COGNITIVE STRATEGIES AND SOCIAL MODELING DETERMINANTS OF PAIN

by

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ABSTRACT

Research and clinical observation implicate cognitive and social influences as critical determinants of pain. The present experiment examined the impact of cognitive coping strategies and social modeling influences upon traditional measures of pain threshold and pain tolerance and Sensory Decision theory indices of sensory discriminability and response bias. Following pain pre-testing via cutaneous electrical stimulation, 60 female undergraduates were trained in one of three classes of cognitive strategies via verbal instruction or instruction by videotaped peer models. During post-assessment, half of each group was exposed to a pain-tolerant peer model. Ten subjects served as no-treatment controls. Analyses of pain threshold and pain tolerance data suggested that cognitive strategies may be potent variables in pain reduction. Directional focus of attention did not appear to be the critical determinant of their efficacy. Training in the use of spontaneously-generated strategies appeared to be as effective as instruction in attention-diversion or sensation-transformation strategies. Videotaped instructional modules appeared to be as viable as training by a therapist. The social modeling procedure enhanced the effects of cognitive strategies. Sensory Decision theory analyses revealed that tolerant modeling reduced discriminability at sensory detection levels, while discriminability effects were not evident at supra-pain-threshold levels. Response bias was not affected by the social influence procedure. No remarkable differences in discriminability or response bias were observed between cognitive strategy groups and

no-treatment controls, suggesting that effects of cognitive strategies may be primarily mediated through the motivational-affective dimension of pain. At sensory detection levels, cognitive strategy groups displayed differential discriminability under the two instructional modality conditions, suggesting that cognitive determinants may also affect sensory-discriminative aspects of pain. Cognitive and social influences were shown to have potent impact on pain response. Implications of these findings for theory and clinical practice were discussed.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

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INTRODUCTION

In recent years, pain and its control have been the focus of increasing concern in both clinical and laboratory settings. Pain, being a complex, multidimensional phenomenon, has received the attention of researchers in a wide variety of academic disciplines. Although clinicians have long been aware of the complexity of the human pain experience, the role of psychological variables in the perception and treatment of pain has only recently been subjected to systematic investigation. Diverse approaches to the modification of pain experience and behaviour such as hypnosis (e.g., Hilgard, 1969), suggestions of analgesia (Barber & Hahn, 1962), preparatory information (Bobey & Davidson, 1970; Neufeld & Davidson, 1974), operant conditioning (e.g., Fordyce, Fowler, & DeLateur, 1968), social modeling (e.g., Craig, 1975), and a variety of techniques termed "cognitive coping strategies" have provoked increasing interest (see Weisenberg, 1977, for a review).

Social Influences

Research and clinical observation from a variety of sources implicates cognitive and social influences as critical determinants of pain. Investigators have demonstrated social and ethnic differences in responses to experimentally induced pain among a wide variety of social groups (e.g., Sternbach & Tursky, 1965; Tursky & Sternbach, 1967). The existence of similarities in pain response among members of a particular social group suggests that socialization experiences play a critical role in determining pain behaviour (Craig, 1978b). Recent work with operant conditioning approaches to pain demonstrated that modification

of pain behaviour may occur as a result of alterations in the response of the social environment to pain displays (Fordyce, 1976).

Social modeling processes are considered to play a major role in the acquisition of styles of response to pain (Craig, 1978a, Fordyce, 1976). Recent reviews of social modeling influences on pain are available elsewhere (Craig, 1975, 1978b; Prkachin, 1978), thus the present review is restricted in this area to a summary of findings to date. Direct evidence that social modeling processes are active sources of pain modulation stems from systematic laboratory research. A series of studies has documented the impact of exposure to social models exhibiting relative tolerance or intolerance for painful electrical stimulation on pain threshold (Craig & Weiss, 1971, 1972; Craig, Best, & Reith, 1973; Craig, Best, & Ward, 1976; Craig, Best, & Best, 1978; Craig & Neidermayer, 1974), and on pain tolerance (Craig, 1978a; Craig & Best, 1977). Similar effects have been reported using different pain induction techniques, such as radiant heat and pressure pain (Neufeld & Davidson, 1971; Chaves & Barber, 1974). Evidence also suggests that autonomically-mediated responses are reduced as a function of exposure to pain-tolerant social models (Craig & Neidermayer, 1974; Craig & Prkachin, 1978). Further, the question of whether pain modulation which results from social influences may be mediated by fundamental alterations in sensory processes has been addressed.

Studies have demonstrated that the exponent of the power function, which relates stimulus intensity to sensation magnitude (Steven's 1975 power law), may be altered in psychophysical magnitude estimation tasks by exposing subjects to a pain-tolerant model (Craig, Best,

& Ward, 1975; Craig, 1978a), suggesting systematic alterations in fundamental qualities of the pain experience. Studies employing Sensory-Decision Theory (SDT) methodology have provided evidence consistent with the position that exposure to tolerant and intolerant social models produces alterations in sensory-discriminative aspects of pain. Craig and Coren (1975) demonstrated that exposure to an intolerant model was associated with enhanced discriminability as reflected by SDT parameters. Craig and Ward (Note 1) found that exposure to a tolerant model was associated with reduced discriminability as reflected by SDT parameters. Methodological criticisms of these two SDT studies (cf. Hall, 1977) were addressed by Craig and Prkachin (1978), who demonstrated that tolerant modeling reduced overall ability to discriminate stimulus intensity levels, and Prkachin (1978), who demonstrated that intolerant modeling resulted in enhanced discriminability at clearly noxious levels of stimulation.

Thus, social modeling has been shown to exert potent influences upon pain as measured by traditional pain threshold and tolerance measures, psychophysical power function analysis, psychophysiological parameters, and SDT measures of discriminability.

The potency and persistence of social modeling influences have not been directly investigated in a context wherein subjects exposed to noxious stimulation are concurrently engaged in specified cognitive activity designed to modulate painful experience. This situation would have direct implications for multimodal treatment approaches to pain which are currently receiving increasing attention (cf. Bonica, 1977).

Cognitive Strategies

Recent years have seen a growth of research concerning the use of cognitive strategies in the control of pain. This approach reflects the increasing concern of behavioural researchers and clinicians with cognitive events (cf. Meichenbaum, 1974; Mahoney, 1974) and the rising concern with central control processes in pain perception since the introduction of Gate Control Theory (Melzack & Wall, 1965; Melzack, 1977). According to the theory, "... cognitive activities such as anxiety, attention, and suggestion can influence pain by acting at the earliest levels of sensory transmission" (Melzack, 1973, pp. 199-200). Thus, cognitive activities may attenuate the pain experience by blocking transmission of sensory information at the spinal gate (sensory-discriminative dimension of pain), as well as affecting the cognitive-evaluative and motivational-affective dimensions. The theoretical suggestion that psychological processes may modify not only the interpretation of pain, but may also attenuate sensory activity before interpretation, has led to renewed interest in the potency of cognitive variables in pain modification. Before critically examining the research concerning cognitive strategies per se, a brief overview of converging lines of research concerning cognitive events and pain is in order.

The importance of cognitive variables in the treatment of pain has been highlighted by various lines of research. For example, one line of research concerning predictability/uncertainty of aversive stimulation in pain control indicated that subjects' perception of self-control results in most cases in elevated pain threshold (e.g., Staub,

Tursky, & Schwartz, 1971; Kanfer & Seidner, 1973). Davison and Valins' (1969) study of the effects of attribution is another case in point, showing that subjects who attributed increases in pain tolerance to their own efforts rather than to the effects of a drug, later exhibited greater tolerance. Investigations of the effects of preparatory communications, information, and rehearsal on subsequent pain measures (i.e., Bobey & Davidson, 1970; Johnson, 1973; Neufeld & Davidson, 1971), in addition to the study of hypnotic analgesia, further point to the importance of cognitive events in the manipulation of pain response.

Cognitive and motivational factors have been proposed as crucial variables accounting for the effects of hypnotic analgesia (e.g., Barber & Hahn, 1962). Although suggestions of analgesia following a hypnotic induction have been demonstrated to be effective in altering experimental pain threshold (e.g., Hilgard, 1969; Hilgard, Ruch, Lange, Lenox, Morgan, & Sachs, 1974), recent studies have suggested that a hypnotic induction may not be a necessary condition for the effectiveness of the suggestions (Barber & Hahn, 1962; Evans & Paul, 1970). Thus, cognitive variables which mediate the observed changes in behaviour (e.g., verbal report of pain) are currently being subjected to experimental scrutiny in their own right, outside the context of hypnosis research. As no hypnotic induction appears necessary, this has important implications for clinical treatment, especially within a self-management framework. A number of cognitive strategies to be reviewed were initially investigated within the context of hypnotic phenomena.

Recent research interest in such cognitive strategy procedures as "distraction" techniques may be traced back historically to research on

"audioanalgesia." Although Gardner and Licklider (1959) and Gardner, Licklider, and Weisz (1960) reported dramatic reductions in reported pain in clinical trials using white noise and stereophonic music, these results were not replicated in experimental studies of "audioanalgesia" (Melzack, Weisz, & Sprague, 1963). However, the suggestion was made that attention distraction might be a potent variable in pain reduction, especially in combination with other procedures such as relaxation techniques. Researchers to the present time have persisted in investigating the effects on pain of various procedures which use some form of distraction of attention in pain modulation.

Kanfer and Goldfoot (1966) studied the effects of distraction (also known as attention-diversion) on cold-pressor pain. The attention-diversion group (1), who viewed travel slides, endured pain significantly longer than control groups who received instructions either to use a clock to set themselves tolerance goals (group 2), to expect severe pain (3), or to verbalize their momentary experiences (group 4). Results also indicated significant differences in pain tolerance between control groups, with group 2 exhibiting greater tolerance than group 3, which in turn showed greater tolerance than group 4. The authors concluded that tolerance for noxious stimulation can be affected by providing subjects with a strategy, or set of controlling responses, to be utilized at their own discretion. Kanfer and Seidner (1973), invoking a Skinnerian self-control rationale, again utilized the viewing of travel slides as a distraction technique (or controlling response) during a cold-pressor test. Results indicated that the effectiveness of the distraction procedure (i.e., the self-controlling mechanism) was

greater when the distracting stimuli were controlled by the subject rather than the experimenter. Post-experimental questionnaires suggested that subjects used the slides to set tolerance goals and to actively engage in fantasy.

Barber and Cooper (1972) also studied similar distraction or attention-diversion procedures. However, their data appear to conflict with the findings of Kanfer and associates as discussed below. As Meichenbaum and Turk (1975) and Hall (1977) have noted, the pain literature is replete with apparently contradictory findings from studies concerning variables which are nominally similar, but which on close inspection reveal important methodological and definitional differences. Comparison of the Barber and Cooper and Kanfer and Goldfoot studies reveals several such differences. Barber and Cooper provided subjects with attention-diversion strategies (listening to a taped story, adding aloud, or counting aloud) and reported that the use of these strategies (listening and adding aloud, but not counting aloud) was only effective in reducing pain for a short period of time (less that one minute). If the pain continued for more than one minute, subjects tended to find the pain intolerable and distraction appeared to be ineffective in reducing it.

Thus, although both of these studies employed distractors as coping strategies, the results appear to be contradictory. Although both studies in question utilized cold-pressor pain, the Kanfer and Goldfoot (1966) study did not involve a pre-exposure to the stressor, whereas Barber and Cooper's (1972) study did. One important difference here was revealed by post-experimental responses to the latter study.

Subjects reported that they employed spontaneous coping strategies during the pre-exposure and would have preferred to employ their own strategies during the second exposure. (This finding was also reported by Chaves and Barber, 1974). Thus, instructions to use the provided distraction tasks might not have had as strong an effect as they would have had without a pretest. This seems especially important in light of Kanfer and Seidner's (1973) findings that subjects with control over distractors employed display greater pain tolerance. Furthermore, dependent measures used were quite different. Where Kanfer and Goldfoot use pain tolerance time, Barber and Cooper used subjective ratings of pain experienced after one and two minutes. Thus, subjects in the latter study knew in advance that they would undergo the stressor for two minutes, whereas subjects in the former study had no prior knowledge of pain duration. Furthermore, the relationship between tolerance time and subjective ratings of pain is not yet well understood. While both studies used female subjects, Kanfer et al. employed a male experimenter, whereas Barber et al. used a female. This may be an important factor in light of Bobey and Davidson's (1970) finding that a cognitive strategy (rehearsal) was more effective with a male experimenter than with a female experimenter using female subjects, indicating that some sort of social interaction took place. The importance of the social context in pain studies is underscored by the work of Craig and associates on social modeling effects (e.g., Craig, 1975). Although well-controlled studies on the effects of sex of experimenter in pain research remain to be done, results of the Bobey and Davidson (1970) study might lead one to predict greater efficacy of cognitive strategies in the Kanfer

and Goldfoot study than in the Barber-Cooper study, as was indeed the case. Where Kanfer and Goldfoot employed external, subject-controlled distractors, Barber and Cooper employed numerical counting tasks invdving no external distractors and a tape which subjects listened to passively (i.e., with no control over stimuli).

