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Evidence for a Relationship Between Attentional Styles and Effective Cognitive Strategies During Performance

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Abstract

The purpose of this study was to determine whether a relationship between attentional styles and effective cognitive strategies affects performance. Participants were 60 novice rowers reduced to a group of internalisers ($N = 7$) and a group of externalisers ($N = 7$) through a rigorous use of the Test of Attentional and Interpersonal Style attentional subcomponents (Nideffer, 1976). Each group completed two 15 minute maximal tests on a rowing ergometer: one in an associative condition and one in a dissociative condition in a counterbalanced design. Immediately following both tests, the participants completed a questionnaire evaluating their performance. Results revealed that the internal group completed a significantly greater distance in the associative condition than in the dissociative condition and, conversely, the external group completed a significantly

greater distance in the dissociative condition. Questionnaire responses indicated that participants clearly preferred the strategy most similar to their attentional style.

Introduction

Attention, although widely regarded as being a crucial cognitive resource in sport, has not been studied to the extent of its importance (Maxeiner, 1987; Moran, 1996). James (1890) first described attention as the ability of our mind, amongst various possible objects or thoughts, to focus on just one. In addition, he proposed a corollary inhibition for objects and thoughts that are not the focus of attention. Research within the sports setting has shown that attention can take different forms during exercise and, in particular, that different individuals manifest different styles of attention while performing physical exercise (Nideffer, 1980). Such styles relate to the way individuals attend to internal and external stimuli (Nideffer, 1980) and to the type of sport they perform (Summers & Ford, 1995).

In order to characterize individual attentional styles, Nideffer (1976) developed a personality inventory known as the Test of Attentional and Interpersonal Style (TAIS). The test is comprised of seventeen subscales of which six define the individual differences within attentional abilities that can indicate an individual's attentional strengths and weaknesses (Abernethy, Summers, & Ford, 1998). Three of the subscales relate to an effective attentional style (see Table 1): broad external attentional focus (BET), broad internal attentional focus (BIT) and narrow attentional focus (NAR). The other three subscales refer to ineffective attentional styles (see Table 1): overloaded external focus (OET), overloaded internal focus (OIT) and reduced attentional focus (RED).

Table 1. The Attentional Subscales of the TAIS (Nideffer, 1976)

BET (Broad External)	A high score suggests that the individual is capable of attending to many external stimuli at one time.
OET (Overload External)	The higher the score the more likely that the individual will make mistakes as they are unable to cope with the stimuli they are facing.
BIT (Broad Internal)	A high score indicates that the individual is able to analyse and integrate several pieces of information from internal sources.
OIT (Overload Internal)	The higher the score the more likely the individual will become distracted and confused when having to think and analyse too many things at the same time.
NAR (Narrow Focus)	A high score would indicate that the individuals consider themselves to be able to narrow their attention and focus when necessary.
RED (Reduced Focus)	The higher the score the more likely the individuals will make an error because their attention is too narrow.

Association is a cognitive strategy in which the individual attends to the body's internal related cues such as muscle tension and breathing (Morgan, 1980) and/or external performance information such as distance completed, stroke rate and race position (Scott, Scott, Bedic, & Dowd, 1999). This strategy allows individuals to alter their movement pattern according to body awareness, racing strategy, and muscular tension (Tammen, 1996). Dissociation, on the other hand, is a cognitive strategy in which the performer focuses on external cues, such as daydreaming, admiring the view, and problem solving; thereby restricting the influence of sensory information from the body (Schomer, 1986).

It has been shown, from the initial research by Morgan and Pollock (1977) and Nideffer (1980) to the more recent work of Scott, et al. (1999) that cognitive strategies affect performance. While a narrative review of the literature advocates the use of an associative strategy over a dissociative strategy in performance situations (Masters & Ogles, 1998), there have been many conflicting results in the studies undertaken to determine which cognitive strategy is most effective in maximizing performance

(Pennebaker & Lightner, 1980). For example, Scott et al. (1999) found that rowers who associated performed better than those who dissociated. On the other hand, Gill and Strom (1985) found that a dissociative condition produced superior performances more than an associative condition in a leg extension exercise.

