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Cognitive Strategies, Perceived Exertion, and Running Performance

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ABSTRACT

The primary purpose of this study was to assess the influence of two cognitive strategies, dissociation and a combination of association and dissociation, on running performance. Novice athletes were given cognitive mental training programs, in addition they were asked to use these skills during a series of 3,200m timed trials. Although there was a significant trial effect for all groups, $F(3,25) = 15.389$ $P < .01$ further analysis revealed that no group improved more than any other group over the series of time trials. It was concluded that the cognitive training programs did not mediate the performances of the treatment groups.

The secondary purpose of this study was to investigate the influence of the two cognitive strategies on perceived exertion. The ANOVA analyses of each treatment group revealed that the cognitive strategies had no significant influence on the subjects perceived exertion during the 3,200m timed trials, dissociation $F(3,36) = .7$ $P > .05$, combination $F(3,36) = .5$ $P > .05$.


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INTRODUCTION

During the 1980's, running has become recognised as one of the most popular recreational and competitive activities. While it is obvious that competitive athletes strive to improve their performances, recreational runners have shown the same desire as a reflection of their interest in aerobic fitness. At the same time, there has been an increased awareness that performance is a function of not only physical but also mental states. This has led to an increasing number of athletes incorporating psychological techniques into their training programs. Techniques such as imagery and relaxation have been used to fulfill a variety of purposes. For example, research with runners has indicated that cognitive techniques may help runners cope with running boredom (Morgan and Pollock, 1977, Morgan 1978) and prevent overuse injuries (Colt and Spyropoulous, 1979). Both of these problems have been cited as important reasons for discontinuing running (Rose, 1985).

Morgan and Pollock (1977) identified two particular cognitive strategies which they claimed were characteristic of either elite or non-elite athletes respectively. The first of these they termed the association strategy, which requires the athlete to focus on bodily sensations, and maintain awareness of the physical factors that are critical to performance. This technique was seen to be favoured by elite performers to assist pace judgement (Orlick 1980), and was thought to minimise overuse injuries (Morgan 1978).

The second technique was the dissociation strategy, which distracts an athlete's attention from the cues of exercise discomfort (Rejeski 1985). This strategy was seen to be more commonly used by non-elite performers. Colt and Spyropoulos (1979) have cautioned that this technique may cause athlete's to sustain injury by ignoring physiological warning signals which indicate damage to tissues.

It has been suggested more recently that a cognitive strategy which incorporates both association and dissociation techniques may combine the benefits of both techniques (Sime, 1982). This technique, labelled "paced" assisted association/dissociation (pada), has not yet been evaluated experimentally.

The economic distribution of effort has also been identified as an important factor in endurance performance (Hatfield and Landers 1987). The individual's perception of exertion may be critical in assisting or inhibiting the allocation of this effort. A measure of perception of exertion (RPE), was developed by Borg (1970). He claimed it was representative of an individual's cognitive integration of various metabolic parameters, for example, heart rate, ventilation rate. It has been proposed that the perception of this effort can be manipulated by mental strategies, expectations, or past experiences (Rejeski 1981). Based on the perception of metabolic cost, an athlete may make a conscious decision to either adjust his/her effort, or terminate participation in a sporting event (Morgan, Horstman, Cymerman, Stokes, 1983).

1.1 Statement of Problem

The primary purpose of this study was to investigate the effects of two cognitive strategies on running performance. Specifically the efficacy of dissociation, and a combined association/dissociation treatments were examined. The secondary purpose of the study was to investigate the effects of cognitive strategies on an athletes perception of exertion.

1.2 Definitions

1.2.1 Dissociation :

A cognitive strategy where the individual diverts his or her focus of attention away from proprioceptive, kinaesthetic, or other physiological bodily signals that are perceived.

1.2.2 Association/Dissociation :

A cognitive strategy where the individual periodically monitors his or her physiological bodily signals, and if appropriate uses this information to make adjustments. These episodes of association alternate with periods of dissociation.

1.2.3 Perceived Exertion :

The integration of various information, including the many signals elicited from the peripheral working muscles and joints, from the central cardiovascular and respiratory functions, and from the central nervous system. These signals provide a "gestalt" of perceived exertion. Borg (1982).

REVIEW

2.1 Theoretical basis for the effects of Association and Dissociation

There have been relatively few attempts to propose a basis for the for the proposed effects of cognitive styles on sporting performance within the sports psychology literature. Specifically, no theories have been advanced to provide a rationale for either the techniques of association or dissociation. However, information drawn from both the pain and motor learning literature can provide useful guidelines. This chapter will review selected theories of attention and theories which consider the perception of pain to provide possible rationales for the claimed benefits of association and dissociation cognitive styles.

2.2 Theories of Attention

An early theory of attention proposed by Broadbent (1958) was termed the theory of undifferentiated fixed capacity. Along with others, Deutsch and Deutsch (1963), and Norman (1969), he proposed the view that the nervous system could only process a limited amount of information at any one time. Incoming sensory information would be passed through a filter from which discriminated information could be selected for processing, while unselected information would then be stored in the short term memory. A bottleneck of sensory information would occur if the limited processing capacity of attention was exceeded. Because of this, the theory has also become known as the bottleneck theory (Broadbent 1958).

Other theorists have considered attention to be more flexible and able to process several sources of information simultaneously. The Cocktail party phenomenon described by Cherry (1953) proposed that information could be selectively identified and processed against a background of other information competing for attention. Easterbrook (1959) has suggested that the ability to select and process informational cues may be affected by the level of arousal. He proposed that the cue-utilization hypothesis is linked to the Yerkes-Dodson theory of arousal; that is, a low level of arousal is matched with the poor selection of informational cues, while a high level of arousal interferes with the ability to discriminate from relevant cues.

In the Signal Detection theory (Tanner and Swets, 1954, Tanner and Birdsall, 1961) an individual's detection of a stimulus is dependent on the ability to discriminate between two types of neural activity : signal and noise. Random neural activity (also referred to as noise) is that which occurs without information input. Incoming sensory signals, for example, signals of exercise discomfort, will increase the overall amount of neural activity. The perception of signals is dependent on the strength of the signal relative to noise, plus the minimum signal threshold over which the signal can be detected. Kerr (1982) summarised this hypothesis as follows :

the probability of detection depends on the intensity of the signal relative to its background. Simply, the greater the level of background noise, the lower the probability of detecting a specific signal.(p143)

This theory would suggest that dissociation, if it is effective, might involve shifts in the signal detection threshold. If the dissociation technique manages to block the signals of exercise fatigue by shifting the minimum threshold for signal detec-

tion, a stronger fatigue signal would be needed before it is perceived. As the exercise fatigue signals will be at their most intense at the latter part of a demanding endurance run, a complex dissociation strategy may be needed to prevent signal detection.

2.3 Pain Perception Theories

Models for the proposed effects of the association and dissociation cognitive styles, might also be drawn from the studies in the perception of pain.

The sensory model of pain perception (Hardy, Wolff, Goodell, 1952) was a theory that suggested that the pain experience is the result of the physical energies acting on specialised receptors within the body. Signals are then transmitted from these receptors to pain centers within the brain, and thus the pain is experienced. This model can be applied to the association technique. It is possible that the chemical and thermal energies generated by exercise may provide noxious stimulation. This information is relayed through the pain nerve pathways to the pain centers of the brain where the pain sensation is generated. The responses of the sensory model are stated as pain ratings and comparisons between pain stimuli. A runner who uses the association technique may consider increasing the pace of the run after comparing and rating pain stimuli. Specifically, if the magnitude of pain is no greater running at a faster pace than a slower pace, it is obviously to the athletes benefit to run at the faster pace.