Such differences in methodology are frequently to be found in the pain literature, making generalizations across studies extremely difficult. However, until such time as universally accepted measures, stressors, and definitions exist, critical comparative scrutiny of nominally similar studies is a particularly imperative burden upon all researchers in the area. The foregoing comparison suggests that specific methodological differences may well account for Barber and Cooper's failure to demonstrate the efficacy of the attention-diversion strategy as had been indicated by the Kanfer and Goldfoot results.

Further research has examined the use of imagery (or "goal-directed fantasy") as a cognitive coping strategy. Chaves and Barber (1974), using pain induced by the Forgione-Barber pressure algometer, instructed subjects either to imagine pleasant events or to imagine the affected body part as being numb and insensitive ("imaginative transformation of pain", an attentional focussing technique). These strategies were contrasted to a no treatment control and a group instructed to expect a reduction in pain. Post-stimulation ratings of average pain experienced indicated that both cognitive strategies produced a significant reduction in pain compared to both control conditions. Although the pleasant imagery condition appeared to result in slightly greater reductions in verbal reports of pain than the second cognitive strategy,

these differences did not achieve statistical significance. The study also examined the use of experimenter modeling in instructing subjects and found that the procedure effectively reduced pain report for high pretest pain level subjects who imagined pleasant events. Chaves and Barber concluded that cognitive strategies produce a reduction in pain over and above that due to expectancies of pain reduction. This conclusion is consistent with Kanfer and Goldfoot's (1966) findings regarding use of external distractors, and extends them to cognitive events independent of external control. Certain aspects of Chaves and Barber's study deserve further investigation. As previously mentioned, the relation of post-stimulation ratings of average pain experienced during one minute intervals to traditional measures of pain threshold or tolerance in unclear. The lack of statistical significance with regard to the observed differences in pain report between the two cognitive strategies does not necessarily imply that they are equally effective coping techniques, especially considering the short (two minute) training period. Thus, although Chaves and Barber's (1974) study indicates the efficacy of the attention-diversion and attentional-focussing strategies in reduction of verbal report of pain, several specific questions remain to be answered. If directional focus of attention is a critical determinant of the efficacy of cognitive strategies, the observed superiority in pain reduction of the attention-diversion strategy over the attentional-focussing strategy might prove "significant" under a different experimental approach (e.g., a design employing threshold and/or tolerance measures, different analysis and design considerations, more detailed training procedures, and possibly

an alternate source of pain stimulation). Further, the use of more detailed procedures might be expected to elucidate the utility of modeling instruction in the use of strategies.

Spanos, Horton, and Chaves (1975), attempting to elucidate possible mechanisms of action of cognitive strategies, instructed subjects to either imagine a situation which, if real, would be incompatible with the experience of pain (the "relevant" strategy, from Barber & Hahn, 1962) or imagine a situation (not defined as pleasant) which was "irrelevant" to the pain situation. During the cold-pressor test, pain threshold was indicated by withdrawal at first experience of pain. Tolerance and subjective ratings of pain were not investigated. Results indicated that, for subjects with high pretest thresholds, use of the relevant strategy led to a greater threshold increase than the irrelevant strategy, which in turn led to a greater increase than the no-treatment control. No significant differences were observed for low pretest threshold subjects. Interestingly, when subjects were divided into high and low involvement groups (assessed by Likert-scale ratings of degree of involvement in imaginings), no significant strategy effect emerged. Analysis of involvement as a dependent variable indicated that high pretest threshold subjects achieved higher involvement in the strategies. Spanos et al. suggest that, since the strategies differed in efficacy but not in degree of eliciting involvement in imaginings, the superiority of the "relevant" strategy over the "irrelevant" strategy cannot be explained by a difference in the relative absorption of subjects' attention. They concluded that both the type of events imagined and degree of involvement in imaginings played a role in elevating

pain threshold. The problem of differential findings for high and low pretest threshold subjects was addressed by suggesting that the interval between onset of stimulation and pain threshold was too brief for low threshold subjects to become involved in the strategies. This contention was supported by the finding that high pretest threshold subjects had higher involvement scores. The findings of Spanos et al. (1975) are consistent with those of Chaves and Barber (1974). The additional finding of differential effects of the two strategies used was found only for high pretest threshold subjects, while an Involvement by Strategy ANOVA did not reveal a significant effect upon threshold for type of strategy. Thus, the theoretical impact of the observed strategy difference is unclear, although the need for further research on differential efficacy of various types of cognitive strategies is underscored.

The "relevant" strategy investigated in the Spanos et al. (1975) study was first investigated by Barber and Hahn (1962) in a study contrasting hypnotically-suggested and "waking-imagined" analgesia. High hypnotic suggestible subjects underwent the cold-pressor test either following a hypnotic induction or after being instructed to imagine that the water was pleasantly cool on a hot day ("waking-imagined" condition) or following no treatment. A further control consisted of no treatment and used water at toom temperature as the "stressor". Results indicated that hypnotic analgesia was no more effective than the cognitive strategy in attenuating pain as measured by verbal report of pain, muscle tension and respiratory irregularities, cardiac acceleration, and drop in skin resistence. This study was a major

impetus for research on cognitive strategies in the modification of pain response outside the context of hypnosis research. Blitz and Dinnerstein (1971), also using the cold-pressor test, found that subjects using the above strategy, as well as subjects instructed to focus on the experience of cold, spent a longer time to first report pain than did control subjects. Spanos, Barber, and Lang (1974), using the Forgione-Barber strain guage, replicated Barber and Hahn's (1962) findings regarding the equivalence of hypnotic and imaginal analgesia, using a different "imaginative transformation of pain" strategy which involved imagining insensitivity of the stimulated body part. Neufeld (1970) reported that use of a similar cognitive strategy (reinterpreting the pain as pleasurable) increased tolerance to radiant heat pain. Thus, the results of the five studies reviewed above indicate the efficacy of the "imagined transformation of pain" strategy in modification of the pain response. All variations of this strategy type employed the focussing of attention toward the source of pain, while concurrently transforming or reinterpreting the experience ("attentional-focussing").

In line with the foregoing concern with imagery techniques, Horan and Dellinger (1974) undertook a preliminary study of "emotive imagery." This procedure, which attempts to produce feelings of pride and self-assertion incompatible with anxiety, was effective in increasing pain tolerance to the cold-pressor test in comparison with control procedures. In a follow-up of this investigation, Westcott and Horan (1977) examined the influence of neutral imagery, anger emotive imagery, and relaxation emotive imagery conditions on cold-pressor pain. Use of imagery

was facilitated by means of tape recordings played during the test which followed imagery training. Analyses indicated no significant differences within the male sample, although males exhibited greater tolerance than females. For females, only the anger emotive imagery condition was significantly different from controls, with females in this condition exhibiting greater tolerance times than those who underwent other conditions. This recent approach seems intriguing despite the lack of "dramatic" results, in that it attempts to manipulate motivational-affective dimensions of the pain experience not specifically addressed by the imagery techniques thus far reviewed.

Grimm and Kanfer (1976) investigated the relative effects of cognitive strategies ("verbal/symbolic respnses"), brief relaxation training, and subjects' expectancies of decreased discomfort , on tolerance duration, heart-rate, and verbal reports of discomfort, utilizing cold-pressor pain. The cognitive strategy was attention-diversion via the use of pleasant imagery. Results indicated that tolerance increased significantly only for the verbal/symbolic group. Significant decreases in heart-rate were also obtained for the cognitive strategy condition, as well as for the relaxation condition, while self-report data indicated significant decreases in discomfort ratings for both of these conditions. Thus, only the subjects who had a specific set of controlling responses exhibited decreases in discomfort and associated physiological changes. Results are consistent with those thus far reviewed. Grimm and Kanfer suggest that covert symbolic activity and the content of such activity play "critical roles" in modification of pain responses, although the role of the specific content of such

activity remains unclear.

In contrast to the detailed examination of specific cognitive strategies, another more recent line of research has employed what has been termed the "smorgasbord" approach, in the attempt to develop viable "treatment packages" for the modification of pain. This approach is characterized by the provision of multiple cognitive strategies that the trainee is encouraged to sample. Turk (1975; see also Meichenbaum & Turk, 1975) employed "stress-inoculation training" in a study utilizing ischemic pain. Their package commenced with an "educational phase", during which Melzack and Wall's (1965) Gate Control theory was described in a simplified form. The three major aspects of pain dealt with by the theory (i.e., sensory-discriminative, motivational-affective, and cognitive-evaluative) were discussed, following which it was emphasized that in coping with pain, it is necessary to deal with each aspect of the pain experience. In the next phase, coping techniques were described which would deal with each aspect of pain experiences as per the Gate Control model. Subjects were instructed to control sensory input or sensory-discriminative aspects by use of relaxation and deep breathing; to control motivational-affective components by use of cognitive strategies such as attention-diversion, imagining pleasant events, and imaginative transformation of pain; and to deal with the cognitive-evaluative component by conceptualizing the painful experience as consisting of several phases: preparing for the stressor, confronting it, coping with thoughts and feelings at critical moments by use of self-instruction and self-reinforcement for coping by self-statements. The "application phase"

consisted of imagery rehearsal and role-playing. This entire training procedure was carried out in a one-hour session.

Tolerance time was significantly greater in post-assessment than pre-assessment, while verbal reports of pain intensity decreased. An attention-placebo control group exhibited no significant pre-post changes.

The approach of offering subjects a range of coping skills for pain seems promising as a treatment approach, although larger-scale studies utilizing alternate measures and stressors, as well as controlled clinical trials are needed. As a research strategy, the study does not enable the determination of which of the eight subjects used which strategies, for how long, etc. -- in other words, which components of the package are necessary or sufficient for treatment efficacy. Perhaps the actual process of switching strategies at critical moments and the sheer number of strategies available to the subject are important factors in increasing tolerance and sense of control. Meichenbaum and Turk (1975) note that subjects may prefer to use their own spontaneous strategies rather than instructed ones. The notion of a treatment "package" should give the subject ample room for choice and development of attributions of self-control.

The cognitive theory of self-control offered by Meichenbaum and Turk in accounting for the mechanisms underlying "stress-inoculation training" fits well with Kanfer's (1975) conceptualization of the self-regulatory process. According to Meichenbaum the process of self-control involves a three-stage process wherein the client: (1) becomes aware of maladaptive behaviours; (2) emits incompatible thoughts and behaviours;

and (3) determines persistence and generalization of treatment effects via the nature and content of the client's "internal dialogue" and images about behaviour change.

A variation of the "smorgasbord" approach was presented by Scott and Barber (1977) who reported an investigation involving cold pain and pressure pain. Groups utilizing multiple (5) cognitive strategies, a single strategy, and a control group were employed. The "package" consisted of (1) attempting not to be bothered by the pain, (2) concentrating on pleasant events, (3) dissociating from pain, (4) reinterpreting stimulation as not painful, (5) imagining numbness and insensitivity. The instructions for use of the strategies were presented either via "long" (3 minute) or "brief" (45 seconds) instructions. (In considering these packages as possible treatment approaches, it would seem that both of these forms of training are "brief.") Data indicated that both package treatments (brief vs. long) resulted in significantly greater tolerance times than the control condition, with the single strategy resulting in tolerance levels which did not differ significantly from those in the control or combined conditions. The "brief" and "long" instruction conditions did not differ. No significant differences were found for any treatment on ratings of pain or distress. Given the very short training phase in this study, it is difficult to postulate to what extent subjects mastered the strategies.