The duration and intensity of the task may play a part in a performer's cognitive strategy. Silva and Applebaum (1989), for example, found that marathon runners finishing in the top 50 places switched between associative and dissociative strategies in the early part of the race (0-8 miles) and were more likely to utilise dissociative strategies in the latter stages of the race (18-24 miles) in an attempt to avoid pain.

Due to the somewhat equivocal results found in previous studies, the suggestion that an associative strategy is more beneficial for performance than a dissociative one may be too simplistic a conclusion in light of the complexity of both the nature of sport and performer. Indeed, the complex nature of sport, performer and their interactions suggest that the effectiveness of different strategies may most importantly depend on individual differences (Gill, 2000). Gill and Strom (1985), for example, found that on a leg extension machine, those using dissociative strategies outperformed those using associative strategies. Nevertheless, although the findings of their study showed that the external focus resulted in superior performance and was preferred by most, there were those who performed better in the internal focus condition and found it more preferable (Gill, 2000).

One question that has not been sufficiently addressed thus far is whether a link exists between attentional styles and effective cognitive strategies. While association and dissociation are two cognitive strategies that are frequently linked with attentional styles (Morgan, 1980; Pargman, 1993) and are sometimes even considered to be synonymous (Moran, 1996), according to Padgett and Hill (1989), these two concepts should be considered as separate. Moran (1996) uses the marathon runner as an example. In adopting an external focus, the runner focuses on specific cues in the external environment such as the lines in the middle of the road. A dissociative technique, however, does not require the runner to focus on specifics but allows them to focus randomly on the condition that the focus remains external. As research between cognitive strategies and attentional styles is conflicting, further research into their relationship is warranted.

While in general, researchers have used the two terms of attentional styles and cognitive strategies interchangeably, there is no guarantee that the measurement of an individual's attentional styles would predict their most effective cognitive strategy. With this in mind, the aim of the research reported here was two-fold: (1) through an experimental research design to determine if by placing an individual in an environment that suits their predicted attentional style, performance would be enhanced, (2) to obtain subjective feedback on the efficacy of the cognitive strategies in both the predicted preferred and non-preferred conditions. Our hypothesis was that internalisers would cover a significantly greater distance in the associative condition than the dissociative

condition and, conversely, that externalisers would cover a significantly greater distance in the dissociative condition than the associative condition.

Method

Participants

Participants were Sports Science university students with a mean age of 22.5 years and mean mass 71 kg. All participants were physically active, without professional sporting experience and familiar with the technique of rowing.

Candidates for participation ($N = 60$, 47 male, 13 female) were voluntarily recruited through the university Sports Science department. Each participant was initially asked to complete the Test of Attentional and Interpersonal Style attentional subcomponents (Nideffer, 1976). Scores from the TAIS were compared against the norms set by Nideffer (1976). In order for participants to be included in the study, they were required to meet two selection criterioncriteria. Firstly, based on the scoring profile set by Nideffer (1976) participants were required to obtain a Z score greater than 0 in either the BET (Broad External Test) or BIT (Broad Internal Test) subscales in order to obtain pure samples (refer to Table 1). Those scoring higher in BET than BIT were placed in the externalisers group and those scoring higher in BIT compared to BET were placed in the internalisers group. Secondly, once placed in a group, candidates were required to have either an internal (BIT) or external (BET) subscale score that was higher than its contrasting overload (OIT and OET). Thus, there were four possible individual profiles and to obtain a pure a sample as possible only the first two were included (1 – internaliser group) BIT > BET & BIT > OIT, (2 – externaliser group) BET > BIT & BET > OET, (3) BIT > BET & BIT < OIT, (4) BET > BIT & BET < OET. The results of this selection process are shown in Table 2.

Table 2. Mean TAIS attentional subcomponent results of internalisers and externalisers in comparison to 0 i.e. above / below average Z score set by Nideffer (1976).

Mean Score	BET	OET	BET - OET	BIT	OIT	BIT - OIT
Internalisers	+ 1.8	+ 3.4	1.6	+ 6.2	- 0.2	6.4
Externalisers	+ 5.85	- 3.14	8.99	+ 3.42	- 0.57	3.99

Note: BET: Broad External Test score, OET: Overload External Test, BIT: Broad Internal Test and OIT: Overload Internal test.