Beecher (1965) considered that the sensory model could be enhanced with the addition of an emotional component. This model became known as the sequential model. In this model, pain is influenced by memory and by the emotional reaction

to the pain. An athlete who had a distressing experience in a marathon race, might interpret exercise stimuli as painful in similar situations. Under this condition, the emotional reaction to the pain might be a function of previous experience. The converse of this would also hold true for the athlete who had experienced minimal discomfort using the association technique in a marathon.

Research that supported the sequential model includes the study of Pennebaker and Skelton (1978) who reported that the interpretation of noxious stimuli will depend on an individual's schema, that is, a set of attitudes toward the noxious stimuli that have been formed as a function of previous experience. McCaul and Mallot (1984) suggested that the non-emotional interpretation of sensations can assist in coping with noxious stimuli.

The parallel processing model of pain (Leventhal and Everhart 1979) arranges the informational and emotional-distress components of pain in a parallel fashion. In this model the pain is pre-consciously processed in the peripheral processing system. This information then has to pass the perceptual field and attentional fields before coming into focal awareness. The perceptual field represents all the processed information that can be recognised. The focal awareness is the segment of the potential stimuli that is given attention. The attentional channels that link the perceptual field to the focal awareness are limited according to this theory. The efficacy of the dissociation cognitive strategy is explained by the limited channel attentional capacity. Filling the attentional channels with distraction tasks may prevent a pain percept reaching the focal awareness.

The parallel processing model may also be used to explain any beneficial effects of the dissociation strategy. Since the information and emotional compo-

may be one that is either mediated by, or stimulated by, endogenous endorphins.

nents of pain are processed in a parallel fashion, the focusing of one component will prevent the focusing of another. If attending to the informational value of pain sensations fills the limited channel capacity without the emotional component of the pain, the pain may not be perceived as threatening. Experimental support for the limited channel hypothesis was provided in a study by Stones (1980) who used specially designed glasses to reduce the field of vision in runners. It was found that the extra vigilance needed for running reduced the athletes awareness of fatigue. He suggested that the perception of fatigue was blocked from the consciousness since the distracting tasks filled the limited channels of information processing.

The theories reviewed in this section have been used as a rationale for use of either the association or dissociation cognitive styles. The signal detection and parallel processing theories have been applied to the dissociation technique. The sensory and sequential models have been applied to the association technique.

2.4 Chemical Basis for Dissociation

It is possible that there is a neurochemical basis for the dissociation cognitive technique. Some of the proposed benefits of endogenous endorphins, a group of opiate like substances found in the brain, are similar to the some of the reported effects of the dissociation technique. Bloom (1976) stated that endogenous endorphins produce an analgesic state; that is a reduction in pain perception. As outlined above, the dissociation technique can enhance endurance performance by altering the individual's perception of exercise fatigue. It is possible that the mechanism which elevates the pain threshold, and alters the perception of pain, may be one that is either mediated by, or stimulated by, endogenous endorphins.

Another suggested property of these endogenous endorphins is that they can produce a cataleptic state (Riggs, 1981). In a cataleptic state, an individual has a reduced responsiveness to stimuli, and an alleged suspension of sensation. These properties could also be used to describe some of the characteristics of the dissociation technique.

This suggested chemical basis for the effectiveness of the dissociation technique may explain some running related phenomena. For example the reported "runners' high", which has been described as a state of altered consciousness (Pargman and Baker, 1980) has been linked to secretions of endorphins. It may be argued that the runners' high is brought about by concentrated dissociative thoughts which in turn stimulate the release of the endorphins. Relationships between dissociation and chemicals remains hypothetical at this time as no studies have been undertaken in the area.

2.5 Perceived Exertion

Perceived exertion is a multidimensional construct which has been researched within both the psychology and physiology areas. Two types of physiological factors are said to mediate the gestalt of perceived exertion. These are local cues, such as, blood lactate and muscle temperature, and central factors such as heart rate and ventilation rate (Ekblom and Goldbarg, 1971). Morgan (1973) suggested that after the consideration of physiological input, one third of the variance of perceived exertion remains unexplained. It may be that psychological variables account for the remaining unexplained variance (Rejeski, p132). Some psychological variables which may mediate perceived exertion include fatigue, task aversion,

motivation (Kinsmen and Weiser 1976, Pandolf, Burse, Goldman, 1975). Pandolf (1983) identified cognition as a variable which may influence perceived exertion.

(p14). Such a view remains at best anecdotal.

Evidence for the beneficial effects of Association and Dissociation Cognitive Strategies

This section will review the evidence as to the effects of these techniques on endurance performance.

Simps (1982), conducted a survey of marathon runners and reported

2.6 (a) : Association

Morgan and Pollock's (1977) original study suggested that a narrow internal focus of attention on bodily cues, which they termed the association strategy, was the preferred cognitive strategy for elite marathon runners. Their work seemed to be in agreement with Nideffer's (1976) theory of attentional style, which suggests that a narrow internal focus of attention could facilitate the performance of endurance activities, although no evidence was offered in support of this contention.

Later, Morgan (1978) reported that elite runners associated with their exercise pain and discomfort through the monitoring of their bodily signals, and claimed that this technique allowed them to run closer to their anaerobic threshold. Celestino, Tape, and Burnet (1979) offered additional evidence for Morgan's contention stating that elite marathon runners had greater internality scores on a test of locus of control than non elite marathon runners.

Faster running times and less trouble with the infamous marathon "wall" have been reported as the benefits from the association technique for marathon runners

(Merrill,1981). He argued that " a constant monitoring of body and environment will probably get you through the wall with greater speed, safety, and comfort" (p44). Such a view remains at best anecdotal.

Reviewing the advantages of Association, Morgan (1981) reported that the strategy allowed an athlete to monitor pace judgement, and to monitor proprioceptive feedback, especially with regards to injury. He suggested that this technique would also help the athlete avoid metabolic disturbances, such as, heat exhaustion. Sime (1982), conducted a survey of marathon runners and reported that 76% of the respondents claimed to use the association technique to monitor their general bodily functioning. These marathon runners stated that this technique reduced the sense of anxiety, of pain, and effort in that order of efficacy.

Three studies have attempted experimentally to demonstrate the efficacy of the association technique in sport. Spink and Longhurst (1986) randomly assigned swimmers to either an association or dissociation condition. Despite the fact subjects were given only a 15 minute instruction period, the authors reported that eight out of nine swimmers decreased their time in the associative condition ($P < .02$). This compared with the dissociative condition where five out of fourteen swimmers decreased their time ($P < .05$). However rather than corroborating the relative efficacy of these cognitive techniques, the results of this study were confounded by the Hawthorne effect because the authors told the athletes that this technique would improve their performance. Thus, it was difficult to ascertain whether the cognitive training or the treatment expectancy produced the desired results.

David Neal (1965) reported on a technique termed *lung-gom-pa* used by Tibetan monks in Tibet. It was claimed that the meditative qualities of this techn-

Schomer (1986) conducted a study designed to identify the thought processes of marathon runners. The subjects were encouraged to verbalise their thoughts during training runs, and to rate their perceived exertion at the end of each run. The verbalised thoughts were recorded on micro cassettes and later analysed for their content. The author concluded that the association technique allowed runners of all levels of ability to invest greater effort to improve their aerobic conditioning more efficiently.

In a follow up study, Schomer (1987) used an association intervention strategy during the training runs of marathon runners. The subjects were asked to carry lightweight two way radios during their training runs. While running the subjects were asked to verbalise their thoughts. Any thoughts which were considered associative were positively reinforced with verbal encouragement from the experimenter. Dissociative thoughts were initially tolerated but actively discouraged with each additional training run. The results of this study suggested that the association technique enabled runners to sustain the intensity of training runs. Furthermore, it was concluded that faster training times and lower rates of injury were the other benefits of this technique. The interpretation of these results was limited by the exclusion of any experimental analysis.

