxiety, and adaptive coping (absence of catastrophizing and presence of a sense of control).

8. Self-deception will correlate positively with avoidant or denial coping styles and with a sense of control over pain.

9. Self-deception will be negatively correlated with catastrophizing.
Figure 2

Predicted Pain Ratings Across Time

A  
Facial Feedback Hypothesis

B  
Self-Perception

or

C  
Impression Management

D  
Cognitive Dissonance: Forced Compliance

Legend

- - - - Exaggerate
- - - - Diminish
- - - - Control

Negative Consequences
No Consequences

Pretest  Manipulation  Posttest

TIME
Method

This section outlines the methodology developed to address the hypotheses. The effects of altering one's expression of pain during a series of painful electric shock stimuli were examined within a forced compliance paradigm. Experimental subjects were induced to exaggerate or diminish their pain expression, with or without negative consequences to others. A control group was exposed to shock trials without instructions to alter their pain expression, also with or without negative consequences.

Study 1 subjects exaggerated or diminished their facial display of pain, purportedly to be judged by data coders in training. The negative consequence condition suggested that trainee coders who failed to reliably distinguish such alterations in pain expression would not be hired.

Study 2 subjects exaggerated or diminished their verbal display of pain, purportedly to be observed by subjects in a subsequent study. The negative consequence condition further suggested that such viewing would cause worse pain for the viewers.

Subjects

Female UBC student volunteers from the departmental subject pool received course credit or pay ($6.00) for their participation in the study. 96 subjects participated in the first study, 60 subjects in the second study.
Apparatus and Materials

The pain stimulus consisted of electric shocks presented in accordance with standardized procedures (Tursky, 1974) and as used in previous studies in this laboratory (Craig & Weiss, 1971; Craig & Prkachin, 1978; Patrick, Craig & Prkachin, 1986; Swalm & Craig, 1991). A Farrall Instruments, Inc. Mark-300 Aversive Conditioner was adapted for use as the shock generator. The power supply was changed from a variable voltage source to a variable resistance source by adding a 5000 Ohm resistor, which makes the unit operate as a constant current source and minimizes the effect that individual variations in skin resistance might have on the overall level of current delivered. Maximum current delivered was 14 milliamperes. The volar surface of the non-dominant forearm was rubbed with Redux paste before attaching the shock electrode. Standard videotape equipment was contained in the experimental room, hidden from view by a one-way mirror.

Visual analogue scales (VAS) were used to measure the affective and sensory qualities of the pain as outlined by Price et al. (1983). Subjects completed the State-Trait Anxiety Inventory (state version, Spielberger, Gorsuch & Lushene, 1970), the Balanced Inventory of Desirable Responding (BIDR, Paulhus, 1984), and the Coping Strategies Questionnaire (CSQ, Rosenstiel & Keefe, 1983) after the first (ascending) series of pain stimuli. After the final series of stimuli, subjects completed a post-experimental questionnaire designed to elicit suspicions regarding experimental hypotheses as well as feelings of
responsibility and discomfort regarding their dishonest behavior.
(See the Appendices for the questionnaires.)

Procedure

The entire procedure required less than sixty minutes. The subject was escorted to a laboratory room and seated at a table. The general nature of the study, procedure, expected duration, the delivery of electric shocks, use of videotape equipment, and rate of pay were explained. The shocks were described as beginning at very low levels and increasing in small increments in the first series. The subject was informed that she was to say "stop" when she wished to accept no further increases and shocks to be presented in three subsequent series of 5 shocks each were selected from this range. She was informed of the right to withdraw at any time or to refuse to answer any questions without loss of remuneration; confidentiality was assured. A consent form outlining this information was signed.

Subjects were initially told that we were gathering data about pain expression from healthy people in order to compare it to pain patients, such as back pain or cancer pain patients. The hypotheses were not explained until a full debriefing at the end of the experimental session.

A stack of pages with 10 cm. sensory and affective VASs was shown to the subject who was instructed to listen to tape-recorded instructions regarding their use. The distinction made between the sensory and unpleasantness aspects of pain was derived from Price et al. (1983) who drew an analogy between pain and sound by suggesting that sensory aspects of pain are like the
loudness of a sound whereas unpleasantness depends on intensity as well as other factors. The sensory scale was anchored at one end by "the most intense pain sensation imaginable" and the unpleasantness scale was anchored by "the most unpleasant feeling imaginable".

An overview of the experimental design is depicted in Table 1. All subjects were subjected to an ascending series of stimuli using the psychophysical method of limits to determine tolerance levels. Then experimental subjects underwent three series of five shocks each: 1) pretest, 2) diminish (D) or exaggerate (E), and 3) posttest series. A control group received three like series. These will now be described in detail.

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* Half of the subjects were told that their behavior would have negative consequences to subsequent viewers.

To establish the subject's pain threshold and tolerance levels, pain stimuli were administered in increasing intensities
(by 0.5 mA steps) until the subject requested to stop. After each stimulus the subject rated the felt affective and sensory pain. The first level at which the subject indicated that the stimulus felt painful constituted the pain threshold; the last stimulus tolerated was the pain tolerance level.

After the ascending series, the subject completed the STAI-state, the CSQ, and the BIDR. Meanwhile, the experimenter calculated the pain sensitivity range (PSR, Wolff, 1978)—the range from threshold to tolerance—and three levels spaced equally between threshold and tolerance. The current intensities corresponding to these five levels were given in a randomized order in the next three series.

The pretest series involved the administration of the five shock stimuli. Ratings on the visual analogue scales were obtained as before.

The manipulation phase repeated the pretest procedure. The manipulation in Study 1 comprised asking the subject to volunteer to fool viewers into believing that she had substantially less pain, or substantially more pain by altering her facial expression (Study 1; see Appendix D for instructions read to subjects). The manipulation in Study 2 comprised making a false, prepared statement following the series (Study 2; see Appendices E & F for protocol instructions and a listing of the statements, including the negative consequence add-on). That is, subjects chose a type-written statement from a box before the manipulation series shocks, they read the statement out loud as a rehearsal, then sat through the shock trials. They stated their prepared
statement on cue when the experimenter returned to the subject room and asked, "How was the pain that time?" Control subjects were not asked to alter their pain display nor to make a false statement about the pain. Study 2 subjects completed a questionnaire after the manipulation phase which measured whether they felt free to choose their experimental condition, their degree of felt discomfort at lying about their pain, and their felt responsibility for any negative consequences that might occur to viewers (see Appendix J for this questionnaire).

A final posttest series proceeded in the same manner as the pretest, to establish whether the subjects' pain ratings and facial activity changed as a result of the earlier manipulation. Subjects were told that this was just a repeat of the normal series of shocks. Then subjects completed a post-experimental questionnaire which elicited their hypotheses about the nature of the study as well as any perceived changes in pain experience over time, her sense of responsibility for negative consequences, and her discomfort due to misleading others. A full debriefing was carried out and the subject was offered the opportunity to discuss any queries or concerns that she had regarding the deception.

Facial Action Coding

Facial expressions were scored by a data coder who had passed proficiency tests as a FACS coder (Ekman & Friesen, 1978a). She was blind to the experimental hypotheses and to current intensities delivered. In accordance with standard scoring procedures, a 3-second videotape segment capturing a
neutral expression of the subject served as a comparison against which other segments were scored using FACS (Ekman & Friesen, 1978b). Facial movements during the threshold, medium, and tolerance level shocks were scored. The interval scored included the 0.5-second period preceding the shock, the 0.5-second shock itself, and the 2-second period following the shock. This interval captures the apex of the facial movements and ends prior to the onset of most extraneous movements (in accordance with procedures followed by Patrick, Craig & Prkachin, 1986). Thus, facial expression data that were analyzed consisted of the threshold, medium, and tolerance level facial action units scored in the pretest, manipulation phase, and posttest (9 segments per subject X a subset of 43 out of the 96 subjects in Study 1, X 60 subjects in Study 2).
Data Analysis: Overview

The mean current level at tolerance was 8.5 mA (±4.0), a level consistent with that found in previous studies using comparable shock delivery systems (Tursky & O'Connell, 1972, reported a tolerance level of 9.0 mA in males; Swalm & Craig, 1991, reported an average tolerance level of 8.8 mA in males and females).

Preliminary analyses of the Study 1 results were disappointing. Time and Intensity showed up as significant effects, but the between-group experimental variables of interest did not appear significant. One obvious reason forwarded by the author was that many of the Study 1 subjects appeared not to take the manipulation seriously. For example, five of the Exaggerate subjects were noticeably laughing during the manipulation phase. Before attempting to repeat the study using more cooperative subjects, it was decided to analyze the data for those subjects who did appear to comply with the instructions. The five Exaggerate group women who were obviously laughing were removed from the sample. In addition, four other subjects were removed on the basis of their post-experimental questionnaire responses: One Diminish and three Exaggerate group subjects reported that the manipulation caused them to feel more or less pain, respectively, which was counter to the desired manipulation effect. Finally, two research assistants and the experimenter previewed the videotapes to select subjects who did appear to comply with the manipulation to alter their facial expression. Each of the three judges independently attempted to guess whether
each subject belonged to the Exaggerate, Diminish, or Control condition by viewing the pretest and manipulation phases of the videotape. Retained for further analyses were those subjects who were correctly classified into the appropriate experimental condition by two out of three judges. Since this left more than twice as many control subjects as experimental subjects, control group subjects were retained only if correctly classified by all three judges. This left 43 subjects (20 control subjects, 13 exaggerate, and 10 diminish subjects). All 60 subjects from Study 2 were retained for analyses.

