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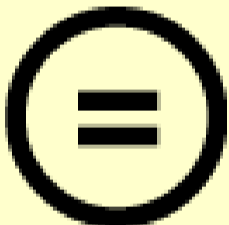
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Cognitive Interference in Sport

by

Antonis Hatzigeorgiadis

A Doctoral Thesis

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ABSTRACT

The present investigation examined the role of cognitive interference in sport. In Study 1 an instrument to assess intrusive thoughts athletes experience during performance was developed (Thought Occurrence Questionnaire for Sport; TOQS). In the first part of the study, which involved modification of an instrument constructed in educational settings, three types of thoughts were identified. These were 'performance worries', 'situation irrelevant thoughts' and 'thoughts of escape'. In the second part of the study, which involved validation of the modified instrument, support for the psychometric properties of the TOQS was provided through tests of convergent, concurrent and discriminant validity.

Study 2 examined situational antecedents of cognitive interference. Discrepancies between expected and actual performance was identified as the best predictor of cognitive interference athletes experience, whereas cognitive anxiety was found moderately related to cognitive interference. Finally, it was found that athletes experiencing their anxiety states as facilitative reported less cognitive interference than athletes experiencing their anxiety states as debilitating.

Study 3 investigated possible effects cognitive interference has on aspects of sport performance based on athletes' perceptions. Participants reported cognitive interference to be detrimental to their concentration. Furthermore, it was revealed that different types of thoughts influence effort input in different ways. The relationship between 'performance worries' and subsequent effort depended on goal attainment expectancies. Athletes holding higher expectancies reported that their worries resulted in increased effort, whereas athletes holding lower expectancies reported their worries to result in decreased effort. 'Situation irrelevant thoughts' were reported not to have any effects on subsequent effort, while 'thoughts of escape' were associated with decreases in effort.

Finally, Study 4 examined relationships between achievement goal orientations and cognitive interference. A negative relationship between task orientation and thoughts of escape was the only strong and consistent association that emerged. Goal profiles analysis revealed that, in contrast to athletes holding self-referenced goals, for those

holding comparative goals outcome is an important determinant of withdrawal thoughts. The results of the present investigation are discussed in relation to findings in educational and sport settings, and a conceptual model regarding the role of cognitive interference in sport is proposed. Overall, cognitive interference is identified as a topic which requires further examination in the sport psychology domain.

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Chapter 1. Introduction

Concentration is a feature of sport performance whose importance is increasingly acknowledged. It is getting more common to hear athletes, coaches, and sport experts to attribute quality of performances to concentration, and also discuss the detrimental effects its momentary loss might have. In fact, it is very rare that sport programmes, or interviews examining athletes' post-performance attributions, do not include references to concentration. Many examples of athletes' accounts regarding the importance of concentration can be found in applied sport psychology texts (e.g. Butler, 1996; Orlick, 1990).

Furthermore, its importance is recognised within the scientific spectrum. Sport psychology practitioners and theorists have demonstrated and supported the significance of concentration. For example, Nideffer (1993) stated that the ability to concentrate on a task is almost universally recognised as the most important key to effective performance in sports. Similarly, Singer, Cauraugh, Tennant, Murphey, & Lidor (1991) proposed that the ability to concentrate on the task without being distracted by irrelevant cues leads to better accomplishments. In a most emphatic fashion, Winter & Martin (1991) suggested that without good concentration, no amount of skill, fitness, or motivation is going to get athletes to their peak, and Orlick (1990) stated that if there is one mental skill that distinguishes successful from less successful athletes, it is the ability to adapt and refocus in the face of distractions.

Nevertheless, attention has captivated the interest of psychologists for almost a century. According to Moran (1996) three aspects of attention have been main areas of interest to psychologists. First, 'selective attention', which refers to the process by which an individual selectively attends to stimuli in preference to others (Kahneman, 1973); second, 'divided attention', which refers to the ability of individuals to efficiently spread mental resources across several concurrent actions (Eysenck & Keane, 1995); and third, 'alertness', which refers to the ability to prepare and sustain a state of readiness to process certain signals (Posner & Petersen, 1990).

Although attention has a relatively long research history, there are issues that have been neglected. Among these, one that seems of particular importance is individuals'

distractibility by self-generated thoughts. As Moran (1996) points out, despite its practical importance, athletes' vulnerability to such distractions have attracted relatively little attention within the cognitive psychology framework. Furthermore, from a methodological perspective, Eysenck & Keane (1995) reported that most of the research dealing with concentration has been concerned with attention to the external environment, ignoring athletes' tendency to allow their thoughts to wander in spite of their efforts to keep concentration high. Moran (1996) refers to these interfering thoughts as 'internal distractions' which disrupt individuals' attention from the task to be performed.

Internal distractions and 'mind-wandering' has received considerable attention in educational settings. Klinger (1996) identifies that human thought shifts focus at a high rate. Stemming from research with individuals trained to estimate the duration of their thoughts, Klinger (1978) reports that the median length during which thought content remain on the same topic is about 5 seconds, with a mean of 14 seconds, which means that thought content on average people shifts about 4,000 times during a 16-hour day, that is approximately 4,000 distinct thoughts per day. Thus, rapid thought shifting is a normal phenomenon.

This phenomenon, however, can become problematic when thoughts shift away from the individuals' immediate goals. Thus, when attempting to complete a task from which thought content keeps drifting away, thoughts that come to the fore are considered interfering and prevent effective accomplishment of the task. Recognising that what people think influences their behaviour (Sarason, Pierce, & Sarason, 1996a), psychologists have emphasised the need to empirically demonstrate the relationships between specific types of cognitive events and processes on the one hand and actions on the other.

In educational psychology, where the quest regarding thought shifting during task performance initiated, the term cognitive interference has been used to describe such disruptions of concentration, and refers to thoughts that occur while executing a task, and are not related to the execution itself. In this context, cognitive interference has been described as task-irrelevant, self-preoccupied thinking including components of worry about performance (Sarason, Sarason, & Pierce, 1990). The concept of cognitive

interference was generated through an attempt to investigate the relationship between test anxiety and cognitive performance. Thus, cognitive interference was introduced as an effect of test anxiety (Deffenbacher & Deitz, 1978; Wine, 1971) and was hypothesised to be the factor that resulted in impaired performance. According to Sarason's (1984) propositions, interfering thoughts lessen individuals' effective behaviour by diverting attention from task relevant cues and using cognitive resources which otherwise could be used for task-processing purposes. Thus, the importance of investigating cognitive interference during task performance is clearly evident in psychological research.

As already stated, the interest in cognitive interference emerged from an attempt to explain relationships between anxiety and performance in achievement settings. In the field of sport psychology anxiety has always been one of the most widely researched topics (Biddle, 1997). However, considering the complexity of a phenomenon like anxiety and the fact that sport psychology is a relatively new scientific discipline, a great deal remains to be explored in this area. Hanin (1998) reviewing what is known and with regard to advances in sport anxiety research suggested that among the questions that have to be addressed in future research is how anxiety functions during competition. Cognitive interference which refers to the occurrence of intrusive thoughts athletes experience while performing can be described as one of the components of anxiety during competition. In reverse to the above proposition, it can also be suggested that the cognitive element of anxiety during competition can be described as one of the components of cognitive interference athletes experience while performing.

Despite its apparent importance, cognitive interference has not been widely investigated within the sport context. The present investigation is an attempt to partially fill this gap in the literature by giving a preliminary insight on the role of cognitive interference in sport. In Chapter 2 the literature related to the purposes of the investigation will be reviewed. This includes references to theories and findings from educational settings where cognitive interference has been widely studied, and also research on sport anxiety, which has been the major focus of sport performance-related research, and has been identified in educational research to be closely related to cognitive interference. Chapter 3 describes the development of an instrument to assess cognitive interference in sport, based on the Thought Occurrence Questionnaire (TOQ; Sarason, Sarason, Keefe,

Hayes, & Shearin, 1986), an instrument developed and used in educational research. Chapter 4 deals with the first research question, that is situational determinants of cognitive interference athletes experience while performing. In Chapter 5 attention is drawn to whether and how cognitive interference might affect performance. Chapter 6 investigates cognitive interference in relation to motivational issues, and in particular achievement orientations. Finally, in Chapter 7, an overview of the findings is made and the main points of the investigations are discussed.

Chapter 2. Review of Literature

This review of literature consists of two parts. The first focuses on research in educational settings where theories regarding cognitive interference have been developed and tested, thus providing sound theoretical grounds on which the current investigation can be based. Considering that advances in cognitive interference theories were founded on anxiety-related research, the second part focuses on anxiety research in sport. Based on the developments in educational psychology and driven by current sport anxiety literature, the major research questions of the present investigation will be formulated.