2.7 (b) : Dissociation

Anecdotal evidence of difficult feats of endurance using dissociation strategies have formed the background for descriptive and experimental studies of dissociation. David-Neel (1965) reported on a technique termed Lung-gom-pa used by Mahetang monks in Tibet. It was claimed that the mediative qualities of this tech-

nique enabled the monks to run 300 miles in 30 hours, seemingly without effort, over the mountain terrain of Tibet. Popkin, Stillner, and Pierce (1981) stated that successful racers in the Iditarod trail sled dog race (a 1000 mile race across Alaska) used a form of dissociation strategy to cope with the physical and mental stress of such a sustained endurance task.

Descriptive studies on dissociation have attempted to identify the content of the thoughts of endurance runners. Lorentzen and Sime (1979) believed that there were three categories of dissociative thought; spontaneity, diversion, and problem solving. Orlick, Power, and Partington (1980) reported that 83% of marathon runners interviewed used dissociative thoughts in their training programs. In a similar study Sime (1982) issued a questionnaire to marathon runners designed to assess the cognitive strategies used in the preparation for their run. It was reported that 76% of respondents claimed to use the dissociation strategy during both training and performance. Of this group 72% of the runners further claimed that the technique was of benefit to their performance. Specifically, there was a reported reduction of perceived effort, pain, and anxiety (in order of importance) through the use of the dissociation technique.

Of the experimental studies which have investigated the influence of the dissociation cognitive strategy on endurance, Pennebaker and Lightner (1980) reported that subjects who used a dissociation strategy ran faster over a cross country course than over a equal distance on the track. They suggested that the technique enabled athletes to cope with exercise discomfort. Benson, Dryer, and Hartley (1978) found that a dissociation treatment group performed a treadmill endurance task 19% better than the control and placebo groups. In a similar study, Morgan

(1981) found that subjects using a dissociation strategy on a treadmill endurance test significantly increased their baseline endurance level 20 percent compared to controls. Neither of these the latter studies outlined how the dissociation instructions were implemented.

Morgan, Horstman, Cymerman, and Stokes (1983) attempted to determine whether a dissociation strategy could facilitate endurance performance. The subjects in three groups (treatment, placebo, control) were asked to run to exhaustion at 80% maximal aerobic power on a treadmill task while using the dissociation technique. Although the blood lactate levels were similar in all of the groups, the treatment group performed the endurance task longer than either the placebo or control groups. The interpretation was open to question because of the author's statement in the dissociation instructions that "by dissociating in this fashion you will not perceive the same amount of fatigue, pain, or discomfort that you experienced the first time you walked at 80% of maximum" (p258). In this way, the Hawthorne effect may have had a significant influence on the results.

The effectiveness of the two cognitive strategies on running performance was the focus of research by Okuwumabua, Meyers, Schleser, and Cooke (1983). The athletes were given a 10 minute instructional package on either the dissociation or association cognitive style four times in one month. There was no provision for feedback, or the shaping of thoughts, and there was no attempt at providing qualitative information concerning styles of thought to the athletes. It was found that all runners became increasingly more associative over the five-week period. In trials over a 1.5 mile course, runners using the dissociation strategy demonstrated greater improvement than runners using the association strategy.

Weinberg, Smith, and Jackson (1984) investigated the effects of association, dissociation, and positive self talk strategies on two endurance tasks. First, the subjects ran as fast as they could for 30 minutes using the assigned strategy, and second they performed an isometric leg extension test. No training period in the use of these techniques was provided for however. In the running task, the subjects reported using the cognitive strategies 75.1% of the time, but no significant differences were found between the performance of the groups. However, dissociation and positive self talk were found to be more effective than the association and control groups on the isometric leg extension test.

The effects of attentional style on an leg extension endurance task were investigated by Gill and Strom (1985). No training program was established for the subjects. They reported that subjects using the external focus of attention (dissociation) achieved significantly more repetitions of the leg strength exercise than the internal focus group (association).

Much of the support for dissociation as a technique can be found in studies which manipulated instructions to examine the effects of dissociation on the perception of pain and discomfort. Bloom, Houston, Holmes, and Burish (1977) claimed that attentional diversion could reduce the stress that was related to the threat of painful shocks. Avia and Kanfer (1980) reported that subjects who were given distraction tasks endured a cold pressor test longer than subjects in a control group. Rosenbaum (1980) stated that subjects who used pleasant imagery as a distraction task increased their tolerance for pressure pain. In a review of the distraction pain literature, McCaul and Mallot (1984) found that distraction was an effective technique compared with uninstructed and expectancy control conditions.

Summarising the literature on distraction complexity, McCaul and Mallot (1984) reported that the subjects who used strategies high in attentional demand coped with pain better. Rejeski and Kenney (1987) stated that the subjects preference for distraction task complexity influenced the effectiveness of this technique. Brucato (1978) had suggested that some distraction tasks may require too much effort, and thus may dissuade an individual from continued use of this technique. A further limiting factor may be boredom and fatigue which could influence the long term effectiveness of the distraction strategy.

A few studies have investigated the influence of cognition on perceived exertion. Rejeski and Ribisl (1980) reported that the subjects perceived exertion was influenced by the anticipated duration of a treadmill run. The authors claimed that the subjects anticipating a lengthy performance on the treadmill suppressed their perceived exertion compared to subjects anticipating a minimal duration. Two studies have specifically investigated the influence of the dissociation technique on perceived exertion. Kerry, Rejeski, and Messier (1987) reported that subjects who were given distress management training (a combination of dissociation strategies and relaxation) reported significantly lower RPE scores (ratings of perceived exertion) running at 85 percent VO₂ maximum than a non-treatment group reported. Johnson and Siegel (1987) investigated perceptions of exertion during physical work at varying intensities. They prescribed treatments of active (arithmetic problems) or passive (asynchronous music) attention manipulation to subjects performing at either 60 percent or 90 percent VO₂ maximum. The subjects perceived their exertion to be less at 90% VO₂ max when using active attentional manipulation ($p < .01$) rather than passive attentional manipulation. This study cor-

rel by hypoxic regulation of exercise.

roborated evidence to suggest that dissociation may be an effective cognitive strategy which reduces the intensity of perceptual cues from exercise.

Research in other related areas of cognitive manipulation has provided further evidence consistent with the dissociation technique. Studies investigating the influence of thoughts (primarily dissociative thoughts) on metabolism have demonstrated a link between cognitions and metabolic responses. The classic studies on altered metabolism as a direct function of cognitive influence were performed in the 1930's. Whitehorn, Lundholm, and Gardner (1930) hypnotically induced anxiety in subjects and found that this produced a 22% elevation in metabolic rate. Nemtsova and Shatenstein (1936) reported that the perception of exercise intensity may influence the metabolic response. They found that hypnotic suggestions of light exercise given to resting subjects increased oxygen uptake 143 ml/min and ventilation 6.9 l/min. Following hypnotic suggestions of heavy exercise however these values increased to 409 ml/min and 14.5 l/min respectively. In the second part of their study the authors investigated metabolic response as a function of cognitive intervention during exercise. Hypnotic suggestions of light and heavy exercise were given to the subjects while they rhythmically lifted weights (20 repetitions per minute). In the light exercise condition the subjects were informed the weights were 3kg, in the heavy condition subjects were informed that the weights were 30kg (the bar actually weighed 10kg). Decreases in ventilation and oxygen consumption of 20-30% were observed under the suggestion of light exercise, while a 50% increase in ventilation and oxygen consumption was reported under the hypnotic suggestion of heavy exercise. Levin and Egolinsky (1936) found that heart rate and oxygen consumption and ventilatory minute volume were all elevated by hypnotic suggestion of exercise.

