1

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS
STANDARD REFERENCE MATERIAL 1010a
(ANSI and ISO TEST CHART No 2)

National Library
of Canada

Bibliothèque nationale
du Canada

Canadian Theses Service

Service des thèses canadiennes

Ottawa, Canada
K1A 0N4

NOTICE

The quality of this microform is heavily dependent upon the quality of the original thesis submitted for microfilming. Every effort has been made to ensure the highest quality of reproduction possible.

If pages are missing, contact the university which granted the degree.

Some pages may have indistinct print especially if the original pages were typed with a poor typewriter ribbon or if the university sent us an inferior photocopy.

Reproduction in full or in part of this microform is governed by the Canadian Copyright Act, R.S.C. 1970, c. C-30, and subsequent amendments.

AVIS

La qualité de cette microforme dépend grandement de la qualité de la thèse soumise au microfilmage. Nous avons tout fait pour assurer une qualité supérieure de reproduction.

S'il manque des pages, veuillez communiquer avec l'université qui a conféré le grade.

La qualité d'impression de certaines pages peut laisser à désirer, surtout si les pages originales ont été dactylographiées à l'aide d'un ruban usé ou si l'université nous a fait parvenir une photocopie de qualité inférieure.

La reproduction, même partielle, de cette microforme est soumise à la Loi canadienne sur le droit d'auteur, SRC 1970, c. C-30, et ses amendements subséquents.

**The Effect of Choice-Control and Use of Cognitive
Strategies on Pain Reduction Reports**

Lea M. Acker

April 1991

National Library
of Canada

Bibliothèque nationale
du Canada

Canadian Theses Service Service des thèses canadiennes

Ottawa, Canada
K1A 0N4

The author has granted an irrevocable non-exclusive licence allowing the National Library of Canada to reproduce, loan, distribute or sell copies of his/her thesis by any means and in any form or format, making this thesis available to interested persons.

The author retains ownership of the copyright in his/her thesis. Neither the thesis nor substantial extracts from it may be printed or otherwise reproduced without his/her permission.

L'auteur a accordé une licence irrévocable et non exclusive permettant à la Bibliothèque nationale du Canada de reproduire, prêter, distribuer ou vendre des copies de sa thèse de quelque manière et sous quelque forme que ce soit pour mettre des exemplaires de cette thèse à la disposition des personnes intéressées.

L'auteur conserve la propriété du droit d'auteur qui protège sa thèse. Ni la thèse ni des extraits substantiels de celle-ci ne doivent être imprimés ou autrement reproduits sans son autorisation.

ISBN 0-315-68833-5

Canada

The undersigned hereby recommend to
the Faculty of Graduate Studies and Research
acceptance of the thesis
submitted by
Lea Acker
in partial fulfilment of the requirements
for the degree of Doctor of Philosophy

Chairman, Department of Psychology

Thesis Supervisor

External Examiner

Carleton University

May 1991

Acknowledgement

My thanks to Professor Nick Spanos, my advisor, for his clear-sighted guidance and support. I also thank my other teachers at Carleton, my colleagues at the hypnosis laboratory, and the administrative staff of the psychology department for all they did to make learning as painless as possible.

Abstract

Two experiments examined the effect of choice-control and perceived self-efficacy on pain reduction reports of subjects administered cognitive strategies. In both experiments a mechanical pressure pain stimulus was applied to a subject's finger on two 60 second trials and pain ratings were taken. Between the two pain administrations the experimental subjects were instructed in one or two cognitive pain reducing strategies, distraction and imagery. Control subjects in both experiments had a waiting period between the two pain trials. Self-efficacy was operationally defined as the level of pain subjects expected to feel on their next pain trial. It was measured immediately after the baseline pain trial before the subjects learned that they would be using cognitive strategies and again after being instructed in the cognitive strategies.

In the first experiment two of the six treatment groups were instructed in the use of only one of the cognitive strategies. The other four groups were instructed in both strategies. Subjects in two of these four groups were asked to choose one of the strategies while those in the other two groups were assigned a strategy to use on post-test. Subjects rated self-efficacy before choosing/being assigned a strategy. This design made it possible to examine the effect of strategy choice on pain reduction reports. Results indicated that experimental subjects rated pain significantly lower at posttest than at baseline and

expected less pain at posttest than at baseline. There were no differences in pain ratings or expectancies for subjects in the imagery and distraction groups. Controls did not change their pain rating or expectancy ratings from baseline to posttest. Choice-control had no effect on subjects' pain ratings.

Expectancy and absorption in the strategy accounted for a significant proportion of the variance in pain reduction scores in the distraction group but not in the imagery group.

In the second experiment all eight treatment groups were exposed to two strategies. Half were allowed to choose a strategy and half were assigned a strategy. Within those groups half rated self-efficacy before they chose/were assigned a strategy. The other half rated self efficacy after they chose/were assigned a strategy. This design makes it possible to examine the effect of strategy choice on self-efficacy ratings. Results of the second study repeated those obtained in the first study with regard to the effect of strategy use on pain ratings and expectancy ratings. Again, choice-control had no effect on pain ratings and absorption ratings. In addition, choice-control did not affect subjects' self-efficacy. Regardless of whether or not they were given strategy choice, subjects who used the strategy they rated as more effective reduced reported pain more than subjects using the strategy they rated as less effective. Expectancy predicted a significant proportion of the variance in pain reduction scores for the imagery groups and absorption was the significant predictor for

the distraction groups.

In conclusion, results indicated that cognitive strategies were effective in comparison to no treatment but there was no difference in the effectiveness of the two strategies used. Strategy choice had no effect on pain, expectancy or absorption ratings. Expectancy and absorption emerged as the important predictors of pain reduction.

Table of Contents

Introduction	1
The Cognitive Approach to Pain Reduction	1
Strategy Use and Pain Reduction	4
The Constructs of Expectancy and Self-efficacy	7
Expectancy, Self-efficacy and Pain Reduction	9
The Sociocognitive Approach and Hypnotic Analgesia	14
Strategy Choice and Pain Reduction	21
Locus of Control and Other Personality Variables as Mediators of Pain Reduction	27
Locus of Control	28
Hypnotic Susceptibility	31
Imagery Ability	31
Social Desirability	32
The Present Experiments	33
Experiment 1	33
Introduction	33
Method	35
Results	44
Pain Ratings	44
The Effect of Efficacy	60
Expectancy Ratings	61
Absorption Ratings	87
Correlational Analysis	90
Regression Analysis	100
Discussion	101

Table of Contents cont'd.

Experiment II	103
Introduction	103
Method	105
Results	109
Pain Ratings	109
The Effect of Efficacy	130
Expectancy Ratings	132
Absorption Ratings	155
Correlational Analysis	162
Regression Analysis	170
 Discussion	 171
References	182
Appendix A Introduction to Experiment - All Subjects	196
Appendix B Informed Consent Form	197
Appendix C Preliminary Instructions - All Subjects	198
Appendix D Pain Rating Scale	199
Appendix E Instructions for Self Efficacy Ratings	200
Appendix F Post Baseline Procedure for the Imagery	
Group	201
Appendix G Post Baseline Procedure for the	
Distraction Group	204

Table of Contents cont'd.

Appendix H	Post Baseline Procedure for all Groups which Rated Self-Efficacy before Choosing/ Being Assigned a Strategy	207
Appendix I	Post-trial Instructions for Control Group	214
Appendix J	Post-trial Absorption Rating Scale for Distraction Task	215
Appendix K	Post-trial Absorption Rating Scale for Imagination Task	216
Appendix L	Post Baseline Procedure for Groups which Chose/Were Assigned a Strategy before Rating Self-Efficacy	217
Appendix M	Crowne-Marlowe Self-Evaluation Questionnaire	224
Appendix N	Spheres of Control	226
Appendix O	Betts QMI	230

A plausible neurological account of how pain perception might be determined by both physiological and psychological factors was provided by Melzak and Wall's (1965) gate-control theory. The gate-control theory led to a surge of scientific interest in psychological methods for pain reduction (Barber, 1963; Fordyce, 1976; Hilgard, 1975; Kamiya, 1969; Meichenbaum, 1977; Sternbach, 1974). The psychological component in the pain experience has been acknowledged in the definition of the subcommittee on taxonomy of the International Association for the Study of Pain. According to this definition pain is an "unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (Bonica, 1979, p. 250). It is important to note that this definition does not tie the experience of pain to any particular stimulus. Instead, pain is defined in terms of a negative experiential quality, and in this sense is more closely related to other unpleasant experiences such as hunger, fatigue and nausea than to such sensory systems as vision and hearing.

The Cognitive Approach to Pain Reduction

A wide variety of pain coping techniques have been used clinically and studied in the laboratory. A far from complete list includes placebo, relaxation, operant conditioning, biofeedback, hypnosis, advanced preparation, social modelling, distraction, imagery, and stimulus reinterpretation (Sternbach, 1978). The fact that all these techniques have been successful

to some extent in attenuating pain (Melzak, 1980) suggest that they may be employing the same "active ingredients".

Conceptualizations of the ingredients that lead to pain reduction vary depending on theoretical orientation. The cognitive approach is based on the premise that responses are a function of people's thinking, beliefs and feelings about reality (Beck, 1967; Meichenbaum, 1977). Coping difficulties are explained in terms of dysfunctional cognitions such as a belief that one is not able to do anything about the situation, or focusing on and exaggerating the negative aspects of a situation. Applying these principles to coping with pain, cognitive psychologists have emphasized active patient participation, fostering self efficacy, focusing on pleasant aspects, diverting attention from aversive aspects, and reinterpretation (Turk & Holzman, 1986; Turk, Meichenbaum, & Genest, 1983).

Turk (1978) classified such coping strategies into two broad classes: Imagery and Distraction. In Turk's classification imagery strategies included imagining the stimulated area as numb and insensitive, engaging in pleasant or neutral imagery that is incompatible with pain (e.g., sunbathing on a beach), imagining a situation in which the pain sensations could be interpreted as pleasant. Distraction included things like counting tiles, doing mental arithmetic or objectively focusing, as if one were a scientist, on the pain sensations. McCaul and Malott (1984) classified pain coping strategies into Distraction and Redefinition. This

classification goes beyond the descriptive because some imagery strategies such as imagining the stimulated area as numb and insensitive are classified under Redefinition. Barber (1977) has suggested that distraction of attention is the "final common pathway" of all cognitive strategies. Wack and Turk (1984), using a multi-dimensional scaling procedure, classified cognitive strategies along three "latent dimensions". The Sensation Acknowledging dimension involved a continuum ranging from strategies involving focusing on the pain stimulus at one end (e.g., "I concentrated on the pain and told myself it was not painful") to strategies involving deflection of attention away from the pain stimulus at the other end. In the cognitive literature the opposite ends of this dimension are usually labelled Reinterpretation and Distraction. The Coping Relevance dimension classified strategies according to subjects' perception of their relevance for coping with pain. "I did breathing exercises" belonged to the Coping Relevant end of the dimension while "I examined the equipment in the room to see how it worked" belonged to the Coping Irrelevant end of the dimension. Devine and Spanos (1990) suggested that this dimension could also be labelled an Expectancy dimension because when subjects perceived strategies as coping relevant they also expected them to be effective in reducing pain. Wack and Turk's (1984) third dimension was labelled Cognitive/Behavioral. Strategies involving overt motor responses (e.g., "I pinched my leg with my free hand") belonged to the Behavioral end of this continuum while strategies involving

covert cognitive responses belonged to the cognitive end.

It is important to emphasize that while the cognitive strategy is viewed as a specific cognitive skill for coping with pain (such as distracting attention from it), the very fact of providing a strategy contains several other messages: it implies that pain can be reduced and that the subject is expected to be active (ie., engage in the strategy provided). The cognitive approach to pain reduction emphasizes these implicit factors which go beyond strategy provision. In addition to strategy provision cognitive pain treatment usually includes specific verbalization aimed at fostering a positive expectancy, feelings of competence and an active attitude in dealing with the pain.

Strategy Use and Pain Reduction

Many studies (Avia & Kanfer, 1980; Barber & Hann, 1962; Beers & Karoly, 1977; Blitz & Dinnerstein, 1971; Chaves & Barber, 1974; Evans & Paul, 1970; Knox, 1973; Spanos, Horton, & Chaves, 1975); compared the effectiveness of various pain coping strategies to no treatment and to spontaneous pain coping behaviours which subjects bring to the experimental situation. Studies (Beers & Karoly, 1977; Devine & Spanos, 1990; Jaremko, 1978; Grimm & Kanfer, 1976; Marino, Maxwell, & Spanos, 1989; Scott & Barber, 1977) have also compared the effectiveness of one strategy against other strategies. Pain reduction studies follow the same general sequence: 1. Subjects are exposed to painful stimulation and baseline pain rating are recorded. 2. Subjects are assigned to no treatment

control or to treatment groups provided with a pain reduction strategy. 3. Subjects are again exposed to the painful stimulation and pain ratings are recorded.

Turk et al. (1983) reviewed a large number of experimental studies which compared the effectiveness of cognitive strategies to no treatment controls. Of the studies reviewed, 28 reported greater pain reduction for the cognitive strategy groups than for no treatment control groups while 16 studies failed to show such a difference. Tan's (1982) review also supports the finding that cognitive strategies are more effective than no treatment. The reviewers explain the negative results obtained in some studies by pointing out that some so called no treatment control subjects may be utilizing their own techniques to cope with pain. Also, in some studies, subjects may not be using techniques provided to them. Turk et al.'s (1983) analysis of the studies reviewed yielded unconvincing evidence for the efficacy of any cognitive strategy compared to strategies subjects themselves bring to the experiment. Spanos, Hodgins, Stam, and Gwyn (1984) found that subjects not supplied with a strategy but instructed to "do whatever you can to reduce pain" reported as much pain reduction as those supplied with a specific imagery strategy.

Comparing the effectiveness of one strategy over others, Turk et al. (1983) conclude that there is little evidence to support the superiority of any particular strategy. He noted

that imagery related strategies tended to be more effective than those with no obvious imagery component but that the evidence is insufficient. Recent studies (D'Eon & Perry, 1983; Dubreuil et al., 1988; Farthing, Venturino, & Brown, 1984, Spanos, McNeil, Gwynn, & Stam, 1984) found that a shadowing type distraction task was as effective as an imagery task in reducing pain. Devine and Spanos (1989) found that both distraction by counting backward and reinterpretation of the pain stimulus as not painful were as effective as imagery strategies.

Turk et al. (1983) consider their conclusions as tentative due to methodological differences between pain studies which make comparing them difficult. These differences include the type of pain stimulus used (e.g., cold pressor pain, strain gauge pain, ischemic pain), the pain measures used (subjective pain reports, tolerance scores, pain threshold). In addition intensity of the pain stimulus used, ceiling effects, specific instructions given, different experimental designs and experimenter's demands can make a difference in results obtained.

Turk et al. (1983) concluded that: 1. Psychological factors do affect response to pain; 2. No conclusive evidence exists to suggest the superiority of one cognitive strategy over another or over subjects' spontaneous pain reduction techniques. Melzak (1980) reached similar conclusions stating that "many of the psychological

methods...are known to produce a measure of pain relief" (p. 149) but that more research is needed before it can be stated that any of the methods is more effective than the others.

The fact that all cognitive strategies seem to produce some pain relief but that no one strategy was found superior to the others may suggest that the same active ingredient or ingredients operate in all of them. Several investigators have suggested expectancy as the active ingredient. Turk et al. (1983) write: "it is not necessarily the strategy per se but the subject's attitude and sense of confidence about the strategies that may play an important role in the pain situation (p. 102). Similarly, Weisenberg (1984) suggested Bandura's (1977) concept of self efficacy as a unifying concept worth investigating.

The Constructs of Expectancy and Self-efficacy

Bandura (1977) defined self-efficacy as "the conviction that one can successfully execute the behaviour required to produce outcomes" (p. 193). He proposed that self-efficacy is a common mediator underlying the behaviour change achieved by psychological interventions. Bandura's definition has two elements: a belief that one can execute the behaviour, and a belief that this behaviour produces the desired outcome. Bandura refers to the first as efficacy expectations and to the second as outcome expectations. It is ambiguous however whether Bandura

proposes that, in order for change to occur, it is sufficient that one believe he/she can execute the required behaviour or whether in addition to that one has to actually execute that behaviour. This distinction is very important because if Bandura proposes the first possibility, his theory is not different from Kirsch's (1985) theory that expectation for an involuntary behaviour to occur is sufficient to result in that behaviour. It seems that in his earlier articles Bandura viewed self-efficacy as necessary and sufficient to produce behaviour change while in his later article (1982) he views self-efficacy as necessary but not sufficient.

The construct of self-efficacy has been criticized by Kirsch (1986) on the ground that it is not different from his expectancy construct. Kirsch (1982, 1985) as well as Maddox and Barnes (1985) point out that the concept has led to a great deal of confusion and has resulted in studies which measure very different things labelled as self-efficacy as well as in studies which measure self-efficacy without labelling it as such. Tryon (1981) suggested that the correlations obtained between self-efficacy measures and behaviour change can be accounted for by the well established observation that in experimental situations subjects tend to behave as they say they would. Borkovec (1978) views self-efficacy as a reflection rather than a cause of behaviour change claiming

that the research Bandura (1977) presents does not support the claim that self-efficacy can account for behaviour change.

In pain experiments self-efficacy can be measured by asking a subject to rate the extent s/he believes s/he will be able to reduce pain when using a given strategy. Though this follows Bandura's (1977) definition of self-efficacy, it is clear that a separate measure of the extent the subject actually used the strategy is needed if the combined effects of self-efficacy and strategy use are to be examined

Expectancy, Self-efficacy and Pain Reduction

Studies which examined the role of expectancy in pain reduction will be reviewed. Some of these studies found that higher levels of expectancy are associated with increased pain reduction and concluded that expectancy by itself can account for pain reduction. However, the association between expectancy and pain reduction cannot lead to the conclusion that expectancy alone is sufficient. Studies which examined the role of absorption in a strategy demonstrate that absorption is important in addition to expectations.

Neufeld and Thomas (1977) manipulated expectancy by providing subjects with false feedback about their ability to cope. Subjects were led to believe that relaxation enhances pain tolerance. Subjects told that they succeeded

at relaxing during pain stimulation showed significantly higher pain tolerance than both subjects who were told they did not succeed at relaxing and control subjects who received no feedback. The groups did not differ in either physiological measures or in verbal reports of relaxation. In this experiment different expectancy levels were associated with different pain tolerance levels.

The importance of expectancy was demonstrated also in a study by Litt (1988). Subjects' perceived self-efficacy concerning their ability to tolerate ice water pain was manipulated by providing them with false feedback. Though subjects were not provided with cognitive strategies, the positive and negative false feedback produced corresponding increases and decreases in both self-efficacy and pain tolerance.

Beers and Karoly (1979) compared subjects provided with positive expectancy and various cognitive strategies to positive expectancy only controls and to no treatment controls. Positive expectancy was manipulated by telling subjects that the second pain trial would be experienced as less aversive and easier to withstand. The treatment group evidenced an increase in pain tolerance and pain threshold scores though not in subjective pain ratings. There was no such increase in pain endurance in the control groups and the expectancy group did not differ significantly in this respect from the no treatment controls. Beers and Karoly

(1979) concluded that expectancy alone does not account for reduction in pain.

Vallis and Bucher (1986) examined the effect of self-efficacy expectations on pain reduction in subjects who were trained in either a skill based (such as attention diversion) or a non-skill based (such as information about the pain response) coping strategy. Pre-training and post-training self-efficacy ratings were taken. Vallis and Bucher (1986) found that changes in self-efficacy magnitude ratings from pre-training to post-training predicted post-training pain tolerance and pain discomfort scores in the non-skill group. This effect was found in the skill group only for tolerance scores but not for discomfort scores. The above results were independent of pretraining pain levels. Bucher and Vallis (1986) concluded that self-efficacy is a good predictor of pain reduction only in the absence of a change in an individual's repertoire of coping skills.

Avia and Kanfer (1980) measured "perceived control" or self-efficacy of subjects given a choice of an imagery strategy and subjects not given imagery choice. The two treatment groups did not differ on perceived control ratings. They evidenced equivalent reductions in their subjective pain ratings in line with their perceived control levels but tolerance scores were higher for the choice group.

Reese (1983) took pre and post-treatment self-efficacy ratings of subjects exposed to self relaxation, general cognitive skills training or pharmacological placebo control. All were compared to no treatment controls on various pain measures. Subjects in all treatment groups reported high post-treatment perceived self-efficacy. However, only subjects in the cognitive training group showed significant reductions on pain measures which corresponded to their high self-efficacy ratings.

Several pain studies which measured both expectancy and use of cognitive strategy obtained consistent results concerning the importance of absorption in a coping strategy.

Spanos and O'Hara (1989) exposed subjects to choice of an imagery or distraction strategy. A strain gauge was used to induce pain. Subjects using these strategies did not differ on their pain attenuation scores and this was in line with no difference on reported self-efficacy levels. However, while self-efficacy ratings were the best predictors of pain reduction for subjects using distraction, post-treatment absorption in strategy ratings were the best predictor of pain reduction for subjects in the imagery group.

In Marino et al.'s (1989) study subjects received false positive expectancy information before using one cognitive strategy and false negative expectancy information before

using another cognitive strategy. Negative information reduced expectancy ratings and decreased reported pain reductions for the ice water stimulus. Degree of absorption in the strategy provided, as well as subjects' levels of social desirability, contributed to the prediction of pain attenuation over and above predictions based on expectancy ratings.

Devine and Spanos (1990) compared pain reduction levels of subjects trained in four different coping strategies to those of no treatment controls as well as to expectancy controls. Expectancy control subjects expected analgesia but were not trained in a coping strategy. Subjects in the four coping groups expected equivalent amounts of analgesia and produced equivalent attenuation of pain. Their pain attenuation levels were significantly higher than those of subjects in the two control groups. Expectancy control subjects expected analgesia but reported no significant pain reduction. No treatment controls neither expected nor achieved significant pain reduction. As in Marino et al.'s (1989) study, absorption in the strategies added significantly to the prediction of pain reduction over and above predictions made by expectancy alone.

Spanos, Perlino, & Robertson (1989) found substantial discrepancies between the amount of pain reduction subjects expected from various treatments and actual amounts of pain reduction reported following exposure to those treatments.

Importantly, subjects who reduced pain engaged in more cognitive coping and less catastrophizing (dysfunctional cognitions) than those who did not reduce pain.

The importance of absorption in a coping strategy is illustrated also in a series of studies which questioned subjects about their ongoing cognitive activity during exposure to pain (Genest, 1978; Genest, Meichenbaum, & Turk, 1977; Spanos, Brown, Jones, & Horner, 1981). These studies found that even before exposure to treatment subjects who coped with the pain by using spontaneous strategies such as distraction or pleasant imagery reported lower levels of pain and showed higher tolerance than subjects who did not use coping strategies.

On the whole, the pain studies reviewed support the hypothesis that expectancy is an important variable in pain reduction. They do not however support the hypothesis that expectancy by itself is sufficient to account for pain reduction. An alternative sociocognitive model (Barber, 1969; Spanos, 1982; Coe, 1978; Sarbin, 1984) emphasizes absorption in a strategy as well as subject's response to situational demands, in addition to expectations.

The Sociocognitive Approach and Hypnotic Analgesia

The body of research on hypnotic responding conducted by investigators who adopt the socialcognitive approach to behaviour modification (Barber, 1969; Coe, 1978; Sarbin, 1984; Spanos, 1982) is relevant to the study of pain

reduction.

A very large body of research (reviewed in Spanos, 1986a; Spanos, 1986b; Spanos & Chaves, 1989) indicates that hypnotic responding is a goal directed activity. Despite sometimes being experienced as involuntary, hypnotic responding results from goal-directed action. According to this perspective the expectancy to respond to hypnotic suggestions is important but not sufficient. Rather, expectancy acts by motivating subjects to actively engage and become absorbed in the imagery provided in the hypnotic suggestion leading to hypnotic responding (ie., imagining the arm as light leads to arm levitation). From this perspective hypnosis is not viewed as a special state happening to a passive subject (Hilgard, 1965, 1977; Orne, 1972). Rather, the same theoretical constructs used to explain everyday activities are considered adequate to account for hypnotic responding.

The sociocognitive approach explains hypnotic analgesia in the same terms as other hypnotic behaviours. Subjects report reduced pain when they become absorbed in cognitive activities.

Spanos (1989) considers three hypotheses regarding the question of what gets reduced in suggested/hypnotic analgesia: reduction of perceptual sensitivity to noxious stimuli, reinterpretation and compliance. There is little support to the hypothesis that hypnosis results in a

decreased ability to perceptually discriminate pain levels. Category rating scales and tolerance measures confound perceptual sensitivity to pain with decisional biases. The use of scaling procedures designed to separate perceptual sensitivity from decisional biases (e.g., signal detection, magnitude estimation and functional measure procedures) did not consistently result in a relationship between hypnotic or non-hypnotic suggested analgesia and reductions in pain sensitivity (Clark, 1974; Clum, Luscomb, & Scott, 1982; Jones, Spanos, & Anuza, 1987; Spanos, Jones, Brown, & Horner, 1983; Stam, Petrusic, & Spanos, 1981). Although reduction in perceptual sensitivity may occur, this cannot be the sole explanation for the effectiveness of suggested analgesia. A second hypothesis is that cognitive activity leads subjects to reevaluate and reinterpret the noxious stimulation as less painful. It is possible that a strain gauge stimulus previously labelled as "painful" can be reinterpreted as "pressing but not painful" or "numb". A number of studies using category rating procedures (Bandler, Madaras, & Bem, 1968; Lanzetta, Cartwright-Smith, & Klek, 1976; Nisbett & Schachter, 1966) are consistent with this hypothesis because they indicate that subjects evaluate painfulness on the basis of cues different than the actual intensity of the noxious stimulus. Nisbett and Schachter (1966) administered a placebo and then a series of electric shocks. Subjects who

were led to believe that their autonomic arousal (e.g., flushing) is due to the placebo rated the shock as less painful and tolerated more shock than those who were led to attribute their arousal to the effects of the shock.

Lanzetta et al. (1976) induced subjects to display behavioral expressions of either suffering (e.g., wincing) or calmness during the administration of electric shock. Though exposed to identical shock levels, those who displayed suffering rated themselves as feeling higher levels of pain than those who displayed calmness. The possibility that compliance is a factor in pain reduction is emphasized by the sociocognitive approach. The role of compliance is not well understood. Several studies (Gelfand, 1964; Sternback & Tursky, 1965; Wolff & Horland, 1967) indicated that mild coaxing with no strategy provision can enhance pain tolerance. On the other hand, Reese (1983) obtained higher levels of pain reduction in cognitive treatment groups compared to a placebo group in spite of equivalent demands for pain reduction and equivalent levels of expectancy. Recently, Spanos, Perlini, Patrick, Bell, and Gwynn (1990) found that compliance strongly influenced hypnotic and nonhypnotic pain reduction reports given by high hypnotizable subjects. The role of compliance in pain reduction reports given by low hypnotizables is not as clearcut. Spanos (1989) suggests that reduction of perceptual sensitivity,

reinterpretation and compliance are not mutually exclusive and that their relative importance may vary in different situations and among different subjects.