Those unable to meet this criterion were rejected from the selection process resulting in fourteen participants ($N = 14$, 12 males, 2 females) evenly distributed between an externalisers group and an internalisers group.

Procedure

Prior to the first test and after an explanation of the study, participants were asked to complete both an informed consent form and health questionnaire. They were assured of total confidentiality and were permitted to leave the testing at any point. Participants were informed that they would be asked to complete a short questionnaire at the end of each trial concerning their perceived performance. The questionnaire was used to assess subjective reactions to the attentional manipulation and asked: (1) How easy was it for you to adhere to the strategy that you were assigned? (2) As you progressed through the trial how difficult did you find it to concentrate on the set task? (3) Will you continue to use the strategy assigned a similar strategy, to the one set in the test?

All testing was completed using a Concept II rowing ergometer with a resistance setting of 4 for both males and females. Participants were instructed to complete as much distance as possible in the fifteen minutes allotted time in each trial and distance completed, measured using a Concept II LCD, was recorded at five, ten and fifteen minutes. The total test time was selected based on two considerations. Firstly, considering the intense nature of the task, a lengthy task would result in too few participants willing to participate without compensation. Secondly the time is similar to the duration of the Oxford-Cambridge boat race.

Participants were required to complete the task once in a condition that should theoretically fit their attentional style and once in a condition that should not theoretically fit their attentional style:

- *Dissociative Condition* – Participants were denied access to the digital display and instead were asked to answer simple flash card multiplication questions (of recommended age 5-7) to encourage them into dissociating (Rejeski & Kenney, 1987). They were informed that there would be no counting of mistakes and were permitted to answer them at whatever pace they found comfortable. Participants in this condition were informed of their time at five, ten, twelve, and fourteen minutes allowing them to evaluate their pace with respect to the time remaining in order to ensure that they were able to complete as much distance as possible in the allotted time.
- *Associative Condition* – Participants were asked to observe the digital display on the Concept II ergometer which displayed indicated a countdown of the time, the distance completed (m), 500m split and the stroke rate per minute. Participants were requested to read out loud the total distance that they had covered so far every fifteen seconds in order to ensure that they were focusing on the display and thereby associating. Participants were informed of their time at five, ten, twelve, and fourteen minutes to ensure that the two conditions were as similar as possible.

Each trial lasted for fifteen minutes each with Participants were specifically requested not to use associative techniques during the dissociative condition and conversely dissociative techniques in the associative condition. The order of the trials was counterbalanced, and the trials were separated by a minimum of one week. All trials were preceded by a warm-up of the participant's own choosing and at the same time of day. No caloric intake prior to performance was recorded for either trial.

Statistical Analysis

A three-way analysis of variance with repeated measures (Group x Tasktype x Time) was used to compare the performance of the internalisers and externalisers (Group) in the associative and dissociative conditions (Tasktype) at five, ten and fifteen minutes (Time) using a 5% significance level. Post hoc analyses were performed using the Tukey Honestly Significance Procedure.

Results

Performance Results

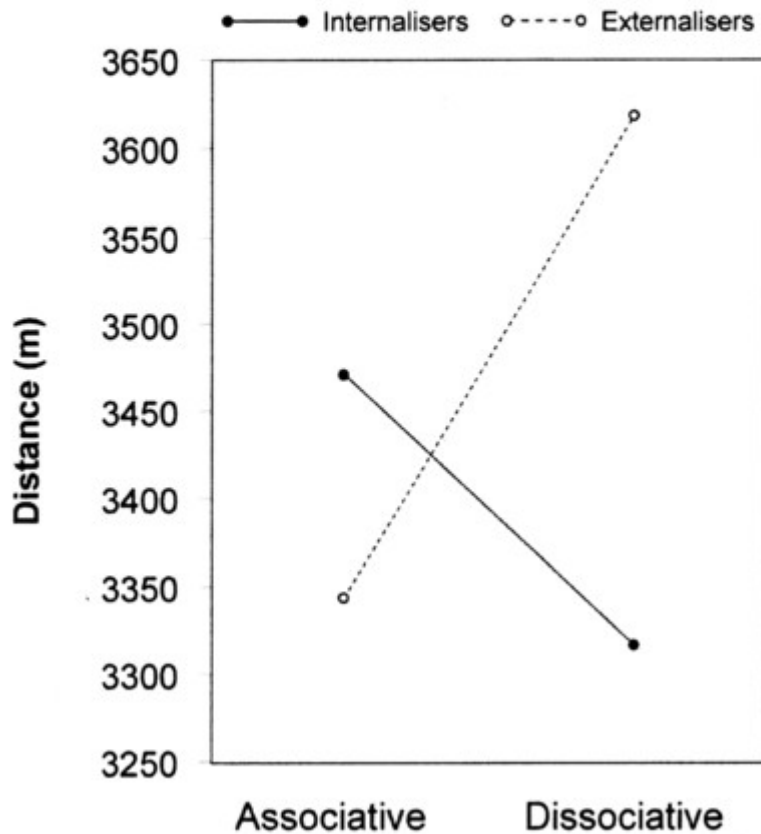
The Group x Task x Time (2 x 2 x 3) repeated measures ANOVA on the performance data (Table 3), using a Greenhouse – Geisser correction due to the significance of Mauchley's Test of Sphericity ($p < .05$), showed no main effect for Task ($F^{(1, 12)} = 0.069, p < .05$) and no interaction of Task with Time ($F^{(1, 296, 15.553)} = 0.189, p < .05$).