Cognitive Interference

Several definitions regarding cognitive interference can be found in the various psychological textbooks, however they all are similar. For example, Sarason, Pierce, & Sarason (1996b, p.139) states that “cognitive interference refers to intrusive thoughts – thoughts that are unwanted, undesirable, and perhaps disturbing”. Sarason & Stoops (1978) describes cognitive interference as intrusive thoughts individuals experience that compete for attentional resources while performing a task. Finally, Yee & Vaughan (1996) refers to it as thoughts that detract from on-task activity. Put together in a more complete description, cognitive interference refers to thoughts individuals experience while performing on a task, which are not related to the execution of the task and therefore interfere with mental processes aiming at task completion.

Going beyond defining cognitive interference Sarason et al. (1996b) argues that cognitive interference can be looked at as the loss of control over one’s thoughts, and that it is a joint product of exposure to challenging or threatening situations and vulnerability to self-focused cognitions, such as worry and preoccupation. A more detailed account of the antecedents and consequences of cognitive interference will be presented throughout the literature review.

As already stated in the introduction, cognitive interference emerged through research on test anxiety, which is one of the most thoroughly investigated areas in psychology

within the last century. In order to better understand how cognitive interference theory was developed references to test anxiety theory and research are essential.

From test anxiety to cognitive interference

Mandler & Sarason (1952), the originators of test anxiety theory, based their propositions on the assumption that in test situations two kinds of drives are evoked: a) learned task drives which are reduced by response sequences leading to the completion of the task, and b) learned anxiety drives which elicit two kinds of responses; those related to task completion, which are anxiety reducing, and those interfering with task completion, which can be manifested as feelings of inadequacy, helplessness, or anticipation of loss of status and esteem. The latter have been characterised as self-rather than task-centered responses.

Subsequently, it was suggested (Sarason, 1960) that high test anxious persons are more self-deprecatory and self-preoccupied than persons lower in test anxiety. Evidence to support this proposition has been provided by a number of studies (e.g. Sarason & Ganzer, 1962; Sarason & Ganzer, 1963; Sarason & Koenig, 1965). In these, individuals with extreme scores on test anxiety were tested on unstructured verbal conditioning paradigms, after being assigned to non-reinforcement, positive reinforcement, and negative reinforcement experimental groups. Overall, the findings indicated that (a) regardless of experimental condition, highly anxious individuals generally described themselves in more negative terms than low anxious individuals, (b) high anxious individuals were extremely responsive to negative self-reference reinforcement, and (c) high anxious individuals did not produce more positive self-references when positively reinforced.

Furthermore, it was hypothesised that these kind of reactions emerge especially under evaluative situations. As Sarason, (1960, p. 405) stated, “subjects scoring high and low in anxiety differ in the response tendencies activated by personally threatening conditions. Whereas low scoring subjects may react to such conditions with increased effort and attention to the task at hand, high scoring subjects respond to threat with self-oriented personalised responses.” Marlett & Watson (1968) found that post-test reports of high anxious individuals included more self-focused thoughts than those of low

anxious individuals, and Ganzer (1968) reported that test situations in the presence of an audience evoked more self-referenced, self-evaluative thoughts in high anxious individuals, than in low anxious ones. Accounting for the above findings, Marlett & Watson (1968) concluded that high test anxious persons spend a part of their task time doing things which are not task oriented. They worry about their performance and about how well others might do, ruminate over choices open to them, and are often repetitive in their attempts to complete the task.

Consequently, investigations examined whether high test anxious individuals perform more poorly than low test anxious ones, under evaluative conditions. In general, experiments have involved task performance in the presence of an audience (e.g. Cox, 1968; Ganzer, 1968) and test situations under instructional variation regarding the importance of the evaluation (e.g. Paul & Eriksen, 1964; Sarason & Minard, 1962). Studies utilising audience presence revealed that performance of high test anxious individuals was debilitated, whereas performance of low anxious ones was facilitated. With regard to the studies utilising instructional variations, results supported an interaction between anxiety levels and evaluation emphasis. In particular it has been found that (a) following highly evaluative instructions performance of high anxious individuals was lower than following non-evaluative instructions, while the opposite effects occurred for low anxious individuals, (b) high anxious individuals performed more poorly than low anxious ones under highly evaluative instructions, while under non-evaluative instructions the former performed better than the latter, and (c) following minimal task instructions high and low anxious individuals displayed similar levels of performance.

Meanwhile, Liebert & Morris (1967) introduced a different conceptualisation of anxiety. They suggested that anxiety could be separated into two major components, worry and emotionality. Within this approach, worry has been described as cognitive concern about the consequences of failing (Liebert & Morris, 1967), preoccupation with performance (Doctor & Altman, 1969), or cognitive concern about one's performance (Spiegler, Morris, & Liebert, 1968), whereas emotionality has been described as one's perceptions of the physiological elements of anxiety, that is indications of autonomic arousal and unpleasant feeling states such as nervousness and tension (Morris, Davis, & Hutchings, 1981). Research on the possible antecedents and the temporal patterning on

the two anxiety components supports the distinction (e.g. Morris & Liebert, 1973; Spiegler et al., 1968).

Consequently, the relationship between worry, emotionality and performance was investigated. A number of studies (e.g. Doctor & Altman, 1969; Morris & Liebert, 1970; Tyron, 1980) supported that worry was consistently and more strongly related to academic performance decrements than emotionality. Furthermore, Morris, Smith, Andrews, & Morris (1975), employing a motor task paradigm, found that worry was related to performance in one of the three experiments they conducted, whereas emotionality was not in any of them.

Based on the above findings, Wine (1971) suggested an attentional interpretation of the aversive effects of test anxiety on performance. Cognitive interference, being described as task-irrelevant, self-preoccupying thinking including components of worry over performance, was considered a product of test anxiety which was hypothesised to have detrimental effects on performance by diverting attention from the task at hand and using up resources that otherwise could be used for task-processing activities. Based on the assumption of Wine (1971) and further suggestions by Deffenbacher & Deitz (1978) and Marlett & Watson (1968), cognitive interference began to be investigated as a mediator of the relationship between test anxiety and performance. Sarason & Stoops (1978) examined the relationship of test anxiety and cognitive interference with subjects performing a task presented as an intelligence test. Their results indicated that high test anxious subjects experienced more cognitive interference. Moreover, the results were enlightening about the nature of the thoughts people have while performing. In particular, high test anxious individuals during task performance were preoccupied about how poorly they were doing, how other people were coping, and what the examiner will think of them.

Sarason (1984), testing a new instrument (Reaction To Test), examined the correlation of its four subscales, namely worry, tension, test-irrelevant thinking, and bodily symptoms, with cognitive interference. He found that worry had the highest correlation with cognitive interference. Furthermore, the fact that the thoughts individuals have when expecting to be evaluated were more consistently related to performance than the test anxiety measures which include emotional reaction was attributed to that worry

over performance is specific to evaluative situation, while emotionality is not. He concluded that high tension combined with worry might have debilitating effects, while high tension alone might have neutral or even facilitative effects, by increasing motivation, especially when the person has overlearned appropriate responses. Furthermore, a number of studies has provided support for the relationship between test anxiety and cognitive interference. Zatz & Chassin (1983) reported that during an anagram task high test anxious children experienced more negative and task-irrelevant thoughts than moderate and low anxious children, while in similar tasks, Arkin, Detchon, & Maruyama (1982), Bruch, Juster, & Kaflowitz (1983), Defenbacher (1978), Deffenbacher & Hazaleus (1985), Gallassi, Frierson, & Sharer (1981), and Hollandsworth, Glazeski, Kirkland, Jones, & Van Norman (1979), found that high levels of test anxiety were associated with more frequent negative and interfering cognitions during performance.

Thus, it can be supported that research on test anxiety has progressively moved towards the formulation that test anxiety impairs performance through interference of self-preoccupying task worries and task irrelevant thoughts. Paulman & Kennelly (1984), examining information-processing deficits in a dual-task paradigm related to cognitive interference, found that elevated cognitive interference scores were associated with lower test performance. Miculiner (1989), in a study concerning learned helplessness, reported similar results. Examining performance differences between high and low cognitive interference scorers in a memory and visual search task following unsolvable problems, he reported that the more frequent the subjects' mind-wandering, the less accurate their performance. He supported that excessive engagement in self-concerned thoughts and in off-task cognitions are important antecedents of performance deficits. Seibert & Ellis (1991), examining the relationship between task-irrelevant thoughts, which they described as thoughts that did not facilitate successful task performance, and performance on a memory task, found that the more irrelevant thoughts participants reported the worse their performance on the task. Finally, Hoffman (1993) reported that in a computer-based task cognitive interference, and in particular task-related worries, was a significant predictor of performance.