In contrast to this account of hypnotic analgesia, the special state theory (Hilgard, 1977) views hypnosis as a particularly effective method for reducing pain because it purportedly leads to the dissociation of pain from conscious awareness in subjects who possess high levels of dissociative ability (ie., high susceptible subjects). Because low susceptible subjects do not possess the ability to dissociate they should be unable to reduce pain as much as high susceptibles, whether they use hypnosis or other methods.

Hilgard's "hidden observer" experiments (Hilgard & Hilgard, 1975; Knox, Morgan, & Hilgard, 1974) were offered as support for the hypothesis of dissociated pain. In these experiments subjects were administered a hypnotic induction and explicitly told that a hidden part of them remained aware of experiences of which their hypnotized part was unaware. Later, during hypnotic analgesia, they were instructed to give ratings of the degree of pain felt by their conscious part as well as ratings of the degree of pain felt by their "hidden" or unconscious part. Many of the high hypnotizables reported low levels of overt pain but high levels of hidden pain. In these experiments, however, there is an obvious demand to present as

experiencing these two pain levels. High hypnotizables may respond to this demand as they do to other demands made during hypnosis sessions. To test this idea, Spanos and Hewitt (1980) exposed high hypnotizable subjects to the same procedure used by Hilgard to elicit hidden pain reports. Another group of Highs was exposed to this procedure but told that their hidden part would feel less pain than their overt part. While the first group reported higher hidden than overt pain, the second group reported lower hidden than overt pain. Spanos, Gwynn and Stam (1983) also repeated Hilgard's procedure but gave subjects no information regarding the relative intensity of hidden and overt pain. Contrary to the dissociation hypothesis subjects in this condition reported no difference in the levels of hidden and overt pain.

The consistently replicated finding of significant correlations between pretested levels of hypnotic susceptibility and degree of pain reduction in both hypnotic or waking analgesia (Evans & Paul, 1970; Hilgard & Hilgard, 1975; Spanos, Stam, & Brazil, 1981) seems to support the claim for the superior analgesic capacity of high susceptibles. However, an alternative explanation for the correlations between susceptibility and pain reduction becomes apparent when hypnotic analgesia is tested first and susceptibility later resulting in no significant correlation between the two (Spanos, Hodgins, Stam, &

Gwynn, 1984). The obtained correlation between susceptibility and analgesia can be explained in terms of subject's response to contextual demands; Low susceptibles do not expect to reduce much pain in an hypnotic analgesia test or in a suggested analgesia experiment which they may associate with hypnosis, if they already know that they respond poorly to hypnosis. When the experimental context does not suggest a relationship between analgesia testing and hypnosis, the correlations between hypnotizability and suggested analgesia drops. Contrary to special state hypotheses numerous studies found that the administration of an hypnotic induction did not result in greater pain reductions over that obtained using waking analgesia even when the subjects tested were high susceptibles (Barber & Hahn, 1962; Spanos, de Groot, Tiller, Weeks, & Bertrand, 1985; Spanos, Perlini, & Robertson, 1989; Spanos, Radtke-Bodorik, Ferguson, & Jones, 1979). Furthermore, a number of studies indicated that low susceptibles using distraction (Farthing, Venturino, & Brown, 1984; Spanos, McNeil, Gwynn, & Stam, 1984) were as effective in reducing pain as high susceptibles using hypnosis. Lows given instructions for analgesia in nonhypnotic contexts also report as much pain reduction as highs given hypnotic analgesia (Spanos, Kennedy, & Gwynn, 1984; Spanos, Voorneveld, & Gwynn, 1987).

In summary, these studies suggest that any strategy

which distracts subjects from the pain is as effective as hypnosis. Absorption in the strategy emerges as a crucial factor leading to pain reduction. Expectation is viewed as a mediating variable which provides the subject with the motivation to engage in the strategy.

Strategy Choice and Pain Reduction

In spite of the fact that strategy choice has been incorporated into Meichenbaum and Turk's (1976) influential pain reduction program and has been used by other clinicians as well (Langer, Janis, & Wolfer, 1975; Levendusky & Pankratz, 1975), there has been little research into the effectiveness of choice in pain reduction. Several studies (Worthington, 1978; Avia & Kanfer, 1980; D'Eon & Perry, 1983) have examined the relationship between strategy choice and pain reduction. Choice has been operationally defined in these studies as the number of options open to the subjects. As we will show in our review, the results of these studies are far from conclusive and point to a need for greater refinement than has been used thus far.

The common explanation for the effectiveness of choice in the pain reduction literature is based on the rational that choice increases feelings of control, self-efficacy, and self-competence. There is a tendency to assume that most people will feel more in control when given a choice rather than when decisions are made for them. None of the

experimental studies to be reviewed, however, actually measured subjects' perceived self-efficacy as a function of strategy choice.

A different rationale for including choice in pain reduction programs could be that the effectiveness of cognitive strategies may be improved by matching people to strategies that are in line with their abilities. However, several studies (Beers & Karoly, 1979; Marino et al., 1989; Spanos & O'Hara, 1989; Worthington, 1978;) found no relationship between subjects' choice of an imaginal strategy and various measures of imagery ability.

In a review of findings regarding personal control and stress reduction Averill (1973) concluded that the relationship between control and stress reduction is more complicated than the simple assumption that the more control people have the better they are able to reduce stress. He pointed out that at times personal control can lead to increased rather than decreased stress and that "about the only statement which can be made with confidence is that the stress-inducing or stress-reducing properties of personal control depend upon the meaning of the control response for the individual; and what lends a response meaning is largely the context in which it is embedded" (Averill, 1973, p. 301). Keeping in mind the complicated relationship between control and stress, Averill (1973) points out the need to refine our analysis by making a

distinction between objective range of choice and experienced choice. Objective range of choice is defined as the number of choices available to a person. The prevailing assumption is that the more choices people have, the better they are able to cope with stress. Experienced choice is based not on the objective range of choices available but "on the degree to which a person agrees or identifies with the choices he does have, no matter how limited" (Averill, 1973, p. 301). Averill suggested that how much control people experience and how much they are able to reduce stress may be a function of experienced choice rather than of objective choice range. The need for making the above distinction is based on an experiment by Lewis and Blanchard (1971). In an ostensible learning situation subjects were assigned to three levels of choice. In the high choice conditions subjects had complete freedom to choose whether they would be "teacher" or "learner". Teachers gave electric shock and learners received the shocks. All subjects chose to be teachers indicating that subjects preferred to give rather than receive shock. In the medium choice condition, it was offhandedly suggested to one half of the subjects that they be teachers and to the other half that they be learners but each subject could then choose the other role if he so desired. In the no-choice condition, subjects were told definitively to be either the teacher or the learner.

After the experiment subjects rated how free they were to assume or reject the roles they were assigned. Results showed that perceived freedom of choice varied as a function of whether subjects (in the medium and low-choice conditions) were assigned the role of teacher or learner. Subjects assigned the teacher role perceived themselves as having more freedom of choice than subjects assigned the learner role. That is, perceived freedom of choice was a function of how well the subject could agree with what was assigned to him rather than with the range of choices actually available to him. Results of several pain experiments which manipulated strategy choice suggest that the distinction between objective and subjective control may lead to a better understanding of subject's behaviour than the simple assumption that subject's behaviour is related to range of choice available.

Avia and Kanfer (1980) hypothesized that a strategy choice group will be more effective in reducing pain than a no choice group. Subjects in the choice group discussed with the experimenter the details of a pleasant trip they would like to take. In addition the experimenter mentioned to these subjects other pleasant images they could use to reduce pain and emphasized that they had many ways of coping with pain. The no-choice subjects also discussed a pleasant trip they would like to take but were not told about other possible images and were not told that they

have many ways of coping. They were asked to use the pleasant trip imagery on post-test. Results showed that the choice group did better than the no choice group on pain tolerance scores but this difference was not found when subjective pain ratings were used as the criterion for pain reduction. The fact that no difference was found on subjective pain ratings is not surprising because subjects rated pain only at the end of each pain tolerance trial rather than at a fixed time during each tolerance trial. Pain ratings taken at the end of tolerance would probably be uniformly high. In addition, though Avia and Kanfer (1980) set out to compare the effect of freedom of choice with no choice, they may actually have compared two groups given freedom of choice. Though the objective range of choices for subjects in the no-choice condition was more limited than in the choice condition, their level of experienced choice might have been as high considering that they did choose their trip and elaborated the details of this imagery.

Worthington (1978) examined the effect of imagery choice, neutral or pleasant imagery content, and the encouragement of self verbalizations on pain reduction. Subjects in the choice group were asked to come up with imagery to use on the post-test pain trial. Subjects in the yoked groups were assigned the imagery used by the member from the choice group with whom they were paired.

Choice was the only significant effect found for pain reports. Worthington's (1978) report does not make it clear whether or not the yoked subjects were aware that they were using another subject's imagery. This distinction is important because having to use another subject's imagery may antagonize subjects who can accept imagery assigned by the experimenter more neutrally than the imagery of another subject. It is possible that the superior results obtained by the choice condition did not reflect the effectiveness of choice but the ineffectiveness of assigning subjects a strategy they could not accept.

D'Eon and Perry (1983) compared high and low susceptible subjects who were given a strategy choice to those who were assigned a strategy. After baseline pain administration the choice subjects were told about an imagery strategy and a distraction strategy and were then asked to choose one of them to use on post-test. The other treatment groups were told about the two strategies but assigned one of them to use on post-test. Subjects given strategy choice exhibited significant pain reduction from the first to the second pain trial and their pain difference scores differed from those of the no treatment controls. There was no such difference in pain reduction scores between subjects assigned a strategy and controls. D'Eon and Perry's (1983) conclusion that strategy choice increases the effect of cognitive techniques is, however,

open to criticism. An alternative interpretation would be that strategy choice does not improve pain reduction but that forcing subjects to use their less favorable strategy interferes with pain reduction. Some of the subjects assigned a strategy would have been assigned their less favorable one. The sense of subjective choice for these subjects could be lower than for subjects simply presented with one strategy in a no-choice condition. In order to conclude that strategy choice improves pain reduction it is necessary to compare subjects exposed to two strategies and allowed to choose one of them to subjects exposed to only one strategy. It would also be interesting to divide the subjects assigned a strategy to those assigned their favorable strategy and those assigned their less favorable strategy.

Locus of Control and Other Personality Variables as Mediators of Pain Reduction

Research on personality variables as mediators of pain reduction can be divided into several topic areas: 1. Locus of control as a mediator of the ability to utilize control; 2. Hypnotic susceptibility as a pre-requisite for analgesia; 3. Imagery ability in relation to the effectiveness of cognitive strategies within groups of subjects; 4. Social desirability scores and the tendency to respond to the demand characteristics of the situation.

Locus of Control

Locus of control is viewed as a generalized tendency to assume that behavioral outcomes across a wide array of situations are under personal control. Self efficacy is viewed as a belief in one's ability to control behavioral outcomes in specific situations. Rotter's (1966) internal versus external locus of control dimension (I-E Scale) places people who tend to view reinforcing events as contingent upon their behavior on the Internal end. People who believe that their behavior has little to do with subsequent reinforcements are placed on the External end. The personality variable of locus of control has a face validity relevance to the area of pain control because of its relation to control and self efficacy.

An interesting hypothesis regarding the relationship between personality variables and the availability of control is that control benefits only those whose personal style allows them to utilize it (Shipley, Butt & Horwitz, 1979). According to this hypothesis subjects with internal locus of control will experience less stress in situations that can be controlled than subjects with external locus of control. This hypothesis was tested using physiological, behavioral and self-report indicators of stress.

DeGood (1975) manipulated perceived control by assigning subjects either to a group which could escape electric shock whenever they asked for a rest period

(situational control group) or to a group which had comparable rest periods imposed on them by the experimenter (situational no control group). Locus of control was measured using Rotter's (1966) scale. DeGood (1975) found that blood pressure elevations were lowest for internal control subjects assigned to the situational control group.

Lundberg and Frankenhaeuser (1976) exposed subjects to an increase in noise intensity while performing mental arithmetic. Subjects classified as internals according to Rotter's Internal-External Locus of Control Scale benefited more than externals from being allowed to exercise control over noise intensity.

Houston (1972) examined the interaction between locus of control scores and situational perceived control for three stress indicators. To manipulate perceived control he told one group that they could avoid electric shock by not making mistakes on a memory task and another group that there was no way of avoiding shock. He found that in the avoidable shock condition internals (as measured by Rotter's scale) performed better than externals. In the unavoidable shock condition externals performed better than internals. However when anxiety, measured both by self report and by physiological arousal, was used as an indicator of stress, no such interaction was found.

Spanos and O'Hara (1989) found no relationship between pain reduction reports of subjects given choice of a

cognitive strategy and their locus of control scores. Neither did this study find a correlation between pain reduction and other personality variables related to control (Eysenck's Neuroticism and Extroversion Scales, and Repression-Sensitization).

Different scales have been devised to measure locus of control (Levenson, 1973; Paulhus, 1983; Rotter, 1966). Paulhus' (1983) Spheres of Control (SOC) differs from Rotter's (1966) scale in that it views locus of control as a multidimensional construct. The SOC scale includes 30 Likert type items which are associated, 10 per sphere, with three spheres of activity: a. Personal Efficacy - control over the non-social environment as in personal achievement; b. Interpersonal Control - control in situations involving other people; c. Sociopolitical Control - control over social and political events and institutions. The scale can be utilized to yield a profile of three scores or a single score.

Reliability and validity data regarding the scale is presented in Paulhus (1983). The subscales show a different pattern of correlations with criterion behaviors. However, the multiple correlation of the three subscales with Rotter's scale is high ($R = .75$) indicating that the subscales together are tapping most of the original construct. Test-retest correlations at 4 weeks were above .90 and at 6 months above .70 for all three

subscales indicating that they measure a fairly stable personality attribute. Contamination by social desirability is minimal as indicated by very low correlations with Marlowe Crowne Social Desirability Scale (Crowne & Marlow, 1966), substantially lower than is the case with Rotter's scale.

Hypnotic Susceptibility

Hilgard's (1977) proposition that high hypnotic susceptibility is a pre-requisite for high levels of analgesia has already been discussed in relation to the cognitive social-psychological approach. The following conclusions are based on research reviewed by Spanos (1986; 1989): 1. The relationship between hypnotic susceptibility and analgesia is found only when the context of the experiment leads subjects scoring as low susceptibles to assume that they cannot reduce much pain; 2. Low susceptibles can reduce as much pain as high susceptibles when hypnosis is not used as a pain reduction technique.

Imagery Ability

Imagery ability as an attribute variable mediating the effectiveness of cognitive pain reduction strategies has been touched upon in relation to the proposition that imagery strategies may be more effective for subjects with good imagery ability.

Spanos and O'Hara (1989) did not find a correlation between imagery ability and pain reduction using an imagery

strategy. Results of other studies examining the relationship between imagery ability and the effectiveness of cognitive imagery strategies or hypnosis are inconsistent (Bowers, 1978; Crawford, 1978; de Groh, Cross, & Spanos, 1986; Diamond & Taft, 1975; Perry, 1973; Spanos, McPeake, & Churchill, 1976). Overall, the results suggest that imagery ability correlates with effectiveness of a strategy utilizing imagery only if the temporal proximity between the administration of the imagery ability questionnaire and the imagery strategy leads the subject to believe that the two are related. When imagery ability is tested in a separate context, no correlation is found between the two. These results are consistent with the finding already reviewed regarding the context dependent relationship between susceptibility level and pain reduction. It is possible that context generated expectancies can also explain inconsistent results in research on other personality variables such as locus of control and pain reduction.

Social Desirability

Social desirability refers to the tendency of people to present themselves in a socially acceptable fashion. Orne (1962) proposed that in an experimental situation subjects tend to behave according to the demand characteristics of the situation; i.e., according to what they think is expected of them. Findings such as those reviewed

regarding the relationship between hypnotic ability and analgesia lend support to this proposition. Because experimental demands exert a strong influence, it can be expected that the relationship between social desirability scores and subjects' behavior is more consistent than the relationship between other personality variables and behavior. Marino et al. (1989) found that social desirability scores accounted for a significant amount of the variability in pain reduction scores, above and beyond what could be accounted for by expectancy scores only.

The Present Experiments

Two experiments in which subjects were assigned to various strategy choice conditions were designed to study the relationship between strategy choice, perceived self-efficacy and pain reduction.

The main questions explored were:

1. Does greater choice range improve pain reduction?
2. Does choice-control improve perceived self-efficacy?
3. Is perceived self-efficacy sufficient to explain pain reduction?

Experiment I

In the first experiment pain reduction levels of subjects who were presented with two cognitive strategies (Distraction, Imagery) and allowed to choose one of them to use on post-test (Choice Choice-Control groups) were compared to pain reduction levels of subjects presented

with the same two strategies but assigned one of them (Force Choice-Control groups). Pain reduction levels of the choice groups were also compared to those of subjects presented with only one of the strategies which they used on post-test (Neutral Choice-Control group). Perceived self-efficacy was defined, following Bandura, as the extent to which subjects believe they will be able to reduce pain when using the strategy. Perceived self-efficacy was measured before strategy choice/assignment. This design made it possible to examine whether the choice effect obtained in previous experiments (D'Eon & Perry, 1983; Worthington, 1978) was due to superior pain reduction of the choice group compared to the no choice (Neutral Choice-Control) group or, alternatively, the poorer pain reduction of those subjects in the forced group who were assigned their less preferred strategy (the one they rated as less likely to reduce pain on the self-efficacy measure). We hypothesized that while strategy choice does not result in improved pain reduction compared to no choice, forcing subjects into their less preferred strategy interferes with pain reduction. We hypothesized that subjects assigned their preferred strategy (the one they rated higher on self-efficacy) would report equivalent pain reduction to subjects given strategy choice. We also expected strategy provision to raise perceived self-efficacy.

Method

Subjects

One hundred Carleton University students (ages 18 and over) volunteered to participate in a study involving painful stimulation. They received course credit for their participation.

Pain Apparatus

Pain was experimentally induced with the use of a modified version of the Forgione-Barber Strain Gauge Pain Stimulator (Forgione & Barber, 1971). By lowering a weighted wedge over the second phalanx of the subject's finger a force of 2040 g was generated. The constant pressure of this device results in a slow but continuous growth of pain. Half of the subjects used their right hand on the two pain trials while the other half used their left hand. Trials were also counterbalanced with respect to the use of index and middle finger.

Pre-baseline Inventories

Prior to the baseline pain trial all subjects completed the following inventories:

Marlowe-Crown Social Desirability Scale (S-D, displayed in Appendix M, Crowne & Marlow, 1966) was used to assess the degree to which subjects were attempting to present themselves in a socially acceptable fashion.

The Spheres of Control Scale (S-C, Appendix N, Paulhus, 1983) was designed to assess the need to exert control over

events in one's life.

In addition to the above measures we had available subjects' objective susceptibility (CURSS-O) and subjective susceptibility (CURSS-S) scores on the Carleton Responsiveness to Suggestion Scale (CURSS) (Spanos, Radtke, Hodgins, Stam, & Bertrand, 1983). CURSS-O scores indicate the number of suggestions subjects responded to overtly. CURSS-S scores reflect the extent to which the events called for by the suggestion were subjectively experienced. CURSS-O and CURSS-S scores were obtained in the course of an hypnotic susceptibility testing session which took place within 3 months either prior to the experiment or after the experiment. CURSS scores are highly correlated with those of other standardized hypnotic susceptibility measures (Spanos, Radtke, Hodgins, Bertrand, Stam, & Murruti, 1983). During the CURSS session subjects were also administered the modified Betts Questionnaire upon Mental Imagery (Betts QMI - Appendix O, Shor, Orne, & O'Connell, 1966). The Betts QMI measures imagery vividness ability.

Pain Rating Scale

The pain apparatus was applied for 60 seconds on each trial. Before the first trial subjects were given an explanation of the category Pain Rating Scale (Appendix D) to be used on each trial. This rating scale (adapted from Spanos & Hewitt, 1980) contains numbers ranging from 0 ("no

pain") to 20 ("excruciating pain"). Subjects were told that at 30 seconds and at 60 seconds, upon receiving a signal, they were to quickly call out a number which best corresponded to the level of pain they experienced.

Self Efficacy Measures (S-E)

To measure self efficacy subjects were presented with the same 21 point category scale used for pain rating. Instead of being asked to rate actual pain levels, subjects were asked to verbally rate levels of pain they expect to feel on the next pain trial (Appendix E). Parallel to the pain rating procedure, subjects were asked to give verbal ratings of expected pain levels at 30 seconds and at 60 seconds. For all subjects self efficacy was measured twice following baseline but before post-test. For the treatment groups the first self efficacy rating was made immediately after the baseline trial, before the subjects learned that they would be using cognitive pain reduction strategies. The second self efficacy rating was made after they received instruction in the cognitive strategies and before the post-test trial. For controls the first self efficacy rating was made after the baseline trial followed by a 3 minute period (approximately the time required for the treatment instructions) in which they were simply asked to sit quietly. The self efficacy measure was then administered again.

Absorption Scale (A)

Treatment subjects were asked to indicate the extent to which they were absorbed in the strategy while undergoing the post-test pain trial. A Likert type 5 point scale was used to rate Absorption (Appendices J, K)

Cognitive Pain Reduction Strategies

Distraction Strategy

A letter shadowing task that was found by D'Eon and Perry (1983) to reduce pain intensity ratings was used for Distraction. Subjects were instructed to listen to and repeat aloud letters that were presented to them through headphones at the rate of three letters every two seconds. The letters were presented in random order. The letters "m", "n" and "g" were omitted because they were confusable, and the letter "w" was omitted because it is multi-syllabic.

Imagery strategy

The imagery task consisted of instructing subjects to keep imagining their finger as numb and insensitive, like a piece of rubber. This strategy was found to reduce rated pain intensity by Spanos and O'Hara.

Procedure

Subjects were randomly assigned to one of six treatment (n = 15) groups or to a control group (n = 10) with the restriction of an equal proportion of males and females in each group (Females, n = 28; Males, n = 72). They were

tested individually by the same female experimenter. Instructions were presented on audiotape by a female voice (not the experimenter's voice).

Upon arrival at the laboratory subjects were informed that the purpose of the experiment was to assess their response to a pain stimulus. They were familiarized with the Strain Gauge Pain Stimulator and told that their finger would be placed in it twice, for 60 seconds each time (see Appendix A). They then signed the Informed Consent Form which repeated the above general information in writing (Appendix B). Following this, the pre-baseline inventories were administered. Before the baseline pain trial subjects were taught the pain rating procedure (Appendix C). They were then administered the baseline trial.

Appendix I is a transcription of post baseline procedure for the control group. After the baseline trial control subjects were administered the first Self Efficacy measure to determine the levels of pain they expected to feel on the forthcoming pain trial. After an interval of 3 minutes in which they simply sat quietly they were again administered the Self Efficacy measure. Following these second expectancy estimates, the pain stimulus was administered again and two pain ratings were recorded. After post-test the subjects were debriefed and thanked for their participation.

The procedure for the treatment group was identical to that of the controls up to and including the first post-baseline self-efficacy ratings. Following is a brief summary of the procedures used for our six treatment groups subsequent to the first self-efficacy ratings.

1. Neutral Choice-Control/Imagery (N/I): These subjects were instructed in the use of the imagery strategy only. They rated their self-efficacy concerning the imagery strategy and then were asked to use it on post-trial.

2. Neutral Choice-Control/Distracton (N/D): Subjects were instructed in the use of the distraction strategy only. They rated their self-efficacy concerning the distraction strategy and then were asked to use it on post-trial.

3. Choice Choice-Control/Imagery (C/I): Subjects were instructed in the use of both the imagery and distraction strategies. They rated their self-efficacy concerning both strategies and then were asked to choose one of them to use on post-trial. Subjects in this group chose Imagery.

4. Choice Choice-Control/Distracton (C/D): Subjects were instructed in the use of both strategies. They rated their self-efficacy concerning both strategies and then were asked to choose one of them to use on post-trial. Subjects in this group chose Distracton.

5. Force Choice-Control/Imagery (SF/I): Subjects were instructed in the use of both strategies. They rated their

self-efficacy concerning both strategies and then were assigned Imagery to use on post-trial.

6. Force Choice-Control/Distracton (F/D): Subjects were instructed in the use of strategies. They rated their self-efficacy concerning both strategies and then were assigned Distraction to use on post-trial.

In summary, of our six treatment groups, two were instructed in the use of only one cognitive strategy - either Distraction or Imagery. The other four groups were instructed in the use of both of these strategies and were then either allowed to choose a strategy or were assigned a strategy to use on post-test. This design made it possible to compare subjects given strategy choice to subjects forced into a strategy. It also made it possible to compare subjects given strategy choice to subjects who though not given a choice, were not put in a situation in which they felt forced (ie., those instructed in the use of only one strategy).

The complete audiotape transcription of the treatment procedure following the first post-baseline self-efficacy ratings appears in Appendices F-H. (Appendix F for the Neutral/Imagery group; Appendix G for the Neutral/Distracton group; Appendix H for the Choice and Force groups). After the first post baseline self-efficacy estimates subjects were given a brief description of either one or two cognitive strategies which, they were told, had

been found effective in reducing pain (Section I in Appendices F-H). Instructions for the distraction task consisted of asking subjects to shadow the letters to be presented over the headphones. Subjects were told that the letters come quickly and that they were to repeat each letter as they heard it. Instructions for the imagery task consisted of asking subjects to continuously imagine that their finger is numb and insensitive. After receiving instructions in a task the subjects went through a 60 second practice period for that task (Practice procedure adapted from Dubreuil, Endler, & Spanos, 1988). Following Distraction instructions subjects shadowed letters they heard over the headphones. At 30 seconds and at 60 seconds they received a "rate" signal followed by a 2 second pause during which they were instructed not to stop focusing on the task while calling out their "pain" ratings (the pain stimulus was not applied during practice). After Imagery instructions subjects followed the same practice procedure while imagining their finger as numb.

Half of the subjects exposed to both strategies were told about and practiced Imagery followed by Distraction. Order of presentation was reversed for the others. The subjects then rated the levels of pain they expected when using the task(s) they practiced (see instructions for Self-Efficacy ratings in Section III, Appendices F-H). Following this, those informed about one strategy were

asked to use that strategy on the post-trial. Half of those informed about two strategies were asked to choose the strategy they thought would be most effective in reducing their pain on the next trial. The others were assigned either Distraction or Imagery, as was randomly determined before the experiment started. Those asked to choose a strategy were told (Section IV, Appendix H):

We would like you to choose which of these two strategies you think would be the most effective for you in reducing pain during the next trial. One strategy is imagining your finger is numb. This is the imagination task. The other is repeating letters - this is the distraction task. Once you have made your choice we will start the next pain trial.

Those assigned a strategy were told (Section IV, Appendix H):

We would like you to use the imagination task - imagining that your finger is numb, on the next trial. We are now going to start the next pain trial.

Or:

We would like you to use the distraction task-shadowing letters, on the next trial. We are now going to start the next pain trial.