A trained FACS coder identified the facial action units (AUs) displayed by the subjects during the low, medium and high intensity shocks of the pretest, manipulation and posttest series. To maximize power by reducing the number of dependent variables, AUs previously associated with pain were weighted and summed according to the procedure described below. The resultant facial activity scores were subsequently used in the repeated measures ANOVAs to be described in the Results sections.

The process of deriving a weighted sum for the facial activity scores will be elaborated next. The most frequently occurring AUs, which were found to be pain-related in previous studies, comprised AUs 1, 2, 4, 6, 7, 12, 14, 25, and 45. These occurred at least an average of .019 times across all subjects across all conditions in Study 2 (their descriptions and weightings are in Appendix B). Optimum weights were derived in a previous study with a similar population undergoing shock-induced pain trials (Swalm & Craig, 1991). That study employed principal
components factor analysis to derive factor score coefficients subsequently used to weight the individual AUs which were then summed. The same weights were used in this study with the rationale that cross-validating the weighting scheme would be useful in extending and replicating the earlier results.*

AUs 1, 2 and 14 received negative weights. The rest were positive. In addition, all of the AUs except AUs 25, 26 and 27 were coded for five levels of intensity. Those AUs were weighted by 0.4, 0.8, 1.2, 1.6, or 2.0 for the five intensity levels A through E, respectively. AUs 25, 26, and 27 represent different levels of lips parting and were recoded as different intensities of AU 25 as per Prkachin & Mercer (1989) (assigned intensity levels were weighted by 0.4, 0.8, and 1.2).

To summarize, pain-related AUs were weighted and then summed to derive a facial activity score for each experimental phase for each subject. The weights reflected how greatly the individual AUs were associated with a pain factor (in a previous factor analysis) as well as how intense each AU appeared to the coder.

The facial activity scores and rating scale scores (both sensory and unpleasantness) were separately analyzed in mixed design ANOVAs.

*The alternative approach is to derive a weighting scheme that maximally discriminates among groups and then to use those weights for the dependent measure on the same sample. This would have built in an obvious bias towards finding significant results since the sample from which the weights were derived is the same sample on which the dependent variable is measured.
Study 1 Results (N=43)

The standard alpha level (< .05) was divided into two for the two self-report measures (Sensory and Unpleasantness Scale ratings) to reduce the experiment-wise error rate for these related measures. Facial Activity was considered separately, therefore, the alpha level for that measure was equal to 0.05. Each of these three dependent measures was analyzed by means of four-way repeated measures analysis of variance. The between-group factors were Condition (Exaggerate, Diminish, or Control), and Consequences (Negative, None). The repeated measures were Time (Pretest, Manipulation, Posttest) and Shock Intensity (5 levels for the rating scales; low, medium, and high for facial activity). Simple interactive effects analyses were conducted where appropriate; these results are tabled in Appendix L. There were no significant group differences for current tolerated as measured by an ANOVA (p > .10).

Both self-report measures yielded highly significant main effects for Time and Intensity. The Sensory Scale Time effect produced an \( F(2,74) = 21.59, \ p < .0001, \) and the Intensity effect produced an \( F(4,148) = 57.83, \ p < .0001. \) Newman-Keuls tests \( (\alpha=.01) \) suggested that ratings decreased significantly over time, with all levels of time significantly different from each other (cell means were: Pretest = 63.28, Manipulation = 56.67, Posttest = 38.28). The intensity variable showed an increase in ratings with increased shock intensity. For adjacent intensity levels, all but the fourth and fifth levels were significantly different as examined by Newman-Keuls tests \( (\alpha=.01; \) cell means
were \( I_1 = 38.44, I_2 = 47.55, I_3 = 63.35, I_4 = 71.73, \) and \( I_5 = 74.84 \).

The Unpleasantness Scale Time effect gave an \( F (2,74) = 12.13, p < .0001 \), and the Intensity effect gave an \( F (4,148) = 54.96, p < .0001 \). Newman-Keuls tests \((\alpha=.01)\) suggested that ratings decreased significantly over time, with all levels of time significantly different from each other (cell means were: Pretest = 58.68, Manipulation = 52.65, Posttest = 48.49). The intensity variable showed an increase in ratings with increased shock intensity. For adjacent intensity levels, all but the fourth and fifth levels were significantly different as examined by Newman-Keuls tests \((\alpha=.01)\); cell means were \( I_1 = 27.1, I_2 = 42.51, I_3 = 55.39, I_4 = 68.03, \) and \( I_5 = 73.34 \).

The Unpleasantness Scale also yielded a marginally significant interaction involving Condition by Time, \( F (4,74) = 2.53, p < .05 \). This may be seen graphically in Figure 3. Simple interactive effects analyses suggested that Condition was not a significant effect with any level of Time held constant. Instead, Time was a significant effect within the Exaggerate condition \((F (2,74) = 14.11, p < .001)\) with pretest ratings significantly higher than the manipulation and posttest ratings as analyzed by Newman-Keuls tests. Neither of the other conditions yielded significant Time effects: the Diminish condition \( F (2,74) = 1.42 (p > .20) \) and the Control condition \( F (2,74) = 1.43 (p > .20) \).
Figure 3

Condition X Time Interaction for the Unpleasantness Scale (Study 1)
The Facial Activity scores yielded significant main effects for Time and Intensity, as well as an interaction effect involving these two factors. The Time effect produced an $F(2, 74) = 4.74$, $p < .015$. Newman-Keuls tests suggested that this was due to a significant decrease in facial activity from manipulation to posttest ($\alpha = .05$; cell means were Pretest = .264, Manipulation = .340, and Posttest = .198).

The Intensity effect gave an $F(2, 74) = 6.80$, $p < .005$. Newman-Keuls tests indicated that facial activity during the lowest intensity level was significantly less than at the highest level ($\alpha = .01$; cell means were Low intensity = .212, Medium intensity = .275 and High intensity = .314).

The interaction between Time and Intensity produced an $F(4, 178) = 3.68$, $p < .01$. The graph of this result (depicted in Figure 4) illustrates that from the pretest to the manipulation phase, facial activity at the low and medium intensities increased but stayed the same for the highest intensity level. Simple interactive effects analyses suggested that at the pretest time only there was a significant intensity effect. Newman-Keuls tests revealed that there were significant differences between all levels of intensity at the pretest time except for the contrast between medium and high (cell means were: low = .145, medium = .287, high = .360). When intensity was held constant, the simple effects analyses revealed that at low intensity only there was a significant time effect. Newman-Keuls tests showed that the pretest trials were not different from the posttest (at low intensity), but all other comparisons were significantly
Figure 4

Facial Activity for Three Intensity Levels Across Time (Study 1)
different (cell means were: pretest=.145, manipulation=.328, posttest=.163).

In contrast to the self-report measures, the Condition by Time interaction for facial activity was not significant (p > .44) although the Exaggerate subjects displayed more facial activity during the manipulation phase as can be seen on Figure 5. The cell means for the complete analysis ranged from .0612 to .621 while the standard deviations ranged from .0384 to .9266, which clearly indicates a severe problem with individual differences and hence poor power.

A discriminant function analysis provided more detailed analysis of the differences between the groups during the manipulation phase. The most frequently occurring AUs (1, 2, 4, 6, 7, 12, 14, 20, 25, 43, and 45) were entered as variables predicting group membership (Exaggerate, Diminish, and Control). The first canonical discriminant function accounted for 95% of the between-group variance and was very useful in discriminating the groups (Chi² = 31.45, p < .026). The standardized canonical discriminant function coefficients for the first function (presented in the table below) illustrate the relative contribution of each variable to group discrimination.
Figure 5

Condition X Time Interaction for Facial Activity (Study 1)
Table 2. Standardized Canonical Discriminant Function
Coefficients for the First Function

<table>
<thead>
<tr>
<th>AU</th>
<th>Coefficient</th>
</tr>
</thead>
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<tr>
<td>1</td>
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<td>6</td>
<td>.104</td>
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<td>7</td>
<td>.142</td>
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<td>14</td>
<td>.227</td>
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<td>20</td>
<td>.404</td>
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<td>25</td>
<td>.028</td>
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<tr>
<td>43</td>
<td>-.251</td>
</tr>
<tr>
<td>45</td>
<td>.445</td>
</tr>
</tbody>
</table>

The table of classification function coefficients below shows how much the AUs are related to each of the conditions. In general, most of the AUs were weighted more heavily for the Exaggerate condition and least heavily for the Diminish condition, with the Control group falling in between. The exceptions to this pattern were AUs 7 and 25.