Based on findings linking test anxiety to performance deficits which were attributed to cognitive interference effects, treatment programmes directed towards anxiety reduction

were designed and applied to test anxious individuals. Such programmes, if effective, should result in anxiety reduction and performance improvement, thus confirming the hypothesised detrimental effects of anxiety on performance. However, results from studies examining treatment effects were not fully supportive of the hypotheses (e.g., Allen, 1971; Kirkland & Hollandsworth, 1980; Mitchel & Ng, 1972; Tyron, 1980). In particular, despite the fact that treatments have been successful in reducing anxiety, their effects on academic performance has not been equally impressive, thus further questioning the causes of performance decrements.

Attempting to explain the failure of treatment programmes and based on findings supporting significant associations between test anxiety and study skills (e.g. Culler & Holahan 1980; Paulman & Kennelly 1984; Witmaier, 1972) Culler & Holahan (1980) stated that test anxiety represents a problem of broader behavioural scope. Offering a somewhat different approach to the issue of test anxiety they suggested that the relationship between test anxiety and academic performance is at least partially a function of differential study-related behaviours between high and low anxious persons. Thus, poor performance of high test anxious individuals should be, at least partly, attributed to inadequate study skills, resulting in poor knowledge of the tested material, which also suggests that test anxiety might be a result of knowledge of inadequate preparation.

Benjamin, McKeachie, Lin, & Holinger (1981) attempting to account for such an approach, tested the applicability of an information processing model that combined the originally hypothesised interference explanation (Sarason, 1984; Wine, 1971) with the study habits hypothesis (Culler & Holahan, 1980). They concluded that worry reported by test anxious individuals may not be entirely a personality characteristic, but also a result of inadequate knowledge of the subject matter.

Concerns regarding the study-skills deficits model were expressed by Tobias (1985) who suggested that the model could not entirely explain performance disadvantage of high anxious individuals. He argued that such an explanation makes it difficult to understand findings showing skilled students to be highly anxious (Culler & Holahan, 1980). If the skill deficits hypothesis is correct, these students should have little reason to be anxious, as their anxiety scores cannot be explained by deficits in study skills.

Furthermore, Tobias (1985) suggested that the study skills deficits hypothesis also makes it difficult to understand how anxiety reduction treatments can succeed in reducing anxiety, but not performance. If anxiety is caused by awareness of inadequate preparation, reductions of anxiety through treatment cannot be justified, because if anxiety is considered as lack of preparation, students should continue being anxious after the treatment, since no improvement on that matter has been achieved. Although it is possible that the treatment effect might be that individuals learn to feel better about the situation, those positive feelings cannot be attributed to perceived mastery.

In relation to this particular conflict and based on findings revealing different performance characteristics for anxious individuals with different study skills Paulman & Kennelly (1984) and Naveh-Benjamin (1991) proposed that two different types of anxious students may exist. Those with effective study skills and sufficient knowledge of the subject, but who fail to use their efficiency due to task-irrelevant responses (interference) occurring during a test situation, and those with insufficient study skills for whom increases in anxiety represent awareness of inadequacy. Naveh-Benjamin (1991) and Naveh-Benjamin, McKeachie, & Lin (1987) provided support for this kind of distinction by testing performance of high anxious students in evaluative and non-evaluative situations. In particular, he found that anxious students with good study skills performed well in the non-evaluative condition, whereas those with poor study skills performed poorly on both the evaluative and non-evaluative conditions. He found that students with good skills and knowledge of the tested material were able to perform when not evaluated, as irrelevant responses did not interfere with task relevant cues, which should be the case under evaluative situations when anxiety levels rise. In contrast, those with poor study skills performed poorly on both occasions due to learning/knowledge deficits. Despite the fact that a cognitive interference interpretation of the test anxiety/performance relationship was supported, the above conflict contributed to a better understanding of the test anxiety responses and the way these are related to performance.

Further research on cognitive interference has tried to identify factors other than test anxiety that generate, or interact with test anxiety contributing to the appearance of interfering thoughts. Arkin et al. (1982) found interactions between test anxiety and task difficulty and also reported perceived ability as another factor predicting cognitive

interference. Zatz & Chassin (1985) reported classroom environment to be a factor influencing the appearance of negative thoughts. Previous performance, examination importance, perceived preparation, grade expectation, were reported by Hunsley (1987) to predict negative internal dialogue on at least one of five examinations. Finally, Seibert & Ellis (1991) found increases in frequency of thoughts that were not related to the task at hand under conditions of happy and sad emotional mood states. Taken together the above findings suggest that despite the fact that anxiety seems to be the most reliable predictor of cognitive interference, other factors can contribute in explaining the generation of interfering thoughts either independently or by interacting with anxiety.

Cognitive interference theory, as originated by Wine, Sarason and colleagues, and subsequently researched within educational contexts, represents a personality/social psychology approach to the issue of cognitive activation that occurs during performance (Yee & Vaughan, 1996). Within this approach, the key elements in the definition of cognitive interference are that thoughts individuals experience (a) occur at the conscious level, (b) are mainly related to worries, and (c) are internally generated. In relation to these principles, assessment of cognitive interference is based on self reports which allows an insight to individuals' experiences and conscious thoughts. Despite the appeal arising from its face validity, this approach is not free of problems. People are not always aware of the processes in their own minds, and in addition retrospective self reports cannot always be considered accurate, since they are dependent on memory. Thus, even though a personality perspective may uncover relationships between psychological constructs, it is unlikely that this approach alone can produce a thorough understanding of the mechanisms by which cognitive interference exerts its effects on performance.

In an attempt to examine cognitive interference from a different perspective, and following advances in psychological thinking, a cognitive psychological approach to test anxiety was subsequently developed. In contrast to the personality/social psychology perspective, the cognitive approach is also concerned with how people deal with external events the environment thrusts upon them. Within this approach, the definition of cognitive interference is based on the assumptions (a) that distractions arise from both the conscious and the unconscious level, (b) that distractions can often

arise from the task itself, that is they are features of the task, and (c) that the origins of the distractions are mainly external to the person. Consequently, to identify how cognitive activation is related to performance, the cognitive approach relies on performance measures in tasks varying in attentional demands, after manipulating the nature of the task and the distractors. The merits of the cognitive approach lie in the development of a paradigm more able to examine the processes through which interference occurs.

Initial research conducted within the cognitive paradigm gave indications that anxiety is not necessarily detrimental to performance. For example, Eysenck (1985) reported anxiety to be related to performance decrements in 3 out of 12 component processes included in a letter transformation task performed under stressful conditions. Calvo (1985) in a nonverbal reasoning task performed by high and low anxious individuals under test conditions, reported that the low anxiety group outperformed the high anxiety group in the presence of reward incentives, but the two groups performed similarly in the absence of rewards. Similar results were also reported by Calvo & Ramos (1989) and Calvo, Alamo, & Ramos (1990). Furthermore, in relation to motor tasks, research has revealed that anxiety not only might have no detrimental effects on performance, but also that some times it might have positive effects (Calvo & Alamo, 1987; Weinberg, 1990).

The processing efficiency theory

Following the cognitive paradigm and based on findings like those presented above, Eysenck & Calvo (1992) objected to the generalisability of test anxiety theory, suggesting alternative explanations to account for findings that could not be interpreted through the cognitive interference hypothesis. They suggested that the problem with test anxiety theory's predictions might lie in the conceptualisation of worry as a factor that influences performance in only one way, namely attentional interference. In their attempt to account for this proposition, and based on earlier suggestions by Sarason (1960, 1984), they suggested the processing-efficiency theory.

According to their hypothesis, worry has two major effects on performance. Similar to the cognitive interference interpretation, the first effect is attentional, that is worry about

task performance pre-empts some of the processing resources of the working memory system. The second effect, which is the new proposition, is that worry serves a motivational function.

“In order to escape from the state of apprehension associated with worrisome thoughts and to avoid the likely aversive consequences of poor performance, anxious subjects try to cope with threat and worry by allocating additional resources (i.e., effort) and/or initiating processing activities (i.e., strategies). Such attempts, if successful, increase available working memory capacity. As a consequence, potential performance impairments caused by the utilisation of working memory resources can be compensated for by the allocation of additional resources or activities.” (Eysenck & Calvo, 1992, p. 415).

Subsequently, they proposed a fundamental theoretical distinction between performance effectiveness and processing efficiency. Accordingly, performance effectiveness refers to the quality of task performance, while processing efficiency refers to the amount of processing resources invested, that is performance effectiveness divided by effort. Thus, in contrast to the cognitive interference theory, Eysenck and Calvo suggested that worry has detrimental effects on processing efficiency, but not necessarily on performance effectiveness, since the processing deficits may be balanced or overpowered by motivational effects.

Calvo & Ramos (1989) and Calvo et al. (1990) found that during difficult experimental tasks individuals high in anxiety reported having significantly higher worry scores than those low in anxiety, however performance of the two groups did not differ. In terms of the processing efficiency theory, it could be suggested that higher levels of worry experienced by high anxious individuals led to the allocation of additional effort which compensated for processing efficiency losses, thus resulting in similar performances by the two groups. In an attempt to account for this proposition, Dornic (1977, 1980) compared performance and subjective effort between individuals high and low in trait anxiety. Performance of the two groups did not differ, but the high anxiety group reported expending significantly more effort than the low anxiety group, thus providing support for the hypothesis.