Subjects were reminded to keep focusing on their task while giving the two pain ratings and the second pain trial was administered (see Section V in Appendix H, Section IV

in Appendices F, G). After post-trial the subjects were asked to indicate the extent to which they were absorbed in the strategy while their finger was in the pain apparatus (Appendix J, K).

Results

Pain Ratings

The Effect of Treatment. To assess the effect of treatment on subjects' pain ratings a 2x3x2x2 mixed ANOVA with two between subjects variables (Strategy: Imagery, Distraction x Choice Control: Neutral, Choice, Force) and two within subject variables (Trial: Baseline, Posttest x Interval; 30 seconds, 60 seconds) was computed on subjects' pain ratings. The control group was excluded from the analysis at this point.

Significant main effects were obtained for Trial and for Interval. In addition, the three way Strategy x Trial x Interval interaction attained significance (see Table 1). The Trial main effect indicates that experimental subjects gave higher pain ratings at baseline ($M = 10.8$, $SD = 3.71$) than at posttest ($M = 7.72$, $SD = 3.80$). The Interval main effect indicates that experimental subjects gave higher pain ratings at the 60 second interval ($M = 11.03$, $SD = 4.11$) than at the 30 second interval ($M = 6.87$, $SD = 3.22$). These main effects were, however, qualified by

Table 1. Mixed ANOVA on Pain Ratings: Strategy x Choice-Control x Trial x Interval

Source	df	MS	F	Sig.
Strategy	1	3.75	.07	.788
Choice-Control	2	8.72	.17	.845
Strategy x Choice-Control	2	38.38	.74	.478
Error	84	51.59		
Trial (baseline/posttest)	1	528.07	76.10	.000**
Strategy x Trial	1	.22	.03	.860
Choice-Control x Trial	2	5.34	.77	.467
Strategy x Choice-Control x Trial	2	2.03	.29	.747
Error	84	6.94		
Interval (30/60 seconds)	1	1500.00	304.72	.000**
Strategy x Interval	1	2.09	.42	.516
Choice-Control x Interval	2	2.16	.44	.647
Strategy x Choice-Control x Interval	2	5.70	1.16	.319
Error	84	4.92		
Trial x Interval	1	1.73	.84	.361
Strategy x Trial x Interval	1	14.02	6.81	.011*
Choice-Control x Trial x Interval	2	.84	.41	.667
Strategy x Choice-Control x Trial x Interval	2	5.42	2.63	.078
Error	84	2.06		

Note: n = 90

*p < .05

**p < .001

the significant interaction.

The Strategy x Trial x Interval interaction was analysed using Strategy x Trial simple interactions at each level of interval (see Figure 1 and relevant means in Table 2).

The simple interaction of Strategy x Trial at 30 seconds was not significant. The simple main effect of Trial, however, was significant, $(1, 88) = 53.7, p < .05$. At the 30 second interval experimental subjects gave significantly higher pain ratings at baseline ($M = 8.06, SD = 3.44$) than at posttest ($M = 5.68, SD = 3.46$).

The simple interaction of Strategy x Trial at 60 seconds was also not significant. Once again, the simple main effect of Trial was significant, $F(1, 88) = 65.61, p < .05$. At the 60 second interval subjects gave significantly higher pain ratings at baseline ($M = 12.30, SD = 4.28$) than at posttest ($M = 9.76, SD = 4.62$).

The significant 3-way interaction probably results from the fact that at 30 seconds subjects in the distraction group expected nonsignificantly higher pain than those in the imagery group at baseline, and nonsignificantly lower pain than those in the imagery group at posttest. However, at 60 seconds those in the distraction group reported nonsignificantly lower pain at baseline than those in the imagery group.

In summary, the mixed ANOVA on subjects' pain ratings

Figure 1. Pain Ratings - Strategy x Trial Interaction at each Interval level

note n=90

Table 2. Mean Pain Ratings for Each Strategy by Trial and Interval

<u>Strategy</u>	<u>30 Seconds</u>		<u>60 Seconds</u>	
	<u>Baseline</u>	<u>Posttest</u>	<u>Baseline</u>	<u>Posttest</u>
Imagery	M	7.87	5.95	12.72
	SD	3.89	3.78	4.43
Distraction	M	8.22	5.48	11.96
	SD	3.06	3.20	4.17

Note: n = 90

resulted in significant main effects for Trial and for Interval and a significant Strategy x Trial x Interval interaction. Analysis of the simple Strategy x Trial interaction at each interval level produced only a significant Trial effect at each interval.

Comparison of Treatment Effects To Control Group.

Subjects in the experimental groups were combined and the combined experimental subjects were compared to the controls. A 2 x 2 x 2 mixed ANOVA with one between subject variable (Treatment: Experimental, Control) and two within subject variables (Trial: Baseline, Posttest x Interval: 30 seconds, 60 seconds) was computed on subjects' pain ratings. Results indicated (see Table 3) significant main effects for Treatment, Trial and Interval. In addition, the two way Treatment x Trial interaction attained significance. The treatment effect (see means in Table 4) indicates that subjects in the control group gave higher pain ratings overall than subjects in the experimental groups. The Interval effect (see means in Table 5) indicates that pain ratings were higher at the 60 second interval than at the 30 second interval. The Trial effect (see means in Table 6) indicates that pain ratings were higher at baseline than at posttest. The main effects for treatment and trials were qualified by the 2 way interaction.

Table 3. Mixed ANOVA on Pain Ratings: Treatment x Trial x Interval

Source	df	MS	F	Sig.
Treatment	1	237.67	4.86	.030*
Error	98	48.89		
Trial	1	43.78	6.71	.011*
Treatment x Trial	1	65.88	10.10	.002*
Error	98	6.52		
Interval	1	779.34	145.66	.000**
Treatment x Interval	1	8.90	1.66	.200
Error	98	5.35		
Trial x Interval	1	.05	.02	.882
Treatment x Trial x Interval	1	.47	.22	.641
Error	98	2.13		

Note: n = 100

*p < .05

**p < .001

Table 4. Mean Pain Ratings for all Subjects by Treatment

Treatment	M	SD
Experimental	8.95	3.52
Control	11.52	3.15

Note: n = 100

Table 5. Mean Pain Ratings for All Subjects by Interval

<u>Interval</u>	<u>M</u>	<u>SD</u>
30 Seconds	7.08	3.29
60 Seconds	11.34	4.15

Note: n = 100

Table 6. Mean Pain Ratings for all Subjects by Trial

Trial	M	SD
Baseline	10.30	3.63
Posttest	8.12	3.96

Note: n = 100

Treatment x Trial Interaction. The two way Treatment x Trial interaction (see Figure 2 and relevant means in Table 7) was further analysed for the simple effects of Treatment at each Trial level and the simple effects of Trial at each Treatment level.

The simple effect of Treatment attained significance at the posttest trial only, $F(1, 98) = 9.91, p < .05$. At posttest the experimental subjects rated pain lower ($M = 7.72, SD = 3.80$) than the controls ($M = 11.65, SD = 3.87$).

The simple effect of Trial attained significance for the experimental group only, $F(1, 89) = 83.23, p < .05$. The experimental subjects rated pain lower at posttest ($M = 7.72, SD = 3.80$) than at baseline ($M = 10.18, SD = 3.71$).

In summary, the experimental subjects, but not the controls, rated pain significantly lower at posttest than at baseline. Pain ratings given by the experimental subjects at posttest were significantly lower than those given by the controls at posttest.

Some Forced Considered Choice - The Effect of Treatment. It is important to note that many subjects assigned to the Forced Choice-Control condition probably did not experience that they were forced into using a strategy. These subjects were taught both strategies, rated the level they expected on posttest when using each of the strategies and then were randomly assigned, i.e., "forced" to use one of the strategies. In the analyses

Figure 2. Pain Ratings - Treatment x Trial Interaction

note n=100

Table 7. Mean Pain Ratings for All Subjects by Treatment and Trial

	Experimental		Control	
	Baseline	Posttest	Baseline	Posttest
M	10.18	7.72	11.40	11.65
SD	3.57	4.04	3.14	4.22

Note: n = 100

that follow, subjects who were assigned the strategy which, judging by their expectancy ratings, they considered more effective for them, were combined with those subjects who chose the strategy they used. In doing this we assume that subjects prefer to use the strategy they expect to be more effective in reducing pain. Thus, if a subject was "forced" into a strategy to which the sum of his posttest expectancy ratings at 30 seconds plus 60 seconds divided by 2 was lower than this sum given to the other strategy, that subject was considered as belonging to the Choice group in the following analysis. In a few cases ($n = 9$) subjects gave equal posttest expectancy ratings to both strategies. When these subjects belonged to the Choice condition they were simply asked to choose the strategy they preferred to use. When these subjects belonged to the Force condition ($n = 3$) they were asked, after the posttest trial, which strategy they would have preferred to use if given the choice. They were combined with the regrouped Choice or Force conditions accordingly.

The effect of treatment on subjects pain ratings was assessed on the following three groups. A Force group ($n = 11$) made up of subjects who were assigned the strategy they rated as less effective in reducing pain. A regrouped Choice group ($n = 49$) made up of subjects who either chose the strategy they considered more effective or were assigned the strategy they considered more effective, and a

Neutral group made up of subjects who were taught only one strategy which they used on posttest. It was necessary to do the analysis collapsing across imagery and distraction strategies because the regrouping resulted in only two subjects who were forced to use Distraction and only nine subjects who were forced to use Imagery. Analysis was done on a combined Imagery-Distraction Forced group ($n = 11$), a combined Imagery-Distraction regrouped Choice group ($n = 49$) and a combined Imagery-Distraction Neutral group ($n = 30$).

A $2 \times 3 \times 2$ mixed ANOVA with one between subjects variable (Choice Control: Neutral, Choice, Forced) and two within subject variables (Trial: Baseline, Posttest x Interval: 30 seconds, 60 seconds) was computed on subjects' pain ratings. The control group was excluded from the analysis at this point. There was only a significant main effect of Trial and a significant main effect of Interval (see Table 8). These main effects involved the same means obtained before regrouping. The Trial main effect indicates that subjects gave higher pain ratings at baseline ($M = 10.18$, $SD = 3.71$) than at posttest ($M = 7.72$, $SD = 3.80$). The Interval main effect indicates that subjects gave higher pain ratings at the 60 seconds interval ($M = 11.03$, $SD = 4.11$) than at the 30 seconds interval ($M = 6.87$, $SD = 3.22$). Neither the Choice Control main effect nor any of the interactions attained

**Table 8. Mixed ANOVA on Expectancy Ratings: Choice-Control
x Trial x Interval**

Source	d.f.	MS	F	Sig.
Choice-Control	2	21.90	.52	.596
Error	87	42.12		
Trial	1	522.21	111.96	.000**
Choice-Control x Trial	2	36.46	7.82	.001*
Error	87	4.66		
Interval	1	1169.58	210.09	.000**
Choice-Control x Interval	2	6.15	1.10	.336
Error	87	5.57		
Trial x Interval	1	3.48	4.35	.040*
Choice-Control x Trial				
x Interval	2	.41	.52	.597
Error	87	.80		

Note: n = 90

***p < .05**

****p < .001**

Table 8. Mixed ANOVA on Pain Ratings (Some Forced = Choice): Choice-Control x Trial x Interval

Source	d.f.	MS	F	Sig.
Choice-Control	2	11.90	.23	.791
Error	87	50.68		
Trial	1	316.34	46.51	.000**
Choice-Control x Trial	2	4.06	.60	.553
Error	87	6.80		
Interval	1	1113.98	226.92	.000**
Choice-Control x Interval	2	2.11	.43	.652
Error	87	4.91		
Trial x Interval	1	.06	.02	.876*
Choice-Control x Trial				
x Interval	2	1.52	.67	.514
Error	87	2.26		

Note: n = 90

*p < .05

**p < .001

significance.

Comparing the experimental groups to the control group on the Trial and Interval effect involves a mixed ANOVA identical to the one already computed before the experimental groups were regrouped (see p. 49). This analysis was therefore not repeated.

The Effect of Efficacy

Subjects were divided into two groups according to whether they ended up using the strategy they rated as more effective or the one they rated as less effective. The Low Efficacy group was made up of those subjects who gave higher posttest expectancy ratings (Sum of expectancy ratings at 30 seconds and 60 seconds divided by 2) to the strategy they ended up using. The High-Efficacy group was made up of subjects who gave lower posttest expectancy ratings to the strategy they ended up using. Nine subjects who gave equivalent expectancy ratings to both strategies were excluded from this analysis. The Imagery and Distraction groups were combined resulting in a combined Imagery-Distraction Low Efficacy group ($n = 10$) and a combined Imagery-Distraction High Efficacy group ($n = 41$).

A $2 \times 2 \times 2$ mixed ANOVA with one between subjects variable (Efficacy: Low, High) and two within subject variables (Trial: baseline, posttest, $\times$ Interval: 30 seconds, 60 seconds) was conducted on subjects' pain ratings. Results indicated significant main effects for

Trial and for Interval only (see Table 9). The Trial main effect indicates that subjects rated pain higher at baseline ($M = 10.43$, $SD = 3.24$) than at posttest ($M = 7.82$, $SD = 3.38$). The interval main effect indicates that subjects rated pain higher at the 60 seconds ($M = 11.22$, $SD = 3.63$), than at the 30 seconds interval ($M = 7.02$, $SD = 2.77$).

Although none of the effects involving Efficacy attained significance, results are in the direction expected according to our hypothesis (see means in Table 10). The High Efficacy group reduced more pain than the Low Efficacy group. This trend is stronger for the 60 seconds than for the 30 seconds interval.

Expectancy Ratings

Effects of Treatment. To assess the effect of treatment on expectancy ratings a $2 \times 3 \times 2 \times 2$ mixed ANOVA with two between-subject variables (Strategy: Imagery, Distraction x Choice-Control: Neutral, Choice, Force) and two within subject variables (Trial: Baseline, Posttest x Interval: 30 seconds, 60 seconds) was computed on subjects' expectancy ratings. The control group was excluded from the analysis at this point.

The analysis resulted in a significant main effect for Trial and Interval. In addition to the main effects there was a significant two-way Trial x Interval interaction and a significant three way Strategy x Choic Control x Trial

Table 9. Mixed ANOVA on Pain Ratings: Efficacy x Trial x Interval

Source	df	MS	F	Sig.
Efficacy	1	13.59	.36	.551
Error	49	37.71		
Trial	1	170.47	25.66	.000
Efficacy x Trial	1	8.12	1.22	.274
Error	49	6.64		
Interval	1	618.77	134.53	.000
Efficacy x Interval	1	3.16	.69	.411
Error	49	4.60		
Trial x Interval	1	.18	.08	.772
Efficacy x Trial x Interval	1	.50	.23	.634
Error	49	2.16		

Note: n = 51

*p < .05

**p < .001

Table 10. Mean Pain Ratings by Efficacy Trial and Interval

<u>Interval</u>		High Efficacy		Low Efficacy	
		<u>Baseline</u>	<u>Posttest</u>	<u>Baseline</u>	<u>Posttest</u>
30 seconds	M	8.34	5.58	8.30	6.30
	SD	2.99	2.88	3.12	3.09
60 seconds	M	12.46	9.61	12.80	11.20
	SD	4.09	4.47	2.57	3.39

Note: n = 51

interaction (see Table 11). The means presented in Tables 12 and 13 relate to the main effects. They indicate that subjects expected less pain for the posttest than for the baseline trial and that they expected less pain at 30 seconds than at 60 seconds. The significant main effects of Trial and of Interval were qualified by the interactions obtained. These were further analysed with a series of simple effects.

Trial x Interval Interaction. The two way Trial x interval interaction (see Figure 3 and relevant means in Table 14) was further analysed with a series of simple effects.

The simple effect of Trial was significant at the 30 second interval, $F(1, 89) = 158.9, p < .001$, and at the 60 second interval, $F(1, 89) = 220.27, p < .001$. Considering the relevant means, this result indicates that expectancy ratings were higher at baseline than at posttest at both the 30 second interval and at the 60 second interval.

The simple effect of interval was significant at the baseline trial, $F(1, 89) = 292.75, p < .001$ and at posttest, $F(1, 89) = 220.71, p < .001$. Considering the relevant means this indicates that expectancy ratings were higher for the 60 second interval than for the 30 second interval at both baseline and posttest.

Table 11. Mixed ANOVA on Expectancy Ratings: Strategy x
Choice Control x Trial x Interval

Source	df	MS	F	Sig
Strategy	1	9.28	.21	.646
Choice-Control	2	5.90	.13	.874
Strategy x Choice-Control	2	4.47	.10	.903
Error	84	43.75		
Trial (baseline/posttest)	1	992.27	201.18	.000**
Strategy x Trial	1	4.93	1.00	.320
Choice-Control x Trial	2	7.64	1.55	.218
Strategy x Choice-Control				
x Trial	2	18.67	3.78	.027*
Error	84	4.93		
Interval (30/60 seconds)	1	1605.80	286.93	.000**
Strategy x Interval	1	9.28	1.66	.201
Choice-Control x Interval	2	6.33	1.13	.327
Strategy x Choice-Control x				
Interval	2	2.37	.43	.656
Error	84	470.11		
Trial x Interval	1	9.92	12.53	.001*
Strategy x Trial x Interval	1	2.73	3.45	.067
Choice-Control x Trial x				
Interval	2	.08	.10	.904
Strategy x Choice-Control				
x Trial x Interval	2	.67	.84	.434
Error	84	.79		

Note: n = 90; *p < .05; **p < .001

Table 12. Mean Expectancy Ratings for all Experimental Subjects by Trial

<u>Trial</u>	<u>M</u>	<u>SD</u>
Baseline	10.24	3.13
Posttest	6.80	3.35

Note: n = 90

**Table 13. Mean Expectancy Ratings for all Experimental
Subjects by Interval**

<u>Interval</u>	<u>M</u>	<u>SD</u>
30 Seconds	6.39	2.79
60 Seconds	10.65	3.97

Note: n = 90

**Figure 3. Expectancy Ratings(Experimental subjects only)-
Trial x Interval Interaction**

note n=90

Table 14. Mean Expectancy Ratings by Trial and Interval

	Baseline		Posttest	
	30 Seconds	60 Seconds	30 Seconds	60 Seconds
M	7.96	12.52	4.82	8.77
SD	3.19	4.12	2.83	4.26

Note: n = 90

Strategy x Choice Control x Trial Interaction. The Strategy x Choice Control x Trial interaction was further analysed using Choice Control x Trial simple interactions at each level of strategy (see Figure 4 and relevant means in Table 15).

The Choice Control x Trial simple interaction at Imagery includes only those subjects ($n = 40$) who ended up using Imagery on posttest. For these subjects there was only a significant main effect for Trial, $F(1, 37) = 4.93$, $p < .01$. Subjects expected less pain after being taught pain reduction strategies ($M = 7.16$, $SD = 3.63$) than before being taught pain reduction strategies ($M = 10.27$, $SD = 3.86$). Neither the simple main effect for Choice Control nor the interaction were significant.

The Choice Control x Trial interaction at Distraction includes only those subjects ($n = 50$) who ended up using Distraction on posttest. For these subjects the simple main effect for Trial attained significance, $F(1, 47) = 131.04$, $p < .01$. Subjects expected less pain for posttest ($M = 6.51$, $SD = 3.12$) than for baseline ($M = 10.22$, $SD = 3.21$). In addition, the simple Choice Control x Trial interaction was significant, $F(2, 47) = 4.59$, $p < .05$ and was therefore further analysed with a series of simple-simple effects for the Distraction groups.

In the Distraction groups the simple-simple effect of Trial was significant for all Choice Control levels. Trial

Figure 4. Expectancy Ratings(Experimental subjects only)
Trial x Choice Control Interaction at each Strategy

note n=90

Table 15. Effect of Treatment on Expectancy Ratings: Mean Expectancy Ratings for each Choice Control by Strategy by Trial

Control		Baseline		Posttest	
		Imagery	Distraction	Imagery	Distraction
Neutral	M	10.53	10.00	6.96	7.73
	SD	4.05	3.45	4.01	3.17
Choice	M	10.4	10.40	6.95	5.95
	SD	3.99	3.11	3.67	2.95
Force	M	9.93	10.20	7.50	6.03
	SD	3.84	3.31	3.42	3.15

Note: n = 90

at Neutral, $F(1,14) = 15.64$, $p < .01$, Trial at Choice, $F(1, 14) = 80.33$, $p < .01$, Trial at Force, $F(1, 84) = 52.93$, $p < .01$. At the Neutral, Choice and Force groups subjects expected less pain for posttest than for baseline (see means in Table 15).

The simple simple effect of Choice-Control for the Distraction groups did not attain significance at either level of the Trial variable. There was no significant difference between the three Choice-Control conditions at either baseline or posttest.

In summary, analysis of the three-way interaction of Strategy x Choice-Control x Trial resulted in a significant simple effect of Trial for subjects who ended up using Imagery. For subjects who ended up using Distraction, there was in addition to a significant simple effect of Trial also a significant Choice-Control x Trial simple interaction. The simple simple effect of Trial was significant for all Choice-Control levels.

Comparison of Treatment Effects to Control Groups.

Subjects in the experimental groups were combined and the experimental subjects compared to the control group. A 2x2x2 ANOVA with one between subject variable (Treatment: Experimental, Control) and two within subject variables (Trial: Baseline, Posttest x Interval: 30 seconds, 60 seconds) was computed on subjects' expectancy ratings. There was a significant main effect for Trial and for

Interval. The main effects are qualified by the interactions obtained. In addition to the main effects there was a significant two-way Treatment x Trial interaction and a significant three-way Treatment x Trial x Interval interaction (see Table 16). The means presented in Tables 17 and 18 relate to the main effects. They indicate that subjects expected less pain for the posttest than for the baseline trial and that they expected less pain at 30 seconds than at 60 seconds. These significant main effects were qualified by the significant interactions obtained. The highest order interaction (Treatment x Trial x Interval) was analysed further in terms of simple effects.

Treatment x Trial x Interval Interaction. The three way Treatment x Trial x Interval interaction was analysed using simple Treatment x Trial interactions at each interval level (see Figure 5 and relevant means in Table 19).

The Treatment x Trial interaction at the 30 second interval resulted in a significant simple effect of Trial, $F(1, 98) = 10.05$, $p < .05$. At the 30 second interval subjects gave higher expectancy ratings at the baseline ($M = 7.95$, $SD = 3.19$) than at the posttest trial ($M = 5.09$, $SD = 2.95$). In addition, the simple Treatment x Trial interaction at 30 seconds attained significance, $F(1, 98) = 12.90$, $p < .05$. This simple interaction was therefore

Table 16. Mixed ANOVA on Expectancy Ratings: Treatment x Trial x Interval

Source	df	MS	F	Sig.
Treatment	1	110.60	2.69	.104
Error	98	41.14		
Trial	1	103.70	21.11	.000**
Treatment x Trial	1	109.90	22.37	.000**
Error	98	4.91		
Interval	1	813.20	142.12	.000**
Treatment x Interval	1	8.90	1.56	.215
Error	98	5.72		
Trial x Interval	1	.02	.03	.862
Treatment x Trial x Interval	1	3.80	5.11	.026*
Error	98	.74		

Note: $n = 100$; * $p < .05$; ** $p < .001$

Table 17. Mean Expectancy Ratings for All Subjects by Trial

Trial	M	SD
Baseline	10.24	3.45
Posttest	7.15	3.46

Note: n = 100

Table 18. Mean Expectancy Ratings for All Subjects by Interval

<u>Interval</u>	<u>M</u>	<u>SD</u>
30 Seconds	6.52	2.84
60 Seconds	10.87	3.96

Note: n = 100

Figure 5. Expectancy Ratings(all subjects)-Treatment x Trial Interaction at each Interval level

note n=100

Table 19. Mean Expectancy Ratings for Each Treatment and Trial Level by Interval

<u>Treatment</u>		30 Seconds		60 Seconds	
		<u>Baseline</u>	<u>Posttest</u>	<u>Baseline</u>	<u>Posttest</u>
Experimental	M	7.96	4.82	12.52	8.77
	SD	3.19	2.83	4.12	4.26
Control	M	7.80	7.50	12.70	13.10
	SD	3.32	3.02	3.46	3.38

Note: n = 90

further analysed using a series of simple simple effects for Treatment at each Trial level and for Trial at each Treatment level.

At the 30 second interval the simple simple effect of Treatment attained significance for the posttest Trial, $F(1,98) = 4.91, p < .05$. At the 30 second interval of the posttest trial the experimental groups ($M = 4.82, SD = 2.83$) gave significantly lower expectancy ratings than the control group ($M = 7.5, SD = 3.02$).

At the 30 second interval the simple simple effect of Trial attained significance for the experimental groups, $F(1,98) = 157.78, p < .05$. This indicates that the experimental groups gave significantly lower expectancy ratings for the 30 second interval of the posttest trial ($M = 4.82, SD = 2.83$) than for the 30 second interval of the baseline trial ($M = 7.96, SD = 3.19$).

The Treatment x Trial interaction at the 60 second interval resulted in a significant simple main effect of Trial, $F(1,98) = 9.47, p < .05$. This simply means that at this interval subjects gave higher expectancy ratings at baseline ($M = 12.54, SD = 4.04$) than at posttest ($M = 9.21, SD = 4.36$). In addition, the simple Trial x Treatment interaction at 60 seconds attained significance, $F(1, 98) = 27.4, p < .05$ and was therefore further analysed with a series of simple simple effects for Trial at each Treatment level and for Treatment at each Trial level.

At the 30 second interval the simple simple effect of Treatment attained significance for the posttest Trial, $F(1,98) = 12.80, p < .05$. At the 60 second interval of the posttest trial the experimental groups ($M = 8.77, SD = 4.26$) gave significantly lower expectancy ratings than the control group ($M = 13.10, SD = 3.38$).

For the 60 second interval the simple simple effect of Trial attained significance for the experimental groups, $F(1,98) = 223.73, p < .05$. Subjects in the experimental groups gave significantly lower expectancy ratings for the 60 second interval of the posttest trial ($M = 8.77, SD = 4.26$) than for the 60 second interval of the baseline trial ($M = 12.52, SD = 4.12$). Control subjects did not change at either the 30 second or the 60 second interval.

In summary, the three way Treatment x Trial x Interval interaction on expectancy ratings was further analysed using Treatment x Trial simple interactions at each interval level. For both the 30 second and the 60 second interval there was a significant simple effect of trial and a significant simple Treatment x Trial interaction. The simple Treatment x Trial interaction was further analysed. For both the 30 second interval and the 60 second interval there was a significant simple simple effect of Treatment at posttest and a simple simple effect of Trial at the experimental treatment. In other words, on the baseline trial experimental and control subjects did not differ

significantly on expected pain at 30 seconds or at 60 seconds. At posttest, however, experimental subjects expected less pain than controls at both 30 and 60 seconds. Experimental subjects expected a significant reduction in pain from baseline to posttest whereas control subjects did not expect to change across these trials.

The Effect of Treatment - Regrouped Choice-Control. The following analysis assessed the effect of treatment on subjects' expectancy ratings when subjects are regrouped so that some original Forced subjects were considered as Choice (see procedure for Choice-Control regrouping on pages 54, 57). Because regrouping resulted in only 2 subjects who were forced to use Distraction, the analysis was done collapsing across Imagery and Distraction.