Table 3. Classification Function Coefficients

<table>
<thead>
<tr>
<th>AU</th>
<th>Exaggerate</th>
<th>Diminish</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.166</td>
<td>0.445</td>
<td>0.906</td>
</tr>
<tr>
<td>4</td>
<td>2.684</td>
<td>-0.081</td>
<td>0.335</td>
</tr>
<tr>
<td>6</td>
<td>0.626</td>
<td>0.110</td>
<td>0.376</td>
</tr>
<tr>
<td>7</td>
<td>0.424</td>
<td>0.346</td>
<td>0.109</td>
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<tr>
<td>14</td>
<td>2.981</td>
<td>0.345</td>
<td>1.393</td>
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<td>20</td>
<td>1.683</td>
<td>0.108</td>
<td>0.202</td>
</tr>
<tr>
<td>25</td>
<td>0.312</td>
<td>0.045</td>
<td>0.460</td>
</tr>
<tr>
<td>43</td>
<td>-0.815</td>
<td>0.706</td>
<td>-0.044</td>
</tr>
<tr>
<td>45</td>
<td>0.896</td>
<td>0.418</td>
<td>0.559</td>
</tr>
</tbody>
</table>

The overall rate of correctly classified cases based on the discriminant function was 67%. Successful classification was
best in the two experimental groups (at 80% or better) and worst in the Control group (at 50%) as can be seen from the table below.

Table 4. Classification Results

<table>
<thead>
<tr>
<th>Actual Group</th>
<th>N</th>
<th>Predicted Group Membership</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Exaggerate</td>
</tr>
<tr>
<td>Exaggerate</td>
<td>13</td>
<td>11 (84.6%)</td>
</tr>
<tr>
<td>Diminish</td>
<td>10</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Control</td>
<td>20</td>
<td>2 (10.0%)</td>
</tr>
</tbody>
</table>

Ratings of the subjects' sense of responsibility for any negative consequences that might occur to trainees who view their videotape were examined for the relationship to the consequences condition. The subjects in the negative consequences condition (N=48) rated their felt responsibility slightly higher than subjects in the no consequences condition (N=48): the means and standard deviations for the two groups were 2.58 (±1.53) and 2.07 (±1.17), respectively. This resulted in a significant difference in the predicted direction as measured by the t test (t = 2.15, df = 94, p < .05), but the means do not appear meaningfully different.

In summary, subjects in the Exaggerate condition tended to rate their pain as less during the manipulation and posttest trials than during the pretest trials. This effect almost reached significance when subjects who did not comply with the
manipulation were removed from the analyses. Nor did other analyses involving the experimental condition reach strict significance levels. However, on the Unpleasantness Scale there was evidence that within the Exaggerate condition, pretest ratings were higher than manipulation and posttest ratings.

The repeated measures of Time and Intensity reached significance across all dependent measures, suggesting that the subjects reliably displayed more pain with higher intensity shocks but their pain expression tended to decrease over time.

**Study 2 Results (N=60)**

As with Study 1, the standard alpha level ( < .05) was divided into two for the two self-report measures (Sensory and Unpleasantness Scale ratings) to reduce the experiment-wise error rate for these related measures. Facial Activity was considered separately with an alpha level equal to 0.05. There were no significant group differences for current tolerated as measured by an ANOVA (p > .10).

The Sensory Scale ANOVAR yielded two significant main effects and one marginally significant interaction effect. This is graphically presented in Figure 6 for the two lowest intensity levels. (Appendix R lists the cell means for all effects.)

Time was the first main effect, \( F(2,108) = 14.64, p < .0001 \). Newman-Keuls analyses suggested that the pretest rating of Sensory pain was significantly higher than either the manipulation phase or the posttest phase ratings (p < .01), but the manipulation and posttest trials were not significantly different over time.
Condition X Time X Intensity Interaction for the Sensory Scale, Lowest Two Intensity Levels (Study 2)
The second main effect was Intensity, $F (4,216) = 101.48, p < .0001$. Newman-Keuls tests indicated that all pair-wise contrasts were significantly different (at $p < .01$) except between the fourth and fifth highest intensity levels.

The Condition by Time by Intensity interaction almost met the stepped-down alpha level of significance, with an $F (16,432) = 1.82, p < .027$. Simple simple interactive effects analyses suggested that during the manipulation phase, for the two lowest intensity levels there was a highly significant condition effect. At the lowest intensity level, the Diminish condition subjects rated their pain significantly less than subjects in the Control condition ($p < .01$). At the second lowest intensity level, the Diminish subjects rated their pain as significantly less than either the Control or the Exaggerate subjects ($p < .01$). (Simple effects analyses are tabled in Appendix L.)

The Unpleasantness Scale results were very similar to those reported for the Sensory Scale, but the three-way interaction effect was clearly significant for this self-report measure for different reasons than reported for the Sensory Scale. These results are depicted in Figure 7 with cell means listed in Appendix S.

The main effect for Time [$F (2,108) = 23.34, p < .0001$] was accounted for by a significant drop in ratings from pretest to manipulation phase (Newman-Keuls tests, $p < .01$), which levelled out towards the posttest phase.
Figure 7

Condition x Time x Intensity Interaction for the Unpleasantness Scale (Study 2)

Unpleasantness Rating
The main effect for Intensity \( [F (4,216) = 102.29, \ p < .0001] \) was accounted for by significant differences between all levels of intensity (Newman-Keuls tests, \( p < .01 \)) except between the highest and second-highest intensities.

The Condition by Time by Intensity interaction met the stepped-down alpha level of significance, with an \( F (16,432) = 2.35, \ p < .005 \). (Simple effects analyses are tabled in Appendix M.) Simple simple interactive effects analyses suggested that during the manipulation phase, for the second lowest intensity level there was a marginally significant condition effect. The Diminish subjects rated their pain as less than either the Control or the Exaggerate subjects, but this failed to reach the stepped-down alpha level of significance (\( p > .01 \)). Probably the significant three-way interaction effect was due to highly significant effects within the Control condition for Intensity by Time. Simple simple interactive effects were found to be highly significant for the top three intensity levels (\( p < .01 \)). Newman-Keuls tests for Time within each of these Intensity levels only suggested significant drops in ratings from pretest to manipulation.

Facial Activity results were similar to the self-report results in that there were the two significant main effects for Time and Intensity, but there were no significant interactions.

The main effect for Time \( [F (2,108) = 14.64, \ p < .001] \) was followed up by Newman-Keuls tests which again suggested a decrement in response after the pretest, but only the contrast between pretest and posttest reached significance (\( p < .01 \)).
The main effect for Intensity \( F(2,108) = 14.09, p < .001 \) was accounted for by significant differences \( (p < .01) \) between the low and medium and between the low and high levels, but not between the medium and high levels.

To determine whether the facial activity in this study was similar in quality to that of the previous study from which the weighting scheme was derived (Swalm & Craig, 1991), a Principle Components Analysis was conducted on the pain-related facial action units for Study 2 subjects. In contrast to previous results, this time a two-factor solution rather than a three-factor solution provided the most comparable results. This two-factor solution accounted for 47% of the variance. The first factor seemed more of an expression of surprise with eyebrows raised, while the second factor appeared more like an expression of pain with furrowed brows, narrowed eyes, and grimacing mouth. The previous solution was the reverse in that the first factor was called pain-related and the second was surprise. AU 23 (lip tight) did not occur commonly enough in the present sample to be retained in the analysis. The factor score coefficients presented in the table below reveal the relationship between the individual AUs and the respective factors for both the previous study and the present one. The two columns correlate moderately for pain-related AUs \( (r=.78) \) and highly for surprise AUs \( (r=.96) \).
Table 5

Pain-related AUs and respective factor score coefficients

<table>
<thead>
<tr>
<th>AU and descriptor</th>
<th>1987 Study</th>
<th>1991 Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  inner brow raise</td>
<td>-.065</td>
<td>-.034</td>
</tr>
<tr>
<td>2  outer brow raise</td>
<td>-.075</td>
<td>-.038</td>
</tr>
<tr>
<td>4  brow lowerer</td>
<td>.337</td>
<td>.134</td>
</tr>
<tr>
<td>6  cheek raise</td>
<td>.464</td>
<td>.437</td>
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<tr>
<td>12 lip corner pull</td>
<td>.332</td>
<td>.450</td>
</tr>
<tr>
<td>14 dimpler</td>
<td>-.029</td>
<td>-.028</td>
</tr>
<tr>
<td>23 lip tight</td>
<td>-.041</td>
<td>N/A</td>
</tr>
<tr>
<td>25 lips part</td>
<td>.206</td>
<td>.355</td>
</tr>
<tr>
<td>45 blink</td>
<td>.188</td>
<td>.027</td>
</tr>
</tbody>
</table>

Surprise AUs and respective factor score coefficients

<table>
<thead>
<tr>
<th>AU and descriptor</th>
<th>1987 Study</th>
<th>1991 Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  inner brow raise</td>
<td>.463</td>
<td>.505</td>
</tr>
<tr>
<td>2  outer brow raise</td>
<td>.464</td>
<td>.504</td>
</tr>
<tr>
<td>4  brow lowerer</td>
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<td>.010</td>
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<tr>
<td>6  cheek raise</td>
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<td>25 lips part</td>
<td>-.010</td>
<td>.048</td>
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<tr>
<td>45 blink</td>
<td>.206</td>
<td>.052</td>
</tr>
</tbody>
</table>

The relationships between the dependent measures. To determine which of the AUs were most related to the self-report measures, the pain-related AUs were entered into two stepwise multiple regression equations with the self-report measures as the criterion values. Inclusion and exclusion criteria were set loosely at \( p < .300 \). AUs which predicted the Sensory report were 4 (brow lowerer) and 45 (eye blink), accounting for 14\% of the variance in the Sensory report, as can be seen in the table below. The beta weights reflect the magnitude of importance of
the relationship between the variables (each AU) and the
criterion (Sensory Scale rating).