The influences of hypnotically induced thoughts of anxiety and exercise were also investigated by Berman, Simonson, and Heron (1954). They found that both thoughts significantly elevated heart rate. Further support for the influence of cognitions on metabolic processes was offered by Dudley, Holmes, Martin, Ripley (1964). Through hypnotic suggestions, they induced thoughts of anxiety, anger, exercise to one group of subjects, while thoughts of deep relaxation were suggested to another group of subjects. The thoughts of anxiety, anger, and exercise, were found to elevate oxygen consumption and alveolar ventilation. The thoughts of relaxation were found to decrease oxygen consumption and ventilation rates in the group given such instructions.

Morgan (1973) hypnotically suggested light, moderate, and heavy exercise to subjects and then asked them to rate their perceived exertion (RPE) during the study. The workload on a bike ergometer remained constant at 100W for the five minute test. The results revealed a graded perceptual response with RPE scores of 9,11,13, matching the experimental conditions (light, moderate, heavy). Morgan concluded that the perception of exercise intensity or demand, may in part, be responsible for the metabolic response.

Hypnotic suggestion and physiological responses were investigated by Morgan, Hirota, Weitz, and Balke (1976). After hypnosis, the subjects were also asked to exercise on a bicycle ergometer for 20 minutes at 100w resistance. The subjects were asked to imagine a hill they were cycling toward. After 10 minutes of cycling on the "level road" the subjects cycled "uphill" for 5 minutes, followed by 5 minutes on the "level road" again. Throughout the study the ergometer resistance stayed the same (100W). The subjects rated their perception of exertion at

these techniques alone is a question that remains unanswered.

each stage of the cycle eg, level, uphill, level. Perception of effort was found to be greatest during the imagined uphill section. The ventilatory minute volume increased by 11 l/min when the work was perceived to be more effortful.

In a similar study, Benson, Dryer, and Hartley (1978) had subjects using meditation while exercising at a fixed work intensity on a bike ergometer. Oxygen consumption was found to significantly ($P < .05$) decrease (0.763 l/min to 0.730 l/min) during exercise in the meditation condition. They stated that the four percent decrease in oxygen consumption would be significant for prolonged endurance activities. They also suggested that individual's who used meditation would experience greater exercise tolerance.

Morgan et al. (1983) adapted Benson's et al. (1978) method. Subjects walked on a treadmill at 80 percent maximal aerobic power (MAP) until they could no longer maintain a normal gait. The 14 subjects using meditation performed significantly longer than 13 control subjects. No differences in metabolic responses were found between the two groups. Morgan et al (1983) suggested that meditation enabled the subjects to tolerate exercise discomfort for a longer period.

Mullen and Sulls (1982) conducted a meta analysis comparing the attention and rejection coping styles. They concluded that for coping with the short term effects of a stressor, rejection, or dissociation, was the most appropriate technique ($Z_{ma} = 7.75$ $P < .00001$) To cope with the long term effects of a stressor attention was considered the best coping style ($Z_{ma} = 4.31$ $P < .00001$) Their results have implications for endurance runners, as it would appear that attention, or association, might be a beneficial technique for such runners. However whether a combination of these techniques would prove more effective than each of these techniques alone is a question that remains unanswered.

A method of combining the benefits of both cognitive styles has been suggested by Sime (1982). This new cognitive technique has been termed the pace-assisted association/dissociation (PADA) technique. By concentrating on their breathing patterns, the runner would be implementing the association part of the technique. A shift of the focus of attention to the runner's stride frequency, that is, the runner counts their strides, would incorporate the dissociation element into this technique. Sime suggested that the runner would alternate between the two techniques periodically throughout the run. This technique has not been researched experimentally in sport.

2.8 Rationale

The literature has suggested that association and dissociation are the preferred cognitive technique for elite runners and non elite runners respectively. Because Sachs (1984) reported that "most experienced runners appeared set in their ways in voicing preferences for their habitual thought processes" (p294), it was decided to use novice athletes in this study. A review of the dissociation literature has indicated that this technique can enhance endurance performance. However, a criticism that may apply to all of the studies reviewed was the limited training (if any) that subjects received for the dissociation technique. The question which arises is whether a systematic mental training program in dissociation would elevate performance levels to a greater degree than no mental training. Further, many of the results from previous studies can be criticised because of the raised expectancy levels that were included in the research instructions. While Sime (1982) suggested the possibility of combining the association and dissociation tech-

niques, no experimental investigations have pursued this option within the sports psychology literature.

It was the purpose of this study to administer a mental training program to novice runners in either the dissociation or combination techniques. During organised training runs or timed performances, the subjects in the dissociation group were asked to concentrate their thoughts on music that was played. Through the repeated practise of this procedure it was expected that the subjects would acquire the mental skill of effective dissociation.

For the combination treatment group, music was also played during organised training runs and timed performances. Periodically throughout their runs the music for the combination group was turned off, this was used as a cue to associate. After a period of association the music was turned back on again to allow dissociation to continue. It was expected that through the repeated practise of this procedure the runners would acquire the mental skill of the combination technique and this would enhance their endurance performances. The control group performed their organised runs or timed performances without music being played.

There was not an association group included in this study because the literature has suggested that this technique is the preferred method for elite runners only. Furthermore, the novice athletes in the combination group received some association mental training, and so it was possible to gain some understanding of how these athletes used this technique.

Based on the available theory, it was hypothesised that the combination group would improve the most for the time dependent variable. When using the association technique this would allow the runner to find their optimal pace, then by

switching to the dissociation technique the runner could block fatigue from their perception. Developing a greater awareness of their effort would contribute to the improvement over the timed trials.

It was also anticipated that the dissociation group would show greater improvement than the control group in this study. The literature has indicated that using a dissociation technique blocks fatigue from perception and thereby facilitates endurance performance.

Although the control group was expected to improve in performance from time trial 1 to time trial 4, it was theorised that the improvement would not be as great as the combination and dissociation groups.

The hypotheses were tested in terms of changes of time (improvement). It was expected that improvement within each treatment group across the time trials would reveal whether the treatments had been effective.

The limited literature on perceived exertion and sport has suggested that cognitions may influence the feelings of exertion. Research is required to establish what type of cognitions influence perceived exertion and consequently levels of performance. The secondary purpose of this study was to evaluate the influence of two types of cognitive style on perceived exertion, and to see if altered perceptions of exertion mediated performance levels.

It was expected that the RPE for the dissociation group would decrease. It was theorised that as the runners became more skilled at using the dissociation technique, they would become better at blocking the exercise discomfort from their perception. Thus the RPE would decrease as their mental skill developed.

increase after each time trial.

The RPE for the combination group was expected to increase after each time trial. As the runners became more skilled at using the combination technique, they would become more aware of their effort during the run. This greater awareness to their physiological responses to exercise would increase the runners RPE. It was expected that there would be no change in the control groups RPE, because they were given no mental training their perceptions of exertion were expected to stay the same throughout the study.

Directional changes in RPE score were predicted for each treatment group. Mean RPE scores were not used in the hypotheses because it was considered that this would not reveal pertinent information on possible interactions between the cognitive treatments and RPE.

2.9 Hypotheses

The study tested the following hypotheses :

1. The combined treatment group would improve more over the time trials than the dissociation group.
2. The combined treatment group would improve more over the time trials than the control group.
3. The dissociation treatment group would improve more over the time trials than the control group.
4. The perceived exertion for the dissociation treatment group would decrease after each time trial.
5. The perceived exertion for the combination treatment group would increase after each time trial.

6. The perceived exertion for the control group would not change after each time trial.

METHODOLOGY

3.1 Subjects

The subjects were 30 volunteer students (15 males, 15 female) from the University of Victoria physical education department. The participants in the study were not actively involved in regular aerobic sporting activities (i.e. they were not runners, swimmers, cyclists, etc).