A $2 \times 3 \times 2$ mixed ANOVA with one between subjects variable (Choice-Control: Neutral, Choice, Forced) and two within subject variables (Trial: Baseline, Posttest x Interval: 30 seconds, 60 seconds) was done on subjects' expectancy ratings. The Control group was excluded from this analysis. The analysis resulted in a significant main effect for Trial and for Interval. In addition, the two way interactions of Choice-Control x Trial and the two way interaction of Trial x Interval attained significance (see Table 20). The Trial and Interval main effects involve the same means obtained in the analysis of the effect of treatment on expectancy ratings before the subjects were

regrouped (see Tables 17, 18). Also the Trial x Interval interaction involves the same means obtained in the analysis of the effect of treatment on expectancy ratings before the subjects were regrouped (see Table 19 and Figure 5) and will therefore not be repeated. The Choice-Control x Trial interaction will be further analysed using a series of simple effects.

Choice-Control x Trial Interaction. The two way Choice-Control x Trial interaction (see Figure 6 and relevant means in Table 21) was further analysed for the simple effects of Choice-Control at each Trial level and for the simple effects of Trial at each Choice-Control level.

The simple effect of Trial attained significant at Neutral Choice-Control, $F(1,29) = 54.75$, $p < .05$, at Choice Choice-Control, $F(1,48) = 184.04$, $p < .05$ and at Force Choice-Control, $F(1,10) = 5.97$, $p < .05$. The relevant means, presented in Table 21, indicate that subjects' expectancy ratings at each of the Choice-Control conditions were higher at baseline than at posttest.

The simple effects of Choice-Control did not attain significance for either the baseline on the posttest trial.

In summary, the simple effects for the Choice-Control x Trial interaction indicated that at each Choice-Control condition expectancy ratings were higher at baseline than at posttest.

Table 20. Mixed ANOVA on Expectancy Ratings:
Choice-Control x Trial x Interval

Source	d.f.	MS	F	Sig.
Choice-Control	2	21.90	.52	.596
Error	87	42.12		
Trial	1	522.21	111.96	.000**
Choice-Control x Trial	2	36.46	7.82	.001*
Error	87	4.66		
Interval	1	1169.58	210.09	.000**
Choice-Control x Interval	2	6.15	1.10	.336
Error	87	5.57		
Trial x Interval	1	3.48	4.35	.040*
Choice-Control x Trial				
x Interval	2	.41	.52	.59
Error	87	.80		

Note: n = 90

*p < .05

**p < .001

**Figure 6. Expectancy Ratings:Choice Control
x Trial Interaction**

Note: $n = 90$

Table 21. Mean Expectancy Ratings for All Experimental Subjects by Choice-Control and Trial

	Baseline			Posttest		
	Neutral	Choice	Force	Neutral	Choice	Force
M	10.26	10.30	9.90	7.35	6.12	8.31
SD	3.71	3.30	4.05	3.57	3.14	3.15

Note. n = 90

Comparison of Treatment Effects to Control Group.

Comparing the experimental groups to the control group on the Trial and Interval effects involves a mixed ANOVA identical to the one already computed before the experimental groups were regrouped (see pages 73-82). This analysis was therefore not repeated.

Absorption Ratings

The Effect of Treatment. To assess the effect of treatment on subjects' absorption ratings a 2 x 3 ANOVA with two between subject variables (Strategy: Imagery, Distraction x Choice-Control: Neutral, Choice, Force) was computed on absorption ratings given by the experimental subjects. Controls did not rate absorption.

No significant main effects or interactions were attained (see Table 22). Thus, (see means in Table 23) strategy use and Choice-Control did not affect subjects' absorption ratings.

Re-Grouped Choice-Control - The Effect of Treatment.

Subjects were regrouped so that some original Forced subjects were combined with Choise subjects in the manner described previously (see procedure for Choice-Control regrouping on pages 54, 57). The Imagery and Distraction groups were combined because regrouping resulted in only 2 subjects who were forced to use Distraction. A one-way ANOVA with 3 Choice-Control levels (Neutral, Choice, Force) was computed on absorption ratings given by the

Table 22. ANOVA on Absorption Ratings: Strategy x Choice-Control

Source	d.f.	MS	F	Sig
Choice-Control	2	.80	1.85	.164
Strategy	1	1.47	.00	.983
Choice-Control x Strategy	2	.00	.41	.662
Error	80	.33		

Note: n = 86

*p < .05

**p < .001

**Table 23. Mean Absorption Ratings for Each Strategy by
Choice-Control**

Choice-Control		Strategy	
		Imagery	Distraction
Neutral	M	2.86	3.06
	SD	1.06	.88
Choice	M	3.40	3.16
	SD	.96	.85
Force	M	2.80	2.84
	SD	.94	.55

Note: n = 86

experimental subjects.

The Choice-Control effect was not significant (see Table 24). Choice-control did not affect subject's absorption ratings (see means in Table 25).

Correlational Analysis

Pearson correlations between our various measures are presented separately for the Imagery groups (Table 26) and the Distraction groups (Table 27) as well as for all experimental subjects (Table 28).

In both the Imagery and the Distraction groups there was a high positive correlation between posttest expectancy ratings at 30 and 60 seconds and post-test pain ratings at 30 and 60 seconds, respectively. These correlations were higher for the Imagery groups (ranges $r(38) = .80 - .82$) than for the Distraction groups (ranges $r(48) = .52 - .68$). The difference between these correlations is significant for the 30 second interval ($Z = 2.61, p < .05$) but not for the 60 second interval ($Z = 1.23, p < .05$).

Correlations between expectancy for pain reduction (Baseline expectancy minus posttest expectancy) and pain reduction scores (pain ratings at baseline minus pain ratings at posttest) in the Distraction group were close to zero at both the 30 seconds or the 60 seconds interval (ranges $r(48) = -.07 - .08$). Correlations between expectancy for pain reduction and pain reduction scores for the Imagery groups were positive and in the moderate range

Table 24. One-way ANOVA on Absorption Ratings (Regrouped Choice-Control)

<u>Source</u>	<u>d.f.</u>	<u>MS</u>	<u>F</u>	<u>Sig.</u>
Choice-Control	2	1.20	1.54	.219
Error	83	.78		

Note: n = 86

*p < .05

**p < .001

Table 25. Mean Absorption Ratings for Each Choice-Control Condition (Regrouped Choice-Control)

	Neutral	Choice	Force
M	2.96	3.13	2.60
SD	.96	.80	.88

Note: n = 86

Table 26. Correlations Among Variables for Imagery Group

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1. Pain Rating, Baseline, 30"	--	.88*	.85*	.72*	.91*	.78*	.82*	.70*	.31*	.10	.20	.31*	.05	.17	.03	-.13	-.37*	-.04	-.31	.30	.14	-.09
2. Pain Rating, Baseline, 60"			.72*	.72*	.84*	.91*	.72*	.76*	.35*	.19	.27*	.34*	.20	.28*	.09	-.10	-.35*	-.13	-.31	.09	.09	.00
3. Pain Rating, Posttest, 30"				.80*	.79*	.68*	.82*	.70*	.11	-.05	.01	-.22	-.25	-.27*	-.00	-.00	-.33*	-.07	-.25	.25	.27	-.23
4. Pain Rating, Posttest, 60"					.60*	.62*	.68*	.80*	.00	-.27*	-.18	-.10	-.52*	-.41*	-.00	-.08	-.40*	-.18	-.21	-.03	-.06	-.24
5. Expec. Rating, Baseline, 30"						.88*	.83*	.68*	.47*	.26*	.37*	.25	.17	.22	.00	-.03	-.34*	-.11	-.26	.09	.20	-.07
6. Expec. Rating, Baseline, 60"							.70*	.76*	.45*	.31*	.40*	.22	.24	.26*	.06	.04	-.30*	-.09	-.18	-.14	-.02	.04
7. Expec. Rating, Posttest, 30"								.79*	-.10	-.14	-.13	.04	-.07	-.03	-.04	-.12	-.47*	-.17	-.45*	.18	.09	-.16
8. Expec. Rating, Posttest, 60"									-.03	-.36*	-.25	.02	-.19	-.12	.06	-.10	-.41*	-.22	-.21	-.31	-.15	.00
9. Expec. Reduction at 30"									.70*	.88*	.38*	.43*	.46*	.08	.14	.14	.14	.06	.11	-.06	.21	.12
10. Expec. Reduction at 60"										.95*	.29*	.63*	.56*	-.00	.21	.17	.17	.19	.02	.15	.11	.06
11. Average Expec. Reduction											.35*	.59*	.56*	.03	.20	.17	.15	.15	.05	.08	.15	.09
12. Pain Reduction at 30"												.57*	.81*	.08	-.24	-.10	-.10	.05	-.22	.19	.25	.24
13. Pain Reduction at 60"													.94*	.13	.00	.13	.14	.09	-.09	.11	.14	.35*
14. Average Pain Reduction														.12	-.10	.06	.06	.09	-.15	.16	.20	.35*
15. Social Desirability														.26	-.05	.30*	.30*	.04	-.19	-.26	-.30	-.02
16. Sphere of Control - Personal																		-.06	.23	.39	.36	.01
17. Sphere of Control - Interper.																			.09	-.08	.37	.37*
18. Sphere of Control - Sociopol.																				-.20	-.19	.30
19. Betts																					.52*	-.40
20. CURSS-0																						-.09
21. CURSS-S																						
22. Absorption Rating																						

Note: n = 40 except for the following variables: Betts, CURSS-0, n = 16
CURSS-S, n = 15

*p < .05

**p < .01

Table 27. Correlations Among Variables for Distraction Groups

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1. Pain Rating, Baseline, 30"	--	.83*	.63*	.61*	.82*	.74*	.63*	.61*	.32*	.16	.25*	.38*	.26*	.35*	-.02	.25*	-.11	-.04	-.06	-.05	.17	.07
2. Pain Rating, Baseline, 60"			.54*	.69*	.64*	.89*	.59*	.83*	.13	.02	.08	.30*	.37*	.38*	-.11	.20	-.13	.06	-.13	-.25	-.45	.12
3. Pain Rating, Posttest, 30"				.70*	.66*	.60*	.52*	.53*	.23	.06	.15	-.47*	-.22	-.37*	-.18	.10	-.21	-.19	.18	.10	-.20	.06
4. Pain Rating, Posttest, 60"					.58*	.76*	.43*	.68*	.23*	.08	.17	-.14	-.41*	-.32*	-.28*	.05	-.31*	-.09	.08	-.10	-.33	.05
5. Exec. Rating, Baseline, 30"						.78*	.60*	.55*	.55*	.35*	.47*	.15	.06	.11	.03	.10	-.14	-.06	.02	-.01	-.29	.09
6. Exec. Rating, Baseline, 60"							.55*	.83*	.35*	.21	.30*	.13	.14	.15	-.11	.08	-.14	-.06	.02	-.22	-.48*	.17
7. Exec. Rating, Posttest, 30"								.76*	-.32*	-.40*	-.38*	.08	.19	.16	-.08	.27*	-.20	.06	-.41*	-.25	-.39	.18
8. Exec. Rating, Posttest, 60"									-.14	-.36*	-.26*	.06	.17	.14	-.18	.23	-.21	.06	-.18	-.24	-.40	.25*
9. Exec. Reduction at 30"										.84*	.96*	.08	-.13	-.03	.13	-.15	.04	-.15	.41*	.21	.02	-.08
10. Exec. Reduction at 60"											.95*	.11	-.07	.01	.13	-.26*	.12	-.20	.44*	.06	-.08	-.17
11. Average Exec. Reduction												.10	-.10	-.01	.13	-.21	.08	-.18	.44*	.14	-.02	-.13
12. Pain Reduction at 30"													.56*	.85*	.20	.17	.11	.17	-.30	-.18	-.18	.00
13. Pain Reduction at 60"														.90*	.21	.18	.23	.20	-.23	-.18	-.14	.08
14. Average Pain Reduction															.23*	.20	.20	.21	-.27	-.20	-.17	.05
15. Social Desirability																.29*	.33*	.07	.26	.22	.37	.06
16. Sphere of Control - Personal																	.38*	.30*	.27	-.05	-.16	-.00
17. Sphere of Control - Interper.																	.24	.18	.47*	.44*	.44*	-.18
18. Sphere of Control - Sociopol.																		-.27	-.12	.09	-.10	
19. Betts																			.08	-.03	.51*	
20. CURSS-0																				.86*	.43*	
21. CURSS-S																						.13
22. Absorption Rating																						

Note: n = 5- except for the following variables: Betts, CURSS-S, n = 17

CURSS-0, n = 21

SD, SOC₁, SOC₂, SOC₃, n = 49

*p < .05

**p < .01

Table 28. Correlations Among Variables for All Experimental Subjects

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1. Pain Rating, Baseline, 30"	--	.84*	.74*	.67*	.87*	.76*	.73*	.65*	.31*	.13	.23*	.34*	.14	.26*	.00	.05	-.25*	-.04	-.18	.11	.04	-.02
2. Pain Rating, Baseline, 60"			.63*	.70*	.73*	.90*	.66*	.80*	.20*	.10	.16	.29*	.30*	.33*	-.02	.07	-.25*	-.01	-.19	-.13	-.23	.05
3. Pain Rating, Posttest, 30"				.76*	.72*	.64*	.68*	.62*	.16	-.00	.07	-.36*	-.22*	-.32*	-.10	.05	-.28*	-.13	-.01	.17	.03	-.10
4. Pain Rating, Posttest, 60"				.59*	.59*	.68*	.56*	.73*	.13	-.11	-.00	-.12	-.46*	-.36*	-.15	-.01	-.36*	-.13	-.02	.01	-.13	-.11
5. Expec. Rating, Baseline, 30"				.82*	.82*	.82*	.71*	.60*	.50*	.30*	.42*	.19*	.11	.16	.02	.03	-.23*	-.09	-.10	.07	-.00	.00
6. Expec. Rating, Baseline, 60"				.63*	.63*	.63*	.63*	.79*	.36*	.26*	.33*	.15	.19*	.20*	-.03	.07	-.24*	-.07	-.06	-.15	-.26	.09
7. Expec. Rating, Posttest, 30"								.77*	-.23*	-.26*	-.26*	.05	.06	.06	-.06	.07	-.36*	-.04	-.42*	-.07	-.14	-.01
8. Expec. Rating, Posttest, 60"									-.11	-.36*	-.26*	.03	.00	.01	-.07	.08	-.33*	-.05	-.18	-.19	-.26	.11
9. Expec. Reduction at 30"										.75*	.92*	.21*	.07	.14	.11	-.05	.11	-.07	.28	.17	.13	.02
10. Expec. Reduction at 60"											.94*	.19*	.29*	.28*	.06	-.02	.15	-.01	.16	.06	-.00	-.02
11. Average Expec. Reduction												.21*	.20*	.23*	.09	-.03	.14	-.04	.23	.12	.06	-.00
12. Pain Reduction at 30"												.52*	.52*	.82*	.15	-.00	.04	.13	-.25	-.04	.00	.71
13. Pain Reduction at 60"													.91*	.91*	.17*	.10	.16	.15	-.17	-.15	-.09	.23
14. Average Pain Reduction														.19*	.19*	.06	.13	.16	-.22	-.12	-.06	.21*
15. Social Desirability															.27*	.27*	.14	.05	.03	.06	.10	.02
16. Sphere of Control - Personal																	.32*	.20*	.32*	-.22	-.29	-.02
17. Sphere of Control - Interper.																	.09	.19	.43*	.40*	-.06	
18. Sphere of Control - Sociopol.																		-.10	-.12	.17	.13	
19. Betts																			.10	.01	.36*	
20. CURSS-0																				.75*	.09	
21. CURSS-S																						.03
22. Absorption Rating																						

Note: n = 90 except for the following variables:

Betts, n = 33

CURSS-0, n = 37

CURSS-S, n = 32

SD, SOC₁, SOC₂, SOC₃, n = 89

* p < .05

** p < .01

(ranges $r(38) = .38 - .63$).

The correlation between ratings of absorption in the strategy used and the average of pain reduction scores (average pain ratings at baseline minus average pain ratings at posttest) was close to zero for the Distraction groups $r(48) = .05$ and positive and in the moderate range for the Imagery group $r(38) = .35$. The very low correlation between this predictor variable and pain reduction scores in the Distraction groups may be due to the fact that in these groups the range of absorption scores was skewed (see Table 29). Subjects were asked to rate absorption on a 1-5 scale. In the Distraction groups only 18% of the subjects gave ratings other than 3 or 4. Only 4% gave an absorption rating of 1 and none rated 5. In the Imagery groups 37.5% of the ratings were different than 3 or 4 and 10% were ratings of 1 or 5.

Correlations between scores on the Social Desirability Scale and average pain reduction scores were low for both the imagery group, $r(38) = .12$ and the distraction group, $r(47) = .23$. Correlations between scores on the Social Desirability scale and average expectancy for pain reduction (ranges $r(38-47) = .03 - .13$) or absorption scores (ranges $r(38-47) = -.02 - .06$) were also low in both groups.

Correlations between scores on the three Spheres of Control scales and average pain reduction scores were also

Table 29. Distribution of Absorption Scores for Imagery and Distraction Groups

Absorption Value	Imagery Groups		Distraction Groups	
	N	Percent	N	Percent
1	3	7.5	2	4.0
2	10	25.0	7	14.0
3	13	32.5	24	48.0
4	13	32.5	13	26.0
5	1	2.5	4	0

low for both the imagery group (ranges $r(38) = -.10 - .09$) or the distraction groups (ranges $r(47) = .20 - .23$).

In order to assess whether the need to feel in control is related to the ability to benefit from choice-control, correlations between the three Sphere of Control scales and average pain reduction scores were computed separately for subjects in the Choice condition (see Table 30). These correlations were low to moderate and consistently positive for the original Choice groups, ranges $r(28) = .19 - .37$). When computed for the subjective choice group which included, in addition to subjects allowed to choose their strategy, also some of the forced subjects who were assigned their preferred strategy these correlations were also low and consistently in the positive direction ranges $r(46) = .23 - .28$).

CURSS-O, CURSS-S and Betts scores were available for only 32-37 subjects. To examine the hypothesis that pain reduction using an imagery strategy correlates positively with subjects' ability to employ mental imagery the correlations between Betts and pain reduction scores were examined separately for each of our strategy conditions. Contrary to the above hypothesis there was a low-negative correlation between Betts and pain reduction scores both in the Imagery groups ($r(14) = -.15$) and in the Distraction groups ($r(15) = -.27$). Correlations between scores on the CURSS-O and CURSS-S and pain reduction scores were low for

Table 30. Correlations for the Choice Groups

Variable	1	2	3	4
1. Average pain reduction	-	.19	.26	.37*
2. Sphere of Control - Personal	.28*			
3. Sphere of Control - Interpersonal	.24*			
4. Sphere of Control - Sociopolitical	.23			

Note: Original choice group (n = 30) correlations are above the diagonal. Regrouped choice group (n = 48) correlations are below the diagonal.

*p < .05

**p < .01

either the Imagery groups (ranges $r(13-14) = .16 - .20$) or the Distraction groups (ranges $r(15-19) = -.17 - .20$) as well as for all experimental subjects combined (ranges $r(30-35) = -.06 - -.12$).

Regression Analysis

Stepwise regressions were conducted separately for the Imagery and the Distraction groups using average pain reduction score as the criterion variable. Average expectancy reduction scores (average expectancy at baseline minus average expectancy at posttest), ratings of absorption in the strategy, Social Desirability and scores on the three Sphere of Control scales were used as predictor variables.

For subjects in the Distraction groups scores on the Social Control scale of Spheres of Control was the only variable entered as a significant predictor of pain reduction, $R = .353$, $F(1,43) = 6.15$, $p = .017$. For subjects in the Imagery groups average expectancy reduction scores were entered first, $R = .567$, $F(1,38) = 18.07$, $p = .000$. Ratings of absorption in the strategy was entered second $R = .64$, $F(1,38) = 12.96$, $p = .000$, and produced a significant increment in prediction.

Discussion

Subjects rated pain higher at baseline, before provision of a cognitive strategy, than at posttest when using a cognitive strategy. Control subjects who were not provided with a cognitive strategy did not change their pain ratings from baseline to posttest. There was no difference in pain ratings given by subjects using imagery or distraction on either baseline or posttest. These results clearly indicate that cognitive strategies are effective in reducing reported pain but that there is no difference in effectiveness of the two strategies used.

The same results were obtained when subjects' expectancy ratings, measured before and after strategy provision, was used as the dependent variable. Strategy provision increased subjects' perceived self-efficacy but no one strategy was superior to the other.

Subjects using the strategy they considered more effective for reducing pain were compared to subjects using the strategy they considered less effective. Although the high efficacy group reduced more pain than the low efficacy group, this trend did not obtain significance.

There was no effect to the Choice-Control variable either on subjects' pain ratings or absorption ratings. This effect was not found either when objective choice range was examined or when subjects were re-grouped to examine the effect of subjective choice range.

Absorption in addition to expectancy accounted for a significant proportion of the variance in pain reduction scores for our imagery group. Neither absorption nor expectancy were entered as predictors of pain reduction in the distraction group. However, the skewed curve of absorption scores in this group probably explains the low correlations obtained between absorption and pain reduction. Social Desirability scores did not emerge as an important predictor of pain reduction.

The context of our experiment did not lead subjects to expect a relationship between hypnotizability scores and pain reduction scores. As expected, correlations between these variables were low.

Experiment II

In the second experiment perceived self-efficacy ratings taken before subjects chose or were assigned one of the two pain reduction strategies, were compared to perceived self-efficacy ratings taken after strategy choice/assignment. This design made it possible to examine the effect of strategy choice on self-efficacy ratings as well as the relationship between self-efficacy and pain reduction. Our hypothesis regarding the relationship between choice range and self-efficacy ratings follows Averill's suggestion. According to Averill (1973) subjects' agreement with their options, whether or not they chose them, rather than the number of options open to them, determines perceived control. Our expectations regarding the relationship between choice control and self-efficacy difference scores were parallel to those regarding the relationship between choice control and pain reduction. We did not expect choice to increase perceived self-efficacy beyond strategy provision only. Therefore, we did not expect that self-efficacy difference scores would be higher when measured after strategy but before choice. We did however expect self-efficacy difference scores of subjects who rated self-efficacy after being assigned a strategy to be lower than self-efficacy difference scores measured before strategy choice/assignment, because some of these subjects were assigned their less preferred strategy.

Central to our main proposition is the idea that self-efficacy is important but not sufficient to produce pain reduction. We propose that self-efficacy mediates pain reduction by providing the subject with the motivation to use the cognitive strategy and become absorbed in it. We therefore expected a relationship between subjects' ratings of their level of absorption in a strategy and their post choice/assignment self-efficacy ratings. We also expected a relationship between absorption ratings and pain reduction.

We view absorption in a strategy, regardless of which strategy is used, as important for pain reduction because absorption in something other than pain deflects attention from pain or allows reinterpretation of pain. Thus we did not expect the two strategies used to result in different pain reduction levels.

In addition to strategy provision and perceived self-efficacy, subjects' tendency to respond to the demands of the situation (demands for pain reduction), was also viewed as an important variable in determining pain ratings. We expected a relationship between subjects' measured social desirability levels and pain reduction scores.

We did not expect the other measured personality variables - imagery ability, locus of control and hypnotic susceptibility - to show a relationship with pain reduction because the context of the experimental situation did not

provide the subjects with cues that these measures were important in this regard. We hypothesized that low susceptibles would reduce pain as much as high susceptibles.

Method

Subjects

One hundred and thirty-seven Carleton University students (ages 18 and over) who did not participate in our first study volunteered to take part in a study involving painful stimulation. They ($n = 128$) received course credit or ($n = 9$) were paid \$5 for participation.

Procedure

Subjects were randomly assigned to one of eight treatment groups ($n = 15$) or to a control group ($n = 17$) with the restrictions of an equal proportion of males and females (Females, $n = 56$; Males, $n = 81$) as well as an equal proportion of paid and unpaid subjects in each group. They were tested individually by the same female experimenter. Instructions were presented on audiotape by a different female voice.

The procedure up to and including the first baseline test and the post baseline self-efficacy ratings was identical to the procedure used in Experiment I. Following is a description of the post-baseline procedure used for the nine groups in Experiment II.

1. Choice-Choice-Control/Imagery-Self Efficacy

(C/I-SE): After being instructed in both strategies these subjects chose Imagery to use on the post-trial. They then rated their self-efficacy concerning both strategies (Post-trial followed).

2. Choice Choice-Control/Distrction-Self Efficacy

(C/D-SE): After being instructed in both strategies these subjects chose Distraction to use on post-trial. They then rated their self-efficacy concerning both strategies.

3. Force Choice-Control/Imagery-Self Efficacy

(F/I-SE): After being instructed in both strategies these subjects were assigned Imagery to use on post-trial. They then rated their self-efficacy concerning both strategies.

4. Force Choice-Control/Distraction Self Efficacy

(F/D-SE): After being instructed in both strategies these subjects were assigned Distraction to use on post-trial. They then rated their self-efficacy concerning both strategies.

5. Self Efficacy-Choice Choice-Control/Imagery

(SE-C/I): After rating their self-efficacy on the two strategies in which they were instructed, these subjects chose imagery to use on the post-trial.

6. Self Efficacy-Choice Choice-Control/Distrction

(SE-C/D): After rating their self-efficacy concerning the two strategies in which they were instructed, these subjects chose Distraction to use on the post-trial.

7. Self Efficacy-Force Choice-Control/Higher

(SE-F/H): After rating their self-efficacy concerning both strategies, these subjects were assigned the strategy for which they rated higher self-efficacy.

8. Self-Efficacy-Force Choice Control/Lower (SE-SF/L): After rating their self-efficacy concerning both strategies, these subjects were assigned the strategy for which they rated lower self-efficacy.

9. Control Group (CG): Subjects were not instructed in a strategy. They rated their self-efficacy concerning the post test pain stimulus twice following the baseline trial but before the posttest trial.

The treatment groups in Experiment II were all exposed to two pain reduction strategies - Imagery and Distraction. Half were allowed to choose a strategy and half were assigned a strategy. Within those groups, half the subjects rated self-efficacy before they chose/were assigned a strategy. The other half rated self-efficacy after they chose/were assigned a strategy. This design enabled us to measure the effect choice control exerted on attributions of self-efficacy in addition to the effect it had on pain reduction.

The complete transcription of post-baseline instructions for the four experimental groups which rated self efficacy before choosing/being assigned a strategy is presented in Appendix H. The procedure for these two Strategy Choice groups is identical to the one used in Experiment I. The

procedure for these two strategy forced groups differs from the one used in Experiment I only in that they were assigned either the strategy they rated higher on the Self Efficacy Measure, or the strategy they rated lower on the Self Efficacy Measure.