The lack of significant findings for pain intensity and distress ratings is intriguing in light of the significant tolerance changes. This is consistent with the results of Kanfer and Goldfoot (1966), Kanfer and Seidner (1973), and Turk (1975) which indicated significant

tolerance changes, but not significant pain rating changes. Also, cognitive strategies did reduce pain ratings in the studies of Barber and Hahn (1962), Chaves and Barber (1974), Evans and Paul (1970), and Spanos et al. (1974). However, these studies did not include pain tolerance as a variable in that all subjects were exposed to the pain stimulus for a constant period. Scott and Barber offer a possible explanation for this phenomenon -- that subjects "find it difficult to succeed at both tasks simultaneously" (i.e., raising tolerance and experiencing less pain). This suggestion appears to make little theoretical, logical, or semantic sense. As Blitz and Dinnerstein (1968) have noted, pain tolerance has in the past been thought to be determined largely by psychological variables, whereas threshold or ratings of pain intensity were thought to be determined largely by physiological variables. They demonstrated that appropriate instructions can elevate threshold and tolerance, and introduced the notion of altering criteria for use of the verbal response "pain" (response bias) as opposed to altering sensory aspects of pain. These notions were invoked prior to the current use of Sensory Decision Theory (SDT) methods, which have been applied to pain research in recent years to specifically address the issue of response bias versus sensory changes as reflected by alterations in verbal report of pain.

In reviewing the use of cognitive strategies in the modification of the pain response, several methodological inconsistencies and inadequacies were evident which restrict generalizability. However, despite use of varied stressors, measures, designs, and strategies, certain consistencies emerge. Supplying subjects with coping

strategies which involve engaging in a cognitive task can reduce the amount of pain reported and increase ability to tolerate pain. Cognitive tasks involving the use of imagery or goal-directed fantasy appear to be consistently effective, as does reinterpretation or transformation of sensations in a manner inconsistent with the experience of pain. The content of the imaginings and degree of involvement in them appear to be important factors, although further research is needed to clarify the role of these variables. Several studies have suggested that spontaneously generated cognitive coping strategies may be preferable to instructed ones. Research efforts need to be directed toward elucidation of mechanisms of action of those cognitive strategies which have been efficacious in the laboratory. Sophisticated theory in this regard is notably absent. A logical step in this direction would be to address the question of which aspects of the pain experience are critically affected by cognitive strategies.

Recently, Sensory Decision Theory methodology has been applied to pain research in the attempt to elucidate changes which are reflected by traditional pain threshold and pain tolerance measures. Clark (1969), in reporting the first application of SDT methods to pain research, argued that changes in verbal report of pain may reflect changes in sensory processes such that actual perception of stimuli have changed, or the verbal changes may reflect changes in decision-making processes such that the criteria for emiting the verbal label "pain" have changed. SDT methodology, based on probability theory, attempts to assess these two aspects of performance as reflected by measures of sensory discriminability and response bias. Recent comprehensive

expositions of SDT methodology in pain research and reviews of findings of pain modulation studies employing SDT procedures are available elsewhere (Chapman, 1977; Clark, 1969; Hall, 1977; Lloyd & Appel, 1976; Prkachin, 1978; Rollman, 1977). Recent debate on SDT methods in pain research (cf. Chapman, 1977; Hall, 1977; Rollman, 1977) has raised the point that the discriminability (or sensitivity) parameter and response bias parameter should not be directly equated with physiological and psychological processes, respectively. Rather, the SDT approach should be used as a probability model for perception and decision making which can be effectively employed in separating discriminative capabilities and decision processes in relation to pain.

To date, the SDT approach has been used to assess such diverse interventions as acupuncture (e.g., Clark & Yang, 1974; Chapman, Gehrig, & Wilson, 1975), placebos (e.g., Clark, 1969; Feather, Chapman, & Fisher, 1972), 33% nitrous oxide (Chapman, Murphy, & Butler, 1973), diazepam (Chapman & Feather, 1973), and social modeling procedures (e.g., Craig & Coren, 1975; Craig & Ward, Note 1; Craig & Prkachin, 1978), among others. However, the approach has not been applied to cognitive strategies as reviewed herein. Clark and Goodman (1974) did apply SDT methodology in an investigation of the effects of instruction and suggestion on pain threshold and tolerance. Clark and Goodman found changes in response bias, but not discriminability, which were associated with pain threshold and tolerance changes following suggestions designed to raise threshold and tolerance levels. They concluded that pain threshold and pain tolerance changes produced by "cognitive control" techniques, such as distraction and hypnosis,

"merely reflect changes in the criterion for reporting pain." The authors note that SDT has not been used to test Melzack and Wall's (1965) suggestion that cognitive variables may act through a central control mechanism to close the "pain gate." They further acknowledge that clinical pain is readily influenced by focus of attention, meaning and expectation, and that diversion of the focus of attention away from pain sensation may produce analgesic effects, although SDT procedures have not yet addressed this question specifically.

The present study addresses these issues by employing SDT methodology in an experimental investigation of the effects of cognitive strategies on the human pain response. The two major classes of cognitive strategies, attentional-diversion and attentional-focussing, are investigated utilizing training procedures which are more detailed than those used in previous studies (cf. Chaves & Barber, 1974; Spanos et al., 1975), in an attempt to elucidate effects on traditional and SDT measures of pain suggested by previous work. The study also incorporates the use of spontaneous coping strategies to investigate suggestions from several sources that the use of spontaneous strategies may be preferable to instructed strategies provided by the experimenter. Further, in accord with interest on social modeling effects, the cognitive strategy training is presented via both verbal and modeling instruction. In contrast to the procedures reported by Chaves and Barber (1974), the modeling instructional modality involves considerable detail and utilizes peer models, in an attempt to elucidate the differential efficacy of the modalities as suggested by these authors. The study also incorporates the tolerant modeling paradigm investigated

by Craig and associates, in order to systematically examine the potency and persistence of social influences on pain while subjects are actively engaged in utilizing cognitive strategies. The notion that social experiences have persistent effects on behaviour, throughout the human development lifespan, would lead to the prediction that the social influence procedure should lead to potent effects on pain response which persist while subjects are actively engaged in cognitive strategies. The effects of social influence should enhance previously reported effects of cognitive strategies on pain response.

METHOD

Subjects

Subjects were paid, undergraduate female volunteers from introductory psychology courses at the University of British Columbia who were contacted by phone and requested to participate in an experiment on perception. Of 81 subjects who arrived at the laboratory, 5 declined to participate after description of the experiment, 3 withdrew during the first session, and 3 declined to return for the second session. Each of the 70 subjects who participated was randomly assigned to one of the 13 conditions of the experiment.

Apparatus

Electric currents of 0.5 seconds duration were delivered by a 60-Hertz Controlled Current Electrostimulator (Lafayette Instrument Co., Model A-6158). Shock durations were controlled by a Hunter Decade Interval Timer. Electrical stimulation was delivered to the volar surface of the left forearm via concentric annular electrodes (Tursky, Watson, & O'Connell, 1965).

During pain testing subjects were seated in an experimental chamber which contained the stimulation equipment. Subjects were seated in front of a table with a wooden screen blocking their view of the experimenter (CHG). To subjects' right was another wooden screen which blocked their view of the model in Session II.

During training in the various coping strategies and their associated control conditions, subjects were seen in a separate laboratory, located in the same building. Videotapes for the modeling instructional

modality were presented on a Sony Model CVM-110UA video monitor via a Sony Model AV-3400 videotape playback unit.

Procedure

Subjects participated in two pain testing sessions approximately two weeks apart. Both pain testing sessions were conducted using identical procedures by the same female experimenter. Prior to their participation in the second pain assessment session, subjects assigned to the experimental manipulations were seen by a second (male) experimenter (HBG) who directed training sessions in the use of cognitive control strategies. These sessions were approximately one hour in duration.

Session I: Pain Pretesting. Subjects were greeted at the laboratory by the experimenter. Prior to undergoing pretesting, subjects completed the S-R Inventory of General Trait Anxiety (Endler & Okada, 1974, see Appendix A) and the Subjective Stress Scale (SSS, Neufeld & Davidson, 1971, see Appendix A). Upon completing the questionnaires, a preliminary set of instructions that described the general nature of the experiment was read and subjects were informed of their right to withdraw from the experiment. Five did so. Following the signing of an informed consent form (see Appendix A), subjects were escorted to the experimental chamber where the following set of instructions was read:

> You will be presented with a series of low level currents which will start at undetectable levels and will gradually increase in intensity. We want you to indicate how uncomfortable each momentary shock feels by assigning it a number which corresponds to a category on the card in front of you.

Subjects were then shown a card which depicted a 7-point category scale

on which the following points were given: (1) undetectable, (2) possible sensation, (3) pre-pain sensation, (4) very faint pain, (5) mild pain, (6) moderate pain, (7) strong pain. (This scale was an adaptation of a scale employed by Chapman, Gehrig, & Wilson, 1976.)

The instructions continued as follows:

> Take a close look at the card for we want you to learn which number corresponds with which level as soon as you can. A rating of "2" would be used to indicate that you can <u>just</u> detect the shock, while "3" indicates that you can definitely feel the shock, but it is not yet painful. Use the number "4" to indicate that level of shock which you would first label as "painful". Higher ratings should reflect increases in physical discomfort, and you will eventually reach a level of shock where you would like to stop. We want you to go on taking shocks for as long as possible after you have reached this level, until you feel you <u>must</u> stop. At that point, pull the switch in front of you and the electrode will be disconnected.

(The above aspect of the instructions was fashioned after Hilgard et al., 1971.)

> After each presentation you should call out the number you choose using only whole numbers. Remember that you are to evaluate the relative discomfort you feel with each subsequent shock. You may use any number as many times as you want but you need not use all the numbers on the scale.

The experimenter then verified that the subject understood the instructions. Following this, the subject's left arm was abraded with Redux electrode paste and the electrode positioned on the arm at a point where the resistance in the skin-electrode circuit was 5,000 ohms, to insure uniformity of stimulus strength (Tursky & Watson, 1964). The pain pretesting session then began. Subjects were exposed to two ascending series according to the psychophysical method of limits.

Shock intensities started at 0.0 milliamperes (mA) and increased in 0.5 mA steps until the subject indicated that she did not wish to accept any further stimuli.

Following the two ascending series subjects were given instructions for the random (signal detection) series:

> Now for the next part of the experiment I'm going to present you with a random series of shocks. None of these shocks will be higher than those you've just accepted and you should rate them just as you did in the ascending series. This series takes a little while so just be patient and we'll work our way through it.

The signal detection series consisted of 20 presentations each of 7 shock levels in a random order. The shock levels were selected in order to represent pairs of low, medium, and high intensities, and a zero stimulus. The low pair was selected as the mean current intensity first given a rating of "2" in the two ascending series and that level minus 0.25 mA. The medium pair was chosen as the mean current first given a rating of "4" (very faint pain) during the two ascending series and that level minus 0.25 mA. The high pair was chosen as the mean current first given a rating of "7" (strong pain) during the two ascending series and that level minus 0.25 mA.

Following the completion of pain pretesting, subjects completed the SSS for a second time and were administered the adjective checklist portion of the McGill Pain Questionnaire (MPQ, Melzack & Torgerson, 1971; Melzack, 1975; see Appendix A) with instructions to rate the highest shock accepted.

Following Session I, subjects were randomly assigned to one of the 13 conditions of the experiment. Sixty subjects were assigned to one of

12 cells which may be conceptualized as the cells of a 3 x 2 x 2 factorial design (Winer, 1971, p. 452) with cognitive strategies (3 levels), instructional modality (2 levels), and modeling (2 levels) representing the manipulated variables. In addition, 10 subjects were assigned to a no-treatment control condition which represents a cell in addition to the factorial design (cf. Himmelfarb, 1975).

Session II: Training Phase. In accordance with the theoretical issues outlined in the introduction, training programmes were designed in order to train subjects in the use of three general classes of cognitive control strategies. This training was conducted during the initial portion of Session II and varied in one of two instructional modalities as discussed below.

The three classes of strategies subjects were trained to employ were: (1) attention directed away from the source of pain (attentional diversion, AD), (2) attention directed toward the source of pain (attentional focussing, AF), and (3) spontaneously generated strategies (spontaneous strategies, SS).

Training in these strategies varied according to which instructional modality condition subjects fell into (i.e., verbal instruction (VI) or instruction via videotaped models (modeling instructions, MI)). During all training conditions, subjects were provided with the same experimental rationale and opportunity for rehearsal of strategies. Number of examples per strategy condition was balanced across all groups. All training sessions were one hour in duration.