Table 6. Multiple Regression Results for the Sensory Scale Ratings

<table>
<thead>
<tr>
<th>Variable</th>
<th>Multiple R</th>
<th>R^2</th>
<th>R^2 Change</th>
<th>Beta</th>
<th>F (Eqn)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. AU 4</td>
<td>.35</td>
<td>.12</td>
<td>.12</td>
<td>.35</td>
<td>8.07**</td>
</tr>
<tr>
<td>2. AU 45</td>
<td>.37</td>
<td>.14</td>
<td>.02</td>
<td>-.13</td>
<td>4.63*</td>
</tr>
</tbody>
</table>

** p < .01.
* p < .02.

AUs which predicted the Unpleasantness Scale ratings were AUs 4 (brow lowerer), 1 (inner brow raise), 2 (outer brow raise) and 6 (cheek raiser), accounting for 27% of the variance (see table below). AUs 4 and 2 received the highest beta weights which suggests that their relationship to the Unpleasantness Scale was greatest.

Table 7. Multiple Regression Results for the Unpleasantness Scale

<table>
<thead>
<tr>
<th>Variable</th>
<th>Multiple R</th>
<th>R^2</th>
<th>R^2 Change</th>
<th>Beta</th>
<th>F (Eqn)*</th>
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</thead>
<tbody>
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<td>.19</td>
<td>.19</td>
<td>.43</td>
<td>13.41</td>
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<tr>
<td>2. AU 1</td>
<td>.45</td>
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<td>.02</td>
<td>-.14</td>
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<tr>
<td>3. AU 2</td>
<td>.50</td>
<td>.25</td>
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<td>3.62</td>
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<tr>
<td>4. AU 6</td>
<td>.52</td>
<td>.27</td>
<td>.02</td>
<td>-.15</td>
<td>1.46</td>
</tr>
</tbody>
</table>

* p < .01.
To further examine whether the experimental manipulation was most successful with subjects scoring high on the BIDR questionnaire measure of self-deception, ANOVARS were conducted using high v. low levels of self-reported self-deception. The complete analyses followed this format: 3 (experimental conditions) X 2 (high v. low questionnaire measure of self-deception) X 3 (time) X 5 (shock intensity), comprising a between-within design as previously outlined. The BIDR self-deception scores were divided at the median to provide the second grouping factor. The consequences condition was dropped as a grouping factor to simplify subsequent analyses (it had not been significant in prior analyses). Different extremes of self-deception scores were used to form high v. low groups, but no relationship was uncovered with self-deception across the experimental conditions. (The results are listed in Appendix N.)

To further examine the question of whether self-deception moderated the experimental effects, stepwise multiple regression analyses were conducted using the subset of data that had shown significant effects reported earlier. This was, namely, on sensory ratings for the two lowest shock intensity levels, the ANOVARs suggested that Diminish subjects rated their pain as less than Control &/or Experimental subjects. Thus, for the regression analyses, the predictor variables comprised group, self-deception, and group by self-deception while the criterion variables were sensory ratings at pretest for the first analysis and at manipulation for the second analysis. There was a weak relationship (.05 < p < .30) between the variables such that the
Diminish subjects who scored high on self-deception tended to rate the shocks as less intense than either Exaggerate or Control subjects at both times examined. (The results of these analyses are tabled in Appendix T.)

Similar median-split analyses were conducted using anxiety as a grouping factor. Anxiety ranged from 21.5 to 67 with the median at 39 (about the 71st percentile). Anxiety was not related to the self-deception manipulation, but it did interact somewhat with shock intensity (p < .05). Highly anxious subjects rated all but the highest intensity level as less painful than less anxious subjects. Anxiety was negatively correlated with shock level tolerated (r=-.20, p=.125). (Results are tabled in Appendix O.)

Analyses were conducted on the Coping Strategies Questionnaire items—Catastrophizing and Sense of Control—entered as grouping variables. Again, no relationship was illuminated between these variables and the experimental conditions. (See Appendices P & Q for tabled results.)

To better understand what correlates with self-reported self-deceptive behavior, several measures were entered into a multiple regression analysis using the Balanced Inventory of DesirableResponding measure of self-deception as the criterion variable. Predictor variables were the subjects' subscale scores from the Coping Strategies Questionnaire*, self-reported anxiety, 

*Factor scores have been derived for this scale using chronic pain populations. But because the present study used the CSQ for a novel population, the entire list of subscales was used rather than factor scores. Moreover, the 3-factor solution previously found is not much simpler than the 8-subscale format.
and post-experimental questionnaire items. Inclusion and exclusion criteria were set to \( p < .10 \). Two predictor variables entered the regression equation to account for 26% of the variance in self-deception. Catastrophizing was negatively predictive of self-deception while a sense of control over pain was positively related to self-deception. See the summary table at the bottom of the table below for details.
Table 8.

**Correlations Between Questionnaire Measures**

<table>
<thead>
<tr>
<th>CC1</th>
<th>CC2</th>
<th>CC3</th>
<th>CC4</th>
<th>CC5</th>
<th>CC6</th>
<th>BC</th>
<th>E1</th>
<th>E2</th>
<th>SD</th>
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<tbody>
<tr>
<td>CC1</td>
<td>36</td>
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<td>-22</td>
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<tr>
<td>CC4</td>
<td>38</td>
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<td>31</td>
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<td>-47</td>
<td>08</td>
<td>-16</td>
<td>21</td>
<td>01</td>
<td>37</td>
<td>24</td>
</tr>
</tbody>
</table>

From the Coping Strategies Questionnaire, are the cognitive coping strategies as follows: CC1 = diverting attention, CC2 = reinterpreting the pain sensations, CC3 = catastrophizing, CC4 = ignoring sensations, CC5 = praying or hoping, and CC6 = coping self-statements. Also from the CSQ are the behavioral coping strategy of increased behavioral activities = BC and the effectiveness ratings of a sense of control over pain = E1 and ability to decrease pain = E2. SD = self-deception as measured on the Balanced Inventory of Desirable Responding.

**Multiple Regression Results for BIDR Self-Deception**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Multiple R</th>
<th>R²</th>
<th>R² Change</th>
<th>Beta</th>
<th>F (Eqn)*</th>
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<tr>
<td>1. Catast</td>
<td>.47</td>
<td>.22</td>
<td>.22</td>
<td>-.47</td>
<td>15.90</td>
</tr>
<tr>
<td>2. Control</td>
<td>.51</td>
<td>.26</td>
<td>.04</td>
<td>.22</td>
<td>9.79</td>
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</table>

* both F values were significant, p < .001.

In summary, Study 2 demonstrated a self-deception effect in the Diminish condition at lower intensities suggesting that these subjects rated their pain as less intense during the manipulation phase. Again, the repeated measures of Time and Intensity...
suggested that higher levels of shocks received higher pain ratings and greater facial expression, while pain expression diminished over time. Moreover, pain ratings were related to facial expression, especially ratings on the Unpleasantness scale. Finally, self-report measures of coping and self-deception suggested that self-deception is highly related to the absence of catastrophizing and presence of a sense of control over pain. But these self-report measures did not interact with the experimental manipulation.
Discussion

The model of self-deception presented in the literature review suggested that telling an untruth about one's pain condition should arouse and motivate subjects to believe the lie through a process of self-deception. In keeping with this view, subjects of the two studies were asked to deceive others about the pain that they experienced. It was predicted that this would motivate them to perceive the pain in the direction of the deception in order to preserve their self-esteem. Forced compliance literature suggests that deceiving others leads to attitude change; this manipulation was extended to the present study examining change in pain perception. Feeling responsible for negative consequences occurring as a result of the deception was expected to amplify the forced compliance manipulation effect.

Discussion of Study 1 Results

In the first study, the experimental manipulation was to have female subjects exaggerate or diminish their facial expression, purportedly to test the skills of data coders in training. The negative consequence condition was to suggest that trainees who failed to reliably distinguish alterations in pain display would not be hired.

As mentioned before, a trained FACS coder coded the facial activity for Study 1 subjects who were judged to comply with the experimental manipulation. Subjects who were judged as showing more or less pain in their faces were reliably distinguished from one another on the discriminant function analysis with Exaggerate
subjects generally showing more of the pain-related AUs than Diminish subjects, and Control subjects falling somewhere in between. The Control group subjects were difficult to separate from the Diminish group subjects. Similar findings have been reported with chronic back pain patients whose exaggerated expressions appeared like an exaggeration of the genuine pain expression (Craig, Hyde & Patrick, 1991). But these researchers found some residual evidence of pain in the diminished ("masked") expressions which was not evident in the present study. Moreover, Poole and Craig (1991) found that judges could reliably discriminate between pain subjects told to diminish their pain expression versus subjects not told to diminish their expression. On the other hand, Kopel & Arkowitz (1974) reported that observers had difficulty separating subjects' "calm" poses from control group poses during painful shock.