Based on such findings Eysenck (1985) hypothesised that motivational factors enhancing effort will benefit the performance of low anxious individuals more than high anxious individuals. For the former, additional available resources that are not used can be activated, whereas for the latter such resources are not available since they are already activated due to increased worry. Comparing performance of high and low anxiety individuals under conditions of high and low monetary incentives he found a significant interaction. In particular, the low trait anxiety group performed much better under the high incentives condition, whereas performance of the high trait anxiety group remained unaffected.

A similar experiment was performed by Calvo (1985) under evaluative and non-evaluative conditions. In the evaluative condition with reward the low anxiety group performed better than the high anxiety group, but both groups performed similarly in the evaluative condition without reward. Moreover, high anxious individuals did not perform better in the reward condition compared to the non-reward condition, whereas low anxious individuals did. These results are in accordance with the hypothesis that motivational incentives would increase effort for low anxious individuals but not for high anxious ones, and therefore provide indirect support that worry is detrimental to processing efficiency, but not necessarily to performance.

Further evidence that worry limits processing efficiency was provided by Calvo, Ramos, & Estevez (1992), who found that high anxious individuals required additional processing time to acquire amounts of information equivalent to that acquired by low anxious ones. In relation to that, Calvo & Carreiras (1993) used a reading task under evaluative conditions to examine the effects of test anxiety on comprehension. Although comprehension performance was not affected by test anxiety, moderate increases in reading times as a function of anxiety were detected. They concluded that although test anxiety may reduce working memory capacity available for reading (as also identified by Calvo et al., 1992) due to task irrelevant responses, i.e. interference, the amount of information acquired is not affected under self-paced conditions. Thus, in accordance with the processing efficiency hypothesis, at the cost of slower processing, highly anxious individuals can compensate for the capacity reduction and achieve equivalent comprehension to low anxious individuals. Finally, using psychophysiological measures, Weinberg & Hunt (1976) reported that although performance of high and low

anxiety groups in a motor task was similar, the high anxiety group was using more energy and over a longer period of time than the low anxiety group.

In summary, the processing efficiency theory introduced the notion that worry might have motivational effects, in addition to the already identified attentional effects, and consequently the effects of worry on performance might differ from those on efficiency. In relation to performance deficits related to anxiety, Eysenck & Calvo (1992) agreed that these represent the result of cognitive interference produced by task irrelevant responses. Furthermore, they argued that such effects are not a product of reduced working memory, but rather are associated with the tendency to employ working memory to sustain certain thoughts, thus leaving less capacity available for the execution of the task.

The reliance on behavioural measures used within the cognitive paradigm approach, rather than self reports used within a personality/social psychology approach, allowed investigation of mental operations that are not accessible through introspective recall. The nature of this paradigm made it possible to explore the role of cognitive mechanisms in dealing with interference in the performance of various tasks. However, this approach is limited by its focus on distractions that are presented through experimental manipulations. Since distraction is introduced rather than assessed, cognitive models fail to explain why some individuals experience more cognitive interference than others and under what circumstances such interference appears. Subsequently, even though such a perspective allows for examining and analysing processes, it is not applicable when the interest focuses on what is going on in the field rather than in the laboratory.

The control process theory

Carver & Scheier (1988), based on research conducted over a decade (Carver, 1979; Carver & Scheier, 1981, 1984, 1986; Carver, Scheier, & Klahr, 1987), proposed a somewhat different interpretation of the anxiety-performance relationship. They suggested that human behaviour is regulated in a system of feedback control. People establish goals in relation to certain values and use these goals as reference points. When intentional behaviour is displayed they monitor themselves with regard to the

goals and accordingly adjust their actions in the direction of the reference value, i.e. the behavioural standard. When, during this process, discrepancies between intended and actual behaviour are detected Carver and Scheier postulate that whether the individual's response will be adaptive or not in terms of subsequent effort depends on the expectancies of the individual of being able to complete the intended action.

“The person who expects to be able to cope, who is sufficiently confident of being able to complete the action, responds to anxiety arousal with renewed effort. When this person's attention is self-directed, the result is enhanced persistence and even enhanced performance. The person who has serious doubts about being able to cope, who has the expectation of bad outcome, is likely not to persist in the face of anxiety arousal. This person is more likely to experience an impulse to disengage... This impulse sometimes results in overt withdrawal from the behaviour setting. It is sometimes expressed more subtly as disengagement of effort toward goal attainment. These responses, in turn, can result in impaired performance when attention is self-directed.” (Carver & Scheier, 1988, p. 19).

Although Carver and Scheier's approach, as originated by Carver (1979), focused on behavioural consequences of self-directed attention and was not developed to deal with issues related to test anxiety and cognitive interference literature, later writings (Carver & Scheier, 1984) linked this theoretical model to test anxiety. The rationale behind this connection was that under stressful situations, such as examinations, self-focusing tendencies of individuals are activated. Consequently, their model of self-attention could be applied in anxiety evoking environments.

They argued that when people high in test anxiety are placed in a stressful situation they are more likely to have doubts about their adequacy. Because of these doubts any interruptions from task efforts these people experience during a test situation are likely to result in impulses of disengagement. Despite that such impulses may be restrained from overt expression, the subsequent off-task thinking, psychological disengagement and the self-deprecatory rumination accompanying unfavourable expectancies are likely to result in impaired performance. Though less anxious individuals also get stressed

during difficult test situations, they presumably have more favourable expectations of being able to successfully complete the task. Thus, despite the fact that frustrations these individuals experience produce interruption in ongoing effort, the sense of confidence to complete the intended action leads to renewed efforts. Subsequently, performance is less likely to be impaired among those individuals.

In accordance with other theorists they accept that it is not the physiological aspect of anxiety, that is emotionality or somatic anxiety, but the cognitive one, that is worry or cognitive anxiety, which impairs performance. While test anxiety theorists (e.g. Wine, 1971; Sarason, 1984) have attributed the dysfunctional effects to self-focus, Carver and Scheier suggest that it is not the self-focus per se, but the process taking place in the person. When having favourable expectancies, the person remains engaged to the task, even when highly anxious. Therefore, it could be argued that the phenomenology of this person can be described as 'task-focused' rather than 'self-focused', since the person remains focused on the comparison between the intended goal and the present state, in the attempt to move from the former to the latter. In contrast, the response is maladaptive when the focus is on the perceived deficits of the self, salient self-doubts, and doubts over goal attainment.

Carver, Blaney, & Scheier (1979) conducted an experiment involving anagrams, during which participants' self-attention was enhanced, and expectancies were manipulated through verbal feedback participants received after an initial set of tasks. The group provided with poor outcome expectancies withdrew from attempts to solve the anagram more quickly than the group which had been provided with positive outcome expectancies. Furthermore, within the two groups differences in persistence emerged in the presence or absence of self-focus. For the high expectancy group persistence was increased when self-focus was enhanced, whereas for the low expectancy group persistence was decreased when self-focus was enhanced. Consequently, they suggested that, given a state of self-awareness, individuals having favourable expectancies perceive that more effort can result in accomplishment of the attained goal and therefore more effort is applied. In contrast, when expectancies are not favourable and individuals perceive they have no control over the outcome, worry discourages further effort and is connected with disengagement from the activity either physically or mentally, depending on the value that is placed on continuing or discontinuing.

In an experiment involving anagrams under moderately stressful conditions Carver, Peterson, Follansbee, & Scheier (1983) examined relationships between test anxiety, self-directed attention and thought content during task performance. High, in contrast to low, levels of self-focus were associated with greater intrusion of task-irrelevant thoughts among individuals high in test anxiety, but less intrusive thoughts among low anxious individuals. In a subsequent experiment, where no time limits were imposed for anagram solution in order to test persistence, self-focus interacted with test anxiety, leading to greater persistence for the low anxiety group and reduced persistence for the high anxiety group. Carver & Scheier (1984) also tested interactions between self-focus and test anxiety in relation to performance and persistence. High levels of self-focus facilitated performance and enhanced persistence among low anxious individuals, whereas among individuals high in test anxiety both performance and persistence were impaired.

The role of goal attainment expectancies was investigated by Rich and Woolever (1988) by manipulating expectancies in two groups of highly anxious students. Performance of students led to hold favourable expectancies was facilitated by self-focus, whereas performance of those in the unfavourable expectancies condition was impaired.

Manipulated expectancies in a more elaborate way, Duval, Duval, & Mulilis (1992) examined the way effort was influenced by self-focus in relation to expectancies. In particular, they initially created conditions of small and large discrepancy between self and standard performance and subsequently they let participants working on the task in order to reduce their deficits while they (participants) were able to observe their rate of progress towards the standard, which was also manipulated. Within participants who were informed they had small discrepancy between self and standard, those making moderate progress towards eliminating the deficiency persisted more on the task than those informed they were making no progress towards discrepancy reduction.