The complete transcription of post-baseline instructions for the four experimental groups which first chose/were assigned a strategy and later rated their self efficacy is presented in Appendix L. These subjects were told that research had found cognitive strategies to be effective in reducing pain and they were given a brief description of the Imagery strategy and of the Distraction strategy (Section I in Appendix L). Complete instructions for each strategy were presented followed by a 60 second period in which they practiced the strategy combined with two pain ratings (Section II in Appendix L). Half of these subjects were told about and practiced Distraction first and Imagery second. The order was reversed for the other half. Half of these subjects were allowed to choose the strategy they think would be most effective in reducing their pain during the next trial. The others were assigned either distraction or imagery (Section III in Appendix L). Following this all rated levels of pain they expected to feel if they were to use each of the strategies on the next pain trial (Section IV in Appendix L). They were administered the post-trial and gave pain ratings at 30

seconds and at 60 seconds (see Section V in Appendix L). After the post-trial all subjects indicated the extent to which they were absorbed in the strategy while their finger was in the pain apparatus (Appendices J, K).

Results

Pain Ratings

The Effects of Treatment. A $2 \times 2 \times 2 \times 2 \times 2$ mixed ANOVA with three between subjects variables (Strategy: Imagery, Distraction x Choice-Control: Choice, Force x Order: Expectancy ratings given before Choice/Force, Expectancy ratings given after Choice/Force) and two within subject variables (Trial: Baseline, Posttest x Interval: 30 seconds, 60 seconds) was conducted to assess the effect of treatment on subjects' pain ratings. The control group was excluded from the analysis at this point. The main effects for Trial and for Interval and the two way interaction of Strategy x Trial attained significance. In addition, the three way interaction of Strategy x Choice-Control x Interval attained marginal significance (see Table 31). The main effect of Trial indicates that all experimental subjects gave lower pain ratings at posttest than at baseline (see means in Table 32). The main effect of Interval indicates that all experimental subjects gave higher pain ratings at the 60 seconds than at the 30 seconds

Table 31. Mixed ANOVA on Pain Ratings: Strategy x Choice-Control x Order x Trial x Interval

Source	df	MS	F	Sig.
Strategy	1	17.35	.27	.601
Choice-Control	1	19.02	.30	.584
Order	1	12.99	.21	.651
Strategy x Choice-Control	1	137.94	2.18	.142
Strategy x Order	1	2.09	.03	.856
Choice-Control x Order	1	4.02	.06	.801
Strategy x Choice-Control x Order	1	.05	.00	.978
Error	112	63.21		
Trial	1	657.54	75.16	.000**
Strategy x Trial	1	49.48	5.66	.019*
Choice-Control x Trial	1	.11	.01	.909
Order x Trial	1	2.37	.27	.604
Strategy x Choice-Control x Trial	1	6.38	.73	.395
Strategy x Order x Trial	1	17.09	1.95	.165
Choice-Control x Order x Trial	1	.11	.01	.909
Strategy x Choice-Control x Order x Trial	1	2.62	.30	.585
Error	112	8.75		
Interval	1	2260.29	496.58	.000**
Strategy x Interval	1	1.69	.37	.543
Choice-Control x Interval	1	.03	.01	.935
Order x Interval	1	.94	.21	.651
Strategy x Choice-Control x Interval	1	17.30	3.80	.054
Strategy x Order x Interval	1	.05	.01	.921
Choice-Control x Order x Interval	1	5.52	1.21	.273
Strategy x Choice-Control x Order x Interval	1	3.32	.73	.395
Error	112	4.55		
Trial x Interval	1	1.39	.90	.344
Strategy x Trial x Interval	1	.86	.56	.456
Choice-Control x Trial x Interval	1	.29	.19	.666
Order x Trial x Interval	1	.07	.05	.828
Strategy x Choice-Control x Trial x Interval	1	.22	.14	.706
Strategy x Order x Trial x Interval	1	.49	.32	.572
Choice-Control x Order x Trial x Interval	1	.00	.00	.996
Strategy x Choice-Control x Order x Trial x Interval	1	1.43	.93	.338

Note: n = 120; *p < .05; **p < .001

Table 32. Mean Pain Ratings for All Experimental Subjects by Trial

Trial	M	SD
Baseline	11.35	4.13
Posttest	8.91	4.22

Note: n = 120

interval (see means in Table 33). These main effects were qualified by the significant interactions. The interactions were further analysed with a series of simple effects.

Strategy x Choice-Control x Interval Interaction. The three way Strategy x Choice-Control x Interval interaction (see Figure 7 and relevant means in Table 34) was further analysed for the simple interaction of Choice-Control x Interval at each Strategy level.

The simple Choice-Control x Interval interaction at Imagery included only those subjects who ended up using Imagery at posttest ($n = 55$). For these subjects there was only a significant Interval main effect, $F(1,53) = 217.99$, $p < .05$. These subjects rated pain higher at the 60 seconds ($M = 12.07$, $SD = 4.25$) than at the 30 seconds interval ($M = 7.81$, $SD = 4.06$).

The Choice-Control x Interval simple interaction at Distraction included only those subjects who ended up using Distraction on posttest ($n = 65$). Also for these subjects there was only a significant Interval main effect, $F(1, 63) = 288.54$, $p < .05$. They rated pain higher at the 60 seconds ($M = 12.53$, $SD = 3.99$) than at the 30 seconds interval ($M = 8.03$, $SD = 3.94$).

The 3-way interaction reflects the fact that those in the Imagery group in the Force condition reported nonsignificantly higher pain than those in the Choice condition. Whereas this trend was reversed in the distraction group.

Table 33. Mean Pain Ratings for All Experimental Subjects by Interval

<u>Interval</u>	<u>M</u>	<u>SD</u>
30 Seconds	7.93	3.98
60 Seconds	12.32	4.10

Note: n = 120

PAGINATION ERROR.

ERREUR DE PAGINATION.

TEXT COMPLETE.

LE TEXTE EST COMPLET.

NATIONAL LIBRARY OF CANADA.

BIBLIOTHEQUE NATIONALE DU CANADA.

CANADIAN THESES SERVICE.

SERVICE DES THESES CANADIENNES.

Table 34. Mean Pain Ratings (Experimental Subjects) for each Choice-Control by Strategy and Interval

		Imagery		Distraction	
<u>Choice-Control</u>		<u>30 Seconds</u>	<u>60 Seconds</u>	<u>30 Seconds</u>	<u>60 Seconds</u>
Choice	M	7.27	11.12	8.19	13.03
	SD	3.87	4.24	3.67	4.16
Force	M	8.33	12.98	7.87	12.03
	SD	4.24	4.13	4.26	3.80

Note: n = 120

Strategy x Trial Interaction. The Strategy x Trial Interaction (see Figure 8 and relevant means in Table 35) was further analysed with a series of simple effects for Trial at each Strategy and for Strategy at each Trial level.

The simple effect of Trial attained significance at Imagery, $F(1,54) = 18.77$, $p < .001$, and at Distraction, $F(1,64) = 68.66$, $p < .001$. For each of the strategies subjects rated pain higher at baseline than at posttest (see relevant means in Table 35).

The simple effect of Strategy did not attain significance at either baseline or posttest indicating that there was no difference between the strategies at either trial levels.

Comparison of Treatment Effects to Control Groups. Subjects in the experimental groups were combined, and the combined experimental subjects were compared to the controls. A $2 \times 2 \times 2$ mixed ANOVA with one between subjects variable (Treatment: Experimental, Control) and two within subject variables (Trial: Baseline, Posttest x Interval: 30 seconds, 60 seconds) was computed on subjects' pain ratings. Results indicated (see Table 36) significant main effects for Trial and Interval and a significant Treatment by Trial interaction. The means for the Trial main effect (Table 37) indicated that subjects rated pain higher at baseline than at posttest. The means for the Interval main effect (see Table 38) indicated that subjects rated pain higher at the 60 seconds than at the 30 seconds interval. The main effects were qualified by the significant interaction.

**Figure 8. Pain Ratings(Experimental subjects only)-
Strategy x Trial Interaction**

note n=120

Table 35. Mean Pain Ratings (Experimental Subjects Only) by Strategy and Trial

	Imagery		Distraction	
	Baseline	Posttest	Baseline	Posttest
M	10.80	9.08	11.80	8.76
SD	4.08	4.44	4.14	4.06

Note: n = 120

**Figure 7. Pain Ratings(Experimental Subjects):
Strategy x Choice Control x Interval Interaction**

note n=120

*p < .05

** < .001

Table 36. Mixed ANOVA on Pain Ratings: Trial x Interval x Treatment

Source	DF	MS	F	Sig.
Treatment	1	252.73	3.87	.051
Error	135	65.28		
Trial	1	78.12	9.02	.003*
Treatment by Trial	1	99.47	11.48	.001*
Error	135	8.66		
Interval	1	1040.22	238.43	.000**
Treatment x Interval	1	2.59	.59	.443
Error	135	4.36		
Trial x Interval	1	.55	.38	.540
Treatment x Trial x Interval	1	.00	.00	.960
Error	135	1.46		

Note: n = 137

*p < .05

**p < .001

Table 37. Mean Pain Ratings for All Subjects by Trial

Trial	M	SD
Baseline	11.44	4.25
Posttest	9.32	4.45

Note: n = 137

Table 38. Mean Pain Ratings for All Subjects by Interval

<u>Interval</u>	<u>M</u>	<u>SD</u>
30 Seconds	8.21	4.16
60 Seconds	12.55	4.25

Note: n = 137

The Treatment x Trial interaction (see Figure 9 and means in Table 39) was further analysed for the simple effects of Treatment at each Trial level and the simple effects of Trial at each Treatment level.

The simple effect of treatment attained significance at posttest only, $F(1,35) = 9.05$, $p < .05$. At posttest the experimental subjects rated pain lower than the controls.

The simple effect of Trial attained significance for the experimental group only, $F(1, 119) = 82.32$, $p < .05$. The experimental subjects, but not the controls, gave lower pain ratings at posttest than at baseline.

The Effect of Treatment - Re-grouped Choice-Control. As in Study I, some subjects in the Force Choice-Control group were moved to the Choice Choice-Control group for the purpose of this analysis. Subjects in the Force group who were assigned the strategy to which they gave lower posttest expectancy ratings (posttest expectancy at 30 seconds plus posttest expectancy at 60 seconds divided by 2) than they gave to the other strategy were moved to the Choice group. We thus compared a Force group to a Choice group on the basis of whether or not subjects had the subjective experience of choosing a strategy. It should be noted that in study I all subjects in the original Choice groups chose the strategy they judged more effective. In study II, however, eight of the subjects allowed to choose a strategy, chose the strategy they judged less effective (but preferred to use for other

Figure 9. Pain Ratings - Treatment x Trial Interaction

note n=137

Table 39. Mean Pain Ratings for All Subjects by Treatment and Trial

	Experimental		Control	
	Baseline	Posttest	Baseline	Posttest
M	11.35	8.91	12.11	12.26
SD	4.13	4.22	5.14	5.05

Note: n = 137

reasons). Eight other subjects rated both strategies as equally effective. Of these eight subjects, those who belonged to the Choice condition were simply asked to choose the strategy they preferred to use. Those who belonged to the Force condition were asked, after the posttest trial, which strategy they would have preferred to use if given the choice. They were then combined with the re-grouped Choice or Force conditions accordingly.

The effect of treatment on subjects' pain ratings was assessed using the above regrouping of subjects in which some Force Choice-Control were considered as Choice Choice-Control. Because the regrouping resulted in only nine subjects who were forced to use Distraction it was decided to do the analysis collapsing across strategies. Analysis was done on a combined Imagery-Distraction Choice group that rated expectancy before choosing ($n = 45$), a combined Imagery-Distraction Choice group that rated expectancy after choosing ($n = 43$), a combined Imagery-Distraction Force group that rated expectancy before being assigned a strategy ($n = 15$) and a combined Imagery-Distraction Force group that rated expectancy after being assigned a strategy ($n = 17$).

A $2 \times 2 \times 2 \times 2$ mixed ANOVA with two between subjects variables (Choice Control: Choice, Force $\times$ Order: Expectancy Ratings given before Choice/Force, Expectancy

Ratings given after Choice/Force) and two within subjects variables (Trial: Baseline, Posttest x Interval: 30 seconds 60 seconds) was computed on subjects' pain ratings. The control group was excluded from the analysis at this point. Significant main effects were obtained for Trial and for Interval. In addition there was a significant two way Choice-Control x Trial interaction (see results in Table 40). The Trial main effect indicates that experimental subjects rated pain higher at baseline than at posttest. The Interval main effect indicates that they rated pain higher at the 60 seconds than at the 30 seconds interval. These main effects involve the same means obtained before the subjects were regrouped (see Tables 37, 38). The main effects were qualified by the interaction obtained. The interaction was further analysed with a series of simple effects.

Choice-Control x Trial Interaction. The two way Choice- Control x Trial Interaction (see Figure 10 and means in Table 41) was further analysed for the simple effects of Choice-Control at Trial and for the simple effects of Trial at Choice-Control.

The simple effect of Trial attained significance at both the Choice, $F(1,87) = 83.5$, $p < .05$ and the Force conditions, $F(1,87) = 6.10$, $p < .05$. At both conditions subjects' pain ratings were higher at baseline than at posttest.

Table 40. Mixed ANOVA on Pain Ratings (Some Choice Considered Force): Choice-Control x Order x Trial x Interval

Source	DF	MS	F	Sig.
Choice-Control	1	76.64	1.24	.268
Order	1	2.17	.04	.852
Choice-Control x Order	1	3.36	.05	.816
Error	116	61.80		
Trial	1	402.50	46.77	.000**
Choice-Control x Trial	1	56.90	6.61	.011*
Order x Trial	1	3.68	.43	.514
Choice-Control x Order x Trial	1	.01	.00	.980
Error	116	8.61		
Interval	1	1838.87	398.19	.000**
Choice-Control x Interval	1	.95	.21	.652
Order x Interval	1	.66	.14	.706
Choice-Control x Order				
x Interval	1	.24	.05	.820
Error	116	4.62		
Trial x Interval	1	1.76	1.17	.282
Choice-Control x Trial				
x Interval	1	.52	.35	.558
Order x Trial x Interval	1	.27	.18	.673
Choice-Control x Order				
x Trial x Interval	1	.31	.21	.649

Note: n = 120; *p < .05; **p < .001

**Figure 10. Pain Ratings(some Force considered Choice):
Choice - Control x Trial Interaction**

Note: n = 120

**Table 41. Mean Pain Ratings for all Experimental Subjects
(Some Force considered Choice) by Choice-Control and Trial**

	Baseline		Posttest	
	Choice	Force	Choice	Force
M	11.17	11.52	8.78	9.04
SD	4.16	4.13	4.14	4.33

Note: n = 120

The simple Choice-Control effect was not significant at either baseline or posttest, indicating that there was no difference between pain ratings given by the Choice compared to the Force subjects on baseline or on posttest.

The Effect of Efficacy

Subjects were divided into two groups according to whether they ended up using the strategy they rated as more effective or the one they rated as less effective. The Low Efficacy group was made up of those subjects who gave higher posttest expectancy ratings (sum of expectancy ratings at 30 seconds and 60 seconds divided by 2) to the strategy they ended up using. The High Efficacy group was made up of subjects who gave lower posttest expectancy ratings to the strategy they ended up using. Eight subjects who gave equivalent expectancy ratings to both strategies were excluded. The Imagery and Distraction groups were combined because there were only 9 subjects in the Low Efficacy-Distraction group.

A 2x2x2x2 mixed ANOVA with two between subjects variables (Efficacy: Low, High x Order: Expectancy Ratings given before Choice/Force, Expectancy Ratings given after Choice/Force) and two within subject variables (Trial: baseline, posttest x Interval: 30 seconds, 60 seconds) was conducted on subjects' pain ratings. Results indicated significant main effects for Trial and Interval and a significant Efficacy x Trial interaction (see Table 42).

Table 42. Mixed ANOVA on Pain Ratings: Efficacy x Order x Trial x Interval

Source	DF	MS	F	Sig.
Efficacy	1	202.64	3.55	.062
Order	1	.27	.00	.946
Efficacy x Order	1	7.86	.14	.711
Error	108	57.07		
Trial	1	519.90	62.99	.000**
Efficacy x Trial	1	87.27	10.57	.002*
Order x Trial	1	4.66	.57	.454
Efficacy x Order x Trial	1	1.10	.13	.716
Error	108	8.25		
Interval	1	2022.36	472.59	.000**
Efficacy x Interval	1	5.94	1.39	.241
Order x Interval	1	.32	.07	.786
Efficacy x Order x Interval	1	5.80	1.36	.247
Error	108	4.28		
Trial x Interval	1	2.98	1.96	.165
Efficacy x Trial x Interval	1	5.49	3.61	.060
Order x Trial x Interval	1	.00	.00	.980
Efficacy x Order x Trial				
x Interval	1	.02	.01	.904
Error	108	1.52		

Note: n = 112; *p < .05; **p < .001

The Trial main effect indicates that subjects rated pain higher at baseline ($M = 11.33$, $SD = 4.02$) than at posttest ($M = 8.75$, $SD = 4.11$). The Interval main effect indicates that subjects rated pain higher at the 60 seconds ($M = 12.25$, $SD = 3.97$) than at the 30 seconds interval ($M = 7.82$, $SD = 3.87$). These effects were qualified by the significant interaction.

The Efficacy x Trial interaction was further analysed for the simple effects of Efficacy at each Trial level and the simple effects of Trial at each efficacy level (see Figure 11 and means in Table 43).

The simple effect of Efficacy was significant at posttest only, $F(1,110) = 9.52$, $p < .01$. The relevant means (see Table 43) indicate that subjects in the High Efficacy condition gave lower pain ratings at posttest than subjects in the Low Efficacy condition.

The simple effect of Trial was significant for both the Low Efficacy conditions, $F(1,37) = 8.13$, $p < .05$ and the High Efficacy conditions, $F(1,73) = 93.17$, $p < .05$. Both conditions gave lower pain ratings at posttest than at baseline.

Expectancy Ratings

Effects of Treatment. The following analysis was conducted to assess the effect of treatment on subjects' expectancy ratings. A $2 \times 2 \times 2 \times 2 \times 2$ mixed ANOVA with three between subjects variables (Strategy: Imagery, Distraction x Choice Control: Choice, Force x Order:

Figure 11. Pain Ratings - Efficacy x Trial Interaction

note n=112

Table 43. Mean Pain Ratings by Efficacy and Trial

	Low Efficacy		High Efficacy	
	Baseline	Posttest	Baseline	Posttest
M	11.64	10.31	11.16	7.94
SD	4.07	4.34	4.01	3.78

Note: n = 112

Expectancy ratings given before Choice/Force, Expectancy ratings given after Choice/Force) and two within subject variables (Trial: Baseline, Posttest x Interval: 30 seconds, 60 seconds) was computed on subjects' expectancy ratings. The control group was excluded from the analysis at this point.

The main effects of Trial and of Interval attained significance. In addition, the two way Choice-Control x Trial interaction and the three way strategy by Choice-Control by Interval interaction were significant (see Table 44). The Trial main effect indicates that the experimental subjects expected more pain before being taught the pain reduction strategies than after being taught the pain reduction strategies. In other words, their baseline expectancy ratings were higher than their posttest expectancy ratings (see means in Table 45). The Interval main effect indicates that the experimental subjects expected more pain for the 60 seconds interval than for the 30 seconds interval (see means in Table 46). These main effects were qualified by the interactions obtained. The interactions were further analysed using a series of simple effects.

Choice-Control x Trial Interaction. The Choice-Control x Trial interaction (see Figure 12 and means in Table 47) was analysed for the effects of Choice-Control at each Trial level and for the effects of Trial at each Choice-Control level.

Table 44. Mixed ANOVA on Expectancy Ratings: Strategy x
Choice-Control x Order x Trial x Interval

Source	df	MS	F	Sig.
Strategy	1	28.45	.43	.511
Choice-Control	1	64.11	.98	.325
Order	1	114.11	1.74	.190
Strategy x Choice-Control	1	81.11	1.24	.268
Strategy x Order	1	44.79	.68	.410
Decision x Order	1	.72	.01	.917
Strategy x Choice-Control x Order	1	.89	.01	.908
Error	112	65.58		
Trial	1	1006.84	176.87	.000**
Strategy x Trial	1	10.67	1.87	.174
Choice-Control x Trial	1	26.43	4.64	.033*
Order x Trial	1	.22	.04	.844
Strategy x Choice-Control x Trial	1	1.76	.31	.580
Strategy x Order x Trial	1	1.00	.18	.676
Choice-Control x Order x Trial	1	4.63	.81	.369
Strategy x Choice-Control x Order x Trial	1	.58	.10	.751
Error	112	5.69		
Interval	1	2300.38	430.69	.000**
Strategy x Interval	1	5.79	1.08	.300
Choice-Control x Interval	1	.00	.00	.988
Order x Interval	1	3.86	.72	.397
Strategy x Choice-Control x Interval	1	22.94	4.29	.041*
Strategy x Order x Interval	1	4.56	.85	.358
Choice-Control x Order x Interval	1	.61	.11	.736
Strategy x Choice-Control x Order x Interval	1	4.03	.75	.387
Error	112	5.34		
Trial x Interval	1	.02	.02	.893
Strategy x Trial x Interval	1	2.63	2.59	.111
Choice-Control x Trial x Interval	1	1.99	1.96	.164
Order x Trial x Interval	1	1.09	1.07	.304
Strategy x Choice-Control x Trial x Interval	1	1.97	1.94	.167
Strategy x Order x Trial x Interval	1	2.35	2.31	.132
Choice-Control x Order x Trial x Interval	1	1.07	1.05	.307
Strategy x Choice-Control x Order x Trial x Interval	1	.59	.58	.447

Note: n = 120, *p < .05; **p < .001

Table 45. Mean Expectancy Ratings for all Experimental Subjects by Trial

Trial	M	SD
Baseline	11.20	4.26
Posttest	8.25	4.09

Note: n = 120

Table 46. Mean Expectancy Ratings for All Experimental Subjects by Interval

<u>Interval</u>	<u>M</u>	<u>SD</u>
30 Seconds	7.50	4.08
60 Seconds	11.95	4.25

Note: n = 120

**Figure 12. Expectancy Ratings :Choice-Control
x Trial Interaction**

Note: n = 120

Table 47. Mean Expectancy Ratings for All Experimental Subjects by Choice-Control and Trial

	Baseline		Posttest	
	Choice	Force	Choice	Force
M	11.12	11.29	7.70	8.81
SD	4.41	4.15	4.18	3.96

Note: n = 120

The simple effect of Choice-Control was not significant at either Trial level. This means that there was no difference between the expectancy ratings given by the Choice compared to the Force groups at either baseline or posttest.

The simple effect of Trial was significant for both the Choice, $F(1,59) = 123.69$, $p < .05$ and the Force, $F(1,59) = 64.59$, $p < .05$ groups. This indicates that both the Choice and the Force groups expected more pain at posttest than at baseline (see means in Table 47).

Strategy x Choice-Control x Interval Interaction. The three way strategy x Choice-Control x Interval interaction (see Figure 13 and means in Table 48) was analysed using the Choice-Control x Interval simple interaction at each of the strategies.

The Choice-Control x Interval simple interaction at Imagery included only those subjects who ended up using Imagery on posttest ($n = 55$). For these subjects there was only a significant simple Interval effect, $F(1,53) = 183.26$, $p < .05$, indicating that their expectancy ratings for posttest were higher than their expectancy ratings after baseline (see relevant means in Table 48).

The Choice-Control x Interval simple interaction at Distraction included only those subjects who ended up using Distraction on posttest ($n = 65$). For these subjects there was only a significant simple effect of interval, $F(1, 63) = 261.08$, $p < .05$.

**Figure 13. Expectancy Ratings(Experimental Subjects):
Strategy x Choice Control x Interval Interaction**

Note: n = 120

Table 48. Mean Expectancy Ratings (Experimental Subjects) for Each Choice-Control by Strategy and Interval

		Imagery		Distraction	
<u>Choice-Control</u>		<u>30 Seconds</u>	<u>60 Seconds</u>	<u>30 Seconds</u>	<u>60 Seconds</u>
Choice	M	6.87	10.62	7.42	12.48
	SD	4.41	4.48	3.65	4.38
Force	M	7.92	12.60	7.76	11.96
	SD	4.17	4.28	4.25	3.82

Note: n = 120.

The significant 3-way interaction was probably obtained because the Force-Imagery subjects rated expectancy nonsignificantly higher than the Choice-Imagery subjects at both intervals while the Force-Distraction subjects rated expectancy nonsignificantly lower at 60 seconds but not at 30 seconds. Analysis of the 3 way interaction resulted in a significant effect of interval only, indicating that subjects rated expectancy higher at the 60 seconds than at the 30 seconds interval.

Comparison of Treatment Effects to Control Group. A 2 x 2 x 2 mixed ANOVA with one between subjects variable (Treatment: Experimental, Control) and two within subject variables (Trial: Baseline, Posttest x Interval: 30 seconds, 60 seconds) was computed on subjects' expectancy ratings. Results (see Table 49) indicated significant main effects for Trial and for Interval and a significant Treatment x Trial interaction. The Trial effect (see means in Table 50) indicated that subjects gave higher expectancy ratings at baseline than at posttest. The Interval effect (see means in Table 51) indicated that subjects gave higher expectancy ratings at the 60 seconds than at the 30 seconds interval. These main effects were qualified by the significant Treatment x Trial interaction. This interaction was further analysed.

The Treatment x Trial interaction (see Figure 14 and means in Table 52) was analysed for the simple effects of Treatment at each Trial level and for the simple effects of Trial at

**Table 49. Mixed ANOVA on Expectancy Ratings: Trial x Interval
x Treatment**

Source	DF	MS	F	Sig.
Treatment	1	153.41	2.30	.132
Error	135	66.84		
Trial	1	112.13	21.36	.000**
Treatment x Trial	1	148.30	28.25	.000**
Error	135	5.25		
Interval	1	1085.54	210.16	.000**
Treatment x Interval	1	1.95	.38	.540
Error	135	5.17		
Trial x Interval	1	.19	.20	.657
Treatment x Trial x Interval	1	.48	.50	.481
Error	135	.97		

Note: n = 137

***p < .05**

****p < .001**

Table 50. Mean Expectancy Ratings for All Subjects by Trial

<u>Trial</u>	<u>M</u>	<u>SD</u>
Baseline	11.21	4.30
Posttest	8.65	4.28

Note: n = 137

Table 51. Mean Expectancy Ratings for All Subjects by Interval

Interval	M	SD
30 Seconds	7.72	4.15
60 Seconds	12.13	4.36

Note: n = 137

Figure 14. Expectancy Ratings: Treatment x Trial Interaction

Note: $n = 137$

Table 52. Mean Expectancy Ratings for All Subjects by Treatment and Trial

	Experimental		Control	
	Baseline	Posttest	Baseline	Posttest
M	11.20	8.25	11.23	11.44
SD	4.26	4.09	4.70	4.68

Note: n = 137

each Treatment level.

The simple effect of Treatment was significant at the posttest trial only, $F(1,135) = 8.37$, $p < .05$. At posttest experimental subjects gave lower expectancy ratings than controls.

The simple effect of Trial was significant for the experimental group only, $F(1, 119) = 199.29$, $p < .05$. Experimental subjects gave lower expectancy ratings at posttest than at baseline.

Effects of Treatment - Re-grouped Choice-Control. The following analysis assessed the effect of treatment on subjects' expectancy ratings. Subjects were regrouped so that some original Force subjects were combined with Choice subjects in the manner described previously (see procedure for Choice-Control re-grouping on page 122). The Imagery and Distraction groups were combined because re-grouping resulted in only 9 subjects who were forced to use Distraction.