One possible reason for not observing residual facial signs of pain in the present study may be that the laboratory subjects tolerated much less pain and felt less pain than the subjects in the Craig et al. (1991) study who were chronic back pain patients videotaped during painful physiotherapy exercises. Moreover, in contrast to back pain patients, the laboratory subjects possibly perceived a greater sense of control over the pain stimuli since each had determined the maximum stimulus intensity to be tolerated through-out the study. Such a sense of control might have dampened the overall facial expressiveness as well as the felt pain. Moreover, the stakes for getting caught lying were
minimal, possibly minimizing the likelihood of leakage or evidence of deceit (Ekman, 1985).

Counter to the hypotheses, subjects in the Exaggerate condition tended to rate their pain as less rather than more during the exaggerate and posttest trials than during the pretest trials. This effect almost reached significance on the ANOVA even when subjects who did not comply with the manipulation were removed from the analyses. R. Kleck (personal communication) suggested that this failure to replicate the earlier studies (Colby et al., 1977; Kleck et al., 1976; Lanzetta et al., 1976) was not unusual. One reason might be that cognitively complex instructions such as those used in Study 1 served to distract subjects from the pain, thereby resulting in decreased pain report. The author's observations in support of the distraction hypothesis were that subjects in the Exaggerate condition demonstrated discomfort and self-conscious laughter, suggesting that they were keenly aware of their faces and less aware of the painful stimuli. Many seemed unable to take the manipulation seriously. But this alone did not account for the distraction as suggested by the failure to demonstrate increased pain report in Exaggerate subjects who did appear to comply with the manipulation. Kleck also reported that their studies involving males may not generalize to female volunteers. In addition, he noted that expressive behavior typically plays a relatively small role in the variance of pain ratings. For example, using meta-analysis to examine the conclusions of facial feedback studies,
Matsumoto (1987) reported that expressive behavior plays a small role in the variance of self-reported mood (12%).

As a manipulation check, a difference in facial expression was readily apparent on the discriminant function analysis but did not result in a group difference on the ANOVAR. One reason is as follows: the ANOVAR facial activity score was a weighted sum of the AUs using weights derived in a separate sample of subjects (Swalm & Craig, 1991). In other words, reliability was reduced by the attempt to cross-validate the weighting scheme.

The negative consequences manipulation was not involved in any significant effects, nor did subjects exposed to the negative consequence rate their responsibility for bringing about negative consequences much higher than no-consequences subjects. Thus, the author concluded that the nonverbal manipulation and the negative consequences manipulation were ineffective in altering pain. In short, Study 1 did not find any evidence in support of self-deception or of the Facial Feedback Hypothesis. Further effects of self-deception were sought in the follow-up study, Study 2.

Compared to Study 1, Study 2 followed more directly from forced compliance literature in that subjects verbally declared an attitude about their pain experience that was discrepant with the truth. Facial expression became a strictly dependent measure rather than the independent variable. Recall that the manipulation was to have subjects state that their pain was worse, less, or the same as what they had expected. The negative consequence was to tell subjects that participants of a later
study would watch the videotape before undergoing a similar series of shocks; such viewing was said to cause worse pain for viewers. The instructions were simplified to prevent what Kleck (personal communication) called "cognitive overload" and distraction.

Discussion of Study 2 Results

As in Study 1, the repeated measures of Time and Intensity were reflected by all of the dependent measures. The relationship between the dependent measures was examined and revealed that AU 4 (brow lowerer) was consistently related to both the Sensory and Unpleasantness Scales, accounting for most of the variance in the stepwise multiple regression equations (12% and 19% of the variance, respectively). Thus, if limited to observing one facial movement only, researchers and practitioners might be advised to observe pain patients' foreheads for evidence of pain.

The overall factorial structure of facial activity during the shock-induced pain stimuli resembled that of the earlier study (Swaim & Craig, 1991). Together these studies suggest that the stimuli induce a combination of pain and surprise characterized mainly by lowering or raisin characterized main respectively. The painful facial expression also typically has a squinting movement called the cheek raise which emphasizes so-called crows feet.

If forced to choose one measure of adaptive coping, the results of Study 2 suggest that self-deception (as measured by Paulhus's Balanced Inventory of Desirable Responding, 1984) is
closely related to the absence of catastrophizing and the presence of a sense of control over pain (as measured by the Coping Strategies Questionnaire, Rosenstiel & Keefe, 1983), two facets of coping which are thought to be useful in coping with chronic pain (Keefe et al., 1987a & 1987b; Reesor & Craig, 1988; Spinhoven & Linssen, 1991; Turner, 1990). These self-report measures did not interact with the experimental manipulation. Thus, we are still uncertain about what variables might predispose an individual towards becoming self-deceived.

It was surprising to discover that subjects scoring high on a measure of anxiety tended to rate the shocks as less painful than subjects scoring low on anxiety. This relationship was possibly confounded by the finding that highly anxious subjects opted to receive less painful shocks when determining their pain tolerance levels.

The results of Study 2 further indicated that low intensity levels of self-reported pain can be reduced by preparing to tell others that one's pain is less. Thus, there was support for the main hypothesis that altering one's pain display leads to a change in one's pain experience. This held for the verbal display of pain but not for the nonverbal display, at the time of the manipulation but not afterwards. The effect was greatest with the Sensory Scale, marginal with the Unpleasantness Scale, but not significant with Facial Activity.

Since negative consequences did not amplify the manipulation effect, and because it was limited in time to the manipulation phase only, one can only conclude that it was due to either self-
deception and/or self-perception, cognitive dissonance, or impression management phenomena. If self-deception were taking place, the altered pain report should have endured over time since the nature of self-deception implies that it results in a deeper cognitive shift than self-perception or impression management. Thus the forced compliance effect was demonstrated in this study, but negative consequences did not amplify the effect.

One caveat is in order: the results and generalizations must be limited to females since only female subjects participated in the study. However, pain perception is generally not all that different between males and females (Davis, 1981; Lander & Fowler-Kerry, 1989) although when other factors such as cultural background and age are considered, gender may mediate alterations in pain report (Koopman & Eisenthal, 1984). Part of the difficulty in sorting out gender differences from cultural stereotypes might be due to the observation that female pain patients are treated differently than males by their physicians (Lack, 1982). For example, female pain patients may be older and may have suffered longer before a referral is made to a pain unit; they may be more likely to receive minor tranquilizers and antidepressants than narcotic analgesics (Lack, 1982).
Future directions

Part of the difficulty in demonstrating that other-deceptive behavior leads to self-deceptive behavior might be that subjects resisted the instruction to simulate greater or lesser pain. Previous studies (Goebel, 1983; Heaton et al., 1978) have reported that a surprising number of student subjects (10-20%) reported during the posttest that they had been unwilling or unable to fake malingering as requested by the experimenter. This is a problem recently noted in malingering research (Bernard, 1990). It may have been a greater problem in the present study because the design necessitated making subjects feel uncomfortable with their deceptive behavior. This discomfort may have been circumvented by subjects who appeared to go along with instructions just enough to satisfy the experimenter's requests but not enough to really fool themselves. In other words, perhaps the experimenter was deceived, but most of the subjects were not. In light of this, future studies involving subjects deceiving others must include posttest measures of the degree to which they felt able to carry out the instructions to fake. As mentioned by Paulhus (personal communication), forced compliance studies require much effort in wording instructions so as to foster a sense of discomfort in subjects but not so much discomfort that subjects elect to withdraw from the study.

The second study demonstrated that pain report can be reduced but not increased by means of the forced compliance manipulation. Several previous studies only demonstrated
reductions in pain report (Bandler, Madaras & Bem, 1986; Totman, 1975; Zimbardo et al., 1966) but some have demonstrated that subjects report pain with minimal stimulation if they are led to expect to feel pain (Bayer et al., 1991). The inability to demonstrate increases in pain report in the present study makes definitive theoretical statements elusive. It was reasoned that if pain can be reduced by self-deception, it should be possible to increase it, too. Mitigating against attempts to increase pain report might be the artifactual effect that over time, pain expression decreased or habituated according to all dependent measures. Thus, attempts to increase pain expression worked against this time effect.

The finding that sensory pain changed more than affective pain was unexpected. Usually psychosocial manipulations alter the affective component of pain more than the sensory pain. However, power analyses suggested that for the Condition by Time interaction in Study 2, there was much more power (and hence greater likelihood of finding significant results) associated with the Sensory Scale than for the Unpleasantness Scale (.666 and .351, respectively). Poor power associated with Facial Activity might account for the dearth of findings for that dependent measure (power = .149). Thus, it is impossible to know whether the manipulation was not evident across all of the dependent measures because of differences in the reliability or individual variations of the measures or because of theoretical differences between the measures.
One theoretical reason why the self-deception manipulation showed up on measures of self-report but not on facial activity might be that this was a "hard case" of self-deception (in Paulhus's terms). That is, self-deception might involve a process akin to different levels of consciousness in which self-deception is seen on verbal report but not on deeper or involuntary measures such as nonverbal expression. Further study is necessary before drawing this conclusion.