Subjects arrived at the laboratory, were greeted by the experimenter, and asked to take a seat. Prior to instruction in cognitive strategies,

subjects were provided with a rationale for the procedures and a brief history of experiences with pain or discomfort was obtained. This procedure was standardized across all conditions as follows.

> I'd like to start off by giving you a bit of the rationale behind our research and then we'll proceed with this phase of the study. When we're finished here, I'll direct you to the lab where you were last time. OK? ... Let me tell you a bit about this research. This particular study is one in a series of studies in a research programme which has been ongoing at UBC for several years. The ultimate aim of the research is the development of techniques to be used with clinical populations -- people who experience chronic pain -- such as certain arthritic conditions, low back pain, prolonged surgical pain and so on.
>
> The management of pain constitutes a serious clinical problem, not only because it is a distressing experience, but also because continued pain has been demonstrated to have a harmful action upon such vital organs as the kidneys and heart. Indeed, pain has been shown characteristically to set off a variety of reaction patterns within the body which have been interpreted as protective -- but when such bodily changes are sustained over long periods of time, they may themselves lead to significant impairment of function or perhaps actual tissue damage. Thus, it seems likely that pain may irritate or perpetuate a biologically destructive process.
>
> For such reasons, the investigation of people's reactions to painful stimulation is an important concern to us here. Our research is aimed at helping people acquire skills that will help them to cope effectively with painful, unpleasant experiences. In this particular study, we are interested in the way people cope with pain or discomfort and in the way people's coping strategies can actually affect their perceptions.
>
> So today, I'd like to start off by discussing with you what types of experiences you have had with pain or discomfort. Then we will proceed to some training and rehearsal of coping strategies. Why don't we start off by you telling me something about your experiences with physical discomfort.

(Underscored segments were adapted from Turk, 1975.)

At this point, a brief history was taken in a standard clinical interview format (cf. MacKinnon & Michels, 1971). Following this standard introduction, subjects were introduced to the cognitive strategies and engaged in rehearsal.

A. Verbal Instructions (VI)

1. Cognitive Strategy I (CSI): Attentional Diversion (AD)

> Most people, when they undergo a painful experience, attempt to reduce the discomfort in some manner. We are interested in evaluating the effectiveness of various coping strategies that people have developed. For example, if you hit your thumb with a hammer, you might try to cope with the discomfort by screaming, by tensing your muscles or by altering the way you appraise the experience. Research indicates that an effective way to cope with discomfort is to direct attention away from its source. Can you think of any way that you have done this in the past or might be able to so this? ....
>
> One way you might redirect your attention is by imagining vividly a pleasant scene which, if real, would be incompatible with the experience of pain. In other words, imagining yourself being in a very pleasant situation -- rather than being in the situation involving discomfort. You would avoid thinking about the discomfort and attempt to involve yourself in a pleasant scene.
>
> Let me give you some examples of situations that other people have imagined in order to cope with their discomfort. I'd like you to attempt to use these strategies when you enter the lab in a while. One thing you might try would be to imagine yourself lying on a sandy beach, on a bright sunny day with blue skies, warm breezes, the smell of fresh salt air and sounds of the waves lapping on the shore. If you sit back, and concentrate on that image, you can construct a vivid fantasy and being to experience that scene in great detail. I'd like you to do that right now; sit back, close your eyes, and imagine yourself on that beach. Try to get the image as vividly as you can. Do you have the image clearly? Just persist in imagining that scene. You can make it more vivid by trying to imagine all the sensations that you might feel in that situation. Imagine the brightness and the colours of the sky. The blues of the sky, the brightness of the sun. Imagine the sea breeze blowing across your skin,

imagine its warmth and gentleness. Pay attention to the sounds you might hear. Listen for the sound of the waves, the calls of sea birds. Imagine the feeling of the sand beneath you. Just work on that fantasy for a moment ... Try to elaborate the fantasy. Add elements to the scene: people walking by, playing games on the beach, and so on.

(Stop; query.)

O.K. So now you're beginning to get an idea of how to develop a distracting fantasy. Now, why don't you try that scene again and <u>try to describe to me</u> the details of the scene, using as many elements as you can. Try for clear, vivid images in which are are as involved as possible.

(Draw out detail. Ten to fifteen minutes of detail and rehearsal.)

O.K. Good. Did you feel that you were able to get quite involved in the scene? _____

Now, let's try another scene. This time, try to imagine yourself at a pleasant party which you have attended. OK, close your eyes and try to picture yourself in the midst of the party -- the sounds of the music playing, the people talking -- try to picture the people vividly -- what they're saying, how they look, their gestures, their laughter, and the different conversations taking place. Put yourself right into the picture -- talking, dancing, drinking, or whichever activities you find pleasant at the party. Let yourself become really involved in the party scene. Try to feel all the different sensations -- what you feel, what you see, what you smell, what you taste. Just work on this fantasy for a moment ...

No, why don't you try to describe your scene to me as you continue to elaborate it, giving as much detail as possible ...

(Ten to fifteen minutes of detail and rehearsal.)

OK, good. You seem to be getting the idea. Do you have any questions so far? ...

Now, let me suggest one more scene. Close your eyes and picture yourself in your favourite restaurant -- perhaps a restaurant you have visited on a special occasion. Close your eyes, and picture yourself seated at the table -- noticing the plate and the cutlery, the tablecloth, the surrounding tables, the other people in

the restaurant -- noticing the waiter or waitress approaching the table. Noticing your companion or group at your table. Try for details -- notice the food as it is brought to the table -- the way it looks and smells -- try to taste it and imagine your sensations as vividly as you can. Imagine what you are drinking, noticing the taste and feeling. Get yourself right into the scene -- Now, continuing in the scene, tell me some of the details of what you are experinecing -- try to really get into as much detail as possible ...

(Ten to fifteen minutes of detail and rehearsal.)

OK, good. You seem to be really getting into it. All right, you seem to have mastered the technique. Now could you tell me in your own words, what the essential principles of these techniques are? ...

2. Cognitive Strategy II (CSII): Attentional Focussing (AF)

Most people, when they undergo a painful experience, attempt to reduce the discomfort in some manner. We are interested in evaluating the effectiveness of various coping strategies that people use. For example, if you hit your thumb with a hammer, you might try to cope with the discomfort by screaming, by tensing your muscles, or by altering the way you appraise the experience. Research indicates that an effective way to cope with discomfort is to direct your attention towards its source, while at the same time using your imagination to transform the sensation into something different.

One way you might transform the sensations would be to acknowledge the experimentally induced sensations, but at the same time transforming or interpreting these sensations as trivial, unreal, or different in some way. In other words, imagining that the sensations you feel are somehow changed so that they are less bothersome.

Let me give you some examples of ways that other people have used this 'sensation transformation' strategy in order to cope with their discomfort. I'd like you to attempt to use these strategies when you enter the lab in a while. One thing you might try would be to imagine that your arm has been injected with Novocaine, or some kind of anesthetic -- thus, your arm would feel numb and insensitive and while you might still feel some sensations -- the unpleasantness of those sensations would be greatly reduced.

If you sit back and concentrate on that image, you can construct a vivid fantasy and begin to experience the effects of the Novacaine in detail. I'd like you to do that right how -- sit back, close your eyes, and imagine that your arm has just been injected with anesthetic and is beginning to become numb. Try to experience this as vividly as you can. Perhaps you can begin to feel a slight tingling sensation. Can you begin to experience this? Just persist in trying to imagine your arm becoming numb and insensitive. You can make it more vivid by trying to imagine all the characteristics of feeling the effects of anesthetic. Perhaps you can remember the feelings when you received Novocaine at the dentist's. Perhaps your arm might feel heavy, difficult to move and might begin to feel cold or warm or tingling. Just try to imagine this process as vividly as you can. Why don't you try to describe to me the details of this process as you try to imagine it as vividly as you can. Try for as much involvement in the imaginings as you can.

(Draw out detail ... ten to fifteen minutes of detail and rehearsal.)

O.K., good. Did you feel that you were able to get quite involved in the imaginary process? _____

Now. let's try another technique. This time, try to imagine that your arm is insensitive by imagining that your arm has turned to some inert substance, such as rubber. If your arm was made of rubber, it would have no feelings -- you would feel no sensations.

I'd like you to sit back right now, close your eyes and imagine that your arm has turned to rubber. Try to experience this as vividly as you can. Just persist in trying to imagine this. Try for detail. Imagine the colour and the texture of the rubber. Imagine that your whole arm is rubber -- no nerves, no bones, no muscles. Thus your arm is inert -- it doesn't move, it doesn't feel sensations. Perhaps your arm feels heavy and 'rubbery'. Just try to imagine this as vividly as you can. Why don't you try to describe the details of this process as you try for as much involvement in the imaginings as you can.

(Draw details ... ten to fifteen minutes of detail and rehearsal.)

O.K., good. Were you able to get involved in the imagery process?

All right. Now let me suggest one more technique. All right, close your eyes and imagine that you are in a hospital and are about to receive a medical treatment to alleviate a problem that has been bothersome to you. For example, you might imagine that you are about to receive acupuncture -- a treatment which would involve sensations in your forearm. These sensations will be beneficial for your problem condition. Try to experience this situation as vividly as you can. You should interpret the sensations as beneficial, necessary treatment that will result in a desirable outcome in the long run. In order to make the situation more realistic for you, imagine the hospital room and the nurses preparing you to receive your treatment. Imagine feeling a sensation in your forearm -- and interpret this sensation as the application of the acupuncture treatment. Now why don't you try to describe the details of this situation as you try for as much detail as possible.

(Draw detail ... ten to fifteen minutes rehearsal.)

All right, you seem to have mastered the techniques.

Now could you tell me, in your own words, what the essential principles of these techniques are?

3. Cognitive Strategy III (CSIII): Spontaneous Strategies (SS)

Most people, when they undergo a painful experience, attempt to reduce the pain in some manner. For example, if you hit your thumb with a hammer, you might try to cope with the pain by screaming, tensing your muscles, or by altering the way you appraise the experience. Research has indicated that most people have developed over the years a number of strategies of their own that allow them to effectively cope with discomfort. You have probably developed some strategies of your own. Can you think of any methods right now that you have used in the past to cope with discomfort?

(Discussion of past experiences -- ten to fifteen minutes.)

Can you think of any ways that might apply these types of strategies to the experimental situation which you underwent last time? Can you think of any way that you attempted to deal with the discomfort during that session?

(Draw detail -- five to ten minutes.)

> Why don't we take the first example you mentioned? What I'd like you to do, is to sit back right now and picture yourself in the experimental situation. I'd like you to describe to me how you would use this strategy of yours. (Draw detail.) OK, can you think of any way that you could modify or expand that strategy? (Draw detail. General discussion of the experience and coping with discomfort.)

At this point, in order to equate time across conditions, short passages regarding pain were read and discussed with the subject. (Excerpts from Melzack, 1975). Then, subjects were engaged in rehearsal of their strategies, as in the other strategy conditions, until the time checkpoint five minutes prior to pain assessment.

Five minutes prior to commencement of the second pain assessment, the following standard instructions were read:

> Remember, try to get as involved as possible in the imagery process. During the next phase of this study, you'll be presented with stimuli of various levels of discomfort in the same manner as last time and asked to rate the levels of discomfort which you experience. I'd like you to use this strategy during the presentation of the stimuli, so as to minimize the discomfort you experience. Now, during this next session, do not verbalize any details of your imagery during the study. We did that here only to ensure mastery of the technique. Try to keep as involved in the imagined scene as possible throughout the time during which you make ratings. In other words, I'd like you try for as much involvement and vividness in the imagined scene as you can -- throughout the entire phase of the study. Try to choose a scene and stick with it, but you may wish to switch scenes at some point. Do you have any questions so far? ...
>
> OK, in a minute I'll direct you to the lab where you will undergo the same procedure as you did last time. You will be asked to indicate how uncomfortable each momentary shock feels by assigning it a number -- just as you did last time. Cindy will briefly review the procedures when you get to the lab. (Pause.) You will be calling your ratings out loud. I'll ask you please NOT to discuss ANY details of our training session here, which we just completed, with Cindy or

with any other subjects who will be rating stimuli at the same time you are. It's a very important consideration in experimental methodology that other people in the study do not have knowledge of the strategy that you are using to cope with your discomfort. Do you have any questions so far? ...

OK, good. Now, to get to the lab (give directions to the lab). Please remember not to discuss this training session with either Cindy or the other person making ratings and try for as much involvement as possible in your strategy.