Furthermore, within participants informed they were making no progress towards the standard those in the large discrepancy condition persisted less than those in the small discrepancy condition. In a subsequent experiment where the dependent variable, of persistence was replaced by a measure of task-approach/avoidance similar results were obtained.

In their final experiment, Duval et al. (1992) reported that increasing the rate of progress for individuals in the large discrepancy condition resulted in increased effort towards deficiency reduction. The researchers concluded that 'self' to 'standard' discrepancy is crucial in moderating the extent to which individuals seek to conform 'self' to 'standard' or withdraw from their attempts. Furthermore, they stressed the importance of the rate of self-standard discrepancy reduction, suggesting that when the rate of the deficiency reduction is adequate, in relation to the magnitude of perceived incongruity between self and standard, efforts to reach the standard will occur. In contrast, when the rate is viewed as inadequate avoidance behavioural patterns will dominate.

Although Carver's (1979) theory was not originally developed within the test anxiety framework, Carver & Scheier (1984) adapting their model to anxiety research tried to further explain the motivational effects, both positive and negative, that worry can have. Overall, Carver and Scheier's propositions are in accordance with Eysenck's hypothesis that worry might have motivational effects and therefore is not always detrimental to performance. In addition, in an attempt to identify when worry can serve motivational purposes, they introduced the notion of goal attainment expectancies as an important moderator of the relationship between worry and subsequent effort.

Their approach focuses on behavioural measures rather than self-reports, thus adopting a cognitive perspective which further tries to explore mechanisms through which anxiety might influence performance. Considering the context of sport, where goal directed behaviour is displayed under achievement environments which elicit stressful responses, it remains of interest to investigate the applicability of the control process model of anxiety in naturalistic settings.

Concluding the first part of the literature review, referring to three major theories (the cognitive interference theory, Sarason, 1988, Wine, 1971; the processing efficiency theory, Eysenck, 1992, Eysenck & Calvo 1992; and the control process theory, Carver & Scheier, 1984, 1988) and psychological research conducted in educational settings regarding the role of thoughts that interfere with task execution, it becomes apparent that their role in relation to task performance has received considerable attention. Moreover, research on the topic of cognitive interference has been regarded as important in identifying how relationships between anxiety and performance can be

explained. In the second part of the review, theories and findings within the sport psychology discipline will be presented in order to identify whether and how approaches from the two areas of research can be integrated in a constructive way to enhance our understanding of the role of cognitive interference in sport.

Sport Anxiety

Sport anxiety, or competition anxiety, is one of the most extensively researched topics in sport psychology. However, considering the relatively short history of sport psychology as a distinct area of psychology, a great deal remains to be investigated. Nevertheless, it has to be stressed that because of the conceptual framework that general psychology has provided, advances in sport anxiety have been and remain rapid. Most of the research on sport anxiety has focused on identifying the relationship between anxiety and performance. A number of theories have been proposed, supported, criticised and modified or rejected, but they have all contributed significantly to our understanding of this relationship.

Early approaches

The relationship between sport anxiety and performance has, until recently, been dominated by general arousal-based explanations. Within this approach two were the most influential approaches, the Drive Theory (Hull, 1943; Spence & Spence, 1966) and the Inverted-U theory (Yerkes & Dodson, 1908; Oxendine, 1970). According to the Drive Theory increases in 'drive' (a term used interchangeably and rather unclearly to describe arousal, stress, or anxiety) are related to linear increases or decreases in performance, depending on the individual's dominant response. It was proposed that in the early stages of learning the dominant responses would be the incorrect ones and therefore performance would be impaired with increases in drive. In contrast, at the later stages of learning and mastery, the dominant responses would be the correct ones and therefore performance would be enhanced with increases in drive. Within the sport psychology literature, drive theory has usually been employed to indicate a positive linear relationship between arousal and performance. Drive theory eventually received considerable amounts of criticism. As Jones (1995) summarises, the major criticism referred to the failure of findings to provide consistent support for the hypothesis, the difficulty in determining a habit hierarchy of correct and incorrect responses in motor

skills, the inadequacy of the theory to accommodate effects of task complexity, and, from a cognitive perspective, the failure to consider cognitive appraisals.

Subsequently, the inverted-U hypothesis became more popular and dominated sport psychologists' thinking. The theory postulated that for every type of behaviour an optimal level of arousal exists. In particular, it was suggested that performance improves with increases in arousal up to a certain level after which further increases in arousal result in impaired performance. The inverted-U hypothesis had intuitive appeal, however contemporary advances in the area resulted in serious doubts over the validity of the hypothesis in sport. Summarising the main criticisms, Fazy & Hardy (1988) stress (a) the lack of consistent evidence to support the predictions of the theory, (b) the failure of the theory to justify why arousal beyond the optimal levels results in impaired performance, (c) the unrealistic assumption of the hypothesis, as represented by the curve, that once individuals become overaroused and performance deteriorates, reductions in arousal would result in increases in performance, and (d) the unidimensional conceptualisation of anxiety the hypothesis adopts in relation to contemporary evidence indicating that anxiety is a multidimensional concept that includes both physiological and cognitive components.

Multidimensional anxiety theory

Following advances in anxiety research in other areas of psychology, sport psychology researchers moved, somewhat belatedly, towards a multidimensional approach of anxiety. In accordance with Liebert and Morris's (1967) conceptualisation, anxiety was described as having two components, namely cognitive and somatic. Martens, Vealey, and Burton (1990), based on advances in the conceptualisation of anxiety and extensive research, developed the Competitive State Anxiety Inventory -2 (CSAI-2), an instrument to evaluate state sport anxiety as a multidimensional construct. Evidence regarding the validity of CSAI-2 supported the distinction of anxiety into somatic and cognitive components which revealed moderate inter-correlations. Furthermore, factor analysis revealed a third component, self-confidence, which was negatively related to both somatic and cognitive anxiety.

Even though the dimension of self-confidence was not anticipated, this subscale was retained and established as one of the questionnaire components. However, its atheoretical nature has been criticised as a limitation of the instrument (Lane, Sewell, Terry, Bartram, & Nesti, 1999). Further discussion regarding limitations of the CSAI-2, especially in relation to discrepancies that were eventually identified between the conceptualisation and operationalisation of sport anxiety, will follow the presentation of research lines and findings of contemporary sport anxiety research at the end of the section.

Since the development of the CSAI-2 research has consistently shown moderate correlations between the three CSAI-2 components (e.g. Gould, Petlichkoff, & Weinberg, 1984; Jones, Cale, & Kerwin, 1988). More convincing evidence regarding the relative independence of the anxiety components emerged through examination and identification of different antecedents. Antecedents of cognitive anxiety are hypothesised to be related to athletes' expectations of success and perceptions of their own and their opponents' abilities, while antecedents of somatic anxiety are hypothesised to be non-evaluative and consist mainly of conditioned responses to environmental stimuli (Martens et al., 1990).

Jones, Swain, & Cale (1990) attempting to operationalise the theoretical predictions regarding anxiety antecedents constructed the Pre-Race Questionnaire (PRQ), an instrument evaluating factors thought to be related to competitive anxiety. Using a sample of middle distance runners, they found cognitive anxiety related to perceived readiness, attitudes towards previous performances, and goal difficulty, self-confidence related to perceived readiness and external environment, whereas no significant relationships emerged for somatic anxiety. However, it should be noted that the development of the PRQ was based on sport-specific sample (male, middle-distance runners).

Using a modified version of the PRQ adapted for duathlon, Lane, Terry, & Karageorghis (1995a) found all anxiety components related to goal difficulty and perceived readiness, while self-confidence was also related to attitudes towards previous performances. In a subsequent study, where the PRQ was adapted for triathlon, Lane, Terry, & Karageorghis (1995b) found athletes' perceptions of race-goals difficulty

positively related to both cognitive and somatic anxiety and negatively related to self-confidence, which was also positively related to perceived readiness. In each of these occasions, despite similarities in the samples (all samples consisted of male athletes competing in endurance sports), evaluation of the factor structure of the PRQ revealed results different to the original validation (Jones, Swain, & Cale, 1990), which verified the sport-specific nature of the PRQ.

Also using a modified version of the PRQ on a swimming sample Hanton & Jones (1995) found cognitive anxiety significantly related to perceived readiness and environment, somatic anxiety significantly related to environment and goal difficulty, and self-confidence related to perceived readiness. Once more, the factor structure of the PRQ was different, which in combination with the results revealing different predictors of anxiety in different sports, indicates the need for sport-specific measurements of anxiety antecedents, and also supports the notion that different sports may involve different stressors.