3.2 Variables

The independent variables (IV) in this study were the nature of the instructions given to the subjects, and the way music was presented to the treatment groups. The dependent variables (DV) in this study were the timed performances of the subjects, and the ratings of perceived exertion (Borg 1982).

3.3 Limitations and Delimitations

The study was limited by the subjects degree of voluntary adherence to the various treatment conditions.

3.1 Instrumentation

An adapted version of the Borg scale (Borg, 1979) was used to assess the ratings of perceived exertion (RPE) at the end of the performance task(s) appendix (1). In addition, the subjects were asked to complete a short questionnaire indicating the degree to which they followed the treatment instructions, and the degree to which they felt the treatment instructions affected their performance.

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3.5 Procedure

At an introductory meeting the subjects were informed of the general requirements of this study. Informed consent forms were then signed by those subjects who volunteered for the study. All of the subjects completed a 3,200m time trial on a 400m running track prior to treatment assignment. From the results of this run the subjects were assigned to one of three treatment groups using a matched ability design (see appendix 3).

1. A Dissociation group
2. A combined association/dissociation group
3. A control group

After a day's rest the subjects took part in their respective treatment group training session, which consisted of a run of 3,200m on the track. Before the start of the organised training run each of the treatment groups were read the following statement;

This is a straight-forward training run. I want you to employ the cognitive strategy to which you have been assigned and use it throughout the run.

(adapted from Weinberg et al 1984 p.27). The subjects were then provided with instructions for the various treatment groups. A neutral position for the efficacy of these treatments was assumed when instructing the subjects. Throughout each organised time trial or training run no encouragement was given to any of the groups. After each training run the subjects were asked to complete the questionnaire (see appendix 2).

At the end of the first week of the study three separate time trials of 3,200m (one for each treatment group) were held at the track with the subjects running under treatment conditions. The dissociation group were asked to concentrate on the music that was being played and to use the music to help block their perception of exercise discomfort. The combination group were also asked to listen to music as they ran, at selected moments the music was turned off and the subjects were asked to use this as a cue to associate. After associating, the music was turned back on to allow the subjects to dissociate again. This procedure was repeated throughout the organised runs or timed trials. The control group were asked to run without music throughout the study (see specific treatment instructions and run schedule for details). Before the start of the time trial each of the treatment groups were read the following statement;

This is a time trial, this run should be a maximal effort. I want you to employ the cognitive strategy to which you have been assigned and use it throughout the run.

(adapted from Weinberg et al 1984 p.27). After this run a meeting for each of the treatment groups, including the control group, was held. Any questions about the treatment instructions were answered, and general feedback was provided to each treatment group.

For the second week of training the subjects ran three times, twice on their own and once at an organised time trial. When running on their own the subjects were asked to run for 20-30 minutes. During each training run or performance time trial the subjects were requested to use their appropriate treatment instructions. Again the time trial was held under treatment conditions. A further meeting was held for all treatment groups after the time trial and feedback was again provided. The subjects then completed a final week of training, again running twice on their own and once more as a 3,200m time trial. During this last time trial no music was played for any of the treatment groups.

3.6 Specific Treatment Instructions

3.6.1 Dissociation

At the organised run and the time trials the dissociation treatment group were read, and given a copy of the following statement;

Your task during each run and time trial is to totally ignore any exercise discomfort that you may perceive. Listen to the music that is being played, try to count the number of beats in each song, or try to memorise the lyrics. Try to absorb your thoughts and focus your concentration on this music ignore as much as possible the exercise discomfort.

If at any stage during the run you cannot help but notice some exercise discomfort do not think that the dissociation is now irrelevant, use this as a cue to try and dissociate even more. At the end of each run complete the questionnaire and ask yourself "What part of my dissociation training was the least effective, what can I do to make it more effective?" Record your thoughts in the diary, note any concerns or suggestions that you may have and these will be commented on at the end of the first week of training during the feedback session.

When running on their own the subjects were asked to utilize the treatment skills that they had practised in the organised training sessions or time trials. It was emphasised that these runs were to be completed without the assistance of music in implementing the mental skills.

3.6.2 Combination Treatment Group

At the organised time trials and training runs the combined treatment group were given their specific instructions to follow in the three week program. The treatment group were read, and given a copy of the following statement:

Your task during each run is two fold. For part of the run you are asked to totally ignore any exercise discomfort that you may perceive (i.e. "dissociate"). Listen to the music that is being played, try to count the number of beats in each song, or memorise the lyrics. Try to absorb your thoughts and focus your concentration on this music. Ignore as much as possible the exercise discomfort. In addition to this you will be told to focus your thoughts briefly on the physiological feedback that your body is given you (i.e. associate). The music will be turned off and you are to ask yourself am I running efficiently ? If you feel that you are running too fast, adjust your pace to one that you feel more comfortable with. If you perceive any exercise discomfort use this information as a cue to relax, i.e. adjust your pace, try to reduce any tension in your muscles. Once you have ensured that you are running both efficiently and economically (i.e. you are running at your optimal pace which you can maintain for the duration of the run) focus your thoughts away from this information (i.e. dissociate again). The music will then be turned on again to help you dissociate. This process will be repeated four times in each run.

At the end of each training run ask yourself " what can I do to make the combination treatment more effective ? " Record your thoughts and any suggestions that you may have for improving the effectiveness of this technique on your questionnaire sheet. These will be commented on during the feedback sessions.

When running on their own the subjects were asked to utilize the treatment skills that they had practised in the organised training sessions or time trials.

3.6.3 Control Group

The control group were given no specific instructions other than to follow the same running program prescribed to the other treatment groups. The control group were given a feedback meeting where running style and any other concerns were discussed.

3.6.4 Pre Performance Testing Instructions

Periodically throughout the study the subjects of each treatment group completed a 3200m time trial on the running track. Prior to each time trial test the subjects were asked not to perform any demanding physical activity, and were encouraged to maintain normal lifestyle patterns (eg sleep patterns) for the days preceding testing. The subjects were read the following statement;

Your task is to run as fast as you can for 3,200m. During the run, use the mental skills that you have been asked to practise. This run should be a maximal effort.

Before the start of each time trial the subjects were familiarised with an adapted version of the Borg RPE scale. At the end of the run they were asked to consider the following question;

"what is the intensity of effort that you perceive right now ? Use the RPE scale to indicate the number which you feel most accurately describes this intensity."

The subjects were also required to complete the questionnaire (see appendix 2) after each run and time trial.

3.7 Running schedule

Week 1

Day 1 Supervised 3,200m time trials at 1.30pm and 5.30pm

- o subjects then assigned to treatment groups

Day 3 Supervised 3,200m training run

- o dissociation group - run with music 12.30pm or 4.30 pm
- o combination group - run with music on/off 1pm or 5pm
- o Control group - run with no music 1.30pm or 5.30pm

Day 5 Supervised 3,200m time trial

- o dissociation group - run with music 12.30pm or 4.30 pm
- o Combination group - run with music on/off 1pm or 5pm
- o control group - run with no music 1.30pm or 5.30pm

Week 2

Day 8 Unsupervised training run - subjects use mental skills

- o dissociation group - run without music
- o combination group - run without music
- o control group - run without music

Day 10 Unsupervised training run - subjects use mental skills

- o dissociation group - run without music
- o Combination group - run without music
- o control group - run without music

Day 12 Supervised time trial 3,200m

- o dissociation group - run with music 12.30pm or 4.30 pm

- o combination group - run with music on/off 1pm or 5pm
- o control group - run with no music 1.30pm or 5.30pm

Week 3

Day 15 Unsupervised training run - subjects use mental skills

- o dissociation group - run without music
- o combination group - run without music
- o control group - run without music

Day 17 Unsupervised training run - subjects use mental skills

- o dissociation group - run without music
- o combination group - run without music
- o control group - run without music

Day 19 Supervised 3,200m time trial

- o dissociation group - run without music
- o combination group - run without music
- o control group - run without music

3.8 Statistics

A mixed multiple analysis of variance (MANOVA) with repeated measures on trials was used to analyse the data. This method of analysis measures the change in dependent variables over several time periods across groups. This procedure was used to analyse the data for each of the dependent variables separately. A MANOVA was also used to assess the significance of changes in time from time trial one to time trial four across all of the groups. Three separate ANOVA's were also conducted on each of the treatment groups for any significance in changes in score from time trial 1 to time trial 4.