A $2 \times 2 \times 2 \times 2$ mixed ANOVA with two between subjects' variables (Choice-Control: Choice, Force x Order: Expectancy ratings given before Choice/Force, Expectancy ratings given after Choice/Force) and two within subject variables (Trial: Baseline, Posttest x Interval: 30 seconds, 60 seconds) was computed on subjects' expectancy ratings. The control group was excluded from the analysis at this point. Significant main effects were obtained for

Trial and for Interval. In addition, the two way Choice-Control x Trial interaction attained significance (see results in Table 53). The Trial main effect indicated that all experimental subjects gave higher baseline than posttest expectancy ratings. The Interval main effect indicated that their expectancy ratings were higher for the 60 seconds than for the 30 seconds interval. The means involved in this analysis are identical to those used before the subjects were regrouped (see Tables 50,51). The main effects were qualified by the significant Choice-Control x Trial interaction. This interaction was further analysed using a series of simple effects.

Choice-Control x Trial Interaction. The Choice-Control x Trial Interaction (see Figure 15 and means in Table 54) was analysed for the simple effect of Choice-Control at each Trial level and the simple effect of Trial at each Choice-Control level.

The simple effect of Trial was significant for both the Choice groups, $F(1,87) = 197.13$, $p < .05$ and the Force groups, $F(1,31) = 16.43$, $p < .05$. Subjects in both conditions gave lower expectancy ratings at posttest than at baseline.

The simple effect of Choice-Control attained significance at posttest only, $F(1,118) = 5.48$, $p < .05$. The relevant means indicated that subjects in the Choice groups gave lower expectancy ratings at posttest than

Table 53. Mixed ANOVA on Expectancy Ratings (Some Force Considered Choice): Choice-Control x Order x Trial x Interval

Source	DF	MS	F	Sig.
Choice-Control	1	111.49	1.74	.190
Order	1	53.24	.83	.364
Choice-Control x Order	1	3.06	.05	.827
Error	116	64.08		
Trial	1	599.13	114.20	.000**
Choice-Control x Trial	1	74.79	14.26	.000**
Order x Trial	1	.01	.00	.971
Choice-Control x Order				
x Trial	1	.57	.11	.742
Error	116	5.25		
Interval	1	1885.09	345.76	.000**
Choice-Control x Interval	1	.85	.16	.694
Order x Interval	1	4.82	.88	.349
Choice-Control x Order				
x Interval	1	3.37	.62	.434
Error	116	5.45		
Trial x Interval	1	.02	.02	.897
Choice-Control x Trial				
x Interval	1	.14	.13	.720
Order x Trial x Interval	1	.88	.83	.366
Choice-Control x Order				
x Trial x Interval	1	.19	.18	.676
Error	116	1.07		

Note: n = 120; *p < .05; **p < .001

**Figure 15. Expectancy Ratings(some Force considered Choice):
Choice - Control x Trial Interaction**

Note: n = 120

Table 54. Mean Expectancy Ratings for all Experimental Subjects (Some Force considered Choice) by Choice-Control and Trial

	Baseline		Posttest	
	Choice	Force	Choice	Force
M	11.12	11.29	7.70	8.81
SD	4.41	4.15	4.18	3.96

Note: n = 120

subjects in the Force groups. It would, however, be wrong to say that the significant effect obtained was due to the effect of choice because about half of the subjects in each Choice-Control condition chose a strategy or were assigned a strategy only after rating expectancy. The meaning of the significant Choice-Control effect at posttest is not clear.

Absorption Ratings

The Effect of Treatment. A 2 x 2 x 2 ANOVA with three between subjects variables (Strategy: Imagery, Distraction x Choice-Control: Choice, Force x Order; Expectancy ratings given before Choice/Force, Expectancy ratings given after Choice/Force) was computed on experimental subjects' absorption ratings. Controls did not rate absorption. A significant Strategy x Order interaction was obtained (see Table 55). This interaction was further analysed using a series of simple effects.

Strategy x Order Interaction. The 2-way Strategy x Order interaction was further analysed for the simple effects of Strategy at each Order level and the simple effects of Order at each Strategy (see Figure 16 and means in Table 56). The simple effect of Strategy was significant for subjects who rated expectancy after choosing or being forced into a strategy, $F(1,58) = 5.06$, $p < .05$. At this Order subjects using Imagery gave higher absorption ratings ($M = 3.33$, $SD = .75$) than subjects using

Table 55. ANOVA on Absorption Ratings: Strategy x Choice-Control x Order

<u>Source</u>	<u>DF</u>	<u>MS</u>	<u>F</u>	<u>Sig.</u>
Decision	1	1.46	1.95	.165
Strategy	1	.34	.45	.504
Order	1	.02	.03	.860
Choice-Control x Strategy	1	.24	.32	.573
Choice-Control x Order	1	.09	.12	.729
Strategy x Order	1	4.58	6.14	.015*
Choice-Control x Strategy x Order	1	1.31	1.75	.188

Note: n = 120

* p < .05

**p < .001

Figure 16. Absorption Ratings: Strategy x Order Interaction

note. Order 1-Expectancy Rated before Choice/Force
Order 2-Expectancy Rated after Choice/Force
n=120

Table 56. Mean Absorption Ratings for each Strategy by Order

	Order 1*		Order 2*	
	Imagery	Distraction	Imagery	Distraction
M	2.96	3.25	3.33	2.83
SD	.93	.74	.75	1.02

Note: Order 1 - Expectancy rated before Choice/Force

Order 2 - Expectancy rated after Choice/Force

n = 120

Distraction ($M = 2.83$, $SD = 1.02$).

The simple effect of Order was not significant at either strategy.

In summary, analysis of the effect of treatment on absorption ratings indicated only that subjects who rated expectancy after choosing/being forced into a strategy and who used Imagery rated Absorption higher than Distraction subjects given this Order. The difference in mean absorption ratings between these groups is however slight. Considering the very small standard deviations of absorption ratings, slight fluctuations in means can lead to statistically significant results.

Re-grouped Choice-Control - The Effect of Treatment.

Subjects were re-grouped so that some original Force subjects were combined with Choice subjects in the manner described previously (see procedure for Choice-Control re-grouping on page 122). Because regrouping resulted in only nine subjects who were forced to use Distraction, the following analysis was done on combined Imagery-Distraction groups.

A 2×2 ANOVA with two between subjects variables (Choice-Control: Choice, Force $\times$ Order: Expectancy ratings given before Choice/Force, Expectancy ratings given after Choice/Force) was computed on absorption ratings given by the regrouped experimental subjects. No significant main effects or interactions were obtained (see Table 57). Results indicate that neither Choice-Control nor Order affected absorption ratings (see means in Table 58).

Table 57. ANOVA on Absorption Ratings (Re-grouped Choice-Control) Choice-Control x Order

<u>Source</u>	<u>df</u>	<u>MS</u>	<u>F</u>	<u>Sig.</u>
Choice-Control	1	2.47	3.25	.074
Order	1	.08	.10	.748
Choice-Control x Order	1	1.02	1.34	.250
Error	116	.76		

Note: n = 120

* p < .05

**p < .001.

Table 58. Mean Absorption Ratings for Each Choice-Control Condition by Order (Re-grouped Choice-Control)

	Order 1		Order 2	
	Choice	Force	Choice	Force
M	3.26	2.73	3.11	3.00
SD	.80	.79	.90	1.00

Note: Order 1 - Expectancy rated before Choice/Force

Order 2 - Expectancy rated after Choice/Force

n = 120

Correlational Analysis

Pearson correlations between our various measures are presented separately for the Imagery groups (Table 59) and the Distraction groups (Table 60) as well as for all experimental subjects (Table 61).

Correlations between posttest expectancy ratings at 30 and 60 seconds and pain ratings at 30 and 60 seconds, respectively, were positive in the high range for both the Imagery groups (ranges $r(53) = .92 - .94$) and the Distraction groups (ranges $r(63) = .87 - .91$). Correlations between expectancy for pain reduction (Baseline expectancy minus posttest expectancy) and pain reduction scores (pain ratings at baseline minus pain ratings at posttest) were positive in the moderate range for the Imagery groups (ranges $r(53) = .31 - .35$). In the Distraction groups however these correlations were low and did not attain significance for the 60 seconds interval (ranges $r(63) = .17 - .20$).

Correlations between ratings of absorption in the strategy used and average pain reduction scores (average pain ratings at baseline minus average pain ratings at posttest) were low-positive for the Imagery groups ($r(53) = .22$) and moderate-positive for the Distraction groups ($r(63) = .49$). Correlations between absorption ratings and posttest expectancy ratings were close to zero in both the Imagery and the Distraction groups (ranges $r(53-63) = -.12 - .08$).

Table 59 Correlations Between Variables for Imagery Groups

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1. Pain Rating, Baseline, 30"	--	.89*	.83*	.69*	.94*	.84*	.82*	.73*	.16	.04	.10	.26*	.08	.17	.20	-.22	.03	.24*	.45	.57*	.69*	-.03
2. Pain Rating, Baseline, 60"			.72*	.71*	.84*	.92*	.81*	.84*	.00	-.03	-.01	.25*	.17	.22*	.22	-.25*	-.00	.35*	.17	.32	.42	.06
3. Pain Rating, Posttest, 30"				.83*	.78*	.64*	.77*	.64*	-.01	-.12	-.08	-.31*	-.31*	-.34*	.08	-.08	.02	.17	.66*	.50	.69*	.15
4. Pain Rating, Posttest, 60"					.63*	.66*	.66*	.75*	-.08	-.27*	-.19	-.27*	-.56*	-.47*	.00	-.16	.04	.09	.44	.38	.49	.19
5. Expec. Rating, Baseline, 30"						.85*	.83*	.71*	.23*	.09	.17	.25*	.11	.18	.23	-.27*	.11	.27*	.49	.54*	.59*	.02
6. Expec. Rating, Baseline, 60"							.73*	.82*	.18	.12	.16	.33*	.15	.24*	.26*	-.23	.05	.25*	.18	.36	.48	.00
7. Expec. Rating, Posttest, 30"								.84*	-.32*	-.33*	-.35*	.06	.03	.05	.21	-.12	.10	.41*	.53*	.49	.54	.06
8. Expec. Rating, Posttest, 60"									-.27*	-.46*	-.39*	.12	-.06	.01	.23	-.03	.12	.39*	.27	.37	.43	.08
9. Expec. Reduction at 30"										.76*	.93*	.31*	.12	.22	.00	-.24*	.02	-.25*	.06	.29	.30	.15
10. Expec. Reduction at 60"											.94*	.30*	.35*	.36*	.00	-.28*	-.11	-.27*	-.15	.04	.20	.16
11. Average Expec. Reduction												.32*	.26*	.31*	.00	-.28*	-.05	-.28*	.06	.16	.26	.17
12. Pain Reduction at 30"													.68*	.88*	.18	-.22	.00	.10	-.34	.02	-.08	.21
13. Pain Reduction at 60"														.94*	.24*	-.07	-.06	.28*	-.36	-.12	-.15	.19
14. Average Pain Reduction															.24*	-.14	-.03	.22	-.36	-.06	-.12	.22
15. Social Desirability																.35*	.10	.06	-.33	-.46	-.60*	.13
16. Sphere of Control - Personal																	.16	.01	-.13	-.20	-.42	.21
17. Sphere of Control - Interper.																		-.00	.46	.39	.00	.18
18. Sphere of Control - Sociopol.																			.16	.31	.26	.01
19. Betts																				.70*	.71*	.17
20. CURSS-0																					.75*	.10
21. CURSS-S																						.32
22. Absorption Rating																						

Note: n = 55 except for the following variables: Betts, CURSS-0, n = 11

CURSS-S, n = 10

SOC-1, SOC-2, SOC-3, n = 50

SU, n = 49

* p < .05

** p < .01

Table 6Q. Correlations Between Variables for Distraction Groups

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1. Pain Rating, Baseline, 30"	--	.86*	.75*	.55*	.91*	.75*	.81*	.66*	.43*	.25*	.37*	.51*	.28*	.41*	.01	-.22*	-.00	.11	.30	.58*	.55*	.07
2. Pain Rating, Baseline, 60"			.69*	.67*	.79*	.87*	.73*	.81*	.33*	.21*	.30*	.39*	.27*	.34*	.10	-.27*	-.00	.11	.19	.48	.57*	.08
3. Pain Rating, Posttest, 30"				.80*	.82*	.74*	.76*	.72*	.33*	.14	.26*	-.17	-.25*	-.23*	-.01	-.14	.07	-.03	.50*	.17	.26	-.25*
4. Pain Rating, Posttest, 60"					.57*	.70*	.54*	.73*	.22*	.05	.15	-.21*	-.52*	-.41*	-.06	-.14	.06	-.03	.25	-.10	.07	-.29*
5. Exec. Rating, Baseline, 30"						.83*	.83*	.71*	.55*	.31*	.47*	.29*	.16	.24*	-.00	-.14	.05	.01	.42	.38	.40	-.03
6. Exec. Rating, Baseline, 60"							.71*	.82*	.44*	.42*	.48*	.16	.09	.13	-.00	-.25*	.03	-.04	.37	.25	.40	-.01
7. Exec. Rating, Posttest, 30"								.79*	.01	-.03	-.01	.22*	.14	.19	-.07	-.32*	-.15	-.03	.44	.37	.39	-.10
8. Exec. Rating, Posttest, 60"									.08	-.16	-.04	.06	-.01	.02	-.11	-.37*	-.10	-.09	.31	.09	.27	-.12
9. Exec. Reduction at 30"										.62*	.89*	.20*	.08	.15	.10	.23*	.33*	.07	.24	.26	.17	.09
10. Exec. Reduction at 60"											.90*	.18	.17	.19	.17	.13	.22*	.06	.10	.31	.17	.17
11. Average Exec. Reduction												.21*	.14	.19	.16	.20	.31*	.07	.16	.30	.18	.14
12. Pain Reduction at 30"												.76*	.76*	.92*	.03	-.14	-.10	.22	-.11	.49	.30	.44*
13. Pain Reduction at 60"													.94*	.94*	.19	-.12	-.09	.16	-.10	.51*	.37	.48*
14. Average Pain Reduction														.13	-.14	-.10	-.10	.20	-.11	.51*	.35	.49*
15. Social Desirability															.27*	.10	.40*	.27*	-.06	.20	.04	.00
16. Sphere of Control - Personal																		.22*	.06	.64*	.71*	.08
17. Sphere of Control - Interper.																			-.28	.39	.39	-.02
18. Sphere of Control - Sociopol.																				.06	.11	.20
19. Betts																					.93*	.26
20. CURSS-0																						.36
21. CURSS-S																						
22. Absorption Rating																						

Note: n = 65 except for the following variables: Betts, CURSS-0, n = 23

CURSS-S, n = 21

SD, n = 109

SOC₁, SOC₂, n = 108

SOC₃, n = 106

* p < .05

** p < .01

Table 61. Correlations Between Variables for Experimental Subjects

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
1. Pain Rating, Baseline, 30"	--	.87*	.78*	.60*	.92*	.79*	.80*	.69*	.31*	.16*	.25*	.42*	.20*	.32*	.08	-.21*	.01	.17*	.36*	.51*	.66*	.02	
2. Pain Rating, Baseline, 60"		--	.69*	.68*	.81*	.89*	.76*	.82*	.20*	.10	.16*	.35*	.25*	.31*	.14	-.24*	-.00	.22*	.19	.34	.54*	.01	
3. Pain Rating, Posttest, 30"			--	.82*	.79*	.68*	.76*	.67*	.15*	.00	.08	-.23*	-.28*	-.28*	.03	-.12	.05	.06	.57*	.32	.53*	-.20*	
4. Pain Rating, Posttest, 60"				--	.59*	.67*	.60*	.74*	.07	-.11	-.02	-.24*	-.53*	-.43*	-.02	-.15	.05	.02	.34	.13	.35	-.24*	
5. Expec. Rating, Baseline, 30"					--	.84*	.82*	.70*	.41*	.21*	.33*	.28*	.15*	.22*	.09	-.19*	.08	.13	.45*	.44*	.51*	-.03	
6. Expec. Rating, Baseline, 60"						--	.71*	.81*	.33*	.28*	.33*	.24*	.13	.19*	.10	-.23*	.04	.09	.26	.28	.48*	-.01	
7. Expec. Rating, Posttest, 30"							--	.82*	-.16*	-.19*	-.19*	.13	.08	.11	.07	-.22*	-.01	.20*	.47	.42*	.46*	-.01	
8. Expec. Rating, Posttest, 60"								--	-.08	-.31*	-.22*	.09	-.02	.02	.05	-.19*	.01	.16*	.29	.22	.41*	-.02	
9. Expec. Reduction at 30"										--	.69*	.27*	.13	.21*	.05	.01	.17*	-.08	.15	.24	.30	-.02	
10. Expec. Reduction at 60"											--	.92*	.24*	.27*	.09	-.06	.05	-.11	-.03	.15	.17	.01	
11. Average Expec. Reduction												--	.28*	.26*	.07	-.03	.12	-.10	.05	.20	.24	-.00	
12. Pain Reduction at 30"													--	.73*	.08	-.14	-.05	.16*	-.19	.27	.17	.33*	
13. Pain Reduction at 60"														--	.23*	-.07	-.07	.21*	-.22	.20	.13	.33*	
14. Average Pain Reduction															--	.16*	-.11	-.07	.20*	.24	.15	.35*	
15. Social Desirability																--	.29*	.10	.26*	-.44*	-.32	.06	
16. Sphere of Control - Personal																	--	.14	-.09	-.12	-.22	.08	
17. Sphere of Control - Interper.																		--	.11	.27	.47*	.12	
18. Sphere of Control - Sociopol.																			--	.33	.21	-.02	
19. Betts																				--	.35*	.12	
20. CURSS-0																					--	.80*	.17
21. CURSS-S																						--	.31

Note: n = 120 except for the following variables: Betts, CURSS-0, n = 12

CURSS-S, n = 11

SD, n = 60

SOC₁, SOC₂, n = 58SOC₃, n = 54

*p < .05

**p < .01

Correlations between the three Spheres of Control scales and average pain reduction scores were low for either the Imagery groups, Distractions groups or all experimental subjects combined (ranges $-.14 - .24$). The correlation between the Socio-political Spheres of Control scale and average pain reduction scores for all experimental subjects ($r(104) = .20$) reached significance.

In order to assess whether the need to feel in control is related to the ability to benefit from choice-control correlations between the three Spheres of Control scales and average pain reduction scores were computed separately for subjects in the Choice condition (see Table 62). These correlations were very low and inconsistent in their direction when computed for the original Choice group (ranges $r(49) = -.12 - .07$). They were low as well when computed for the subjective choice group which included, in addition to subjects allowed to choose their strategy, also some of the Force subjects who were assigned their preferred strategy (ranges $r(76) = -.12 - .17$).

Correlations between the Social Desirability scale and average pain reduction scores were low-positive for the Distraction groups ($r(58) = .13$), the Imagery groups ($r(47) = .24$) or all experimental subjects combined ($r(109) = .16$). The last two correlations reached significance. Correlations between scores on the Social Desirability scale and average expectancy for pain reduction scores or

Table 62. Correlations for Choice Groups

	1	2	3	4
1. Average pain reduction	-	-.12	-.06	.07
2. Spheres of Control - Personal	-.12			
3. Spheres of Control - Interpersonal	-.08			
4. Spheres of Control - Sociopolitical	.17			

Note: Original choice group (n = 51) correlations are above the diagonal. Re-grouped choice group (n = 78) correlations are below the diagonal

* p < .05

** p < .01

absorption scores, calculated for each of the strategy conditions separately, were all low (ranges $r(47-58) = .00 - .16$)

CURSS-0, CURSS-S and Betts scores were available for only 21-23 subjects. To examine the hypothesis that pain reduction using an imagery strategy correlates positively with subjects' ability to employ mental imagery the correlation between Betts and pain reduction was examined separately for each of our strategy conditions, in spite of the small subject number. Contrary to the above hypothesis there was a moderate negative correlation ($r(9) = -.35$) between Betts and pain reduction scores in the Imagery groups. This correlation in the Distraction group was low-negative ($r(10) = -.11$). Low-positive correlations were obtained between CURSS-0 ($r(21) = .24$) or CURSS-S ($r(19) = .15$) and pain reduction scores for the experimental subjects combined.

Because of the small samples available for correlations involving the Betts and CURSS scores, subjects from both studies were combined and correlations between these variables were computed separately for the Imagery and Distraction conditions (Table 63). Correlations between Betts and average pain reduction scores were low-negative in both Imagery ($r(25) = -.23$) and Distraction ($r(27) = -.20$) groups. Correlations between CURSS-0 or CURSS-S scores and average pain reductions scores were close to

Table 63. Correlations for experimental subjects from both studies combined

	1	2	3	4
1. Average pain reduction	-	-.23	-.02	.07
2. Betts	-.20			
3. CURSS-O	.06			
4. CURSS-S	.01			

Note: Imagery subjects ($n = 25-27$) correlations are above the diagonal. Distraction subjects ($n = 28-33$) correlations are below the diagonal.

* $p < .05$

** $p < .01$

zero in both Imagery and Distraction groups (ranges
 $r(23-31) = -.02 - .07$)

Regression Analysis

Stepwise regressions were conducted separately for the Imagery and the Distraction groups using average pain reduction scores as the criterion variable. Average expectancy reduction scores (average expectancy at baseline minus average expectancy at posttest), ratings of absorption in the strategy, Social Desirability scores and the three Sphere of Control scores were used as predictor variables.

For subjects in the Distraction groups absorption in the strategy was the only variable entered as a significant predictor of pain reduction, $R = .49$, $F(1,56) = 18.39$, $p = .000$. For subjects in the Imagery groups average expectancy reduction scores were entered first, $R = .34$, $F(1,47) = 6.51$, $p = .014$, followed by the Socio-political Control scale of Spheres of Control, $R = .47$, $F(2,46) = 6.82$, $p = .002$, followed by absorption in the strategy used, $R = .54$, $F(3,45) = 6.46$, $p = .001$.

It is interesting to note that although the socio-political scale of Spheres of Control had a nonsignificant correlation of $r = .22$ with average pain reduction scores in the Imagery groups, this scale was entered as one of the significant predictors of pain reduction for this group, after expectancy for pain reduction was partialled out.

The correlation between expectancy for pain reduction and scores on the socio-political Sphere of Control scale for the Imagery groups is a low negative of $r = -.28$ indicating that expectancy for pain reduction acted as a suppressor variable in the correlation between the Socio-political Sphere of Control scale and pain reduction for this group. Examination of the pattern of correlations between these three variables in the Distraction group or in study I, however, reveals that this is not a consistent pattern. The correlation between Sociopolitical control and pain reduction in the Imagery group may be spurious.

Discussion

Strategy Effectiveness

Subjects reported significantly less pain on posttest, when employing a pain reduction strategy they were taught than on baseline, before exposure to a strategy. Control subjects, who were not taught a pain reduction strategy after baseline, reported no change on posttest. These results clearly indicate that cognitive strategies are effective in reducing reported pain when compared to no treatment controls and support the results obtained in other pain reduction studies reviewed by Turk et al. (1983) and by Tan (1982). It should be noted that our results say nothing about the effectiveness of strategy provision

compared to subjects' spontaneous pain reduction strategies. Spanos, Hodgins, Stam, and Gwynn (1984) found that subjects instructed to do "whatever they can to reduce pain" reported as much pain reduction as those supplied with a specific pain reduction strategy.

We found no difference in the effectiveness of the two cognitive strategies used, Imagery and Distraction, either at lower pain levels (30 second interval) or at higher pain levels (60 second interval). This result supports Turk et al.'s (1983) conclusion that no evidence exists to suggest the superiority of one cognitive strategy over another.

McCaul and Mallot (1984) proposed that distraction strategies are more effective at low pain intensities while redefinition strategies are more effective at high pain intensities. Our imagery strategy falls under McCaul and Mallot's (1984, p. 517) definition of a redefinition strategy (i.e., "strategies that encourage reinterpretation of the stimulus"). McCaul and Mallot (1984) however do not define what constitutes "high" and "low" pain intensities. Consequently, it is difficult to determine whether pain intensities employed in different studies meet McCaul and Mallot's criteria for "high" or "low" pain intensity. McCaul and Mallot cited a study by McCaul and Haugtvedt (1982) in support of their hypothesis. McCaul and Haugtvedt (1982) used a 7°C cold pressor pain stimulus which they applied for 4 minutes. They found that the distraction strategy was more effective up to the 2 minute interval while the redefinition

strategy was more effective at the 3 and 4 minute intervals. Spanos, Hodgins, Stam, and Gwynn (1984) found that a 0-2°C cold pressure pain stimulus produced equivalent reported pain at 1 minute as the pressure pain device used in our study. Although it is difficult to compare studies across pain stimuli, it is questionable that 4 minutes of 7°C cold pressure stimulus is more painful than 1 minute of immersion in 0-2° ice water or 1 minute of finger pressure. McCaul and Mallot also cite Barber and Cooper's (1972) study in support of their proposition saying that in this study subjects using distraction reduced pain at 1 minute but not at 2 minutes. Subjects in Barber and Cooper's (1972) study gave pain ratings of 3.8 and 4.2 on a 0-10 scale at 1 and 2 minutes respectively. Since McCaul and Mallot cite this study they presumably consider a mean rating of 4.2 on a 0-10 scale an intense pain. The mean pain rating of 12 on the 0-20 scale given by the subjects in our study was no lower proportionately than the ratings obtained by Barber and Cooper. Our pain stimulus appears to produce reports of pain that are in the range of what McCaul and Mallot (1984) consider intense. Our studies do not support their proposition. We found that there was no difference in the effectiveness of the two strategies at the 30 second interval or at the 60 second interval. Likewise, Dubreuil, Endler, and Spanos (1988) found that distraction was more effective than redefinition in enhancing pain tolerance which by definition implies high pain intensity.

Expectancy and Absorption

Results clearly indicate that provision of a cognitive strategy raised subjects' feelings of self-efficacy. Subjects' expected pain ratings were significantly lower after they trained in a cognitive strategy than before. Control subjects, who also rated their expected pain twice but were not trained in a cognitive strategy after the first rating, did not change their expectancy ratings.

In turn, expectancy affected pain reduction. Subjects who ended up using the strategy which they expected to be more effective in reducing pain were compared to subjects who ended up using the strategy they expected will be less effective in reducing pain. In both studies the high efficacy subjects reduced reported pain more than the low efficacy subjects although this effect attained significance only in study II.

Expectancy for pain reduction and absorption in the strategy used were the two most important predictors of success in pain reduction in our studies. In the first study, expectancy for pain reduction entered first in stepwise regression and accounted for 31% of the variance in pain reduction scores for the Imagery groups. Ratings of absorption in the strategy were entered second and accounted for an added 9% of the variance in pain reduction scores. Neither expectancy nor absorption were entered as significant predictors of pain reduction for the Distraction groups in this study. This however may be due to the fact that the distribution of absorption scores was much more skewed for the

Distraction groups than for other groups. In the second study Expectancy was entered first in the stepwise regression analysis for the Imagery group, accounting for 11% of the variance in pain reduction scores. Absorption was entered as the only predictor of pain reduction in Distraction groups accounting for 24% of the variance. While Expectancy and Absorption emerged as the important predictors of pain reduction, they account only for a modest portion of the variance.