Taken together the above findings indicate that research on situational antecedents of anxiety has not shown consistent results. However, having shown that cognitive and somatic anxiety share some antecedents, but also that there are factors which are unique to each of the anxiety components, support for the multidimensional conceptualisation of sport anxiety was provided.

Further support regarding the multidimensional nature of anxiety has been provided from research on the temporal patterns the two anxiety components follow. In general, findings have been fairly consistent suggesting that cognitive anxiety remains relatively stable prior to competition, whereas somatic anxiety tends to increase rapidly close to the start of the competition (Gould et al., 1984; Jones & Cale, 1989; Parfitt & Hardy, 1987). As it is the case with antecedents of anxiety, evidence suggests that the temporal patterning of anxiety components differs as a function of sport (Martens et al., 1990), but also depending on individual characteristics, such as skill level (Martens et al., 1990), gender (Jones, Swain, & Cale, 1991), and competitiveness (Swain & Jones, 1992). However, the fact that temporal patterns of anxiety components differ between them further supports the multidimensional nature of sport anxiety.

Following this new research line regarding the conceptualisation of anxiety, an increasing number of studies have examined the relationship between performance and the different components of anxiety. Initial theoretical predictions (Martens et al., 1990) suggested that cognitive anxiety is negatively related to performance, while the relationship between somatic anxiety and performance takes the shape of an inverted-U. Preliminary research to investigate the hypothesised relationships has been equivocal.

Gould et al. (1984) tested relationships between anxiety components and performance based on points scored in the first period of a wrestling match and match outcome over two games. For the first game, no significant relationships emerged. For the second game, a marginally significant multivariate relationship between anxiety and performance was revealed, with the cognitive component predicting match outcome.

Evaluating performance in relation to previous performances in a sample of swimmers, Barnes, Sime, Dienstbier, & Plake (1986) found cognitive anxiety to be a significant predictor of performance. Increases in cognitive anxiety were associated with decreases in performance, while somatic anxiety and self-confidence could not add to the prediction of performance variance.

Relationships between multidimensional anxiety and performance were examined in golfers and gymnasts by McAuley (1985) and golfers by Krane & Williams (1987). In neither study were anxiety components significantly related to performance. Bird & Horn (1990) examined the relationship between cognitive anxiety and mental errors, which were evaluated by coaches, in a softball sample. After dividing participants into high and low mental errors groups they reported that the group displaying more errors scored significantly higher on cognitive anxiety compared to the low mental errors group.

Thus, initial research has failed to support the predictions of multidimensional anxiety theory regarding the anxiety/performance relationship. However, examination of methodological issues identified several weaknesses concerning the research designs that have been used. For example Gould et al. (1984), after failing to find support for the hypothesised relationships using absolute levels of state anxiety, suggested that intraindividual analyses considering relative levels of anxiety, a technique initially used

by Sonstroem & Bernardo (1982), should be more appropriate in order to examine relationships between anxiety and performance. Performance measurement has been another point of criticism regarding early research designs. Measures such as competition outcome (win/loss), or other measures involving comparisons between participants have been inadequate in controlling for skill levels, and therefore less accurate than intraindividual measures (Burton, 1988; Gould, Petlichkoff, Simons, & Vevea, 1987). Finally, as Jones (1995) indicates the lack of analysis in investigating non-linear relationships has been another methodological shortcoming.

Subsequently, further research on the anxiety/performance relationship attempting to account for the detected problems was conducted. Burton (1988) used Sonstroem & Bernardo's (1982) intraindividual assessment of anxiety and performance together with polynomial trend analysis, which can identify curvilinear in addition to linear effects, on a sample of swimmers. Their analysis revealed a linear negative relationship between cognitive anxiety and performance, an inverted-U shaped relationship between somatic anxiety and performance and a linear positive relationship between self-confidence and performance, thus providing support for the multidimensional anxiety theory predictions.

However, research employing similar research designs has not confirmed the expected relationships. Gould et al. (1987) used the same design on a sample of pistol shooters. In accordance with the predictions of multidimensional anxiety theory, they found an inverted-U relationship between somatic anxiety and performance, but no effect was found for cognitive anxiety. Furthermore, an uninterpretable negative effect between self-confidence and performance was revealed. The fact that in this particular study somatic anxiety accounted for more performance variance than cognitive anxiety was attributed to the nature of the sport. Caruso, Dzewaltowski, Gill, & McElroy (1990) using also an intraindividual assessment of performance on students competing on a bicycle event found no significant relationships between components of anxiety and performance.

Despite advances in anxiety and performance assessment findings on the relationship under investigation remained equivocal. Based on this inconsistency and further suggestions by Gould et al. (1987) that there is a need to examine the way components

of anxiety affect performance on tasks varying in neuromuscular and attentional characteristics, Parfitt, Jones, & Hardy (1990) suggested that performance measures tended to be rather global in nature and therefore insufficiently sensitive to detect anxiety effects. In accordance with this proposition research should focus on the effects of anxiety on subcomponents of performance.

Following the above suggestions, Ussher & Hardy (1986) attempted to investigate whether the cognitive and somatic components of anxiety have differential effects on cognitive and motor processes involved in rowing. Results revealed that increases in somatic anxiety were associated with impaired hand grip strength, while increases in cognitive anxiety were not related to any of the performance subcomponents. Parfitt & Hardy (1987), using a similar approach on a variety of cognitive and motor skills, reported that cognitive anxiety was related to positive effects, while somatic anxiety was associated with both positive effects on a sargent jump (motor) task and negative effects on a short-term memory (cognitive) task.

Jones et al. (1988) tested a sample of cricketers one day, one hour and immediately prior to participation on a simple reaction task and on a discrimination reaction task which were regarded as relevant to the participants. In all testings anxiety was also assessed. Cognitive anxiety remained relatively stable across the three time periods, whereas somatic anxiety was higher immediately before competition than it was for the other two measures. Although reaction times for the two tasks did not differ significantly between the three measures, in the last testing, when somatic anxiety was increased, participants made significantly more errors on the discrimination reaction task.

Following a similar paradigm, Jones & Cale (1989) examined the relationship between anxiety components and cognitive (digit span) and motor (perceptuo-motor speed) tasks during a period leading up to an important hockey competition. Increases in somatic anxiety 20 minutes before the event were accompanied by improved motor task performance. Furthermore, somatic anxiety was a better predictor of performance for both tasks. Parfitt & Hardy (1993) tested a sample of basketball players on a short memory task (letter span) and a low memory, motoric-sustained information task

(rebound shooting) 1 hour before competition. Cognitive and somatic anxiety negatively related to the letter span task, but positively related to rebound shooting.

Although this latest approach may be criticised for not examining in vivo performance, it allowed a more sensitive investigation of the relationship between anxiety and performance. In particular, three important issues emerged from this line of research. First, somatic anxiety, which was originally thought to have a weaker relationship to performance than cognitive anxiety, appears to play an important role in influencing performance at least in the case of motor tasks; second, cognitive and somatic anxiety might have mode-specific effects on cognitive and motor subsystems; third, anxiety is not always detrimental to performance.

Catastrophe theory

One of the latest approaches concerning the anxiety/performance relationship is the one involving catastrophe models (Fazey & Hardy, 1988). The results of the previously presented studies indicated mixed positive and negative effects associated with elevated somatic anxiety and physiological arousal. Based on such findings and having identified certain limitations regarding multidimensional anxiety theory and research, Hardy and his associates (Fazey & Hardy, 1988; Hardy, 1990; Hardy & Parfitt, 1991) in an attempt to clarify the relationships between cognitive anxiety, physiological arousal and performance adapted, based on models developed and applied in behavioural and natural science (Zeeman, 1976; Thom, 1975), a three dimensional catastrophe model of anxiety and performance.

A serious weakness in the way researchers operationalise multidimensional anxiety is that the effects of the different components of anxiety have been examined in isolation (Hardy, 1996a). Therefore, it is unjustifiably assumed that the effects of cognitive and somatic anxiety upon performance are additive rather than interactive. What is wrong, according to Hardy (1996a), is that researchers try to explain a three-dimensional relationship (cognitive anxiety, somatic anxiety, performance) in terms of a series of two-dimensional relationships. Instead, he proposes that research should consider the interactive effects of cognitive and somatic anxiety.

The basic characteristics of a catastrophe model in sports and how it is different from multidimensional anxiety theory were outlined by (Hardy, 1996b). The catastrophe model proposes that when cognitive anxiety is low, changes in physiological arousal lead to small and continuous changes in performance. When cognitive anxiety is high, changes in physiological arousal result in small and continuous changes in performance when physiological arousal is low or high, but in large and discontinuous changes in performance when physiological arousal is at intermediate levels.