B. Modeling Instructions (MI)

Instructions were as follows for all modeling instruction conditions.

Most people, when they undergo a painful experience, attempt to reduce the discomfort in some manner. We are interested in evaluating the effectiveness of various coping strategies that people have developed.

Right now, I'm going to show you a videotape in which you will observe some examples of people verbalizing strategies for coping with the experimental situation. Please pay close attention to the examples, and afterwards I will ask you how you might apply such strategies to cope with the experimental situation.

(Twenty minutes -- play tape.)

Now that you've seen some examples of people using strategies to cope with the experimental situation, I'd like you to sit back down now, and close your eyes as if you were in the experimental situation. Take a minute or two, and think about what strategies YOU might use. Now, attempt to relate to me how you might better cope with the experimental situation. Try to tell me in as much detail as possible what strategy you are using. Go ahead, try it right now. (Draw detail.)

(Rehearsal approximately 25 minutes.)

Any questions? (Any particular portion of the tape you'd like to review?)

Instructions for CSIII condition were modified slightly as follows, since models did not verbalize their cognitions.

> Most people, when they undergo a painful experience, attempt to reduce the discomfort in some manner. We are interested in evaluating the effectiveness of various coping strategies that people have developed.
>
> Right now, I'm going to show you a videotape in which you will observe some examples of people demonstrating how they cope with the experimental situation. Please pay close attention to the examples, and afterwards I will ask you how you might better cope with the experimental situation.
>
> (Play tape.)
>
> Now, that you've seen ....

Five minutes prior to commencement of the second pain assessment, the standard instructions, described for verbal instruction conditions, were read.

1. Modeling Videotape Format

The videotapes were constructed to correspond with verbal instruction conditions. In each of the three strategy conditions, three different female models demonstrated the use of the same three strategy examples utilized in the corresponding verbal instruction condition. Models were fully crossed with conditions.

The models were depicted seated in the experimental chamber, receiving shocks via the identical apparatus employed during subjects' pain pretesting. In each condition, models verbalized ratings of the stimulus presentations according to a format derived from the ratings of one pilot subject. During the interval between presentations, models verbalized the cognitive strategies for that experimental condition. The tape for the CSIII condition (spontaneous strategies) depicted the same three models, in the same situation, verbalizing the same ratings. However, they did not verbalize their cognitive processes. Subjects

were informed that these models had already received training (e.g., elaboration and rehearsal of spontaneously generated strategies). Thus, all training videotapes were balanced for models used, number of series depicted, and time. All tapes were approximately twenty minutes in length. Immediately following the training session, all subjects completed the SSS.

C. No Treatment Control

Subjects in this condition received no training whatsoever. Session II consisted of the Pain Assessment Phase only.

Session II: Pain Assessment Phase. Following the training phase, subjects were directed to the testing laboratory for the final pain assessment phase.

During this phase the third independent variable (tolerant modeling vs. no tolerant modeling) was manipulated. Models were presented to the subjects as naive participants in the experiment. Tolerant models consistently assigned the shocks in the ascending series a lower scale rating than the subject. Models' ratings were determined by the following regimen.

Models commenced with a ratings of '1' and continued to rate '1' until one trial beyond the point that the subject gave a rating of '3'. At this point, the model gave a rating of '2' and continued to rate '2' until one trial following the subject's advancement to a rating of '4'. The model continued to respond in this fashion until the subject terminated, at which point the model gave two ratings of each successive rating category up to termination.

During the random series, subjects were instructed to call their

ratings out loud, while the model was instructed to remain silent and write her ratings down. Following pain assessment, subjects completed the MPQ, SSS, and a Spontaneous Strategy Questionnaire which included: two Likert-Type scales (Effectiveness of Cognitive Coping Strategy and Degree of Involvement), an index of Percentage of Time Spent Engaged in Cognitive Coping Strategy, and a checklist of coping strategies used.

Finally, all subjects were debriefed and questions regarding the nature of the experiment were answered, in accord with Basic Rights and Privileges of Volunteer Subjects (see Appendix A).

RESULTS

Pain Threshold and Pain Tolerance

Analyses of pain threshold and tolerance data were performed in the following stages. First, in order to ascertain the equivalence of groups prior to treatment, analyses of variance (ANOVAs) were performed on mean pretest threshold and tolerance values according to the method due to Winer (1962, p.263). The error term used in the analysis reflects the variability within the no treatment control group (Group 13, see Figure 1) as well as the experimental conditions (Groups 1 to 12).

Analysis of mean current intensities provoking initial ratings of "very faint pain" during the two pretest ascending series (pain threshold) indicated no significant between-groups differences in the factorial ANOVA. Comparison of the control group mean versus the mean of experimental treatment groups revealed no significant differences, $t(57) = -1.95$, $p \geq .05$. Similarly, analyses of pain tolerance data (mean maximum current intensity accepted in Session 1) revealed no significant between-group effects and no significant differences between control and experimental treatment groups, $t(57) = -0.64$, $p > .05$. Thus, all groups may be considered equivalent on measures of pain threshold and pain tolerance prior to Session 2.

In order to evaluate whether the no-treatment control group differed in pain threshold or tolerance across sessions, repeated measures ANOVAs were performed. The analyses indicated no significant differences across sessions for pain threshold, $F(1,9) = 0.15$, $p \geq .10$,

Figure 1

Experimental Conditions and No-Treatment Control Group

		TM	No TM
CSI	VI	Group 1	Group 7
	MI	Group 2	Group 8
CSII	VI	Group 3	Group 9
	MI	Group 4	Group 10
CSIII	VI	Group 5	Group 11
	MI	Group 6	Group 12
No-Treatment Control		Group 13	

or for pain tolerance, $F(1,9) = 0.06$, $p > .10$. Thus, the no-treatment control group did not exhibit significant change on measures of pain threshold and tolerance and may appropriately be used in comparisons with experimental conditions in Session 2.

In order to assess the effects of cognitive strategy training, instructional modality and exposure to the social influence procedure, the Session 2 data were then subjected to a 3 (Cognitive Strategy) x 2 (Instructional Modality) x 2 (Tolerant Modeling) ANOVA, excluding the no-treatment control group. The pooled error term suggested by Winer (1962, p.263) and Himmelfarb (1975) was used in the analysis. For threshold data, the ANOVA revealed a significant Tolerant Modeling effect, $F(1,57) = 7.27$, $p < .01$, which reflected greater mean threshold for the TM condition ($\bar{X}$ condition TM = 5.77 mA, S.D. = 3.01; $\bar{X}$ condition No TM = 4.10 mA, S.D. = 1.52). No other significant effects emerged. Mean threshold values are displayed in Tables 1 and 2. Although the Cognitive Strategy conditions did not differ significantly from each other, it was of further interest to determine whether the Cognitive Strategy conditions differed from the no-treatment control group. This was done using a 1 df comparison as suggested by Himmelfarb (1975). Thus, Groups 7 to 12 (No TM condition), which received Cognitive Strategy training only, were contrasted with the no-treatment control group. Since the Bartlett-Box test indicated heterogeneity of variance, $F = 2.46$, $p < .01$, the separate variance estimate was used for the comparison. This analysis indicated that the effect approached, but did not attain, conventional levels of statistical significance, $t(20) = 1.08$, $p > .10$, one-tailed.

Table 1

Mean Pain Threshold Values By Condition*

Condition	Session 1	Session 2
CSI (attentional diversion)	2.93	4.83
CSII (attentional focussing)	3.16	4.71
CSIII (spontaneous strategies)	3.08	5.26
TM (tolerant modeling)	3.33	5.78
No TM	2.78	4.10
Verbal Instruction	3.10	4.93
Modeling Instruction	3.01	4.93
No-Treatment Control	3.84	3.61

*Current intensities provoking initial ratings of "very faint pain" in mA.

Table 2

Mean Pain Threshold Values by Cell*

		TM		No TM	
		Pre	Post	Pre	Post
CSI	VI	3.63	5.80	2.00	3.50
	MI	3.88	7.15	2.20	2.85
CSII	VI	2.98	6.05	3.43	4.45
	MI	3.38	4.45	2.88	3.90
CSIII	VI	3.65	6.60	2.93	3.20
	MI	2.45	4.55	3.28	6.70

No Treatment Control	Pre	Post
	3.84	3.61

*Current intensities in mA

Pain tolerance data displayed a similar pattern. Mean tolerance values are displayed in Tables 3 and 4. The factorial ANOVA for pain tolerance indicated that the TM effect approached, but did not attain, conventional levels of statistical significance, $\underline{F}(1,57) = 3.44$, $\underline{p} \lesssim .10$. No other significant terms emerged. To determine whether groups receiving CS training only differed from the no-treatment control condition, Groups 7 to 12 were contrasted with Group 13. Again, since the Bartlett-Box test indicated heterogeneity of variance, $\underline{F} = 2.25$, $\underline{p} < .01$, the separate variance estimate was used for the comparison. The comparison indicated that Cognitive Strategy conditions displayed significantly greater mean tolerance values, $\underline{t}(16) = 1.90$, $\underline{p} << .05$, one-tailed, ($\bar{X}$ groups CS = 9.08 mA, S.D. = 2.44; $\bar{X}$ group 13 = 7.3 mA, S.D. = 2.48).

Results of pain threshold and tolerance analyses may be summarized as follows. The tolerant modeling procedure resulted in increased threshold levels which were significantly greater than levels for groups not undergoing the social influence procedure, while for tolerance data, this effect approached, but did not attain, conventional levels of statistical significance. The three cognitive strategy conditions did not exhibit differential influence upon post-treatment threshold or tolerance levels. The two instructional modality conditions were not differentially effective. Cognitive Strategy training resulted in tolerance levels which were significantly greater than no-treatment control levels, while for threshold data, this effect approached, but did not attain, conventional levels of statistical significance. Since analyses of pain threshold and tolerance indicated effects of

Table 3

Mean Pain Tolerance by Condition*

Condition	Session 1	Session 2
CSI (attentional diversion)	5.94	9.41
CSII (attentional focussing)	6.85	9.58
CSIII (spontaneous strategies)	6.76	10.98
TM (tolerant modeling)	6.75	10.90
No TM	6.27	9.08
Verbal Instruction	6.49	9.55
Modeling Instruction	6.54	10.43
No-Treatment Control	7.10	7.30

* Maximum current intensity accepted in mA

Table 4

Mean Pain Tolerance Values by Cell*

		TM		No TM	
		Pre	Post	Pre	Post
CSI	VI	7.25	11.35	4.80	7.80
	MI	7.15	12.00	4.55	6.50
CSII	VI	6.10	9.95	7.95	10.30
	MI	7.05	9.70	6.30	8.35
CSIII	VI	6.20	10.50	6.65	7.40
	MI	6.80	11.90	7.40	14.10

No-Treatment Control	Pre	Post
	7.10	7.30

* Maximum current intensity accepted in mA

treatments on verbal report of pain (threshold) and pain avoidance behaviour (tolerance), SDT analyses were then performed to determine if treatments had differential effects on discriminability and response bias.

SDT analyses: Data reduction and selection of parameters. In order to derive SDT indices, ratings from the random series were initially converted to cumulative probability matrices in the following manner. The conditional probabilities of occurrence of each response category given the presentation of a particular stimulus level were calculated. Then the probabilities were cumulated from the highest to the lowest response category for each stimulus level. These matrices then were employed in estimation of SDT parameters. Initially, the DI index of discriminability was calculated for adjacent stimulus pairs at all rating scale categories where the measure is defined (cf. Craig & Coren, 1975). The measure is incalculable where the probability of a hit or the probability of a false alarm equals 0.0 or 1.0. It became apparent that there were a large number of instances where DI was incalculable and that the points at which these instances occurred were widely dispersed across stimulus intensities, response categories, and experimental conditions. The parametric index of response bias, L_x, was incalculable in these same instances. This situation resulted in considerable data loss and thus greatly restricted possible analysis strategies for between-group comparisons of SDT parameters.

Due to these problems with the parametric SDT indices, non-parametric indices of sensitivity and bias were selected for analysis.[1]

These indices have recently received increasing attention (cf. Grier, 1971; Hodos, 1970; McNicol, 1972; Simpson & Fitter, 1973), largely due to the fact that they do not require the strong Gaussian assumptions made for parametric indices regarding the nature of underlying distributions of responses. A further advantage is that the non-parametric indices of sensitivity and bias minimize the amount of data loss since all responses enter into the calculations.