Table 3. Associative and dissociative group performance means and standard deviations (S.D.) in the associative and dissociative tasks.

Task	Group	5 min		10 min		15 min	
		Mean	SD	Mean	SD	Mean	SD
Associative	Internalisers	1167	136.6	2301	279.1	3471	394.7
	Externalisers	1170	217.3	2272	397.7	3343	536.3
Dissociative	Internalisers	1120	165.2	2210	289.5	3316	417.0
	Externalisers	1221	167.4	2391	283.7	3618	383.0

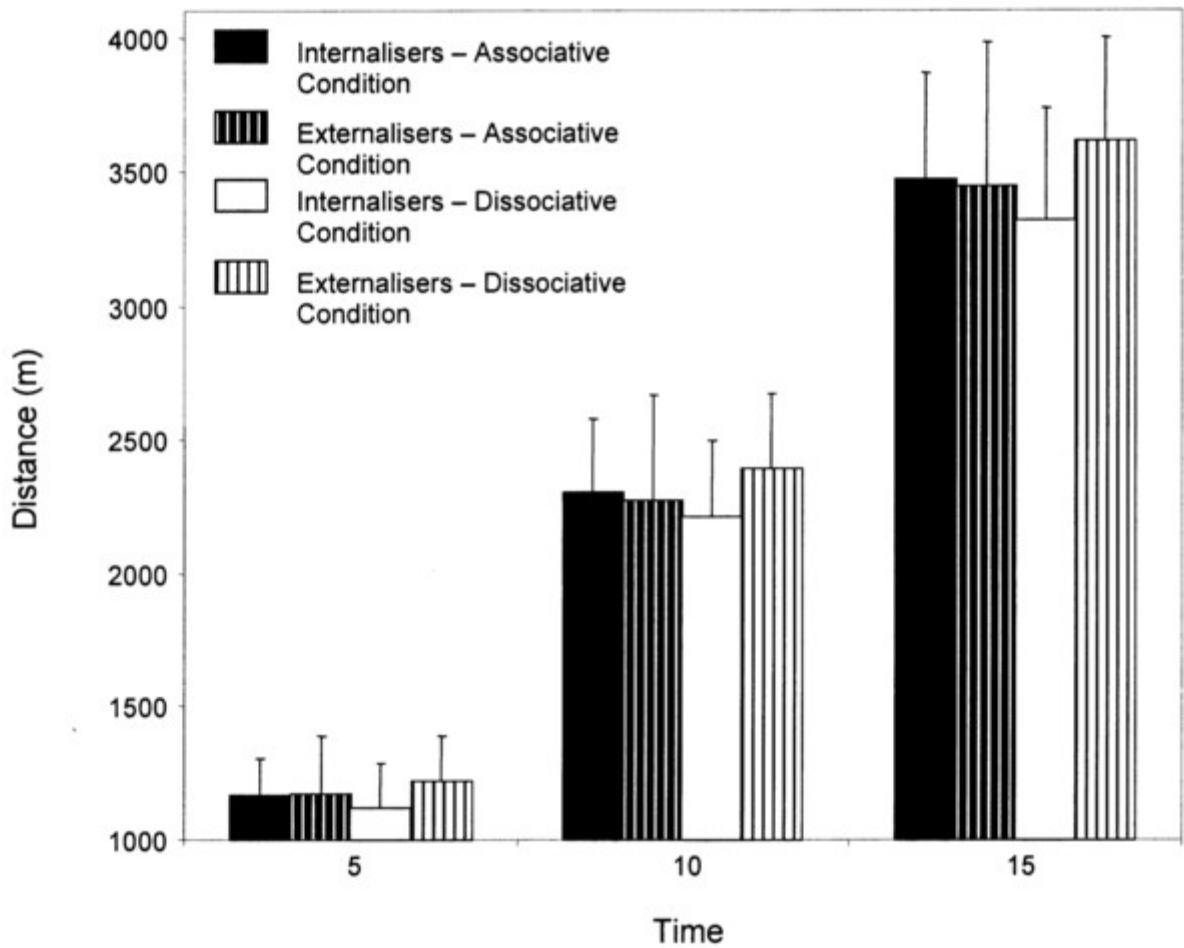
There was, however, a significant Task x Group crossed interaction ($F^{(1, 12)} = 10.762, p < .05$) with internalisers performing significantly better in the associative condition than in the dissociative condition while externalisers performed significantly better in the dissociative than the associative condition (see Figure 1).