An important distinction between the multidimensional anxiety theory and the catastrophe model is that the latter uses physiological arousal rather than somatic anxiety in order to explain effects on performance. Although research has shown that physiological arousal and somatic anxiety follow similar temporal patterns, Parfitt et al. (1990) and Hardy (1996b) argues in favour of the former suggesting that arousal can affect performance by two means, that is directly by altering the availability of cognitive and physiological resources to performers, or alternatively via performers' positive or negative interpretation of physiological symptoms. In contrast, somatic anxiety has been hypothesised to affect performance when the intensity of the somatic response is such that individuals become preoccupied with their physiological symptoms. Another fundamental difference from multidimensional anxiety theory is that according to the catastrophe model, the effects of cognitive anxiety on performance can be either positive or negative, thus encompassing existing evidence reporting positive relationships between cognitive anxiety and performance (Hardy & Parfitt, 1991; Hardy, Parfitt, & Pates, 1994).

One of the major points of the model involves the hysteresis hypothesis. According to Hardy (1996b, p. 72) "under conditions of high cognitive anxiety, hysteresis, will occur; that is to say, the point at which performance suddenly drops from the upper performance level to the lower performance surface when physiological arousal is increasing, is different from the point at which performance suddenly jumps from the lower performance surface to the upper performance surface when physiological arousal is decreasing. Under conditions of low cognitive anxiety hysteresis will not occur; changes in performance will be smooth and follow the same path, whether physiological arousal is increasing or decreasing."

Applying catastrophe theory in sports using a three-dimensional model Hardy (1996b) summarised some of the currently testable predictions of the catastrophe theory as follows: (a) when cognitive anxiety is high, performance improves with increases in physiological arousal up to a critical threshold, after which further increases in arousal result in a fatal drop in performance (the point at which performance will jump back to the higher surface when physiological arousal is decreasing is different than the point when the fatal drop occurs); (b) when cognitive anxiety is low, changes in performance will be smooth and follow a similar path, whether physiological arousal is increasing or decreasing; (c) when physiological arousal is high, increases in cognitive anxiety should result in impaired performance; (d) when physiological arousal is low, increases in cognitive anxiety should result in improved performance.

The interactive effects of anxiety intensity on performance were examined by Edwards & Hardy (1996) on a sample of netball players. Their results provided support for the catastrophe model of performance. In particular, when physiological arousal was high participants with lower cognitive anxiety performed better than those with higher cognitive anxiety. In addition, under low physiological arousal, players with high cognitive anxiety performed better than those with low cognitive anxiety. Thus, in accordance with the catastrophe model it was indicated that cognitive anxiety can have either positive or negative effects on performance depending on levels of physiological arousal.

The hysteresis hypothesis has been tested by Hardy and colleagues on two occasions. Hardy & Parfitt (1991) tested the hypothesis on a sample of basketball players who were asked to perform a shooting task, whereas Hardy et al. (1994) tested the hypothesis on a sample of bowlers who were asked to perform a bowling task. On both occasions, participants were tested under conditions of high and low cognitive anxiety, while in each of these conditions physiological arousal was manipulated by means of physical work, so that participants were tested with physiological arousal increasing and decreasing. Examination of the hypothesis that the performance by heart rate interaction graph would follow a different path for heart rate increasing compared to heart rate decreasing, was supported in the high but not in the low cognitive anxiety condition. The analysis supported the predictions indicating that the interaction was due to

hysteresis occurring in the high cognitive anxiety condition but not in the low cognitive anxiety condition.

The catastrophe model, even though still in its infancy, seems to account for some of the previous inconsistent findings, and preliminary research seems promising, despite the fact that the model has been criticised as overcomplicated and difficult to be tested (Gill, 1994). However, considering the need for explicitly understanding the nature of a phenomenon as complex as anxiety, it seems justifiable that complex models have to be encountered. As Jones (1995) concludes, unraveling the precise details of the catastrophe model approach presents a major challenge in contemporary sport psychology.

Direction of anxiety

Findings from research investigating the effects of anxiety on subcomponents of performance, but also evidence emerging from examination of the catastrophe model indicating that anxiety effects are not always detrimental to performance, provided the impetus for researchers (e.g. Jones, 1991) to question the adequacy of anxiety measurements, and to point out that dimensions other than anxiety intensity should be considered in order to better understand and evaluate anxiety responses.

Based on research evidence indicating that cognitive and/or somatic anxiety might be either positively or negatively associated with performance or components of performance, Parfitt et al. (1990) introduced the notion of direction of anxiety. In particular, they suggested that intensity of anxiety symptoms can be perceived by performers as either helpful or detrimental to performance. Thus, different performers experiencing symptoms similar in intensity may interpret these symptoms differently on a debilitating-facilitative continuum. Moreover, it might be also possible that an individual interprets similar anxiety symptoms in different ways depending on situational factors. Considering such an approach, Parfitt et al. (1990) suggested that investigating intensity of anxiety alone probably offers a limited view of the anxiety picture. Consequently, they speculated that the direction of anxiety might prove a better predictor of performance and contribute to the understanding of the anxiety/performance relationship. Since the above propositions are relatively new, few investigations have examined the role and usefulness of the direction of anxiety.

In an initial attempt to provide support for the importance of anxiety direction, Jones, Hanton, & Swain (1994) and Jones & Swain (1995) examined differences in anxiety intensity and direction between elite and non-elite swimmers and cricketers respectively. In both studies the results revealed that the elite and non-elite athletes did not differ in intensity of cognitive and somatic anxiety, whereas significant differences were found in the way participants interpreted the anxiety symptoms. In particular, in both studies elite athletes reported their anxiety states as being more facilitative to performance than non-elite athletes.

Relationships between intensity and direction dimensions of anxiety and performance were examined by Jones, Swain, & Hardy (1993) in a sample of gymnasts competing on the beam. Results revealed that the higher performance group interpreted their anxiety symptoms as being more facilitative and less debilitating than the lower performance group. Analysis conducted to examine whether intensity and direction of anxiety could predict performance revealed no significant results, however the correlation between cognitive anxiety direction and performance was higher than the correlation between cognitive anxiety intensity and performance. In a similar fashion, the correlation between somatic anxiety direction and performance was higher than the correlation between somatic anxiety intensity and performance.

Accounting for criticism that between-subjects comparisons have received, Swain & Jones (1996) applied an intraindividual design to assess the relative contribution of intensity and direction of anxiety in predicting performance variance. They found that the relationship between cognitive anxiety intensity and performance was best predicted from an inverted-U relationship which accounted for 18.4% of performance variance. A positive relationship between cognitive anxiety direction and performance which accounted for 23.4% of performance variance was also identified. Somatic anxiety intensity and direction were positively related to performance but while intensity accounted for only 2% of the variance, direction explained 17%.

However, in contrast, Edwards & Hardy (1996), also using an intraindividual design with netball players, found performance more strongly related to anxiety intensity than anxiety direction. In addition, contrary to expectations, anxiety direction scores were

negatively related to performance. Thus, despite its initial appeal, the notion of anxiety direction has produced equivocal results.

Moreover, the assessment of anxiety direction has received criticism since the modified version of CSAI-2 (Jones & Swain, 1992) used for that purpose has not been validated. Further research is required to examine whether direction of anxiety is a better predictor of performance, however, this particular approach brought to the fore questions regarding the operationalisation and measurement of anxiety.

Critique of anxiety measurement in sport

Objecting to the latest advances regarding anxiety conceptualisation, i.e. the anxiety direction dimension, Burton & Naylor (1997) and Burton (1998) questioned whether anxiety can really be facilitative. Burton focuses his reaction on the way anxiety is being measured within the last decade by means of the CSAI-2. In particular, he argues that many of the symptoms listed in the anxiety scale (especially in the cognitive anxiety subscale) are worded neutrally, a strategy originally employed by the constructors of the questionnaire (Martens et al., 1990) in order to avoid social desirability effects when completing the questionnaire. Consequently, some of the described symptoms are not necessarily characteristics of anxiety but may also be representative of other more positive affective states such as excitement and challenge. Thus, if athletes indicate experiencing such symptoms intensively, the result would be high anxiety scores even though responses might actually reflect positive emotional states athletes experience which can facilitate performance.

Considering evidence that anxiety can be perceived by athletes as facilitative, Burton's (1998) question whether anxiety can really be facilitative, is actually questioning whether researchers really measure anxiety or simply mislabel other positive affective states such as excitement. In relation to Burton's propositions, Swain & Harwood (1996) found that intensity of cognitive and somatic anxiety was more closely related to negative affect, whereas direction of anxiety symptoms were more strongly associated with positive affect, thus further supporting the hypothesis that current sport anxiety measurement needs reconsidering.

Finally, latest evidence regarding the construct validity of CSAI-2 support the limited efficiency of the instrument. Lane et al. (1999), assessing CSAI-2 through Confirmatory Factor Analysis, a more powerful method to examine construct validity (compared to exploratory factor analysis), and based on sample sizes considerably larger than those used in the original validation of the questionnaire, revealed several weaknesses. Lane et al. (1999) firstly expressed methodological concerns regarding the initial validation of the instrument. They pointed out that (a) the samples that were used were rather small when considering the length of the questionnaire versions that were tested, (b) that several data sets were factor analysed more than once, a technique accused of being data driven, instead of using different samples for each analysis, and (c) that for some of the data sets the collection of anxiety scores were based on hypothetical rather than on actual competitions.