The analysis of the RPE scores was also by MANOVA. Three separate ANOVA's were also conducted on the RPE scores for each treatment group. In addition a one way ANOVA with Tukeys B post hoc analysis was used to identify which groups contributed to the significant MANOVA effect. Caution should be exercised in interpreting the results for both RPE and time because there may be spurious inflation of significance through the repeated use of the same data for analysis.

A univariate analysis of variance was conducted after the first 3,000m run. There was no significant difference among the three groups $F(2,27) = .09 P > .05$. From this result it was determined that the groups were evenly matched on ability before the treatments started.

To test the hypotheses a series of MANOVA's were conducted on the dependent variables. The MANOVA for the time dependent variable revealed no significant group effect, $F(2,27) = .60 P > .05$. This result suggested that there was no difference in the group means when they were pooled across the four trials. The group by trial-effect was not significant, $F(6,50) = .49 P > .05$. This result suggested that there was no interaction between the treatment group and time in the results. There was a significant trial effect, $F(3,25) = 15.38 P < .01$ (see table 3 for summary). This result indicated that there was a linear trend for timed performance, and as indicated in figure 1 all treatment groups decreased in this fashion.

A MANOVA was conducted on the time dependent variable to test for the significance of changes in time for all groups between each timed trial. The changes in time reached significance between time trials 1 to 4, $F(1,27) = 22.79 P < .01$. Significance was also achieved between time trials 2 to 4, $F(1,27) = 21.93 P < .01$ (see table 4 for summary).

4

RESULTS AND CONCLUSIONS

A univariate analysis of variance was conducted after the first 3,200m run. There was no significant difference among the three groups $F(2,27) = .89 P > .05$. From this result it was determined that the groups were evenly matched on ability before the treatments started.

To test the hypotheses a series of MANOVA's were conducted on the dependent variables. The MANOVA for the time dependent variable revealed no significant group effect, $F(2,27) = .60 P > .05$. This result suggested that there was no difference in the group means when they were pooled across the four trials. The group by trial effect was not significant, $F(6,50) = .69 P > .05$. This result suggested that there was no interaction between the treatment group and time in the results. There was a significant trial effect, $F(3,25) = 15.38 P < .01$ (see table 3 for summary). This result indicated that there was a linear trend for timed performances, and as indicated in figure 1 all treatment groups decreased in this fashion.

A MANOVA was conducted on the time dependent variable to test for the significance of changes in time for all groups between each timed trial. The changes in time reached significance between time trials 1 to 4, $F(1,27) = 22.78 P < .01$. Significance was also achieved between time trials 2 to 4, $F(1,27) = 22.93 P < .01$ (see table 4 for summary).

Because there was a significant trial effect three separate ANOVA's were conducted on each of the treatment groups to test for any significance in the changes in time from time trial 1 to time trial 4. None of the three groups reached significance, dissociation $F(1,18) = 2.5$ $P > .05$. Combination group $F(1,18) = 1.2$ $P > .05$. Control group $F(1,18) = 1.3$ $P > .05$. The MANOVA identified a significant trial effect by collapsing the scores of each trial across the three groups, but as the ANOVA analyses have suggested there was no significance in the changes of time (time trial 1 to time trial 4) for each treatment group (see table 5 for summary).

The MANOVA for the RPE dependent variable produced a significant group effect, $F(2,27) = 3.80$ $P < .05$. This result suggested that there was a difference in the treatment group means when pooled across the four trials. The group by trial effect was not significant $F(6,48) = 1.41$ $P > .05$. The lack of an interaction effect suggested that each groups scores changed in the same way over the trials. There was a significant trial effect $F(3,25) = 16.50$ $P < .01$ (see table 6 for summary). This result together with the means, indicated that the RPE scores of each treatment group increased in a linear fashion (see figure 2).

To identify which treatment groups contributed to the significant group effect in the RPE MANOVA, a one way ANOVA with Tukey's B post hoc analysis was conducted on the RPE data. The ANOVA, as expected, identified a significant difference between the groups $F(2,27) = 3.79$ $P < .05$. The Tukey B post hoc analysis identified the dissociation group and the control group as being significantly different in changes of RPE score across the trials.

To test the specific hypotheses three separate ANOVA's were conducted on the RPE data. The ANOVA for the dissociation group's RPE data did not reveal a significant change in the RPE scores over the four trials $F(3,36) = .7$ $P > .05$. For the combination group there was no significance in the change of RPE scores over the four trials $F(3,36) = .5$ $P > .05$. The ANOVA of the control group RPE scores did not reach significance $F(3,36) = 3.0$ $P > .05$.

Table 1 Group Means (time in seconds) and standard deviations for each time trial.

	<u>Time Trials</u>			
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
Dissociation	m 13.5 sd 1.19	m 14.8 sd 1.72	m 15.9 sd 0.99	m 16.4 sd 0.96
Combination	m 13.5 sd 1.43	m 14.5 sd 1.17	m 15.2 sd 1.3	m 15.1 sd 1.3
Control	m 14.0 sd 0.94	m 13.7 sd 1.16	m 14.2 sd 1.0	m 15.1 sd 1.2

Table 2

Summary of the MANOVA analysis with time (DV)

Dissociation	m 870.4 sd 82.8	m 849.6 sd 107	m 806.3 sd 95.5	m 806.5 sd 93.9
Combination	m 834.5 sd 78.0	m 824.3 sd 85.9	m 794.1 sd 72.0	m 799.8 sd 67.0
Control	m 883.0 sd 91.3	m 859.9 sd 111.4	m 841.3 sd 92.0	m 837.6 sd 88.2
Group effect				
Group by Trial	6.50	.69003		>.05
Trial effect	3.25	15.389		<.01*

* Significant at the $P < .01$ level.

Table 2Group Means and Standard Deviations for RPE at each time trial

		<u>Time Trials</u>			
		<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
Dissociation	m 13.9 sd 1.19	m 14.8 sd 1.22	m 15.9 sd 0.99	m 16.4 sd 0.96	
Combination	m 13.5 sd 1.43	m 14.5 sd 1.17	m 15.2 sd 1.3	m 15.1 sd 1.3	
Control	m 14.0 sd 0.94	m 13.7 sd 1.16	m 14.4 sd 1.0	m 15.1 sd 1.2	

Table 3Summary of the MANOVA analysis with time (DV)

	<u>DF</u>	<u>F</u>	<u>P</u>
Group effect	2,27	.60	>.05
Group by Trial	6,50	.69003	>.05
Trial effect	3,25	15.389	<.01*

* Significant at the P <.01 level.

Table 4

Summary of the MANOVA analysis for changes in time

	<u>DF</u>	<u>F</u>	<u>P</u>
T1 - T2	2,27	.59026	>.05
T2 - T3	2,27	1.1306	>.05
T3 - T4	2,27	.34181	>.05
T1 - T4	2,27	22.783	<.01*
T2 - T4	2,27	22.937	<.01*

Table 5

* Significant at the P < .01 level.

Table 5

Summary of the three ANOVA analyses for changes in time (T1 to T4).