Discriminability. The non-parametric index of discriminability selected was

$$E = (\bar{i}_A - \bar{i}_B)\left(\frac{2}{S_A^2 + S_B^2}\right)^{\frac{1}{2}}$$

where $\bar{i}_A$, $\bar{i}_B$ are mean ratings given to stimuli A and B, and S_A, S_B are the standard deviations of the two rating distributions (cf. Simpson & Fitter, 1973). This measure has been recommended as a valuable non-parametric index which converges with parametric indices and curve-fitting procedures as rating distributions tend toward normality.

E was calculated from Session 2 data for each subject at each adjacent stimulus pair and between-group ANOVAs were performed at each of these levels. No significant main effects or interactions were revealed at stimulus levels at or above pain threshold , nor at the level of the zero ("blank") stimulus. However, at sensory-detection levels, two significant terms emerged. A significant TM effect, $F(1,38) = 4.51$, $p < .05$, reflected reduced discriminability in the TM group ($\bar{X} = 0.08$, S.D. = 0.07) relative to the

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[1] The author is indebted to Dr. Larry Ward for suggesting the use of non-parametric indices.

No TM group ($\bar{X}$ = -.15, S.D. = 0.12). A significant Cognitive Strategy x Instructional Modality interaction emerged, $F(2,38) = 3.95$, $p < .05$. Means for this interaction are displayed in Table 5. Post-hoc analyses of simple effects by Tukey's HSD procedure (Kirk, 1968) revealed that training in CSI under the VI modality was associated with reduced discriminability relative to training under the MI modality. Conversely, training in CSIII under the VI modality was associated with increased discriminability relative to the same training under the MI modality (Tukey HSD critical value ($\alpha = .01$) = 0.11). Within the VI condition, discriminability values for CSIII subjects were significantly elevated relative to those for CSI and CSII subjects (Tukey HSD critical value ($\alpha = .01$) = .13). Under the MI condition, none of the CS group differences in discriminability were significant.

Comparison of groups receiving CS training only (No TM condition) versus controls indicated no significant differences in discriminability.

Response bias. The non-parametric measure of response bias, B" (Grier, 1971), was calculated for each subject in order to determine whether the experimental conditions were differentially associated with biases toward reporting lesser or greater pain. This measure of bias reflects the degree to which an outcome lies away from the negative diagonal when the probability of a hit is plotted against the probability of a false alarm. Thus, the measure ranges from -1.0 to +1.0 and equals zero when there is neither positive nor negative response bias. The measure was calculated from Session 2 data using standard procedures (cf. Grier, 1971) at each stimulus pair and response category and then a mean bias index was derived for each subject.

Table 5

Mean Discriminability Values (E) for Session 2 Detection Level: Cognitive Strategies by Instructional Modality

	Verbal Instruction	Modeling Instruction
Cognitive Strategy I	0.05	0.19
Cognitive Strategy II	0.10	0.10
Cognitive Strategy III	0.24	0.08

These values were then entered into a factorial ANOVA to determine if the experimental conditions exhibited differential bias. No significant main effects emerged. A marginally significant Tolerant Modeling x Instructional Modality interaction was revealed, $F(1,48) = 4.04$, $p = .050$. Inspection of the interaction via Tukey's HSD procedure indicated that no pairwise comparisons were significant at the .01 level of statistical reliability which has been recommended for the Tukey procedure when Type I errors are more undesirable than Type II errors. Kirk (1968, p. 89) notes that the F statistic generally provides a more powerful test of a false null hypothesis than does the range statistic used in Tukey's procedure, suggesting that the interaction may be spurious. To determine the source of the marginally significant interaction, the simple effects were then tested at the .05 level of reliability. This approach revealed that, under the No TM condition, Verbal Instruction was associated with positive bias ($\bar{X} = .07$, S.D. = .10) which was significantly greater than the negative bias associated with Modeling Instruction ($\bar{X} = -.04$, S.D. = .14), Tukey HSD critical value, $\alpha = .01 = .10$; No TM, VI - MI difference = .11). Thus, the interaction reflects small bias effects for the No TM (CS only) condition under VI and MI modalities. Comparison of groups receiving CS training only (NO TM condition) with no-treatment controls indicated no significant differences in bias. Due to the lack of significant TM or Instructional Modality main effects, the marginal significance of the interaction, results of the Tukey procedure, and lack of a significant Control versus No TM comparison, any interpretation of the observed interaction should be

made with caution.

Results of SDT analyses may be summarized as follows. No differential discriminability was revealed at stimulus intensity levels at or above pain threshold, or with respect to the zero stimulus. At sensory detection levels, the TM group exhibited reduced discriminability relative to the No TM group. A significant CS x Instructional Modality interaction was also revealed at this level. No discriminability differences were observed between CS only (No TM) conditions and no-treatment controls at any stimulus levels. No response bias differences were observed between No TM conditions and controls. No significant main effects emerged in analyses of response bias, although a marginally significant TM x Instructional Modality interaction was observed.

DISCUSSION

In general, results of the present study support and extend findings of previous research. The data suggest that, in addition to previously reported effects on pain tolerance and pain threshold exerted by the use of cognitive strategies alone (Barber & Hahn, 1962; Blitz & Dinnerstein, 1971; Chaves & Barber, 1974; Grimm & Kanfer, 1976; Neufeld, 1970; Spanos, Horton, & Chaves, 1975) or social influences alone (cf. Craig, 1975, 1978), a combination of the two approaches may have an enhancing effect. This effect appeared more pronounced for threshold than for tolerance data. The Tolerant Modeling main effect reflects a comparison between groups receiving Cognitive Strategy training only (No TM condition) and groups receiving a combination of CS training and the social influence procedure (TM condition). For threshold data, the TM condition displayed significantly greater levels than the No TM condition, which had displayed threshold levels which were marginally elevated relative to controls. For tolerance data, the TM effect was marginally significant, however the No TM condition in this case displayed tolerance levels which were significantly elevated relative to controls. Thus it seems clear that the combination of cognitive strategies and the social influence procedure has demonstrated potency with regard to traditional pain threshold and tolerance measures, although the enhancing effect may not operate in a simple additive fashion. There appears to be a "ceiling effect", either on the extent to which a subject's pain responses may be affected by cognitive and social determinants, or on the levels of discomfort which

one might be prepared to accept. The former argument seems more plausible in light of the subject's finite capacity to process the complex information involved in cognitive and social influence procedures. Subjects in earlier studies in the same laboratory have accepted greater mean maximum current intensity levels than those observed in the present study, casting doubt upon the latter argument. The social influence procedure was capable of modulating pain responses even while subjects were actively involved in utilizing cognitive strategies and simultaneously performing the psychophysical judgement task. It is likely that, in the present context, the model's responses were considerably less salient than in earlier studies, suggesting the potency of social influence.

The SDT analyses provide further information regarding the Tolerant Modeling effect. Consistent with earlier work of Craig and associates which examined the social influence procedure in isolation, the combination of cognitive strategy training and tolerant modeling had a demonstrable effect on discriminability of cutaneous electric shocks. In the present study, discriminability was affected at sensory detection levels while such effects were not apparent at supra-pain-threshold levels. It might be argued that toward the upper end of the continuum, the effects of the combined procedures operate primarily on the motivational-affective dimension of pain rather than the sensory-discriminative or cognitive evaluative components (Melzack & Casey, 1965). The lack of TM effects on response biases would be consistent with such an interpretation. As further SDT research on various pain modulation techniques accumulates, the import of discriminability changes at

various levels of the sensory continuum for theoretical formulations of pain should be clarified. At present, social influences and cognitive interventions have been associated with alterations in sensory discriminability at some levels of the continuum. The potency of social determinants was highlighted by the efficacy of the modeling procedure in the presence of considerable ongoing cognitive activity. Further, the fact that the model was no longer active during the SDT series suggests that social influences are critical, persistent determinants of pain experience and is consistent with the results of previous investigations (Craig & Coren, 1975; Craig & Ward, Note 1).

With regard to Cognitive Strategy training, several points deserve discussion. Instruction in the use of the strategies via peer models did not result in differential efficacy relative to verbal instruction, suggesting that modeling covert processes (verbalizing strategies) does not result in superior learning and mastery of the cognitive techniques, relative to verbal instruction. The finding does suggest that the use of videotaped instructional modules may be as viable as training by a therapist in the use of cognitive strategies. The lack of differential efficacy among three classes of cognitive strategies with respect to pain tolerance and threshold has two noteworthy implications. First, consistent with the work of Chaves and Barber (1974) and Spanos et al. (1975), the attentional-focus distinction between CSI and CSII appeared to have little utility with random samples of persons exhibiting various pre-test pain thresholds. The more extensive training and rehearsal employed in the present

study did not lead to the emergence of differences between the strategy types. This suggests that the directional focus of attention may not be the critical determinant of the effectiveness of cognitive strategies in the control of pain.

Another implication of the present findings derives from the status of the CSIII condition. The data suggest that aiding people to make explicit and effectively rehearse their own idiosyncratic coping strategies may be equally as effective as instruction in the specific techniques thus far investigated.

The finding that the effects of cognitive strategies were more clearly evident with respect to pain tolerance than pain threshold is consistent with the premise that "psychological" influences exert their effects more readily upon tolerance than threshold (Blitz & Dinnerstein, 1971). The present study extends the findings of Chaves and Barber (1974) and Spanos et al. (1975) in that cognitive strategies were shown to enhance pain tolerance, a measure which may have more direct implications for clinical pain than the previously investigated measures of pain threshold or average pain experienced.

The SDT analyses offer some further information regarding Cognitive Strategy training. Overall, no remarkable differences between CS groups and controls emerged on measures of discriminability or bias, suggesting that the effects of cognitive strategies may not be primarily mediated through the sensory-discriminative or cognitive-evaluative dimensions of pain. This interpretation is consistent with the findings of Chapman and Feather (1973) regarding the effects of diazepam on human pain tolerance and pain sensitivity. They found effects

of diazepam on pain tolerance measures, but not on SDT measures of sensitivity (discriminability) or response bias and concluded that the emotional-motivational component of pain had been affected, rather than the sensory-discriminative component or central control of pain.

Although it would seem that previously demonstrated effects of cognitive strategies on traditional pain threshold and pain tolerance measures are not primarily accounted for by discriminability changes, the present study does offer evidence that cognitive strategies do have the capacity to significantly affect measures of discriminability. At sensory detection levels, Cognitive Strategy groups displayed differential discriminability under the two Instructional Modality conditions. The CSIII group is most noteworthy, in that increased discriminability was displayed under Verbal Instruction relative to CSI and CSII under the same modality and relative to the same training under Modeling Instruction. Thus, verbal instruction in spontaneous strategies may enhance discriminability about the sensory detection level. The pattern of these discriminability differences may ultimately be of some utility for theoretical formulations of the mechanisms of action of cognitive strategies on sensory processes. However, in the present study, these differences suggest little of practical significance in light of the lack of significant discriminability differences between CS groups and no-treatment controls at detection levels, the lack of corresponding interactions at levels of the sensory continuum at or above pain threshold, and the lack of differential CS effects on measures of pain tolerance and pain threshold. The interaction is of theoretical import to the extent that this is the

first demonstration that cognitive strategies are associated with alterations in measures of discriminability. This finding stands in contrast to Clark's (1974; Clark & Goodman, 1974) position that "cognitive control" strategies "merely" reflect changes in response bias.

Thus, the present study offers evidence that social and cognitive determinants may affect the sensory-discriminative dimension of the pain experience in addition to well-known effects on verbal report of pain and pain avoidance behaviour.

In addition to these theoretical considerations, the present study offers some suggestions for clinical practice. Clinically, one is ultimately concerned with the modification of pain behaviour, both verbal and non-verbal, as exemplified by successful operant programmes which focus upon verbal pain report and non-verbal pain behaviour (e.g., Fordyce, 1976). As the data from this and previous studies show, training in several types of cognitive strategies has demonstrated efficacy in altering verbal and non-verbal pain behaviour. In view of current increasing concern with multimodal, comprehensive treatment approaches to clinical pain (cf., Bonica, 1976) and growing emphasis on self-management techniques, these approaches to the complex problem of the human pain experience seem promising in applied as well as theoretical domains.

REFERENCE NOTES

1. Craig, K.D. & Ward, L.M. Social modeling influences on the discriminability of painful stimuli: a sensory-decision analysis. Unpublished manuscript, University of British Columbia.