Although, on the whole, Imagery and Distraction subjects gave equivalent expectancy, absorption and pain reduction ratings, the above regression analyses results indicate that Expectancy played a more important role in predicting pain reduction for Imagery subjects while Absorption played a more important role for Distraction subjects. It is possible that although Imagery was as effective as Distraction in reducing pain, the avenues used by Imagery and Distraction subjects to reduce pain were different.

One possible explanation for the differential role of absorption and expectancy in accounting for pain reduction in the imagery and distraction groups in our studies would be that imagery subjects rated absorption more on the basis of how hard they tried than on the basis of how well they actually succeeded in being absorbed in the strategy. The facts that fewer subjects chose imagery and that some imagery subjects said after the experiment that they found this strategy more difficult supports this explanation. Another possible

explanation is that imagery subjects presented themselves as absorbed in the strategy by giving relatively high absorption ratings but in effect did not try to be absorbed. The covert or private nature of the imagery strategy made monitoring of subjects' absorption in it impossible. While distraction was a public activity which could be monitored by the experimenter (ie., subjects repeated aloud the letters they heard) no such monitoring was possible over the private use of imagery. Both explanations suggest that Imagery subjects were less absorbed in the strategy than their absorption ratings suggest. It is possible that they tried but did not succeed or, alternatively, did not try. However, other studies using the same or similar imagery and distraction strategies (Spanos & O'Hara, 1989, Marino et al., 1989) found that expectancy played a bigger role for Distraction subjects than for Imagery subjects. Further research may clarify this point.

Contrary to Kirsh (1977), the results of our studies indicate that absorption in the strategy, in addition to expectation, is an important factor in reported pain reduction. Similar findings were obtained in pain studies which measured subjects' degree of absorption in the strategy in addition to measuring expectancy (Marino et al., 1989; Spanos & O'Hara, 1989; Devine & Spanos, 1989). These studies all found that absorption in the strategy added significantly to prediction of pain reduction over and above predictions made by expectancy only. The above conclusion regarding the role of expectancy and absorption is open to criticism. Tryon (1981)

suggested that the correlation between self-efficacy and behaviour is obtained simply because in an experimental situation subjects behave as they say they would. If this were the case, we would expect a high correlation between pain reduction and a tendency to present oneself in a socially desirable way. In our study the correlations between scores on the Social Desirability scale and pain reduction scores were consistently low. It can also be argued that the correlation between our measure of absorption in the strategy and pain reduction was obtained because subjects judge their absorption level on the basis of whether or not they succeeded in reducing pain. This ambiguity could be reduced in a future study by using a direct measure of absorption rather than asking subjects to rate it. For example, subjects could count backwards or solve simple arithmetic problems to distract from pain and the number of correct responses could serve as a objective measure of absorption in the strategy. The findings of a correlation between absorption and pain reduction can also be attacked on the basis that a high level of absorption is the result rather than the cause of pain reduction since it is easier to be absorbed in cognitive activity when not in pain. However, we obtained much higher correlations between pain reduction and Absorption than between posttest pain ratings and Absorption. Correlations between Absorption and posttest pain ratings were all in the low range ($r = -.29 - .19$). This indicates that absorption ratings are only minimally affected by pain ratings.

The Effect of Choice-Control

In the first study pain ratings of subjects who chose a

strategy were compared to those who were forced into a strategy as well as to a neutral Choice-Control condition. In the second study pain ratings of a Choice group were compared to those of a Force group. In addition, the design of the second study made it possible to examine the effect of Choice-Control on subjects' expectancy ratings. There were no significant differences either in pain ratings absorption ratings or expectancy ratings which were due to the effect of Choice-Control. These differences were not found either when objective choice ranges were considered or when subjects were re-grouped in order to examine the effect of subjective choice. Results did not confirm our hypothesis that subjects given a larger subjective choice range would experience higher levels of self-efficacy, be more absorbed in the strategy and reduce more pain.

It is not clear why we failed to replicate the choice effect found in D'Eon and Perry's (1983) study, in spite of the fact that we employed a stronger Choice-Control treatment. D'Eon and Perry's (1983) subjects were told about the two strategies but did not practice them before choosing or being assigned a strategy. In our study an attempt was made to create a stronger preference for one of the strategies by having subjects practice both before choosing or being assigned one. It is possible that other subtle differences between the studies made the difference in results.

Personality Variable

Correlational analysis resulted in low to moderate negative correlations between scores on the Betts imagery scale and pain reduction scores in the imagery groups (ranges $r = -.15 - -.35$).

These results clearly do not support the hypothesis that a imagery based strategy is more effective for subjects with a good imagery ability. Also Spanos and O'Hara (1989) found no relationship between Betts scores and the ability to benefit from an imagery pain reduction strategy. Some subjects in our studies remarked that they did not find the practice period for the imagery strategy long enough. It would be interesting to study whether longer practice brings forth subjects' ability to utilize imagery.

Our results do not support Hilgard's (1977) claim that analgesic ability is dependent upon hypnotic susceptibility. Correlations between objective as well as subjective CURSS scores and pain reduction in either Imagery or Distraction groups were consistently low in our studies (ranges $r = -.02 - .07$).

Our results regarding the relationship between hypnotic susceptibility or imagery ability and pain reduction support results of other studies (reviewed in Spanos, 1989) which found that a significant relationship between these variables is obtained only when the context of the experiment leads subjects to believe that they are related. In our studies hypnotic susceptibility and imagery ability scores were obtained from CURSS sessions which were separate from our pain study in time and space. Our subjects did not expect their pain reduction ability to be related to scores on the CURSS sessions and were not affected by the expectations.

Social Desirability did not emerge in our studies as an important predictor of pain reduction in regression analyses. Correlations between Social Desirability and pain reduction scores

were all positive but consistently low (ranges .12 - .24). This suggests that the desire to please the experimenter played only a relatively minor role in pain reduction. Other studies obtained conflicting results regarding the role of Social Desirability in pain reduction (Spanos & O'Hara, 1989; Devine & Spanos, 1989).

We examined the relationship between the need to view oneself as being in control and the ability to utilize Choice Control. We also examined it in relation to the ability to exercise control by reducing pain across the Choice-Control conditions. Results regarding the predictive power of this personality variable were inconsistent.

Low to moderate positive correlations (ranges .19 - .37) were found between the three Spheres of Control scales and pain reduction scores for the Choice condition in the first study. However, in the second study, these correlations were very low and inconsistent in direction (ranges -.12 - .17).

Results were inconsistent also with respect to the relationship between the need to view oneself as being in control and pain reduction across Choice-Control conditions. While correlations between scores on the three Spheres of Control scales and pain reduction scores were all low (ranges -.14 - .22), scores on the Interpersonal Control scale entered as the only predictor of pain reduction for the Distraction group in Study I accounting for 12% of the variance in pain reduction scores. Scores on the Socio-political scale accounted for 11% of the variance in pain reduction scores for the Imagery group in Study II. While our results suggest some relationship between the need for control and

pain reduction, replication is needed to rule out the possibility that the correlations found are spurious.

Considering the results of our studies and of other studies in the field we can conclude that cognitive pain reduction strategies are effective in comparison to no treatment controls and that there is no evidence to suggest a difference in the effectiveness of imagery based and distraction based strategies. Expectancy and absorption in the strategy emerge as the important predictors of pain reduction. In our studies strategy choice had no effect on pain ratings, expectancy ratings or absorption ratings.

Regardless of whether or not given strategy choice, subjects using the strategy they considered more effective reduced more pain than subjects using the strategy they considered less effective.

Rather than ask whether one strategy is more effective than another it may be more productive to study variables which mediate the effectiveness of one cognitive strategy. Considering the centrality of expectancy and absorption it is important to use objective measures of absorption as well as study variables which increase subjects' expectancy and absorption.

3 of/de 3

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS
STANDARD REFERENCE MATERIAL 1010a
(ANSI and ISO TEST CHART No. 2)

References

- Averil, G. R. (1973). Personal control over aversive stimuli and its relationship to stress. Psychological Bulletin, 80, 286-303.
- Avia, M. D. & Kanfer, F. H. (1980). Coping with aversive stimulation: The effects of training in a self-management context. Cognitive Therapy and Research, 4, 73-80.
- Bandler, R. J., Madaras, G. R., & Bem, D. J. (1968). Self-observation as a source of pain perception. Journal of Personality and Social Psychology, 9, 205-209.
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review, 84, 191-215.
- Barber, T. X. (1969). Hypnosis: A scientific approach. New York: Van Nostrand Reinhold.
- Barber, T. X. & Cooper, B. G. (1972). Effects of pain on experimentally induced and spontaneous distraction. Psychological Reports, 31, 647-651.
- Barber, T. X. & Hahn, K. W., Jr. (1962). Physiological and subjective responses to pain producing stimulation under hypnotically-suggested and waking-imagined "analgesia". Journal of Abnormal and Social Psychology, 65, 411-18.

- Beck, A. J. (1976). Cognitive therapy and the emotional disorders. New York: International Universities Press.
- Beers, T. M., Jr., & Karoly, P. (1979). Cognitive strategies, expectancy, and coping style in the control of pain. Journal of Consulting and Clinical Psychology, 47, 179-180.
- Blitz, B. & Dinnerstein, A. J. (1971). Role of attentional focus in pain perception: Manipulation of response to noxious stimulation by instructions. Journal of Abnormal Psychology, 77, 42-45.
- Bonica, G. G. (1979). The need of a taxonomy. Pain, 6, 247-252.
- Borkovec, T. D. (1978). Self-efficacy: Cause or reflection of behavioral change? Advances in Behavior Research and Therapy, 1, 163-170.
- Bucher, B. & Vallis, T. M. (1986). Self-efficacy as a predictor of behavior change: Interaction of type of training for pain tolerance. Cognitive Therapy and Research, 10, 79-94.
- Chaves, J. F. & Barber, T. X. (1974). Cognitive strategies, experimenter modeling and expectation in the attenuation of pain. Journal of Abnormal Psychology, 83, 356-63.
- Clark, W. C. (1974). Pain sensitivity and the report of pain: An introduction to sensory decision theory. Anesthesiology, 40, 272-287.

- Clum, G. A., Luscomb, R. L., & Scott, L. (1982).
Relaxation training and cognitive redirection
strategies in the treatment of acute pain. Pain, 12,
175-183.
- Coe, W. C. (1978). The credibility of posthypnotic amnesia:
A contextualist's view. International Journal of
Clinical and Experimental Hypnosis, 26, 281-86.
- Crawford, H. J. (1978). Relationship of Hypnotic
Susceptibility to Imagery Vividness, Absorption and
Daydreaming Styles. Paper presented at the annual
meeting of the Western Psychological Association, San
Francisco, California.
- DeGood, D. (1975). Cognitive control factors in vascular
stress responses. Psychophysiology, 12, 399-401.
- de Groh, M. M., Cross, W. P., & Spanos, N. P. (1986).
Attitudes and Imagery in the Prediction of Hypnotic
Susceptibility, Unpublished manuscript, Carleton
University, Ottawa, Canada.
- D'Eon, J. L. & Perry, C. W. (1983). Response to pressure
pain as moderated by susceptibility, type of suggestion
strategy, and choice. Presented at the annual meeting
of the Society for Clinical and Experimental Hypnosis,
Boston.
- Devine, D. P. & Spanos, N. P. (1990). The
effectiveness of maximally different cognitive
strategies and expectancy in the attenuation of
reported pain.

- Diamond, M. J. & Taft, R. (1975). The role played by ego permissiveness and imagery in hypnotic responsivity. International Journal of Clinical and Experimental Hypnosis, 12, 346-353.
- Dubreuil, D. L., Endler, N. S., & Spanos, N. P. (1988). Distraction and redefinition in the reduction of low and high intensity experimentally-induced pain. Imagery, COgnition, and Personality, 7.
- Dubreuil, D. L., Spanos, N. P., & Bertrand, L. D. (1983). Does hypnotic amnesia dissipate with time? Imagination, Cognition and Personality, 2, 103-13.
- Evans, M. & Paul, G. L. (1970). Effects of hypnotically suggested analgesia on physiological and subjective responses to cold stress. Journal of Consulting and Clinical Psychology, 35, 362-71.
- Farthing, W. G., Venturino, M., & Brown, S. W. (1984). Suggestion and distraction in the control of pain: Test of two hypotheses. Journal of Abnormal Psychology, 93, 259-65.
- Fordyce, W. E. (1976). Behavioral methods for chronic pain and illness. St. Louis: C.V. Mosby.
- Forgione, A. G., & Barber, T. X. (1971). A strain guage pain stimulator. Psychophysiology, 8, 102-106.
- Gelfand, S. (1964). The relationship of experimental pain tolerance to pain threshold. Canadian Journal of Psychology, 18, 26-42.

- Genest, M., Meichenbaum, D. H., & Turk, D. C. (1977). A cognitive-behavioral approach to the management of pain. Presented at the 11th Annual Convention of the Association for the Advancement of Behavior Therapy.
- Grimm, L. & Kanfer, F. H. (1976). Tolerance of aversive stimulation. Behavior Therapy, 7, 593-601.
- Hilgard, E. R. (1965). Hypnotic susceptibility. Harcourt, Brace & World.
- Hilgard, E. R. (1977). Divided consciousness. Wiley.
- Hilgard, E. R. & Hilgard, J. R. (1975). Hypnosis in the relief of pain. Los Altos, Calif.: William Kaufman.
- Houston, B. K. (1972). Control over stress, locus of control, and response to stress. Journal of Personality and Social Psychology, 21, 249-255.
- Jaremko, M. E. (1978). Cognitive strategies in the control of pain tolerance. Behavior Therapy and Experimental Psychiatry, 9, 239-44.
- Jones, B., Spanos, N. P., & Anuza, T. (1987). Functional measurement analysis of suggestions for hypnotic analgesia. Unpublished manuscript, Carleton University, Ottawa, Canada.
- Kamiya, G. (1969). Operant control of the EEG alpha rhythm and some of its reported effects on consciousness. In C. T. Tart (ed.), Altered states of consciousness (pp. 507-517). New York: Wiley.

- Kirsch, I. (1982). Efficacy expectations or response predictions: The meaning of efficacy ratings as a function of task characteristics. Journal of Personality and Social Psychology, 42, 132-136.
- Kirsch, I. (1985). Self-efficacy and expectancy: Old wine with new labels. Journal of Personality and Social Psychology, 49, 824-830.
- Kirsch, I. (1986). Response expectancy as a determinant of experience and behavior. American Psychologist, 40, 1189-1202.
- Knox, V., Morgan, A. H., & Hilgard, E. R. (1979). Pain and suffering in ischemia: The paradox of hypnotically suggested anesthesia as contradicted by reports from the hidden observer. Archives of General Psychiatry, 30, 840-847.
- Langer, E. J., Janis, I. L., & Wolfer, J. A. (1975). Reduction of psychological stress in surgical patients. Journal of Experimental Social Psychology, 11, 155-165.
- Lanzetta, J. T., Cartwright-Smith, J., & Kleck, R. E. (1976). Effects of nonverbal dissimulation on emotional experience and autonomic arousal. Journal of Personality and Social Psychology, 33, 354-370.
- Levendusky, P. & Pankratz, L. (1975). Self-control techniques as an alternative to pain medication. Journal of Abnormal Psychology, 84, 165-168.
- Levenson, H. (1973). Multidimensional locus of control in psychiatric patients. Journal of Consulting and Clinical Psychology, 41, 397-404.

- Lewis, P. & Blanchard, E. B. (1971). Perception of choice and locus of control. Psychological Reports, 28, 67-70.
- Litt, M. D. (1988). Self-efficacy and perceived control: Cognitive mediators of pain tolerance. Journal of Personality and Social Psychology, 54, 149-160.
- Lundberg, A. & Frankenhaeuser, M. (1976). Adjustment to noise stress. Reports from the Department of Psychology, University of Stockholm, No. 489, 16.
- Maddux, J. E., & Barnes, J. (1985). The orthogonality and relative predictive utility of self-efficacy expectancy, outcome expectancy, and outcome value: A review of empirical studies. Manuscript submitted for publication.
- Marino, J., Gwynn, M. I., & Spanos, N. P. (1989). Cognitive mediators in the reduction of pain: The role of expectancy, strategy use, and self-presentation. Journal of Abnormal Psychology, 98, 256-262.
- McCaul, K. D., & Mallott, J. M. (1984). Distraction and coping with pain. Psychological Bulletin, 95, 516-533.
- Meichenbaum, D. (1977). Cognitive-behavior modification: An integrative approach. New York: Plenum Press.
- Melzack, R. (1980). Psychologic aspects of pain. In J. J. Bonica (Ed.), Pain (pp. 143-154). New York: Raven Press.
- Neufeld, W. J. & Thomas, P. (1977). Effects of perceived efficacy of a prophylactic controlling mechanism on self-control under pain stimulation. Canadian Journal of Behavioral Science, 9, 224-232.

- Nisbett, R. E., & Schachter, S. (1966). Cognitive manipulation of pain. Journal of Experimental Social Psychology, 2, 227-236.
- Orne, M. T. (1962). On the social psychology experiment: With particular reference to demand characteristics and their implications. American Psychologist, 17, 776-83.
- Orne, M. T. (1972). On the stimulating subject as a quasi-control group in hypnosis research: What, why, and how. In E. Fromm & R. E. Shor (Eds.), Hypnosis: Research developments and perspectives. Aldine-Atherton.
- Paulus, D. (1983). Pher-specific measures of perceived control. Journal of Personality and Social Psychology, 44-6, 1253-1265.
- Perry, C. (1973). Imagery, fantasy and hypnotic susceptibility: A multidimensional approach. Journal of Personality and Social Psychology 26, 217-221.
- Reese, L. (1983). Coping with pain: The role of perceived self-efficacy. Dissertation Abstracts International, 44, 1641B.
- Schachter, G. (1966). Generalized expectancies for internal versus external locus of control of reinforcement. Psychological Monography, 80.
- Sarbin, T. R. (1984). Nonvolition in hypnosis: A semiotic analysis. Psychological Record, 34, 537-49.
- Scott, D. S. & Barber, T. X. (1977). Cognitive control of pain: Four serendipitous results. Perceptual and Motor Skills, 44, 569-570.

- Shipley, R. H., Butt, J. H., Horwitz, E. A., & Farbry, J. E. (1978). Preparation for a stressful medical procedure: Effect of repetitious videotape exposure and coping style. Journal of Consulting and Clinical Psychology, 46, 499-507.
- Spanos, N. P. (1982). A social psychological approach to hypnotic behavior. In G. Wesry & H. L. Mirels (Eds.), Integration of clinical and social psychology, Oxford University Press.
- Spanos, N. P. (1986a). Hypnosis and the modification of hypnotic susceptibility. A social psychological perspective. In P. L. N. Nash (Ed.), What is hypnosis? (pp. 85-120. Philadelphia: Open University Press.
- Spanos, N. P. (1986b). Hypnotic behavior: A social psychological interpretation of amnesia, analgesia and trance logic. Behavioral and Brain Sciences, 9, 449-467.
- Spanos, N. P. (1989). Experimental research on hypnotic analgesia. In N.P. Spanos & G. F. Chaves, Hypnosis: The Cognitive Behavioral Perspective (pp. 206-241), Prometheus Books.
- Spanos, N. P., Brown, J. M., Jones, B. & Horner, D. (1981). Cognitive activity and suggestions for analgesia in the reduction of reported pain. Journal of Abnormal Psychology, 90, 554-61.

- Spanos, N. P., & Chaves, G. F. (1989). The cognitive-behavioral perspective: Synopsis and suggestions for research. In N. P. Spanos & G. F. Chaves (Eds.), Hypnosis: The cognitive-behavioral perspective (pp. 437-446). Prometheus Books.
- Spanos, N. P., de Groot, H. P., Tiller, D. K., Weekes, J. R., & Bertrand, L. D. (1985). "Trance logic" duality and hidden observer responding in hypnotic, imagination control, and simulating subjects. Journal of Abnormal Psychology, 94, 611-23.
- Spanos, N. P., Gwynn, M. I., & Stam, H. J. (1983). Instructional demands and ratings of overt and hidden pain during hypnotic analgesia. Journal of Abnormal Psychology, 92, 479-88.
- Spanos, N. P. & Hewitt, E. C. (1980). The hidden observer in hypnotic analgesia: Discovery or experimental creation? Journal of Personality and Social Psychology, 39, 1201-14.
- Spanos, N. P., Hodgins, D. C., Stam, H. J., & Gwynn, M. I. (1984). Suffering for science: The effects of implicit social demands on response to experimentally induced pain. Journal of Personality and Social Psychology, 46, 1162-72.
- Spanos, N. P., Jones, B., Brown, J. M., & Horner, D. (1983). Magnitude estimates of cold pressor pain: Effects of suggestions, cognitive strategy, and tolerance. Perception, 12, 355-362.

- Spanos, N. P., Horton, C. & Chaves, J. F. (1975). The effects of two cognitive strategies on pain threshold. Journal of Abnormal Psychology, 90, 75-77.
- Spanos, N. P., Kennedy, G. K., & Gwynn, M. I. (1984). The moderating effect of contextual variables on the relationship between hypnotic susceptibility and suggested analgesia. Journal of Abnormal Psychology, 93, 285-294.
- Spanos, N. P., McNeil, C., Gwynn, M. I., & Stam, H. J. (1984). The effects of suggestion and distraction on reported pain in subjects high and low on hypnotic susceptibility. Journal of Abnormal Psychology, 93, 277-84.
- Spanos, N. P., McPeake, J. D., & Churchill, N. (1976). Relationships between imaginative ability variables and the Barber Suggestibility Scale. International Journal of Clinical and Experimental Hypnosis, 19, 39-46.
- Spanos, N. P. & O'Hara, P. (in press). Effects of hypnotizability, strategy type, strategy use and expectations on reported reductions in experimentally induced pain.
- Spanos, N. P., Perlini, A. H., Patrick, L., Bell, S., & Gwynn, M. I. (1990). The role of compliance in hypnotic and nonhypnotic analgesia. Journal of Research in Personality, 24, 433-453.

- Spanos, N. P., Perlini, A., & Robertson, L. A. (1989). Hypnosis, suggestion and placebo in the reduction of experimental pain. Journal of Abnormal Psychology, 98, 285-293.
- Spanos, N. P., Radtke-Bodorik, H. L., Ferguson, G. D., & Jones, B. (1979). The effects of hypnotic susceptibility, suggestions for analgesia and the utilization of cognitive strategies on the reduction of pain. Journal of Abnormal Psychology, 88, 282-292.
- Spanos, N. P., Radtke, H. L., Hodgins, D. C., Bertrand, L. D., Stam, H. J., & Moretti, P. (1983). The Carleton University Responsiveness to Suggestion Scale: Relationships with other measures of susceptibility, expectancies, and absorption. Psychological Reports, 53, 723-34.
- Spanos, N. P., Stam, H. J., & Bracil, K. (1981). The effects of suggestion and distraction on coping ideation and reported pain. Journal of Mental Imagery, 5, 75-90.
- Spanos, N. P., Voorneveld, P. W., & Gwynn, M. I. (1987). The mediating effect of expectation on hypnotic and nonhypnotic pain reduction. Imagination, Cognition, and Personality, 6, 231-246.
- Stam, H. J., Petrusic, W. M. P., & Spanos, N. P. (1981). Magnitude scales for cold pressor pain. Perception and Psychophysics, 29, 612-617.

- Sternbach, R. A. (1974). Pain patients: Traits and treatment. New York: Academic Press.
- Sternbach, R. A. (1984). Acute versus chronic pain. In P. D. Wall & P. R. Melzack (Eds.), Textbook of pain. New York: Churchill Livingstone.
- Sternbach, R. A., & Tursky, B. (1965). Ethnic differences among housewives in psychophysical and skin potential responses to electric shock. Psychophysiology, 1, 241-246.
- Thompson, S. C. (1981). Will it hurt less if I can control it? A complex answer to a simple question. Psychological Bulletin, 90, 89-101.
- Tryon, W. (1981). A methodological critique of Bandura's self-efficacy theory of behavioral change. Journal of Behavior Therapy and Experimental Psychiatry, 12(2), 113-114.
- Turk, D. C. (1978). Cognitive-behavioral techniques in the management of pain. In J. P. Foreyt & D. P. Rathjen (Eds.), Cognitive behavior therapy: Research and application. New York: Plenum.
- Turk, D. C., Meichenbaum, D., & Genest, M. (1983). Pain and behavioral medicine: A cognitive-behavioral perspective. New York: Guilford Press.

- Wack, G. T., & Turk, D. C. (1984). Latent structure of strategies used to cope with nociceptive stimulation. Health Psychology, 3, 27-43.
- Weisenberg, M. (1984). Cognitive aspects of pain. In P. D. Wall & Melzak, R. (Eds.), Textbook of Pain.
- Wolff, B. B., & Horland, A. A. (1967). Effects of suggestion upon experimental pain: A validation study. Journal of Abnormal Psychology, 72, 402-407.
- Worthington, E. L. (1978). The effects of imagery content, choice of imagery context and self-verbalization on the self-control of pain. Cognitive Theory and Research, 2, 225-40.

Appendix A

Introduction to Experiment - All Subjects

The experiment will involve assessing your response to this pain stimulus. The tip of one of your fingers will be placed under the bar and when you are ready I will slowly let the weight down and you will feel the pressure of the weight on your finger. Although most people find the weight uncomfortable, I would like you to try and keep your finger in the apparatus for at least one minute, and for as long after one minute as possible. However, you may remove your finger from the apparatus at any time that you feel too uncomfortable. During the time that your finger is in the apparatus I will ask you to rate the sensations you are experiencing on a scale that ranges from 0 to 20. This procedure will be repeated twice, for 60 seconds each time. If this is acceptable I would like you to read and sign this consent form. Do you have any questions?

Appendix B**Informed Consent Form**

This session may involve some discomfort. As such, we would like to be sure that you are aware of the main procedure involved before you agree to participate further. Following is a written description of the procedure.

During this experiment, one of your fingers will be placed in the pressure apparatus. At 30 seconds and again at 60 seconds you will be asked to rate the intensity of the sensations that you experience on a 0 to 20 scale. We would like you to try to keep your finger in the pressure apparatus for one minute. However, if your finger becomes too uncomfortable you may ask to stop the experiment at any time. You will have one of your fingers placed in the apparatus on two occasions. I will also ask you to fill out a few short questionnaires.

I, _____, understand the procedure involved and agree to participate. I also understand that I have the freedom to withdraw from the experiment at any time.