	<u>DF</u>	<u>F</u>	<u>P</u>
Dissociation	1,18	2.5	>.05
Combination	1,18	1.2	>.05
Control	1,18	1.3	>.05

Table 6

Summary of the MANOVA analysis with RPE (DV)

	<u>DF</u>	<u>F</u>	<u>P</u>
Group effect	2,27	3.80	<.01*
Group by Trial	2,27	1.4151	>.05
Trial effect	3,25	16.501	<.01*

* Significant at the P <.01 level.

Table 7

Summary of the three ANOVA analyses for significant changes in RPE means across trials

	<u>DF</u>	<u>F</u>	<u>P</u>
Dissociation	3,36	.7	>.05
Combination	3,36	.5	>.05
Control	3,36	3.0	>.05

DISCUSSION

The results are discussed in response to each of the hypotheses. Explanation and implications of these results are then considered. Finally suggestions for future research are made.

5.1 Hypothesis 1

The combined treatment group will improve more over the time trials than the dissociation group.

This hypothesis was rejected by the MANOVA which stated the the group by trial effect was not significant $F(2,27) = .60$ $P > .05$. Theoretically, it was assumed that the combination treatment would permit the runners to run closer to their anaerobic threshold. Through the periodic monitoring of their physiological signals runners might have been able to harness their metabolic resources more efficiently. A possible explanation for this result may be the time allocated for the mental skill acquisition. If the subjects had received more extensive mental training, there might have been some difference in the performance scores. This result suggests that the mental training in the combination technique did not improve endurance performance.

5.1.1 Hypothesis 2

The combined treatment group will improve more over the time trials than the control group.

This hypothesis was also rejected because the group by trial effect was not significant $F(2,27) = .60$ $P > .05$. It can be argued that the undirected thoughts of the control group might have enhanced or detracted from performances. The subjects could have been associating, dissociating, using a combination of the strategies, or using no technique at all. A possible solution to this problem would be training the runners to use a Zen technique which enables the individual to execute a skill without the interruption of thoughts. However, Zen masters state that it takes many years to achieve this goal (Nakamura, 1985) which would make such a study impractical. It could be argued that the Zen technique might be the supreme form of dissociation further limiting the use of this technique for control purposes.

5.1.2 Hypothesis 3

The dissociation treatment group will improve more over the time trials than the control group.

This hypothesis was rejected because group by trial effect was not significant, $F(2,27) = .60$ $P > .05$. As with the other hypotheses, this result may in part be explained a lack of mental skill acquisition by the subjects. The subjects adherence to the treatment instructions, and reliance on a maximal effort from the subjects, are some of the uncontrollable variables which may have produced this result.

5.1.3 Hypothesis 4

The perceived exertion for the dissociation treatment group will decrease after each time trial.

This hypothesis was rejected. Although the ANOVA revealed that there was no significant difference in the dissociation RPE scores over the four trials, $F(3,36) = .7$ $P > .05$, there were some small changes in the RPE scores but they were not in the predicted direction. This hypothesis was based on the premise that the distractive qualities of the dissociation technique would shift the focus of the runner away from exercise fatigue. This shift in focus would then alter the perception of exertion so that the task was perceived as demanding less effort. A possible explanation for this result is that the dissociation may not have been effective in distracting the exercise cues. Because there was an increase in effort with improving efficiency as the runner repeatedly ran over the 3,200m time trial, this was likely to have been matched by an increase in the perception of this effort.

5.1.4 Hypothesis 5

The perceived exertion for the combination treatment group will increase after each time trial.

This hypothesis was rejected by the ANOVA $F(3,36) = .5$ $P > .05$. An examination of the raw data did reveal a trend which was in the direction of the hypothesis, however. The increase in perceived exertion could be explained by increased effort through a habituation to the time trial distance. If the periods of association had their desired effect, that is to make the athletes aware of their distribution of metabolic resources, then this could also explain the increase in perceived exertion.

5.1.5 Hypothesis 6

The perceived exertion for the control group will not change after each time trial.

Although there was a slight increase in the RPE score after each time trial this result was not significant $F(3,36) = 3.0$ $P > .05$. If there was a habituation effect, it is possible that this would have been uniform in both the combination and the control group. Because the increase for the control group was minimal and the combination increase greater, thus it is possible that the combination treatment was influencing the subjects perceived exertion.

The RPE scores of each of the treatment groups increased after each time trial (although it should be noted that these increases were marginal and were not statistically significant). This result could be explained by habituation to the time trial conditions and through this habituation the subjects were exerting a greater effort. Habituation to the Borg scale could have explained the results also, the subjects may have used previous exertion assessments as a baseline measure and compared their additional performances to that score.

5.2 Discussion of Self Report Data

Although the statistical analyses generally failed to reach significance, a study of the self report data revealed that each of the treatments were considered useful by the subjects, and that these techniques may have helped to facilitate their performances. This section discusses this self report data and uses direct quotes from the subjects to demonstrate their beliefs.

5.2.1 (a) Combination group

It was theorised that the periods of association would allow the runner to adapt their pace. Anecdotal support for this theory, and for the benefits of the combination treatment group, was provided by most of the subjects in this group. One subject stated " I found it was most effective when I did short associating moments. I did this when I felt myself not working too hard", while another subject stated " during my periods of association I realized that I could go faster, i.e. I was lagging behind during my dissociation periods". One quote demonstrated how the periods of association might mediate pace judgement; " I found that when the music came on or off, I sped up, just at that changing point I would increase my pace ".

Although the subjects anecdotally reported some benefit for using the combination technique the results of this study did not support their claims. Some of the subjects in the combination group apparently thought this technique enhanced their performance, it would seem that expectancy may play a role in determining the perceived effectiveness of this technique. Some of the subjects from the dissociation group made similar claims.

Several runners from both the combination and dissociation groups made a comment alluding to a type of social facilitation effect. One runner stated " I push myself harder when I'm in front of the stands", while another reported " when I come to the home stretch I feel myself running easier and faster". Even though there were no people watching from the stands the runners in all of the groups appeared to speed up in front of the stands. It is likely that the stand conveyed a competitive atmosphere which somehow facilitated their performance.

One subject in the combination group stated " during association, when the music is turned off, I could hear my breathing, I was much more conscious of my fatigue, and if I can't hear myself breath, I don't think I'm tired ". This comment suggested that this person might be better suited to using the dissociation technique, rather than the combination technique.

5.2.2 (b) Dissociation group

The subjects in the dissociation group reported using a variety of methods to achieve the benefits of the dissociation technique. One subject stated " I noted my lap times and tried to calculate in my mind what my final time would be ". Another runner reported that " I focused on my upcoming math test and recited formulas throughout my run. It definitely took my mind off the run and it helped my math test too! ". "I noticed that the distance was extremely effortless, it does appear that as long as I can concentrate and keep the thoughts flowing I don't need to or want to stop running as I used to ". These three quotes demonstrate three different ways of achieving dissociation that were suggested by Lorentzen and Sime (1979); problem solving, diversion, and spontaneity.

From the self report data it became clear that the way of achieving effective dissociation depended on the subjects preference for a particular method. Some subjects found the music to be most helpful in achieving the dissociation, " the louder the music is, the easier it is to dissociate ". Unstructured dissociation also seemed to be effective, " I dissociated by letting my mind wonder, this worked surprisingly well ".

A possible problem with the dissociation technique is that an athlete can become too involved with dissociation, and consequently perform below his/her

ability. One subject in the dissociation group reported " my time was slower than usual, I think it was because I was dissociating and relaxing too much ".

5.2.3 (c) Control group

Since the instructions for the treatment group were nothing more specific than "concentrate on your form throughout the run", the self report data did not provide any information of value. The comments reflected the instructions, " I tried to stay relaxed during my run", etc.