REFERENCES

Bandura, A. Self-efficacy: toward a unifying theory of behavior change. Psychological Review, 1977.

Barber, T. & Cooper, B. Effect on pain of experimentally induced and spontaneous distraction. Psychological Reports, 1972, 31, 647-651.

Barber, T. & Hahn, K. Physiological and subjective responses to pain producing stimulation under hypnotically suggested and waking-imagined "analgesia". Journal of Abnormal and Social Psychology, 1962, 65, 411-418.

Blitz, B. & Dinnerstein, A. Effects of different types of instructions on pain parameters. Journal of Abnormal Psychology, 1968, 73, 276-280.

Blitz, B. & Dinnerstein, A. Role of attentional focus in pain perception: manipulation of response to noxious stimulation by instructions. Journal of Abnormal Psychology, 1971, 77, 42-45.

Bobey, M. & Davidson, P. Psychological factors affecting pain tolerance. Journal of Psychosomatic Research, 1970, 14, 371-376.

Bonica, J.J. Organization and function of a multidisciplinary pain clinic. In M. Weisenberg & B. Tursky (Eds.) Pain: New perspectives in therapy and research. New York: Plenum, 1976.

Chapman, C.R. Sensory decision theory methods in pain research: a reply to Rollman. Pain, 1977, 3, 295-305.

Chapman, C.R. & Feather, B.W. Effects of diazepam on human pain tolerance and pain sensitivity. Psychosomatic Medicine, 1973,

35, 330-340.

Chapman, C.R., Gehrig, J.D., & Wilson, M.E. Acupuncuture and 33% nitrous oxide modify detectability of painful stimuli. Anesthesiology, 1975, 42, 532-537.

Chapman, C.R., Murphy, J.M., & Butler, S.H. Analgesic strength of 33% nitorus oxide: a signal detection theory evaluation. Science, 1973, 179, 1246-1248.

Chaves, J. & Barber, T. Cognitive strategies, experimenter modeling, and expectation in the attenuation of pain. Journal of Abnormal Psychology, 1974, 83, 356-363.

Clark, W.C. Sensory-decision theory: an analysic of the effects of a placebo on the criterion for pain and thermal sensitivity (d'). Journal of Abnormal Psychology, 1969, 74, 363-371.

Clark, W.C. Pain sensitivity and the report of pain: an introduction to sensory decision theory. Anesthesiology, 1974, 40, 272-287.

Clark, W.C. & Goodman, J.S. Effects of suggestion on d' and C_x for pain detection and pain tolerance. Journal of Abnormal Psychology, 1974, 83, 364-372.

Clark, W.C. & Yang, J.C. Acupunctural analgesia? Evaluation by signal detection theory. Science, 1974, 184, 1096-1098.

Craig, K.D. Social modelling determinants of pain processes. Pain, 1975, 1, 375-378.

Craig, K.D. Social disclosure, coactive peer companions, and social modeling determinants of pain communications. Canadian Journal of Behavioural Science, 1978a (in press).

Craig, K.D. Social modeling influences on pain. In R.A. Sternbach

(Ed.) The psychology of pain. New York: Raven, in press.

Craig, K.D. & Best, J.A. Perceived control over pain: individual differences and situational determinants. Pain, 1977, 3, 127-135.

Craig, K.D., Best, H., & Best, J.A. Self-monitoring sensory and affective dimensions of pain experiences. Journal of Consulting and Clinical Psychology, 1978, in press.

Craig, K.D., Best, H., & Reith, G. Social determinants of reports of pain in the absence of painful stimulation. Canadian Journal of Behavioural Science, 1974, 6, 169-177.

Craig, K.D., Best, H., Ward, L.M. Social modeling influences on psychophysical judgements of electrical stimulation. Journal of Abnormal Psychology, 1975, 84, 366-373.

Craig, K.D. & Coren, S. Signal detection analyses of social modeling influences on psychophyiscal judgements of electrical stimulation. Journal of Psychosomatic Research, 1975, 19, 105-112.

Craig, K.D. & Lowery, N.J. Heart-rate components of conditioned vicarious autonomic responses. Journal of Personality and Social Psychology, 1969, 11, 381-387.

Craig, K.D. & Neidermayer, H. Autonomic correlates of pain thresholds influenced through social modeling. Journal of Personality and Social Psychology, 1974, 29, 246-252.

Craig, K.D. & Prkachin, K.M. Social modeling influences on sensory-decision theory and psychophysiological indexes of pain. Journal of Personality and Social Psychology, 1978, in press.

Craig, K.D. & Weiss, S.M. Vicarious influences on pain threshold determinations. Journal of Personality and Social Psychology, 1971, 19, 53-59.

Craig, K.D. & Weiss, S.M. Verbal reports of pain without noxious stimulation. Perceptual and Motor Skills, 1972, 34, 943-948.

Davison, K. & Valins, S. Maintenance of self-attributed and drug-attributed behaviour change. Journal of Personality and Social Psychology, 1969, 11, 25-33.

Endler,N.S. & Okada, M. A multidimensional measure of trait anxiety: the S-R inventory of general trait anxiousness. Journal of Consulting and Clinical Psychology, 1975, 43, 319-329.

Evans, M. & Paul, G. Effects of hypnotically suggested alangesia on physiological and subjective responses to cold stress. Journal of Consulting and Clinical Psychology, 1970, 35, 362-371.

Feather, B.W., Chapman, C.R., & Fisher, S.B. The effect of a placebo on the perception of painful radiant heat stimuli. Psychosomatic Medicine, 1972, 34, 290-294.

Fordyce, W.E. Behavioural methods for chronic pain and illness. St. Louis: C.V. Mosby, 1976.

Fordyce, W., Fowler, R., & DeLateur, B. An application of behavior modification technique to a problem of chronic pain. Behavior Research and Therapy, 1968, 6, 105-107.

Gardner, W. & Licklider, J. Auditory analgesia in dental operations. Journal of the American Dental Association, 1959, 59, 1144-1149.

Gardner, W., Licklider, J., & Weisz, A. Suppression of pain by sound. Science, 1960, 32-33.

Geer, J., Davison, G., & Gatchel, R. Reduction of stress in humans through nonveridical perceived control of aversive stimulation. Journal of Personality and Social Psychology, 1970, 16, 731-738.

Greir, J.B. Non-parametric indices for sensitivity and bias: computing formulae. Psychological Bulletin, 1971, 75, 425-429.

Grimm, L. & Kanfer, F. Tolerance of aversive stimulation. Behavior Therapy, 1976, 7.

Hall, W. Psychological processes in pain perception: the prospects of a signal detection theory analysis. Doctoral dissertation, University of New South Wales, February, 1977.

Hilgard, E. Pain as a puzzle for psychology and physiology. American Psychologist, 1969, 24, 103-113.

Hodos, W. Nonparametric index of response bias for use in detection and recognition experiments. Psychological Bulletin, 1970, 74, 351-354.

Horan, H. & Dellinger, J. In vivo emotive imagery: an experimental test. Perceptual and Motor Skills, 1974, 39, 359-362.

Johnson, J. Effects of accurate expectations about sensations on the sensory and distress components of pain. Journal of Personality and Social Psychology, 1973, 27, 261, 265.

Kanfer, F. & Goldfoot, D. Self-control and tolerance of aversive stimulation. Psychological Reports, 1966, 18, 79-85.

Kanfer, F. & Seidner, M. Self-control factors enhancing tolerance of noxious stimulation. Journal of Personality and Social Psychology, 1973, 25, 381-389.

Kirk, R.E. Experimental design: Procedures for the behavioural sciences. Belmont, California: Brooks/Cole, 1968.

Lloyd, M.A. & Appel, J.B. Signal detection theory and the psychophysics of pain: an introduction and review. Psychosomatic

Medicine, 1976, 38, 79-94.

Mahoney, M. Cognition and behavior modification. Cambridge, Mass.: Ballinger Publishing Co., 1974.

McNicol, D. A primer of signal detection theory. London: George Allen and Unwin, 1972.

Meichenbaum, D. Cognitive behavior modification. Morristown, N.J.: General Learning Press, 1974.

Meichenbaum, D. & Turk, D. The cognitive-behavioral management of anxiety, anger and pain. In P.O. Davidson (Ed.) The behavioral management of anxiety, depression, and pain. New York: Brunner/ Mazel, 1976.

Melzack, R. The puzzle of pain. Harmondsworth, England: Penguin, 1973.

Melzack, R. & Wall, P. Pain mechanisms: a new theory. Science, 1965, 150, 1971.

Melzack, R. & Torgerson, W.S. On the language of pain. Anesthesiology, 1971, 34, 50-59.

Melzack, R., Weisz, A., & Sprague, L. Strategies for controlling pain: contributions of auditory stimulation and suggestion. Experimental Neurology, 1963, 8, 239-247.

Neufeld, R.W.J. The effects of experimentally-altered cognitive appraisal on pain tolerance. Psychonomic Science, 1970, 20, 106-107.

Neufeld, R.W.J. & Davidson, P. The effects of vicarious and cognitive rehearsal on pain tolerance. Journal of Psychosomatic Research, 1971, 15, 329-325.

Neufeld, R.W.J. & Davidson, P.O. Scaling of the subjective stress scale with a sample of university undergraduates. Psychological Reports , 1972, 31, 821-822.

Prkachin,K.M. Interpersonal influences on pain expressions. Unpublished doctoral dissertation, University of British Columbia, 1978.

Rollman, G. Signal detection theory measurement of pain: a review and critique. Pain, 1977, 3, 187-211.

Scott, T. & Barber, J. Cognitive control of pain: effects of multiple cognitive strategies. Psychological Record, 1977, 2, 373-383.

Simpson, A.J. & Fitter, M.J. What is the best index of detectability? Psychological Bulletin , 1973, 481-488.

Spanos, N., Barber, T., & Lang, G. Cognition and self-control: cognitive control of painful sensory input. In H. London & R.E. Nisbett (Eds.) Thought and feeling: Cognitive alteration of feeling state. Chicago: Aldine, 1974.

Staub, E., Horton, C., & Chaves, J. The effects of two cognitive strategies on pain. Journal of Abnormal Psychology, 1975, 84, 677-681.

Staub, E., Tursky, B., & Schwartz, G. Self-control and predictability: their effects on reactions to aversive stimulation. Journal of Personality and Social Psychology, 1971, 18, 157-162.

Sternbach, R.A. & Tursky, B. Ethnic differences among housewives in psychophysical and skin potential responses to electric shock. Psychophysiology, 1965, 1, 241-246.

Stevens, S.S. Psychophysics. New York: Wiley, 1975.

Turk, D. Cognitive control of pain. a skills training approach.

Unpublished M.A. thesis, University of Waterloo, 1975.

Tursky, B. & Sternbach, R.A. Further psychiological correlates of ethnic differences in responses to shock. Psychophysiology, 1967, 4, 67-74.

Tursky, B. & Watson, P.O. Controlled physical and subjective intensities in electric shock. Psychophysiology, 1964, 1, 152-161.

Tursky, B., Watson, P.O., & O'Connell, D.M. A concentric shock electrode for pain stimulation. Psychophysiology, 1965, 1, 196-198.

Weisenberg, M. Pain and pain control. Psychological Bulletin, 1977, 84, 1008-1044.

Westcott, T. & Horan, J. The effects of anger and relaxation forms of in vivo emotive imagery on pain tolerance. Canadian Journal of Behavioural Science, 1977, 9(3), 216-223.

Winer, B.J. Statistical principles in experimental design. New York: McGraw-Hill, 1962.

Winer, B.J. Statistical principles in experimental design. 2nd edition. New York: McGraw-Hill, 1971.

APPENDIX A

McGill Pain Questionnaire

Spontaneous Strategy Questionnaire

Subjectvie Stress Scale

S-R Inventory of General Trait Anxiety (Physical Danger Scale)

Informed Consent Form

Basic Rights and Privileges of Volunteer Subjects

NAME _____

Please answer the following two questions:

1. What did your pain feel like when you received the most intense shock?

Some of the words below describe the pain you experienced. Circle ONLY those words that best describe it. Leave out any category that is not suitable. Use only a single word in each appropriate category -- the one that applied best.