Participant Signature

Date

Investigator Signature

Appendix C

Preliminary Instructions - All Subjects

Before we begin I'd like to explain to you how to rate the sensations you will experience. Here is a 0 to 20 scale, where 0 means no pain, 1 means the sensations are just recognizable as pain, 10 means moderate pain and 20 means excruciating pain. The other numbers on the scale represent various gradients of sensation you experience. Now, at 30 seconds and at 60 seconds I will say "rate", and when I say "rate" I would like you to give me a number from the scale which best corresponds to your level of pain. Please don't spend a long time thinking about the rating, just quickly state in a clear voice the number that best corresponds to the sensations you are experiencing. As I said before, try to keep your finger in the apparatus for one minute, that is, long enough to give the two pain ratings. O.K.? So now you tell me what you are going to do. Now, when you are ready I would like you to say "begin" and I will lower the bar over your index middle finger. Whenever you want to stop just say "stop" and I will remove the bar from your finger. Tell me when to begin.

Appendix D
Pain Rating Scale

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
NO PAIN											EXCRUCIATING PAIN									
MODERATE PAIN																				

Appendix E

Instructions for Self Efficacy Ratings

For Treatment groups: We are interested in finding out how much pain you expect to feel if you were to use the Imagery/Distraction strategy in the next pain trial.

For Control group: We are interested in finding out how much pain you expect to feel in the next trial.

All groups: Use this 20 point scale (subjects presented with scale on Appendix D) to tell me your expected pain at 30 seconds and at 60 seconds.

Appendix F

Post Baseline Procedure for the Imagery Group

Section I: Description of Strategy

Now that you have been through the procedure once, I would like to see if you can alter the sensations you experienced. Research has shown that the following strategy is effective in reducing the intensity of people's pain. I will describe this strategy:

People can reduce pain by imagining things that are inconsistent it. For instance, people find it very helpful to imagine that their finger has become numb, dull and insensitive - like a piece of rubber. By intently imagining that their finger is numb and like a piece of rubber, people are able to greatly reduce pain.

I will now explain more about this strategy as well as give you a chance to practice it.

Section II: Strategy Instructions and Practice

Close your eyes. I want you to succeed in not being disturbed by the weight by doing the following. Try, to the best of your ability, to imagine and think of your finger as numb and insensitive. Think of your finger as unable to sense any pain or discomfort. Please try to imagine your finger as numb and insensitive as if it were a piece of rubber. Although this is a difficult task do not get discouraged. Continue imagining your finger as numb

and insensitive as long as you can. What I would like you to do is to continuously imagine and think that your finger has no feeling. Keep thinking that it is unable to feel any pain or discomfort, or feeling of any kind. Please try to the very best of your ability to think continuously and to imagine vividly that your finger is numb, insensitive and like a piece of rubber until the weight is off.

I will give you a 60-second practice trial before we actually put your finger in the apparatus. Every 30 seconds I will say "rate" just like before, and I would like you to state clearly the number from the scale that best represented the sensations you experienced when I said "rate". That is, please do not stop imagining your finger as numb and insensitive, just quickly state the number that best corresponds to the sensations you experienced as you imagined your finger was numb. O.K.?

- - Practice Trial - -

Section III: Instructions for Self Efficacy Ratings

We are interested in finding out how much pain you expect to feel if you were to use the imagery strategy in the next pain trial.

Use this 20 point scale to tell me your expected pain at 30 seconds and at 60 seconds.

Section IV: Post-Trial Instructions

Now, I would like you to do this task while your finger is in the apparatus. Just as in the practice trial, I will ask you to rate the sensations you are experiencing, every 30 seconds. Again, without thinking about it too much, state the number from the scale which best corresponds with the sensations you are experiencing. As before, I would like you to keep your finger in the apparatus for one minute, that is for two pain ratings. Now, keep thinking and vividly imagining that your index/middle finger is becoming more and more numb and insensitive. Tell me when to begin.

Appendix G

Post Baseline Procedure for the Distraction Group

Section I: Description of Strategy

Now that you have been through the procedure once, I would like to see if you can alter the sensations you experienced. Research has shown that the following strategy is effective in reducing the intensity of people's pain. I will describe this strategy:

People can reduce pain by distracting themselves from it and occupying their mind with an unrelated task.

For example, by repeating letters that are presented to them rapidly over headphones people are able to distract themselves effectively and greatly reduce their pain.

I will now explain more about this strategy as well as give you a chance to practice it.

Section II: Strategy Instructions and Practice

Close your eyes. I want you to succeed in not being disturbed by the weight by doing the following. I would like you to shadow the letters you hear over the headphones. This means that you are to repeat, out loud in a clear voice, the letters that come over the headphones, as you hear them. The letters come quickly and I would like you to try to repeat each letter as you hear it, one at a time. Please do not string the letters together, i.e., af gp dk. Continue repeating each letter as you hear

it and if you get off track, or lose a few letters, that's okay. Don't try to correct mistakes or catch up, just try to get the ones you hear correct. Continue from the next letter if you miss one. Although it is a difficult task, try not to get discouraged.

I will give you a 60 second practice trial before we actually put your finger in the apparatus. Every 30 seconds I will say "rate" on the tape, just like before, and I would like you to state clearly the number from the scale that best represented the sensations you experienced when I said "rate". Please do not stop distracting yourself. That is, do not try to refocus the pain - don't spend a lot of time thinking about the rating, just quickly state the number that best corresponds to the sensations you experienced as you were distracted. You may find that you too will say "rate" after you hear it on the headphones: that's O.K., then just try to rate the sensation as quickly as possible, O.K.?

--- Practice Trial ---

Section III: Instructions for Self Efficacy Ratings

We are interested in finding out how much pain you expect to feel if you were to use the distraction strategy in the next pain trial.

Use this 20 point scale to tell me your expected pain at 30 seconds and at 60 seconds.

Section IV. Post Trial Instructions

Now, I would like you to do this task while your finger is in the apparatus. Just as in the practice trial, I will ask you to rate the sensations you are experiencing every 30 seconds. Again, without thinking about it too much, state the number from the scale that best corresponds with the sensations you experience. As before, I would like you to keep your finger in the apparatus for one minute, that is, for two pain ratings. Now, keep trying to shadow the letters as you did before. Tell me when to begin.

Appendix H

Post Baseline Procedure For All Groups which Rated Self-Efficacy Before Choosing/Being Assigned a Strategy

(Exp. I: C/I, C/D, F/I, F/D

Exp. II: SE- C/I, SE- C/D, SE- F/H, SE- F/L)

Section I: Description of Strategies (Both strategies presented to all groups)

Now that you have been through the procedure once, I would like to see if you can alter the sensations you experienced. Research has shown that there are several different strategies that are effective in reducing the intensity of people's pain. I will describe two such strategies:

1. One strategy...
2. Another Strategy...

Imagery: ...that works very well for some people is to imagine things that are inconsistent with pain. For instance, some people find it very helpful to imagine that their finger has become numb, dull and insensitive - like a piece of rubber. By intently imagining that their finger is numb and like a piece of rubber these people are able to greatly reduce pain.

Distraction: ...that works very well for some people is to distract themselves from the pain by occupying their mind with an unrelated task. For example, by repeating letters that are presented to them

rapidly over headphones some people are able to distract themselves effectively and greatly reduce their pain.

I will now explain more about these strategies as well as give you a chance to practice them.

Section II: Strategy Instructions and Practice (All groups instructed in and practiced both strategies)

1. We will start with the...strategy.
2. We will now practice the.....strategy.

Distraction:

Close your eyes. I want you to succeed in not being disturbed by the weight by doing the following: I would like you to shadow the letters you hear over the headphones. This means that you are to repeat, out loud in a clear voice, the letters that come over the headphones, as you hear them. The letters come quickly and I would like you to try to repeat each letter as you hear it, one at a time. Please do not string the letters together, i.e., af gp dk. Continue repeating each letter as you hear it and if you get off track, or lose a few letters, that's okay. Don't try to correct mistakes or catch up, just try to get the ones you hear correct, continue from the next letter if you miss one. Although it is a difficult task, try not to get discouraged.

I will give you a 60 second practice trial in the distraction strategy before we actually put your finger in the apparatus. Every 30 seconds I will say "rate" on the tape, just like before, and I would like you to state clearly the number from the scale that best represented the sensations you experienced when I said "rate". Please do not stop distracting yourself. That is, do not try to refocus the pain - don't spend a lot of time thinking about the rating, just quickly state the number that best corresponds to the sensations you experienced as you were distracted. You may find that you too will say "rate" after you hear it on the headphones: that's O.K., then just try to rate the sensation as quickly as possible, O.K.?

--- Practice Trial ---

Imagery:

Close your eyes. I want you to succeed in not being disturbed by the weight by doing the following. Try, to the best of your ability, to imagine and think of your index/middle finger as numb and insensitive. Think of your index/middle finger as unable to sense any pain or discomfort. Please try to imagine your finger as numb and insensitive as if it were a piece of rubber. Although this is a difficult task do not get discouraged. Continue imagining your finger as numb and insensitive as long as you can. What I would like you to do is to continuously imagine

and think that your index/middle finger has no feeling. Keep thinking that it is unable to feel any pain or discomfort, or feeling of any kind. Please try to the very best of your ability to think continuously and to imagine vividly that your hand is numb, insensitive and like a piece of rubber until the weight is off.

I will give you a 60-second practice trial in the imagery strategy before we actually put your finger in the apparatus. Every 30 seconds I will say "rate" just like before, and I would like you to state clearly the number from the scale that best represented the sensations you experienced when I said "rate". That is, please do not stop imagining your finger as numb and insensitive, just quickly state the number that best corresponds to the sensations you experienced as you imagined your finger was numb. O.K.?

- - Practice Trial - -

Section III. Instructions for Self Efficacy Ratings (All groups rated both Strategies)

Distraction:

We are interested in finding out how much pain you expect to feel if you were to use the distraction strategy - shadowing letters - in the next pain trial.

Use this 20 point scale to tell me your expected pain at 30 seconds and at 60 seconds.

Imagery:

We are interested in finding out how much pain you expect to feel if you were to use the imagery strategy - imagining that your finger is numb - in the next pain trial.

Use this 20 point scale to tell me your expected pain at 30 seconds and at 60 seconds.

Section IV. Instructions for Strategy Choice/Assignment

Strategy Choice

I would like you to choose which of these two strategies you think would be the most effective for you in reducing pain during the next trial. One strategy is imagining your finger as numb - this is the imagination task. The other strategy is repeating letters - this is the distraction task.

Imagery assignment

We would like you to use the imagination task - imagining that your finger is numb, on the next pain trial.

Distraction assignment

We would like you to use the distraction strategy - shadowing letters, on the next pain trial.

Section V. Post-Trial Instructions (Give either Imagery or Distraction)**Imagery:**

Now, I would like you to do this task while your finger is in the apparatus. Just as in the practice trial, I will ask you to rate the sensations you are experiencing, every 30 seconds. Again, without thinking about it too much, state the number from the scale which best corresponds with the sensations you are experiencing. As before, I would like you to keep your finger in the apparatus for one minute, that is for two pain ratings. Now, keep thinking and vividly imagining that your index/middle finger is becoming more and more numb and insensitive. Tell me when to begin.

Distraction:

Now, I would like you to do this task while your finger is in the apparatus. Just as in the practice trial, I will ask you to rate the sensations you are experiencing every 30 seconds. Again, without thinking about it too much, state the number from the scale that best corresponds with the sensations you experience.

As before, I would like you to keep your finger in the apparatus for one minute, that is, for two pain ratings. Now, keep trying to shadow the letters as you did before. Tell me when to begin.

Appendix I

Post-trial Instructions for Control Group

We are interested in finding out how much pain you expect to feel on the next pain trial. Use this 20 point scale to tell me your expected pain at 30 seconds and at 60 seconds.

---Self-Efficacy Measure Administered---

[Subjects sit quietly for 3 minutes]

We would like you to estimate again how much pain you expect to feel on your next pain trial. Please turn to the 20 point scale. Use the scale printed on this page to tell me your expected pain at 30 seconds and at 60 seconds.

Now that you have been through the procedure once, I would like you to go through it again, exactly as before, except this time we will use your other finger. Again, I will ask you to rate the sensations you are experiencing after 30 seconds and after 60 seconds. Without thinking about it too much, please give me the number from the scale which best corresponds to the sensations you are experiencing. As before, I would like you to keep your finger in the apparatus for one minute, that is, for two pain ratings. Tell me when to begin.

Appendix J**Post-Trial Absorption Rating Scale for Distraction Task**

Complete the following statement by filling in the blank with one of the options provided:

"I was _____ absorbed in the distraction task while my finger was in the pain device".

1. not at all
2. slightly
3. moderately
4. strongly
5. completely

Appendix K**Post-Trial Absorption Rating Scale for Imagination Task**

Complete the following statement by filling in the blank with one of the options provided:

"I was _____ absorbed in imagining my finger as numb and insensitive while in the pain device."

1. not at all
2. slightly
3. moderately
4. strongly
5. completely

Appendix L

Post Baseline Procedure For Groups which Chose/Were

Assigned a Strategy Before Rating Self-Efficacy

(Experiment II: for C/I-SE, C/D-SE, F/I-SE,

F/D-SE groups)

Section I: Description of Strategies (All groups)

Now that you have been through the procedure once, I would like to see if you can alter the sensations you experienced. Research has shown that there are several different strategies that are effective in reducing the intensity of people's pain. I will describe two such strategies:

1. One strategy...

2. Another Strategy...

Imagery: ...that works very well for some people is to

imagine things that are inconsistent with pain.

For instance, some people find it very helpful to imagine that their finger has become numb, dull and insensitive - like a piece of rubber. By intently imagining that their finger is numb and like a piece of rubber these people are able to greatly reduce pain.

Distraction: ...that works very well for some people is to

distract themselves from the pain by occupying their mind with an unrelated task. For example, by repeating letters that are presented to them

rapidly over headphones some people are able to distract themselves effectively and greatly reduce their pain.

I will now explain more about these strategies as well as give you a chance to practice them.

Section II: Strategy Instructions and Practice (Instructed in and practiced both strategies)

1. We will start with the strategy.
2. We will now practice the.....strategy.

Distraction:

Close your eyes. I want you to succeed in not being disturbed by the weight by doing the following: I would like you to shadow the letters you hear over the headphones. This means that you are to repeat, out loud in a clear voice, the letters that come over the headphones, as you hear them. The letters come quickly and I would like you to try to repeat each letter as you hear it, one at a time. Please do not string the letters together, i.e., af gp dk. Continue repeating each letter as you hear it and if you get off track, or lose a few letters, that's okay. Don't try to correct mistakes or catch up, just try to get the ones you hear correct, continue from the next letter if you miss one. Although it is a difficult task, try not to get discouraged.

I will give you a 60 second practice trial in the distraction strategy before we actually put your finger in the apparatus. Every 30 seconds I will say "rate" on the tape, just like before, and I would like you to state clearly the number from the scale that best represented the sensations you experienced when I said "rate". Please do not stop distracting yourself. That is, do not try to refocus the pain - don't spend a lot of time thinking about the rating, just quickly state the number that best corresponds to the sensations you experienced as you were distracted. You may find that you too will say "rate" after you hear it on the headphones: that's O.K., then just try to rate the sensation as quickly as possible, O.K.?

--- Practice Trial ---

Imagery:

Close your eyes. I want you to succeed in not being disturbed by the weight by doing the following. Try, to the best of your ability, to imagine and think of your index/middle finger as numb and insensitive. Think of your index/middle finger as unable to sense any pain or discomfort. Please try to imagine your finger as numb and insensitive as if it were a piece of rubber. Although this is a difficult task do not get discouraged. Continue imagining your finger as numb and insensitive as long as you can. What I would like you to do is to continuously imagine

and think that your index/middle finger has no feeling. Keep thinking that it is unable to feel any pain or discomfort, or feeling of any kind. Please try to the very best of your ability to think continuously and to imagine vividly that your hand is numb, insensitive and like a piece of rubber until the weight is off.

I will give you a 60-second practice trial in the imagery strategy before we actually put your finger in the apparatus. Every 30 seconds I will say "rate" just like before, and I would like you to state clearly the number from the scale that best represented the sensations you experienced when I said "rate". That is, please do not stop imagining your finger as numb and insensitive, just quickly state the number that best corresponds to the sensations you experienced as you imagined your finger was numb. O.K.?

- - Practice Trial - -

Section III. Instructions for Strategy Choice/Assignment

Strategy Choice

I would like you to choose which of these two strategies you think would be the most effective for you in reducing pain during the next trial. One strategy is imagining your finger as numb - this is the imagination task. The other strategy is repeating letters - this is the distraction task.

Imagery assignment

We would like you to use the imagination task-imagining that your finger is numb, on the next pain trial.

Distraction assignment

We would like you to use the distraction strategy - shadowing letters, on the next pain trial.

Section IV. Instructions for Self Efficacy Ratings (All groups rated both Strategies)

Distraction:

We are interested in finding out how much pain you expect to feel if you were to use the distraction strategy - shadowing letters - in the next pain trial.

Use this 20 point scale to tell me your expected pain at 30 seconds and at 60 seconds.

Imagery:

We are interested in finding out how much pain you expect to feel if you were to use the imagery strategy - imagining that your finger is numb - in the next pain trial.

Use this 20 point scale to tell me your expected pain at 30 seconds and at 60 seconds.

Section V. Post-Trial Instructions (Give either Imagery or Distraction)

Imagery:

Now, I would like you to do this task while your finger is in the apparatus. Just as in the practice trial, I will ask you to rate the sensations you are experiencing, every 30 seconds. Again, without thinking about it too much, state the number from the scale which best corresponds with the sensations you are experiencing. As before, I would like you to keep your finger in the apparatus for one minute, that is for two pain ratings. Now, keep thinking and vividly imagining that your index/middle finger is becoming more and more numb and insensitive. Tell me when to begin.

Distraction:

Now, I would like you to do this task while your finger is in the apparatus. Just as in the practice trial, I will ask you to rate the sensations you are experiencing every 30 seconds. Again, without thinking about it too much, state the number from the scale that best corresponds with the sensations you experience.

As before, I would like you to keep your finger in the apparatus for one minute, that is, for two pain ratings. Now, keep trying to shadow the letters as you did before. Tell me when to begin.

Appendix M

Crowne-Marlowe Self-Evaluation Questionnaire

Directions: Listed below are a number of statements concerning personal attitudes and traits. Read each item and decide whether the statement is true or false as it pertains to you personally. Circle the corresponding letter to the right of the statement.

1. Before voting I thoroughly investigate the qualifications of all the candidates. T F
2. I never hesitate to go out of my way to help someone in trouble. T F
3. It is sometimes hard for me to go on with my work if I am not encouraged. T F
4. I have never intensely disliked anyone. T F
5. On occasion I have had doubts about my ability to succeed in life. T F
6. I sometimes feel resentful when I don't get my way. T F
7. I am always careful about my manner of dress. T F
8. My table manners at home are as good as when I eat out in a restaurant. T F
9. If I could get into a movie without paying and be sure I was not seen, I would probably do it. T F
10. On a few occasions, I have given up doing something because I thought too little of my ability. T F
11. I like to gossip at times. T F
12. There have been times when I felt like rebelling against people in authority even though I knew they were right. T F
13. No matter who I'm talking to, I'm always a good listener. T F
14. I can remember "playing sick" to get out of something. T F
15. There have been occasions when I took advantage of someone. T F

16. I'm always willing to admit it when I make a mistake.	T	F
17. I always try to practise what I preach.	T	F
18. I don't find it particularly difficult to get along with loud mouthed, obnoxious people.	T	F
19. I sometimes try to get even, rather than forgive and forget.	T	F
20. When I don't know something I don't mind at all admitting it.	T	F
21. I am always courteous, even to people who are disagreeable.	T	F
22. At times I have really insisted on having things my own way.	T	F
23. There have been occasions when I felt like smashing things.	T	F
24. I would never think of letting someone else be punished for my wrong doings.	T	F
25. I never resent being asked to return a favour.	T	F
26. I have never been irked when people expressed ideas very different from my own.	T	F
27. I never make a long trip without checking the safety of my car.	T	F
28. There have been times when I was quite jealous of the good fortune of others.	T	F
29. I have almost never felt the urge to tell someone off.	T	F
30. I am sometimes irritated by people who ask favours of me.	T	F
31. I have never felt that I was punished without cause.	T	F
32. I sometimes think when people have a misfortune they only got what they deserved.	T	F
33. I have never deliberately said something that hurt someone's feelings.	T	F

Appendix N

Spheres of Control

For each of the following statements, please circle a number from 1-7 to indicate the extent to which you agree with each statement. On this scale 1 means that you disagree with the statement and 7 means that you agree with the statement.

1. When I get what I want it's usually because I worked hard for it.

Disagree **Agree**
1 2 3 4 5 6 7

2. When I make plans I am almost certain to make them work.

Disagree **Agree**
1 2 3 4 5 6 7

3. I prefer games involving some luck over games requiring pure skill.

Disagree **Agree**
1 2 3 4 5 6 7

4. I can learn almost anything if I set my mind to it.

Disagree 1 2 3 4 5 6 Agree

5. My major accomplishments are entirely due to my own work and ability.

Disagree 1 2 3 4 5 6 Agree 7

6. I usually don't set goals because I have a hard time following through on them.

Disagree **Agree**

1 2 3 4 5 6 7

- 7. Competition discourages excellence.**

Disagree **Agree**

1 2 3 4 5 6 7

- 8. Often people get ahead just by being lucky.**

Disagree **Agree**

1 2 3 4 5 6 7

9. On any sort of exam or competition I like to know how well I did relative to everyone else.

Disagree						Agree
1	2	3	4	5	6	7

10. It's pointless to keep working on something that's too difficult for me.

Disagree						Agree
1	2	3	4	5	6	7

11. Even when I'm feeling self-confident about most things, I still seem to lack the ability to control social situations.

Disagree						Agree
1	2	3	4	5	6	7

12. I have no trouble making and keeping friends.

Disagree						Agree
1	2	3	4	5	6	7

13. I'm not good at guiding the course of a conversation with several others.

Disagree						Agree
1	2	3	4	5	6	7

14. I can usually establish a close personal relationship with someone I find attractive.

Disagree						Agree
1	2	3	4	5	6	7

15. When being interviewed I can usually steer the interviewer towards the topics I want to talk about and away from those I wish to avoid.

Disagree						Agree
1	2	34	4	5	6	7

16. If I need help in carrying off a plan of mine, it's usually difficult to get others to help.

Disagree						Agree
1	2	3	4	5	6	7

17. If there is someone I want to meet I can usually arrange it.

Disagree						Agree
1	2	3	4	5	6	7

18. I often find it hard to get my point of view across to others.

Disagree						Agree
1	2	3	4	5	6	7

19. In attempting to smooth over a disagreement I usually make it worse.

Disagree						Agree
1	2	3	4	5	6	7

20. I find it easy to play an important part in most group situations.

Disagree						Agree
1	2	3	4	5	6	7

21. By taking an active part in political and social affairs we, the people, can control world events.

Disagree						Agree
1	2	3	4	5	6	7

22. The average citizen can have an influence on government decisions.

Disagree						Agree
1	2	3	4	5	6	7

23. It is difficult for people to have much control over the things politicians do in office.

Disagree						Agree
1	2	3	4	5	6	7

24. Bad economic conditions are caused by world events that are beyond our control.

Disagree						Agree
1	2	3	4	5	6	7

25. With enough effort we can wipe out political corruption.

Disagree						Agree
1	2	3	4	5	6	7

26. One of the major reasons we have wars is because people don't take enough interest in politics.

Disagree						Agree
1	2	3	4	5	6	7

27. There is nothing we, as consumers, can do to keep the cost of living from going higher.

Disagree **Agree**

1 2 3 4 5 6 7

28. When I look at it carefully I realize it is impossible to have any really important influence over what big businesses do.

Disagree **Agree**

1 2 3 4 5 6 7

29. I prefer to concentrate my energy on other things rather than on solving the world's problems.

Disagree **Agree**
1 2 3 4 5 6 7

30. In the long run we, the voters, are responsible for bad government on a national as well as a local level.

Disagree 1 2 3 4 5 6 Agree 7

Appendix O

Betts QMI

Directions: This questionnaire involves certain situations. For each of the following questions, please indicate which of the responses in the key below best applies.

- a) perfectly clear, and as vivid as the actual experience
- b) very clear, and comparable in vividness to the actual experience
- c) moderately clear and vivid
- d) not clear or vivid, but recognizable
- e) vague and dim
- f) so vague and dim to be hardly recognizable
- g) no image present at all; you only know that you are thinking of it

In addition, sometimes persons experience their imagining as effortless; their images seem to require no mental work. At other times, a great deal of mental work is required. This questionnaire is also designed to assess the degree to which you experienced your imagining as effortless. Please indicate which of the responses in the key below best applies.

- a) completely effortless: the image seemed to appear by itself
- b) mostly effortless: the image required some mental work
- c) moderately effortless: the image requires a moderate amount of mental work
- d) slightly effortless: the image required a lot of mental work
- e) my imagining required constant mental work

Please circle one response for each question.

1. When you close your eyes and try to imagine a specific automobile which you have seen many times, how vividly can you imagine it?

a b c d e f g

How effortlessly did you experience your imagining?

a b c d e

2. When you keep your eyes open and try to imagine the automobile, how vividly can you imagine it?

a b c d e f g

How effortlessly did you experience your imagining?

a b c d e

3. When you close your eyes and try to imagine a colour, such as a bright blue, how vividly can you imagine it?

a b c d e f g

How effortlessly did you experience your imagining?

a b c d e

4. When you keep your eyes open and try to imagine a patch of the wall becoming a different colour, how vividly can you imagine the changed colour?

a b c d e f g

How effortlessly did you experience your imagining?

a b c d e

5. When you close your eyes and try to imagine your name and address written on a paper before you, how vividly can you imagine the words?

a b c d e f g

How effortlessly did you experience your imagining?

a b c d e

6. When you try to imagine hearing a tune, how vividly can you imagine it?

a b c d e f g

How effortlessly did you experience your imagining?

a b c d e

7. When you try to imagine yourself running, how vividly can you imagine yourself actually moving? (This refers to the feeling of your muscles in motion, not to visually seeing yourself running.)

a b c d e f g

How effortlessly did you experience your imaginings?

a b c d e

8. When you try to imagine your arms as being especially heavy, how vividly can you imagine it?

a b c d e f g

How effortlessly did you experience your imagining?

a b c d e

9. When you try to imagine a common odour, such as a fragrant cup of hot coffee, how vividly can you imagine it?

a b c d e f g

How effortlessly did you experience your imagining?

a b c d e

10. When you try to imagine a common taste, such as the sweetness of sugar, how vividly can you imagine it?

a b c d e f g

How effortlessly did you experience your imagining?

a b c d e

11. When you try to imagine the room as becoming especially warm, how vividly can you imagine it?

a b c d e f g

How effortlessly did you experience your imagining?

a b c d e

12. When you try to imagine the room as becoming especially cold, how vividly can you imagine it?

a b c d e f g

How effortlessly did you experience your imagining?

a b c d e

13. When you imagine yourself stroking fur, how vividly can you imagine the fur? (This refers to the feeling of touching, not visually trying to see it.)

a b c d e f g

How effortlessly did you experience your imagining?

a b c d e

14. When you try to imagine how it feels when you have a stomach ache how vividly can you imagine it?

a b c d e f g

How effortlessly did you experience your imagining?

a b c d e

15. When you try to imagine the room spinning, how vividly can you imagine it?

a b c d e f g

How effortlessly did you experience your imagining?

a b c d e

END

03·03·92

FIN