Figure 1. Performance of internalisers and externalisers during associative and dissociative conditions at the end of the trial.



Results also revealed a significant Group x Task x Time interaction ($F^{(1.296, 15.553)} = 17.155, p < .05$) showing that externalisers in the dissociative condition were the most effective over time (see Figure 2). Tukey's Honestly Significant Difference post hoc tests failed to reveal a significance after five minutes ($p < .05$), but significant differences were found at both ten minutes ($p < .05$) and fifteen minutes ($p < .05$) where internalisers performed significantly better in the associative condition than in the dissociative condition, and externalisers performed significantly better in the dissociative condition than in the associative condition.

Figure 2. A comparison of internalisers and externalisers in both experimental conditions.

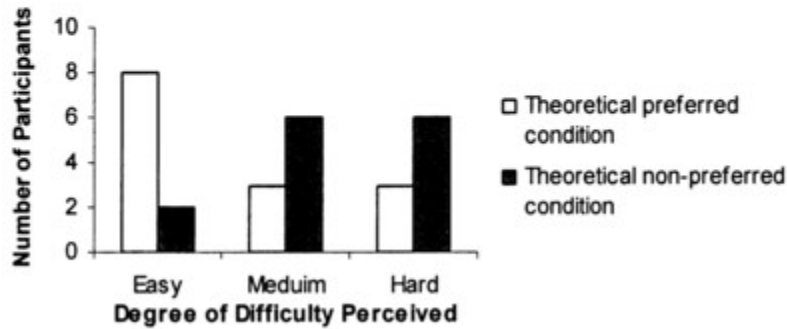


Note that externalisers showed the largest contrast in performance between the dissociative and the associative context over time.

Questionnaire Responses

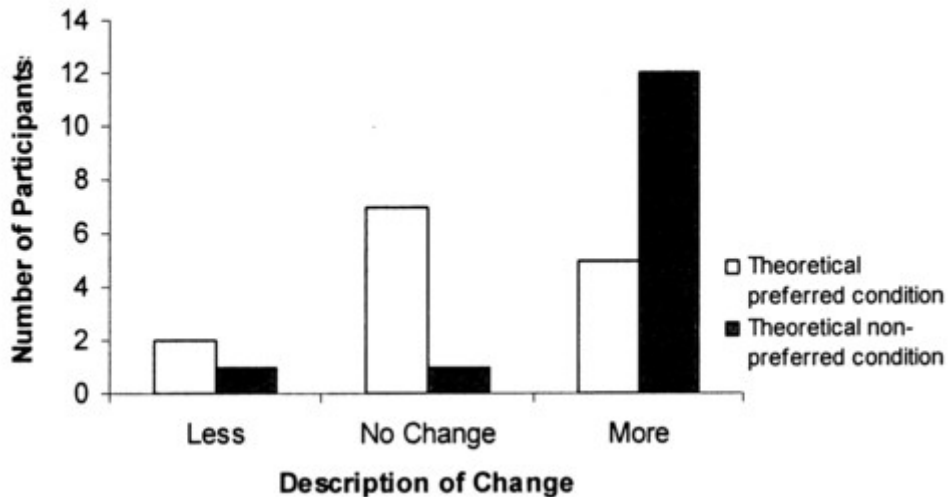
Questionnaire responses were consistent with performance results overall. Because the data was based on an ordinal scale, the Mann-Whitney U test was employed. Participants found it significantly more difficult to adhere to their predicted non-preferred cognitive strategy than their predicted preferred cognitive strategy ($U = 56, p = 0.041$, see Figure 3).