A second reason why the sensory pain might have been altered more might be related to the similar finding in other laboratory pain studies. For example, laboratory subjects undergoing noxious heat stimulation rated the sensory dimension of their pain higher than the affective dimension (Gaston-Johansson et al., 1985; Price, Harkins & Baker, 1987). On the other hand, some clinical patients (especially those with a high threat to health) report greater affective discomfort than sensory pain intensity (Price, Harkins & Baker, 1987). Pain that triggers affective distress tends to be rated higher on a dimension tapping unpleasantness than on a dimension tapping sensory intensity (Wade et al., 1990).

No evidence was gathered to support the notion that negative consequences amplifies the forced compliance effect. Berkowitz and Devine (1989) questioned the necessity of negative consequences in forced compliance manipulations. They might be correct and/or the negative consequences manipulation in the present study might have been weak. Again it is difficult to ensure that subjects will voluntarily concede to deceive others
especially when negative consequences will accrue to other participants. This is a difficulty that future researchers will face, too. Having conducted one such study, the author remains uncertain of how to overcome this in the modern research world which allows students to withdraw from participating. Moreover, few psychology students remain naive about studies that examine their compliance with authority as a result of learning about the Milgram (1965) studies.

The questionnaire measure of self-deception was related to key factors found to predict adaptive coping or good functioning --absence of catastrophizing and presence of a sense of control over pain. Thus, self-deception might be an adaptive way of coping with acute pain. This contradicts former conclusions that self-deception might be a poor strategy in coping with long-term illness (Linden et al. 1986). However, this result must be viewed with caution since the questionnaire measure of self-deception did not interact with the experimental manipulation designed to demonstrate self-deceptive behavior.

Since optimism has been shown to predict good physical health (Scheier & Carver, 1985, 1987), optimism might also be correlated to self-deception. Future studies should examine the relationship between these two constructs which might account for a more generally adaptive way of dealing with stress than specific coping strategies, especially in light of research findings indicating that any kind of coping strategy use is superior to no use (Devine & Spanos, 1990). If so, then self-
deception or optimism or adaptive coping might represent the same construct.

An implication of the present literature review and study is that present treatments for pain might include self-deceptive phenomena. For example, the demand characteristics of the treatment situation encourages some obedient patients to state that their pain is less of a problem as a result of the physician's ministrations. While this might be effective in reducing pain while the patient is telling this untruth, the present study suggests that the pain might return a short time later such as when the patient leaves the physician's office.

No evidence was found to support the contention that people who fake more pain come to convince themselves that they have more pain. This contradicts the self-deception model proposition that patients who repeatedly tell their pain story while "doctor shopping" become entrenched in their complaints. However, the high personal stakes involved in pain patients' descriptions might make them more susceptible to self-deception than laboratory subjects who tell a pain story only once to a mirror which purportedly hides a video camera capturing their statements allegedly to be seen by some unknown fellow student. My colleagues and the author have observed pain patients entering a back pain program at the Workers' Compensation Board of British Columbia exaggerating their complaints to ensure that "you guys know I'm in serious pain" (a recent quote from one of my patients). Thus, this area of exaggerated pain displays deserves further study. At the very least, pain displays would
focus attention on one's pain and thereby increase suffering through such a preoccupation with pain. It remains to be seen whether self-deception is another process that can increase pain and suffering.

Future research might better simulate the clinical situation by having subjects tell the pain story to someone introduced as medical specialists. Repeated episodes of describing the pain to a doctor would be expected to harden the self-deception such that the subject might resist attempts to dissuade him/her of the pain. Longitudinal research with actual pain patients might be the best research approach to address these hypotheses since patients have real stakes involved in their pain complaints. Moreover, actual pain patients might prove to be more cooperative subjects. For example, other researchers in the Craig laboratories (e.g., S. Hyde and H. Hadjistavropoulos) have succeeded in getting clinical pain patients to exaggerate and diminish their facial expressions without undue self-conscious behavior such as laughing.

A further implication from the literature review is that if other-deception leads to self-deception, then questionnaire measures designed to measure these constructs might cause a change over repeated measurement trials. Over time, subjects would be expected to answer both other- and self-deception questions increasingly more similarly. Moreover, self-deception may result in great difficulty distinguishing patients who are "genuinely" in pain from those who have consciously attempted to deceive others (Faust & Guilmette, 1990; Pankratz & Erickson,
1990) as in the case of ongoing litigation or disability insurance battles. Adversarial pressures can worsen a patient's functioning through dissimulation and/or stress (Weissman, 1990). The self-deception model provides an appealing (but unproven) account of the underlying process involved in dissimulation leading to "real" altered pain.
Summary

Chronic pain is a widespread and expensive problem. Moreover, pain is difficult to measure, explain and treat. It is hoped that by furthering our understanding of pain, we can begin to effect better treatments for it.

Several models of pain have been forwarded to account for some cases of chronic pain, but no one explanation can account for the underlying processes involved in the genesis of chronic pain in all cases. The present analysis offers the additional factor of self-deception, defined as a contradiction between one's words or attitude and behavior which is motivated by protecting self-esteem. For example, by attempting to demonstrate subjective pain to observers, a pain patient may convince him- or herself of the displayed painfulness through a process of self-deception. The analyses presented in this thesis were designed to address the validity of this model. That is, does altering one's pain expression come to change one's experience of pain through a process of self-deception?

To explore the self-deception model of chronic pain, a laboratory analogue study was devised using female student volunteers who rated the painfulness of shock-induced stimuli under conditions designed to foster self-deception, namely the forced compliance manipulation. Painfulness was measured 1) verbally by means of two visual analogue scales which reflected the pain intensity and affective unpleasantness and 2) nonverbally by means of quantified facial muscle movements. After determining the subject's pain threshold and tolerance
levels, she underwent a pretest comprising five random shocks from her threshold to tolerance range. Next, a manipulation phase was to ask the subject to display more, less or the same degree of pain while undergoing another random series of shocks. A final posttest was identical to the pretest and provided a measure of the durability of the altered pain display effect.

In the first of two studies, the altered pain display was nonverbal: subjects exaggerated, diminished or did not change their facial expressiveness while undergoing the pain stimuli. In the second study, the altered pain display was verbal: subjects were told that at the end of the series they would be required to tell a fellow student (via videotape) that the shocks hurt more, less or about the same as what they had expected. Half of all subjects were further told that their deceptive communication would have negative consequences for viewers.

Misleading fellow students about the pain experienced was expected to make the subjects feel badly, motivating them to change their attitude or beliefs about the pain experienced. They were expected to change their pain reports in keeping with the deceptive communication. That is, other deception was expected to foster self-deception. This effect was expected to endure and it was expected to be greatest for those in the negative consequences condition.

The results of the first study showed that exaggerated facial expressions of pain appear as an amplification of normal pain expression. However, increases or decreases in facial
expression did not bring about changes in verbal report of pain perceived, calling into question the facial feedback hypothesis.

The results of the second study suggested that pain was altered only for subjects who prepared to state that their pain felt less painful than expected. This effect reached significance on the pain intensity visual analogue scale for low intensity shocks. This effect did not carry over into the posttest phase, nor were negative consequences effective in amplifying the manipulation, leaving the theoretical mechanism underlying the change in pain unclear.

One particular facial movement (brow lowerer) was consistently related to the verbal pain reports, attesting to the validity of facial expression as a measure of pain. However, there was generally a dearth of findings for the dependent measure of facial activity.

Self-reported self-deception was related to factors found to predict good functioning in chronic pain patients, namely a sense of control over pain and the absence of catastrophizing thoughts. Thus, the construct of self-deception might hold promise as an adaptive coping style.

One major problem with research involving forced compliance (or more generally, subject deception) is that subjects may appear to comply with experimental instructions to deceive others while avoiding personal responsibility for their actions through a variety of mechanisms yet to be determined. The author remains convinced that one such mechanism is self-deception, but this is difficult to prove. It is especially difficult to separate self-
deception from other related or similar constructs including cognitive dissonance, self-perception, impression management, attentional and memory biases, and maybe even optimism—another new construct recently linked to health.
References


A. Visual Analogue Scales (Adapted from Price et al., 1983)

Painful:  __ Yes  __ No

Sensory intensity:

-------------------------------------
the most intense pain
sensation imaginable

Unpleasantness:

-------------------------------------
the most unpleasant
feeling imaginable
### B. FACS Pain-related Action Units (Ekman & Friesen, 1978)

<table>
<thead>
<tr>
<th>AU</th>
<th>FACS Name</th>
<th>Weight from previous study*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Inner brow raise</td>
<td>-.065</td>
</tr>
<tr>
<td>2</td>
<td>Outer brow raise</td>
<td>-.075</td>
</tr>
<tr>
<td>4</td>
<td>Brow lowerer</td>
<td>.337</td>
</tr>
<tr>
<td>5</td>
<td>Upper lid raise</td>
<td>N/A</td>
</tr>
<tr>
<td>6</td>
<td>Cheek raiser</td>
<td>.464</td>
</tr>
<tr>
<td>7</td>
<td>Lid tightener</td>
<td>N/A (used AU 6 weight)</td>
</tr>
<tr>
<td>10</td>
<td>Upper lip raise</td>
<td>N/A</td>
</tr>
<tr>
<td>11</td>
<td>Nasolabial deepen</td>
<td>N/A</td>
</tr>
<tr>
<td>12</td>
<td>Lip corner pull</td>
<td>.332</td>
</tr>
<tr>
<td>14</td>
<td>Dimpler</td>
<td>-.029</td>
</tr>
<tr>
<td>20</td>
<td>Lip stretcher</td>
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<tr>
<td>23</td>
<td>Lip tight</td>
<td>-.041</td>
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<tr>
<td>25</td>
<td>Lips part</td>
<td>.206</td>
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<td>26</td>
<td>Jaw drops</td>
<td>N/A (used AU 25 weight)</td>
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<tr>
<td>27</td>
<td>Mouth stretches</td>
<td>N/A (used AU 25 weight)</td>
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<tr>
<td>43</td>
<td>Eyes close</td>
<td>N/A</td>
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<tr>
<td>45</td>
<td>Blink</td>
<td>.188</td>
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</table>

*Swalm & Craig, 1991, used factor score coefficients derived from the first factor of a Principle Components Factor Analysis of the most frequently occurring AUs in shock-induced pain. These are listed where available, otherwise weights were used from a similarly occurring AU (as in the cases of AU 7, 26, and 27) or else weights were not used since they were not available (listed as N/A in the table).
C. Experimental Participation Consent Form: Studies 1 & 2

Study: Pain Display
The principle investigator of this study is Dr. Kenneth D. Craig of the Psychology Department, telephone 228-3948. Funding has been provided by the SSHRC.