1	2	3	4	5
Flickering	Jumping	Pricking	Sharp	Pinching
Quivering	Flashing	Boring	Cutting	Pressing
Pulsing	Shooting	Drilling	Lacerating	Gnawing
Throbbing		Stabbing		Cramping
Beating		Lancinating		Crushing
Pounding				

6	7	8	9	10
Tugging	Hot	Tingling	Dull	Tender
Pulling	Burning	Itchy	Sore	Taut
Wrenching	Scalding	Smarting	Hurting	Rasping
	Searing	Stinging	Aching	Splitting
			Heavy	

11	12	13	14	15
Tiring	Sickening	Fearful	Punishing	Wretched
Exhausting	Suffocating	Frightful	Gruelling	Blinding
		Terrifying	Cruel	
			Vicious	
			Killing	

16	17	18	19	20
Annoying	Spreading	Tight	Cool	Nagging
Troublesome	Radiating	Numb	Cold	Nauseating
Miserable	Penetrating	Drawing	Freezing	Agonizing
Intense	Piercing	Squeezing		Dreadful
Unbearable		Tearing		Torturing

2. How strong was the most intense pain?

The following 5 words represent pain of increasing intensity.

1	2	3	4	5
Mild	Discomforting	Distressing	Horrible	Excruciating

Write the number of the most appropriate word in the space beside the question.

Which word describes the shock at its worst? _____

Name _____

Date _____

SPONTANEOUS STRATEGY QUESTIONNAIRE

In your own words, please describe any and all strategies which you used during this session to aid you in coping with the discomfort you felt.

Please finish this page before going on.

Appendix continued

The following is a list of strategies which people sometimes use to cope with discomfort.

Please check any strategies listed which you actually did use during the session.

_____ (1) gritting your teeth

_____ (2) attempting to relax your body

_____ (3) imagining that you were somewhere else involved in a pleasant activity

_____ (4) telling yourself that the shocks were not really painful

_____ (5) paying attention to other things in the environment, i.e., distracting yourself by looking around the room.

_____ (6) counting or doing mental arithmetic.

_____ (7) concentrating on trying to solve a personal problem.

_____ (8) planning an upcoming activity.

_____ (9) imagining that your arm was insensitive to stimulation.

_____(10) mentally transforming or reinterpreting the sensations you experienced

_____(11) analyzing rationally your sensations

_____(12) telling yourself that you should be able to cope with the discomfort

Appendix continued

Please indicate on the following scale how effective you deemed your strategy to be in helping you cope with discomfort. Indicate by circling the appropriate number.

1	2	3	4	5	6	7
Not at all effective			Mod-erately effective			Extremely effective

Effectiveness

of

Cognitive Coping Strategy

Appendix continued

Degree of Involvement

in

Cognitive Coping Strategy

Please indicate on the following scale your estimation of the degree to which you were actually involved in the coping strategy which you employed during the session. Indicate your choice by circling a number on the scale.

1	2	3	4	5	6	7
Not involved at all			Mod-erately involved			Extremely involved

Degree of Involvement

Appendix continued

Please indicate on the following scale your best estimate of the proportion of time you spent engaged in the coping strategy during the time that you were being exposed to shock. Indicate your choice by placing an "X" in the appropriate box.

10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

Percentage of Time Spent

Engaged in Cognitive Coping Strategy

Name: _____

Pick only one word of the following list which best described how you feel right at this moment.

Wonderful

Steady

Comfortable

Fine

Indifferent

Didn't bother me

Timid

Unsteady

Unsafe

Nervous

Worried

Frightened

Panicky

Scared stiff

"YOU ARE IN SITUATIONS WHERE YOU ARE ABOUT TO OR MAY ENCOUNTER PHYSICAL DANGER"

(We are primarily interested in your reactions in General to those situations that involve dealing with inanimate and potentially dangerous things or objects.)

Mark on the ANSWER SHEET one of the five alternative degrees of reaction or attitude for each of the following 9 items.

10.	Seek experiences like this	1 Very much	2	3	4	5 Not at all
11.	Perspire	1 Not at all	2	3	4	5 Perspire much
12.	Have an "uneasy feeling"	1 Not at all	2	3	4	5 Very much
13.	Feel exhilarated and thrilled	1 Very much	2	3	4	5 Not at all
14.	Get fluttering feeling in stomach	1 Not at all	2	3	4	5 Very much
15.	Feel tense	1 Not at all	2	3	4	5 Very much
16.	Enjoy these situations	1 Very much	2	3	4	5 Not at all
17.	Heart beats faster	1 Not at all	2	3	4	5 Much faster
18.	Feel anxious	1 Not at all	2	3	4	5 Very anxious

Experimental Participation Consent Form

Name of the Subject: _____

I hereby consent to participate in the study as described by _____ to me at this time. I understand that the risks to me as a subject are minimal.
I further acknowledge that I have been advised that I can withdraw from participation in the project at any time.

Signature: _____

Date: _____

Experimental Participation Consent Form,

Name of the Subject: _____

I hereby consent to participate in the study as described by _____ to me at this time. I understand that the risks to me as a subject are minimal.
I further acknowledge that I have been advised that I can withdraw from participation in the project at any time.

Signature: _____

Date: _____

DEPARTMENT OF PSYCHOLOGY

THE UNIVERSITY OF BRITISH COLUMBIA

Basic Rights and Privileges of Volunteer Subjects

Any person who volunteers to participate in experiments conducted by full or part-time members of the faculty of the Department of Psychology at the University of British Columbia, by their employees, or by the graduate and undergraduate students working under the direction of faculty members of the above named Department, is entitled to the following rights and privileges.

1. The subject may terminate and withdraw from the experiment at any time without being accountable for the reasons for such an action.

2. The subject shall be informed, prior to the beginning of an experiment, of the maximum length of time the experiment might take and of the general nature of the experiment.

3. The subject shall be informed, prior to the beginning of an experiment, of the nature and function of any mechanical and electrical equipment which is to be used in the experiment. In cases where the subject is in direct contact with such equipment, he shall be informed of the safety measures designed to protect him from physical injury, regardless of how slight the possibility of such injury is.

4. The subject shall be informed, prior to the beginning of an experiment, of the aspects of his behavior that are to be observed and recorded and how this is to be done.

5. Any behavioral record that is obtained during the course of the experiment is confidential. Any behavioral records that are made public through either journal papers or books, public addresses, research colloquia, or classroom presentations for teaching purposes, shall be anonymous.

6. The subject shall be offered, at the end of an experiment, a complete explanation of the purpose of the experiment, either orally by the experimenter or, at the option of the experimenter, in writing. The subject shall also have the opportunity to ask questions pertaining to the experiment and shall be entitled to have these questions answered.

7. The subject has the right to inform the Chairman of the Departmental Committee on Research with Human Subjects of any perceived violations of, or questions about, the aforementioned rights and privileges.

APPENDIX B

Psychometric Data

Psychometric Data

Degree of Effectiveness, Degree of Involvement, Time Spent Involved, Anxiety

Pearson product-moment correlation coefficients are displayed in Table B-1. Several significant correlations are noteworthy. Subjects' ratings of Degree of Effectiveness of Cognitive Strategies were significantly correlated with Session 2 pain tolerance and pain threshold. Interestingly, although the measures of Degree of Effectiveness, Degree of Involvement, and Time Spent Involved in Cognitive Strategies were highly correlated, subjects' ratings of Degree of Involvement and Time Spent Involved were significantly correlated with Session 2 pain tolerance, but not with pain threshold. The fact that measures of involvement in cognitive strategies correlate significantly with tolerance, but not with threshold may be viewed as being consistent with the notion that "psychological" variables (i.e., cognitive strategoes) more readily exert influence upon tolerance than threshold. Further, since subjects' ratings of the effectiveness of the techniques did correlate significantly with both threshold and tolerance, the data may be interpreted as being consistent with the position that subjects' feelings of "self-efficacy" (cf., Bandura, 1977) are important determinants of performance in the context of pain modulation.

Ratings of anxiety appeared to be correlated with Degree of Involvement and Time Spent Involved (marginal significance) but not with Degree of Effectiveness, suggesting that subjects who were more anxious in the situation initially tended to become more involved in

using the strategies, although the degree of anxiety was not related to subjects' ultimate perception of the effectiveness of the strategies. Interestingly, level of anxiety demonstrated an inverse relationship with pain threshold in both sessions, although this measure of anxiety did not show a relationship with pain tolerance in either session. 3 (Cognitive Strategies) x 2 (TM) x 2 (Instruction modality) ANOVAs were performed to investigate between-group differences on these measures. No significant differences emerged for Anxiety or Time Spent Involved. However, a significant TM effect was observed for Degree of Effectiveness, $F(1,48) = 4.05$, $p = .05$.

These effects suggest that the degree to which subjects were able to become involved in the cognitive strategies and the perceived efficacy of the strategies were affected by the presence of the peer model who verbalized ratings during the pain assessment session. The fact that this effect did not approach significance for Time Spent Involved in Cognitive Strategies suggests that subjects in both conditions attempted to use the strategies to the same extent (i.e., for the same percentage of time available).

Subjective Stress Scale (SSS)

The SSS was administered before and after each session. Scale score values (Neufeld & Davidson, 1972) were entered into a 3 (CS) x 2 (TM) x 2 (Instructional Modality) x 4 (Administration) ANOVA to investigate between-group differences. A significant Administration effect, $F(3,144) = 8.172$, $p < .001$, reflected a reduction in subjectively appraised stress after Session 1 which remained at reduced levels during Session 2. This finding suggests that subjective stress

was reduced and remained relatively stable once subjects were familiar with the experience. A significant CS x Administration interaction, $F(6,144) = 2.52$, $p < .05$, did not readily lend itself to interpretation. A marginally significant TM effect, $F(1,48) = 3.75$, $p = .06$, suggested reduced subjective stress ratings for the TM group ($\bar{X} = .87$) relative to the No TM group ($\bar{X} = 1.08$). In general, the findings suggest that subjective stress was reduced once subjects were familiar with the experience. Differential between-group effects were not particularly noteworthy.

McGill Pain Questionnaire (MPQ)

The MPQ was administered after both sessions. The adjective checklist portion provides rank scores for three dimensions of pain: Sensory, Affective, and Evaluative, and a "miscellaneous" category (Melzack & Torgerson, 1971). Further, the MPQ provided a Pain Intensity Rating of the highest current accepted in the present study. The rating derives from a 5-point scale ranging from mild to excrutiating. These scores were entered into 3 (CS) x 2 (TM) x 2 (Instructional Modality) x 2 (Sessions) ANOVAs to investigate between-group differences. No significant effects emerged for the Sensory, Affective, or Miscellaneous scores. A significant CS x Sessions interaction was observed for the Evaluative analysis, $F(2,48) = 3.26$, $p < .05$. This did not readily lend itself to interpretation, as the CSIII group differed from the pattern on pre-scores. Analysis of Pain Intensity ratings revealed a significant CS x TM interaction, $F(2,48) = 4.12$, $p < .05$. The pattern of results suggested that the CSIII group may have demonstrated higher Pain Intensity ratings under No TM ($\bar{X} = 3.2$) than

under TM conditions ($\bar{X}$ = 2.35), however mean differences did not approach statistical significance using Tukey's HSD procedure (Tukey critical value (α = .05) = 1.09; largest difference - .85). Thus, MPQ data did not reliably differentiate between groups.

Table B-1

Pearson Correlation Coefficients: Psychometric Data

	Pre-Tolerance	Post-Tolerance	Anxiety	Degree of Effectiveness	Degree of Involvement	Time Involved	Pre-Threshold	Post-Threshold
Pre-Tolerance	1.0	0.46 (p=.001)	-0.05 (p=0.34)	0.03 (p=.40)	0.03 (p=.41)	-0.02 (p=.44)	0.74 (p=.001)	0.23 (p=.03)
Post-Tolerance		1.0	-0.08 (p=.25)	0.29 (p=.008)	0.23 (p=.03)	0.23 (p=.03)	0.30 (p=.006)	0.77 (p=.001)
Anxiety			1.0	0.07 (p=.27)	0.23 (p=.03)	0.19 (p=.06)	-0.26 (p=.02)	-0.24 (p=.02)
Degree of Effectiveness				1.0	0.86 (p=.001)	0.80 (p=.001)	-0.13 (p=.14)	0.21 (p=.04)
Degree of Involvement					1.0	0.92 (p=.001)	-0.18 (p=.07)	0.11 (P=.19)
Time Involved						1.0	-0.14 (p=.13)	0.17 (p=.08)
Pre-Threshold							1.0	0.35 (p=.001)
Post-Threshold								1.0