Figure 3. Degree of difficulty in adhering to the cognitive strategy set.



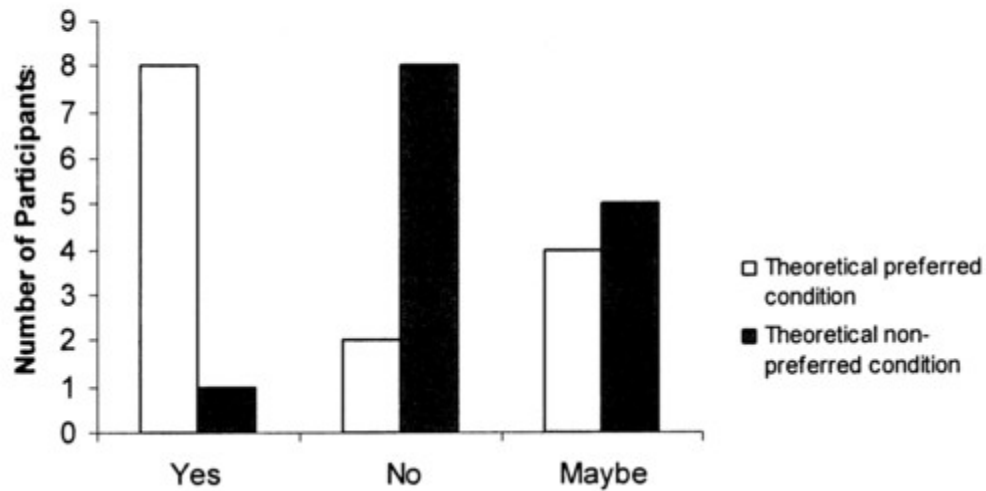
As time progressed, participants found it significantly more difficult to concentrate in their theoretical non-preferred condition ($U = 51.5, p = 0.014$, see Figure 4).

Figure 4. Change in the difficulty of concentration as the trial progressed.



Finally, a significant interaction was found between participants' responses concerning future cognitive strategies and their predicted preferred cognitive strategy ($U = 38, p = 0.003$, see Figure 5). Participants clearly favored the cognitive strategy most similar to their TAIS-obtained attentional style as the majority indicated that they would be employing this strategy in the future. Of the fourteen participants, eight stated that they would be using this strategy in future, four were unsure of their strategy and two indicated that they would not be using the strategy in future.

Figure 5. Future use of the cognitive strategy set in both conditions.



Discussion

The findings of this study supported the prediction the main hypothesis that when employing a cognitive strategy that suits a preferred attentional style, performance can be enhanced. Conversely, employing the alternative strategy appears to have a debilitating effect. Post questionnaire responses indicate that individuals consciously prefer to attend to a cognitive strategy that correlates to their attentional strengths. The lack of consideration for individual attentional preferences in research addressing associative and dissociative strategies may account for the somewhat equivocal results obtained previously (Gill, 2000).

Because no previous research into effective cognitive strategies has considered the possibility that attentional styles may influence performance, it is difficult to compare directly our results with previous findings. However, numerous similarities and some differences with previous research are worth considering.

It has also been shown that novice rowers, when encouraged to associate, outperform those encouraged to dissociate (Scott et al., 1999). The results of our study, however, suggest that those who are encouraged to associate would improve more provided that their attentional style is dominantly internal. While employing non-elite rowers could be considered a weakness of this study, participants were unlikely to have developed any previous cognitive strategies in relation to professional training, thus increasing the likelihood that they could be manipulated into the strategy at test (Weinberg, Smith, Jackson, & Gould, 1984). Further research studying elite athletes may provide complementary insight in this matter.