We are attempting to define the normal responses to pain stimuli so that we might contrast these with chronic pain patients' responses. For that reason, we are using a standard procedure that involves carefully measured pain stimuli—electric stimuli—delivered to the forearm through a 1-inch electrode.

The first series of shocks will begin at current intensities that cannot be detected and will increase each time in small amounts, up to a level that is no longer tolerable. At any time during this sequence of shocks, simply saying "stop" will end the series of shocks, and no further increases will be delivered. Following the series of increasing shocks, another series of 5 shocks will be administered; these will be within the tolerable range and will be delivered in a random order of intensities. These 5 shocks will be repeated twice more under varying conditions.

After each stimulus, you will rate the discomfort on a couple of scales. A videotaping of the procedure will capture your nonverbal reactions. Your videotape will be shown to a select few research assistants and students who are involved in this research project. You will also be asked to complete some questionnaires designed to measure how you deal with the experience. The entire procedure should take less than 60 minutes for which you may receive course credit if your instructor has agreed, or you may be paid $6.00 for your participation. All of your responses will be kept confidential by using a number rather than your name.

If you have any questions at any time, please feel free to ask the experimenter, Delphin Swalm.

I hereby consent to participate in the study as described. I understand that the risks to me as a subject are minimal. I further acknowledge that I am aware that I can withdraw from participation in the study at any time and I may refuse to answer any questions without prejudice or loss of remuneration.

Date: ____________________

Signature: ________________
D. Protocol pertaining to manipulation phase for Study 1.

(Read to subject:)

THE NEXT SERIES IS MORE STIMULI IN A MIXED UP ORDER. BUT THIS TIME YOU MAY BE ASKED TO CHANGE YOUR FACIAL EXPRESSION. THE REASON FOR THIS IS THAT WE WISH TO USE YOUR TAPE FOR TRAINING STUDENTS AS DATA CODERS. STUDENTS LIKE YOURSELF WILL BE TAUGHT TO JUDGE PAIN PATIENTS' FACES FOR THE DEGREE OF PAIN THAT THEY FEEL, AND TO DETECT WHEN THE PATIENTS FAKE MORE OR LESS PAIN. PLEASE THROW A DIE TO DETERMINE WHICH CONDITION YOU'LL BE IN: (hand die to S)*

A 1 OR 2 MEANS YOU'RE IN THE EXAGGERATE CONDITION,
A 3 OR 4 MEANS YOU'RE IN THE DIMINISH CONDITION,
WHILE A 5 OR 6 MEANS YOU'RE IN THE CONTROL CONDITION. (give S die to toss; put up sign for Exaggerate, Diminish, or Control on mirror)

WHAT THIS MEANS IS THAT YOU ARE TO {EXAGGERATE YOUR FACIAL EXPRESSION / DIMINISH YOUR FACIAL EXPRESSION / JUST ACT NATURALLY AS BEFORE} DURING THIS NEXT SERIES OF STIMULI WHILE I VIDEOTAPE YOU. (MAKE IT LOOK AS IF YOU'RE IN MUCH {MORE/LESS} DISCOMFORT THAN YOU REALLY ARE IN.)

NEXT, I NEED YOU TO TOSS THE DIE TO DETERMINE WHETHER YOUR TAPE WILL BE USED AS A TRAINING TAPE OR AS A TESTING TAPE. (give S die to toss; put up sign for Training or Testing on table in front of subject, facing mirror; explain the nature of that condition:)

(training condition:) THIS MEANS THAT YOUR TAPE WILL BE USED TO TRAIN OUR STUDENT DATA CODERS. THEY WILL LEARN TO CODE THE DEGREE OF PAIN, AND WHETHER OR NOT PEOPLE ARE FAKING MORE OR LESS PAIN USING YOUR TAPE AND THE TAPES OF OTHER SUBJECTS.

(testing condition:) THIS MEANS THAT YOUR TAPE WILL BE USED TO TEST OUR STUDENT DATA CODERS. THEY WILL BE TESTED ON WHETHER THEY CAN CODE THE DEGREE OF PAIN, AND WHETHER OR NOT PEOPLE ARE FAKING MORE OR LESS PAIN USING YOUR TAPE AND THE TAPES OF OTHER SUBJECTS. THOSE CODERS WHO CAN'T PASS THE TEST WON'T BE HIRED.

*In a study of cognitive dissonance and shock-induced pain, Sakai & Andow (1980) had subjects toss a die to enhance their sense of responsibility for the subsequent behavior that they engaged in.
E. Protocol pertaining to manipulation phase for Study 2.

(Read to subject:)

THE NEXT SERIES IS MORE STIMULI IN A MIXED UP ORDER.
BUT THIS TIME YOU MAY BE ASKED TO STATE A FALSE ATTITUDE
REGARDING THE PAIN EXPERIENCED.
WE'RE GOING TO SHOW YOUR TAPE TO STUDENTS LIKE YOURSELF WHO WILL
BE IN A SECOND STUDY.
THAT STUDY EXAMINES THE EFFECT THAT SEEING SOMEONE IN PAIN HAS ON
AN OBSERVER'S PAIN EXPERIENCE.

I CAN GIVE YOU A CHOICE HERE ABOUT WHICH CONDITION YOU'LL BE IN.
IN THE EXPERIMENTAL CONDITIONS, YOU'D BE ASKED TO SAY THAT THE
PAIN YOU'D EXPERIENCED WAS MORE OR LESS THAN WHAT YOU'D EXPECTED
IT TO BE.
IN THE CONTROL CONDITION, YOU'D BE ASKED TO SAY THAT THE PAIN WAS
ABOUT THE SAME AS WHAT YOU'D EXPECTED IT TO BE.
DO YOU WISH TO MAKE A CHOICE OR WOULD YOU LIKE TO LEAVE IT UP TO
CHANCE AND PICK A CONDITION FROM THIS BOX?
(pause)

OKAY, GO AHEAD AND PICK ONE FROM THE BOX.

WHAT THIS MEANS IS THAT AFTER THE NEXT SERIES, I'LL COME IN AND
ASK YOU 'HOW WAS THE PAIN THAT TIME?'
I'D LIKE YOU TO SAY:

(read off of statement sheet)

ARE YOU WILLING TO SAY THIS? (pause)
OKAY. GO AHEAD AND PRACTISE SAYING THIS OUT LOUD FOR ME.
F. Prepared Statements for Study 2.

The following statements were typed on separated strips of paper; half also had the negative consequences paragraph added (see below):

1. My pain was much worse than I'd expected. It really hurt a lot.
2. My pain was much less than I'd expected. It really didn't hurt much.
3. My pain was about the same as I'd expected. It felt about the same.

The negative consequences manipulation was an additional paragraph on the prepared statement sheet which explained that students who view the videotape would experience worse pain due to a particular effect relevant to the statement condition.

1. Subjects in the "pain worse" condition read:

**Expectation effect:** As you know, one's expectations are powerful predictors of what one experiences. Subjects who see you say that you're in a lot of pain will expect to feel a lot of pain, too. As a result, they'll feel more pain after viewing your videotape.

2. Subjects in the "pain less" condition read:

**Surprise effect:** As you know, when one is emotionally aroused, one becomes more physically aroused and thus more sensitive to pain. After seeing you say that you're in little or no pain, subjects will be unpleasantly surprised during their shocks and they'll become emotionally aroused. As a result, they'll feel more pain after viewing your videotape.

3. Subjects in the "pain same" condition read:

**Empathy effect:** As you know, when one is emotionally aroused, one becomes more physically aroused and thus more sensitive to pain. Subjects who see you say that you're in pain will be very distressed and emotionally aroused. As a result, they'll feel more pain after viewing your videotape.
G. Post-Experimental Questionnaire: Study 1

Your answers to the following questions will help us to evaluate this study; all answers will be kept confidential. Please answer each question carefully and honestly. Circle the appropriate number or write your answer for each question.

1. In your own words, please state what you think the purpose(s) of this study was.

2. How responsible do you feel for any negative consequences (e.g., not getting hired) that might occur to the trainees who view your videotape?