5.3 Summary of Research Problems

A major concern in this study was whether the treatment conditions could be controlled effectively. Extraneous noise, for example, roadside traffic, may have impaired the cognitive treatment manipulations. In addition it was possible that the subjects were not applying the appropriate cognitive manipulations since there was no direct intervention in the runners' cognitions. Practical considerations prevented this possibility.

As commented already, no attempt was made to monitor the thought processes of the control group and this possibly reduced the purity of the control situation. A retrospective interview appears to be a practical way to overcome this problem. The self report data revealed that the subjects of the dissociation group used a variety of methods to achieve dissociation, which questions whether one of these methods is more effective than another ?

Because there was no direct thought intervention for the combination group (see Schomer 1987 for example of direct thought intervention) it is likely that the subjects may have spent more time in one of the cognitive styles than the other.

If the subjects had been instructed to dissociate for a set time then associate for a set time, etc, it might have been possible to evaluate the influence of this technique on performance. It is difficult to direct styles of thought in any test carried out in the field.

In the area of perceived exertion one confounding influence on the results was the time delay between finishing the exercise and indicating a RPE score. A memory factor can change the RPE score after a few minutes rest, for example, the subject might think " the exercise fatigue was not really that bad " !

5.4 Future Research

The underlying research question the study tried to answer was whether mental training could enhance endurance performance. Despite the results of this study, the directional findings suggested that further research is necessary. Some of the questions arising from this study consider whether there had actually been some form of mental skill acquisition. Research should be directed toward determining what kind of feedback has best helped to shape these mental skills. The feedback protocol, that is, the length and type of instructions, the consistency of instruction, are factors which also need to be considered. If there is to be skill learning, a system of identifying and correcting errors is needed. It is not known whether there will be improvements in mental skill as a function of practise, that is, the more you practise the better you become at the skill.

Future research could be directed toward assessing running performance while there is direct thought intervention. For example, adopting a method of intervention suggested by Schomer (1987), runners could be instructed to run laps of a

track using dissociative thought, while each lap time is recorded. Measuring lap times during association intervention may determine whether the association technique has facilitated performance. This experimental protocol could also be used to evaluate various combinations of cognitive style.

Future research should also consider whether the combination of expectancy plus cognitive training enhances endurance performance more than each of these variables separately. It may be possible that expectancy alone, i.e. the belief that you will improve your performance, can improve performance more than other mental techniques alone.

Research in RPE should be directed toward identifying the cognitive mediators of perceived exertion, to date there is limited research to examine these influences on sporting performance. To eliminate the problem of a memory factor in the perception of exertion the RPE could be periodically measured during the activity. The Borg scale could be read out aloud to the subjects as they ran, they would then shout out a number.

5.5 Conclusion

This study attempted to train novice runners with cognitive strategies and to see if these techniques influenced endurance performance. While the results were generally inconclusive the directional findings of this study would seem to warrant further investigation. Because there is a practical application of these strategies to elite and non elite runners, this would seem further justification for further research.

The secondary purpose of this study was to evaluate the influence of the cognitive strategies on perceived exertion. The cognitive strategies did not significantly mediate the perception of exertion. Because perceived exertion and cognitions are important components of endurance performance their relationship would seem to merit further research.

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APPENDIX 1 BORG SCALE

6		
7	Very, Very Light	- This run required almost no effort
8		
9	Very Light	- This was an easy run
10		
11	Fairly Light	- This run did not require too much effort
12		
13	Somewhat Hard	- Although challenging at times, I had plenty left.
14		
15	Hard	- This was a demanding run
16		
17	Very Hard	- I could not keep going for much longer
18		
19	Very, Very Hard	- I am totally exhausted
20		

Choose the number you feel most accurately describes your answer.

To what degree did you follow the treatment instructions during your run today?

APPENDIX 2 QUESTIONNAIRE

- 1
- 2 Not very much
- 3
- 4
- 5 Half of the time
- 6
- 7 Most of the time
- 8
- 9 All of the time

Do you feel the treatments helped you in your performance or training session today?

- 1 Not at all
- 2
- 3 Not very much
- 4
- 5 A fair bit
- 6
- 7 Very much
- 8
- 9 A great deal

Briefly describe your thoughts during the training sessions (or time trial), i.e. What did you think about? What were you concentrating on? What did you notice about yourself or the surrounding environment? What was the most/least effective method that you used in your training today? Do you have any suggestions as to how your cognitive training could be improved?

Choose the number you feel most accurately describes your answer.

To what degree did you follow the treatment instructions? during your run today ?

- 1 Not at all
- 2
- 3 Not very much
- 4
- 5 Half of the time
- 6
- 7 Most of the time
- 8
- 9 All of the time

Do you feel the treatments helped you in your performance or training session today?

- 1 Not at all
- 2
- 3 Not very much
- 4
- 5 A fair bit
- 6
- 7 Very much
- 8
- 9 A great deal

Briefly describe your thoughts during the training sessions (or time trial), i.e. What did you think about? What were you concentrating on? What did you notice about yourself or the surrounding environment? What was the most/least effective method that you used in your training today ? Do you have any suggestions as to how your cognitive training could be improved ?

APPENDIX 3 METHOD OF ASSIGNMENT

After completing an initial time trial (a maximum effort) over a distance of 3,200m, the subjects were assigned to their treatment groups using a matched ability design. According to their performance on this time trial the subjects were ranked from fastest to slowest. The names of the three fastest performers were put into a hat and were randomly assigned to one of the three groups. This process was continued for all subjects, thus each of the groups had a cross section of ability that was approximately equal.



Dear Student:

APPENDIX 4 INFORMED CONSENT FORM

As a Researcher at the University of Victoria, I am conducting research in sports science. It is generally believed that sporting performance is influenced by mental practice. The study that I would like to conduct is designed to investigate exactly what role such practice has in running performance.

For this study I need thirty volunteers to participate in a one-month running program. The volunteers will be asked to complete a short running program four times a week, and to follow prescribed instructions during each run. The volunteers will also be asked to participate in a laboratory test.

This letter is to ask for your consent to participate in this study. As a volunteer in this study you maintain the right to withdraw from this study at any time. You are assured that any data collected from this study will remain totally confidential.

If you have any questions please do not hesitate to contact me.

Yours sincerely,

Gary Barber
Gary Barber

_____, Having attended the introductory lecture and been advised of the content of this research project do hereby consent to participate in this study. While I have not been actively involved in regular sporting activities, I have determined for myself that I am fit and capable of undertaking the level of exertion and frequency of activity which has been explained to me."

Name: _____
(please print)

Signature: _____

Date: _____



UNIVERSITY OF VICTORIA

P.O. BOX 1700, VICTORIA, B.C., CANADA V8W 2Y2
TELEPHONE (604) 721-8373 TELEX 049-7222

SCHOOL OF PHYSICAL EDUCATION

Dear Student:


As a Master's degree student at the University of Victoria, I am conducting research in sports science. It is generally believed that sporting performance is influenced by mental practice. The study that I would like to conduct is designed to investigate exactly what role such practice has in running performance.

For this study I need thirty volunteers to participate in a one-month running program. The volunteers will be asked to complete a short running program four times a week, and to follow prescribed instructions during each run. The volunteers will also be asked to participate in a laboratory test.

This letter is to ask for your consent to participate in this study. As a volunteer in this study you maintain the right to withdraw from this study at any time. You are assured that any data collected from this study will remain totally confidential.

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Yours sincerely,


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"I, _____, having attended the introductory lecture and been advised of the content of this research project do hereby consent to participate in this study. While I have not been actively involved in regular sporting activities, I have determined for myself that I am fit and capable of undertaking the level of exertion and frequency of activity which has been explained to me."

Name: _____
(please print)

Signature: _____

Date: _____

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