It has also been suggested that attentional styles are modulated by the intensity of the exercise. Although Schomer (1986) reported that runners will use associative coping

strategies during the latter stages of the race, Silva and Applebaum (1989) found that marathon runners were more likely to use dissociative strategies.

This study suggests that in the latter stages of a performance, athletes find it increasingly difficult to adhere to their non-preferred strategy as determined by the TAIS attentional subcomponents. Of the fourteen participants in this study in their non-preferred condition, all but two reported that as the trial progressed it became more difficult to concentrate on the set task. In the participant's theoretical preferred condition, however, only five of the fourteen participants found that it became more difficult to concentrate while the remaining nine reported either no change or that it became easier (see Figure 4).

It has also been suggested that attentional strategies change from dissociative to associative as the exercise progresses (Schomer, 1987; Smith, Gill, Crews, Hopewell, & Morgan, 1995). Schomer's study of runners suggested that because the later stages of a run require more of the depleted energy stores and more mental focus, association would help monitor somatic sensations better and subsequently allow the individual to optimize the exercise. The present study suggests that rather than those placed in the dissociative condition finding it more difficult to adhere to the required task as time progressed, adherence suffered the greatest in the TAIS selected non-preferred condition of both groups (see Figure 3). In light of this, further development in this field of study could measure the interaction of intensity with attentional styles in order to give a more accurate picture of how intensity and perceived exertion interrelate as in the study by Johnson and Siegal (1992).

Another consideration that must be taken into account is that it is not the associative or dissociative strategy per se which alters performance, but the task-strategy combination (Clingman & Hillard, 1990). In order to test this hypothesis, Clingman and Hillard (1990) examined the effects of attentional focus on race walking performance. Although they found that there were no differences between employing an associative or dissociative strategy, those who were asked to focus their attention on stride length performed significantly better than those who were asked to focus on cadence. This suggests that athletes can improve their performance by focusing on critical variables and the improvement is dependent on what the athlete is attending to (Clingman & Hillard, 1990). Recent research would suggest that focusing attention on movement technique results in a superior performance and an enhanced learning effect than when compared against a target related focus of attention (Wulf, McNevin, Ritter, & Toole, 2000). On the basis of this evidence it is possible that some participants may not have performed as well as they could have due to being forced to focus on variables that were not conducive to their individual preference. Research into the two dimensional classification system proposed by Stevinson and Biddle (1999) may prove fruitful in clarifying this issue. It is suggested that future research either test participants in more than one internal / external condition (for example counting backwards) or allow the participants themselves to select a preferred condition. The danger of the second option, however, is that the participant may not know which specific condition is best for them. Consequently, it might be

prudent for future research to incorporate a third test into the study as a control measure in which the participants are permitted to identify their own preferred cognitive strategy.

It has been found that the complexity of the dissociative task bears no significant effect on participants' performance and that task complexity should be set at an intermediate level (Rejeski & Kenney, 1987). With the use of a task such as multiplication, however, what may prove to be a simple cognitive task for one individual might be considered complex to another and by placing all participants under the same cognitive conditions, the performances of some might have been affected. Because the idea of a preference regarding task complexity is sound, a future recommendation would be to allow the participant to experience different tasks of variable complexity prior to any testing thus allowing them to select at what complexity-level they prefer to perform.

Finally, this study was based on a mixed gender of participants who had no previous experience of their task and therefore the results may not necessarily be applicable to elite, experienced athletes. Because participants completed no journaling as part of the study, it may be that some used inappropriate techniques at critical times during the study. As such, future research may wish to replicate this study using variable skill levels, intensities and task complexities as well as considering the athletes' preferred sport and gender.

Conclusion

This study shows that endurance performance can be affected by the combination of individual attentional styles and cognitive strategies. While experimental in nature, the study provides an indication of the direction future research may wish to pursue. The results indicate that although the task type, intensity of the exercise, the type and complexity of the cognitive task and the level of ability are all likely to play some part in determining what cognitive strategy is most effective for an athlete, what may be the most important factor is their dominant attentional style. By determining their dominant style athletes could therefore be advised to use an effective cognitive strategy most suited to them in order to help produce their best possible performance.

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