   1...2...3...4...5...6...7
   not at all       very responsible

3. How responsible is the research team for any negative consequences (e.g., not getting hired) that might occur to the trainees who view your videotape?

   1...2...3...4...5...6...7
   not at all       very responsible

4. How responsible are the student data coders themselves for any negative consequences (e.g., not getting hired) that might occur to them?

   1...2...3...4...5...6...7
   not at all       very responsible
5. If you were asked to change your facial expression, please answer these questions:

   a. How uncomfortable did you feel about misleading data coders in training?

       1...2...3...4...5...6...7

       not at all   very uncomfortable

   b. How did you go about changing your facial expression?

   c. Did this seem to alter your experience of pain?

   d. If so, how was your pain experience altered?
H. Post-Experimental Questionnaire: Study 2

Please answer the following questions. Some are repeated from the earlier questionnaire.

1. In your own words, please state what you think the purpose(s) of this study was.

2. On average, how much did you dislike the shock stimuli?

1...2...3...4...5...6...7

didn't mind it  strongly disliked it

3. How responsible do you feel for any negative consequences (e.g., more sensitive to pain) that might occur to the students who view your videotape?

1...2...3...4...5...6...7

not at all  very responsible

4. If you were asked to lie about your pain experience, please answer these questions:

   a. How uncomfortable or guilty did you feel about telling a lie?

      1...2...3...4...5...6...7

      not at all  very uncomfortable

   b. Did lying about your pain seem to alter your experience of pain?

   c. If so, how was your pain experience altered?
I. Debriefing: Study 1

Study: Self-deception as a Source of Incongruous Pain Display
Dr. Kenneth D. Craig & Delphin Swalm
Department of Psychology, UBC

Thank-you very much for participating in this study. Your contribution to our understanding of pain will hopefully lead to better understanding of and treatments for pain patients.

In addition to the reasons outlined earlier, this study was designed to examine the impact that "telling a lie" with the face has on subsequent pain responses. Some subjects exaggerate their facial response, others diminish it, while a third group does not change their facial expression. We expect the first two groups to experience more and less pain, respectively, as a result of this manipulation.

Furthermore, it is believed that when subjects are given a weak reason to deceive others (who in turn might be adversely affected), these subjects also deceive themselves. Past studies have shown that when people lie about their attitude on some issue, they come to believe their own lie, especially if they tell the lie to another student. We are attempting to generalize this finding to the pain domain. This process of self-deception is expected to change the pain response in the direction of the deceptive communication.

Actually, we do not presently plan to show your videotape to data coders in training, but only to trained data coders assigned to this research project. In general, most subjects comply with the experimenter's request to tell a lie, and so your compliance is perfectly normal.
The various questionnaires that you completed were designed to measure self-deception and other constructs that might be closely related (such as anxiety and coping strategies).

Finally, we are interested in how the face changes during and after deception; for that reason a trained coder will list the discrete movements in the face captured on videotape.

Since we will be asking some of your classmates or acquaintances to participate in this study, it is important that you avoid discussing this study's purpose with potential subjects. Thank-you very much for your cooperation. If you have any further questions about the study, please call the experimenter, Delphin Swalm, at 228-4927.

Now that you are aware of the true nature of the study, you may refuse to permit use of the videotape or other data without prejudice or loss of remuneration. Otherwise, please sign below to indicate your consent to permit our use of your videotape and other data.

Signature: ___________________________
J. Debriefing: Study 2

Debriefing: Study number 90-022
Title: Self-deception as a Source of Incongruous Pain Display
Dr. Kenneth D. Craig & Delphin Swalm, Dept. of Psychology, UBC

Thank-you very much for participating in this study. Your contribution to our understanding of pain will hopefully lead to better understanding of and treatments for pain patients.

In addition to the reasons outlined earlier, this study was designed to examine the impact that "telling a lie" about pain has on subsequent pain responses. Some subjects are asked to say they have more or less pain, while a third group says that they have about the same pain as before. We expect the first two groups to experience more and less pain, respectively, as a result of this manipulation.

Furthermore, it is believed that when subjects are given a weak reason to deceive others (who in turn might be adversely affected), these subjects also deceive themselves. Past studies have shown that when people lie about their attitude on some issue, they come to believe their own lie, especially if they tell the lie to another student. We are attempting to generalize this finding to the pain domain. This process of self-deception is expected to change the pain response in the direction of the deceptive communication. In general, most subjects comply with the experimenter's request to tell a lie, and so your compliance is perfectly normal.

Actually, we do not presently plan to show your videotape to other students, but only to trained data coders assigned to this research project. We are interested in how the face changes during and after deception; for that reason a trained coder will list the discrete movements in the faces captured on videotape.
The various questionnaires that you completed were designed to measure self-deception and other constructs that might be closely related (such as anxiety and coping strategies).

Since we will be asking some of your classmates or acquaintances to participate in this study, it is important that you avoid discussing this study's purpose with potential subjects. Thank-you very much for your cooperation. If you have any further questions about the study, please call the experimenter, Delphin Swalm, at 822-5280.

Now that you are aware of the true nature of the study, you may refuse to permit use of the videotape or other data without prejudice or loss of remuneration. Otherwise, please sign below to indicate your consent to permit our use of your videotape and other data.

Signature: _______________________________
K. Study 2. Manipulation phase questionnaire

Your answers to the following questions will help us to evaluate this study; all answers will be kept confidential. Please answer each question carefully and honestly. Circle the appropriate number or write your answer for each question.

1. Did you have a choice about making a statement regarding your pain experience? Yes..... No..... (tick off one)

2. How do you think viewing your videotape will affect other subjects?

3. How responsible do you feel for any negative consequences (e.g., more sensitive to pain) that might occur to the students who view your videotape?

1...2...3...4...5...6...7
not at all     very responsible

4. If you were asked to lie about your pain experience, please answer this question:

a. How uncomfortable or guilty do you feel about telling a lie?

1...2...3...4...5...6...7
not at all     very uncomfortable
L. Study 2: Simple interactive effects analyses for the Sensory Scale

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<th>Factor Held Constant</th>
<th>Other Factors</th>
<th>F ratio (df), p value</th>
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Newman-Keuls tests for Control X Intensity₃ X Time:

\[ \text{Time}_1 > \text{Time}_2 \text{ or Time}_3 \quad (p < .01) \]

cell
means:  73.75  58.3  54.05

Newman-Keuls tests for Control X Intensity₅ X Time:

\[ \text{Time}_1 > \text{Time}_2 \text{ or Time}_3 \quad (p < .01) \]

82.25  72.25  74.3

Newman-Keuls tests for Time₂ X Intensity₁ X Condition:

Exaggerate or Control > Diminish \((p < .01)\)

42.4  41.1  19.95

Newman-Keuls tests for Time₂ X Intensity₂ X Condition:

Exaggerate or Control > Diminish \((p < .01)\)

51.7  58.1  29.3
### M. Study 2: Simple interactive effects analyses for the Unpleasantness Scale

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Newman-Keuls tests for Control X Intensity\textsubscript{3} X Time:

\[ \text{Time}_1 > \text{Time}_2 \text{ or Time}_3 \ (p < .01) \]

\begin{tabular}{lll}
    & cell & means:  \\
\end{tabular}

\begin{tabular}{lll}
   & 65.55 & 50.55 & 44.75 \\
\end{tabular}

Newman-Keuls tests for Control X Intensity\textsubscript{4} X Time:

\[ \text{Time}_1 > \text{Time}_2 \text{ but not } \text{Time}_3 \ (p < .01) \]

\begin{tabular}{lll}
   & 71.6 & 61.25 & 65.4 \\
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Newman-Keuls tests for Control X Intensity\textsubscript{5} X Time:

\[ \text{Time}_1 > \text{Time}_2 \text{ or Time}_3 \ (p < .01) \]

\begin{tabular}{lll}
   & 76.95 & 65.6 & 67.45 \\
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Newman-Keuls tests for Time\textsubscript{2} X Intensity\textsubscript{2} X Condition:

\[ \text{Exaggerate or Control } > \text{Diminish } (p < .05; \text{n.s. @ } p < .01) \]

\begin{tabular}{lll}
   & 43.85 & 50.65 & 30.36 \\
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N. Study 2: ANOVAR Results with Self-Deception as a Grouping Variable (Sensory Pain Ratings) - Median Split Removing Middle 9 Subjects

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O. Study 2: ANOVAR Results with Anxiety as a Grouping Variable (Sensory Pain Ratings)
- Median Split Removing Middle 2 Subjects

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P. Study 2: ANOVAR Results with Catastrophizing as a Grouping Variable (Sensory Pain Ratings)  
- Median Split Removing No Subjects

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Q. Study 2: ANOVAR Results with Sense of Control as a Grouping Variable (Sensory Pain Ratings) - Median Split Removing One Middle Subject

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T. Multiple Regression Results Using Self-Deception as a Moderator Variable

Pretest Sensory Ratings (averaged for two lowest intensities), using Diminish (coded = 2) v. Control group (coded = 1):

Correlation Matrix

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Multiple Regression Results

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Manipulation Sensory Ratings (averaged for two lowest intensities), using Diminish (coded = 2) v. Control group (coded = 1):

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Multiple Regression Results

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