Subsequently, confirmatory factor analysis failed to provide strong support for the hypothesised factor structure of the CSAI-2, thus bringing in to question the validity of the three factor model proposed by Martens et al. (1990). Lane et al. (1999) focused their criticism on the fact that in the cognitive anxiety scale the item 'I have self doubts' which theoretically represents the construct of anxiety stronger than the rest of the items in the scale (which refer to feeling concerned) had the lowest loading on the factor. This seems to suggest that the scale actually assess a construct slightly different from the one it is supposed to assess (cognitive anxiety). They argue that athletes who are about to compete are likely to report feeling concerned about performance, even though they might remain confident in their beliefs to meet their goals. Thus, being concerned does not necessarily mean that individuals experience negative thoughts (a typical anxiety symptom), but maybe acknowledge the likely importance and difficulty of the competition. Therefore, they suggest that Martens et al. (1990) by replacing the word 'worry' (used in the initial versions of the scale) with 'concern' in their attempt to reduce social desirability bias may have hampered the conceptual integrity of the cognitive anxiety construct. Finally, Lane et al. (1999) expressed concerns regarding the structure of the self-confidence subscale suggesting that four of the items included in the scale (e.g. 'I feel comfortable', 'I feel at ease') seem to assess what could better be described as a sense of calmness.

Therefore, Burton's concerns regarding the operationalisation of anxiety seem to be justified. Just as anxiety theorists discriminate between cognitive and somatic anxiety because the two components have different antecedents and temporal patterning, it seems "conceptually explicit" to also differentiate negative, debilitating symptoms from positive affective states that might facilitate performance. Stemming from the above arguments, it becomes apparent that it would be more appropriate to deal with intensity and direction of anxiety separately. If these measures represent separate affective states, then the two dimensions of anxiety need to be combined in one instrument that can accurately describe the nature of the emotion as well as the intensity at which it is felt.

Integrating Cognitive Interference and Sport Anxiety

As it becomes apparent from the above critique of sport anxiety literature, a vast amount of research has been dedicated to the identification of the anxiety/performance relationship which, however, is far from conclusive. In addition to the methodological considerations presented, there are at least two characteristics for which anxiety research in sports could be criticised.

The first characteristic is that research has focused solely on pre-competition anxiety. Even though researchers have tried to assess anxiety as close to the competition as possible, it is reasonable to assume that psychological and physiological states of athletes change, some times dramatically, once a competition is under way. Jones (1995) states that it seems over-optimistic to expect that performance can be predicted satisfactorily by measures acquired as much as 30 minutes before the start of a competition. Hardy & Jones (1994, pp.70-71) identified this problem and attributed the lack of such research to methodological limitations. "Due to the obvious practical constraints on testing performers during performance, there is a dearth of knowledge concerning during-performance psychological states. The vast majority of research work has examined pre-competition anxiety, and this has tended to predict only a relatively small amount of performance variance. Consequently, there is a need to develop the means whereby athletes' psychological states can be examined during actual performance."

The second is that research has focused on **what** is the relationship and has almost totally ignored asking **how** the hypothesised relationships are formed, that is the mechanisms through which anxiety influences performance. It is only during the last decade that some researchers have tried to explain results concerning the anxiety/performance relationship based on theoretical grounds developed in educational psychology. Some of these studies (also cited in previous sections of the review) will now be revisited.

Jones et al. (1993) found cognitive anxiety intensity unrelated to performance and reported that successful performers perceived their cognitive anxiety symptoms as more facilitative than non-successful performers. Furthermore, no significant relationship emerged between cognitive anxiety intensity and direction. They went on to explain these results based on Eysenck & Calvo's (1992) propositions that cognitive anxiety can be helpful to performance. They suggested that this type of positive effect may be a result of additional effort applied to the task which serves a compensatory role for the decreases in processing efficiency due to the allocation of additional attentional resources. According to Eysenck, anxiety reduces working memory capacity due to worry thus impairing processing efficiency. However, such deficits can be countered by increases in effort. Thus, performance levels can be maintained or even enhanced under conditions of high anxiety at the expense of utilising extra resources.

Similar reasoning was presented by Parfitt & Hardy (1993) who found cognitive anxiety positively related to rebound shooting before a basketball competition. In this study it was also found that cognitive anxiety was negatively related to a letter span task. This finding, in combination with the previous one also seems to fit well with Eysenck's propositions. In particular, performance on the short memory task (letter span) was hindered by elevated cognitive anxiety, but enhanced on the low memory motor task. According to Eysenck, anxiety may result in the allocation of additional effort. If it is assumed that physical effort is more controllable and thus effective, it could be justifiable to argue that in the case of the low memory motor task physical effort might have stronger positive effects than mental effort in the short term memory-cognitive task.

Testing the catastrophe model, Hardy et al. (1994) and Edwards & Hardy (1996) found that high levels of cognitive anxiety were associated with improved performance when physiological arousal was low, but with impaired performance when physiological arousal was high. Combining Eysenck's processing efficiency hypothesis and Carver and Scheier's control model they suggested that under high cognitive anxiety and low arousal, performance was maintained due to the compensatory mechanism of effort. In contrast, as arousal increased and expectancies over goal attainment decreased, the demands of the task (increasing cognitive anxiety) possibly began to outweigh the effects of effort and subsequently performance was hampered. Furthermore, Edwards & Hardy (1996) found self-confidence related to a more facilitative interpretation of anxiety intensity symptoms. They suggested that this finding is in line with Carver and Scheier's proposition that expectancies of goal attainment, and therefore confidence, facilitates performance due to renewed efforts resulting from beliefs that the goals can be attained. Similar reasoning has been provided by Hardy (1996a) and Swain & Jones (1996) in attempts to explain findings suggesting that anxiety might facilitate performance.

As it becomes apparent, Sarason's (1984) and Wine's (1971) cognitive interference interpretation, Eysenck's (1992) processing efficiency hypothesis and Carver & Scheier's (1988) control process model of anxiety have been cited in paper discussions in order to explain findings, however, to date, no attempts have been made to test these hypotheses. Although results of research in sport anxiety seem in line with the view that cognitive interference approaches act as exploratory mechanisms, it would be useful and important to assess as directly and accurately as possible the role of interfering thoughts athletes experience while performing. This particular question has been largely neglected within sport psychology. As Swain & Jones (1996) state, a great deal can be learned from advances in the test anxiety literature. Guided from the literature just reviewed the research questions of the investigation have been formulated.

Key Research Questions

The purpose of the present investigation was to explore the role of cognitive interference in sport. Stemming from research lines in educational psychology where cognitive interference was introduced as a result of test anxiety (Sarason, 1984; 1988;

Wine, 1971), but also considering the identified need to extend sport anxiety research to anxiety symptoms during competition (Hanin, 1998), the first issue to be examined was the relationship between precompetition anxiety and cognitive interference athletes experience during sport performance. Furthermore, regarding Carver and Scheier's (1984, 1988) control process model of anxiety, cognitive interference was also examined as a function of discrepancies between expected and actual behaviour.

Accounting for calls in sport psychology to explore possible mechanisms through which anxiety affects performance (Hardy & Jones, 1994), and based again on findings (e.g. Naveh-Benjamin, 1991; Naveh-Benjamin et al. 1987) and theories (Eysenck & Calvo 1992; Sarason et al. 1990) in educational psychology manifesting the importance of thought content in determining cognitive performance, the next issue to be examined involved the relationship between cognitive interference and performance.

More specific hypotheses emerged as the investigation progressed and those will be presented in the individual studies. However, in order to test the research hypotheses, an instrument to assess cognitive interference was required. Considering the relative absence of research regarding cognitive interference in sport, it is not surprising that such an instrument was not available. Therefore, the initial study deals with the development of a sport-specific instrument to assess cognitive interference.

Chapter 3. Questionnaire Development

Study I: Assessing cognitive interference in sport: The development of the Thought Occurrence Questionnaire for Sport

Within the broader sphere of cognitive psychology assessing cognitions has been a critical issue for the development of cognitive-behavioural theories and interventions. The process of cognitive assessment is not at all simple and as Klinger (1978) identifies cannot be error-free due to the covert and inaccessible nature of individuals' thoughts. However, in order to progress in any kind of cognitive, behavioural or clinical analysis assessment will always be the starting point. Throughout the years, several methodologies and techniques have been developed and used to assess thought content in different settings (Kendall & Korgeski, 1979). However, considering the focus of the current project, techniques regarding thought content during task performance is the major focus.

One way used to assess thought content while performing on experimental tasks has been the 'think aloud' procedure, where participants, after receiving relevant and adequate training, are required to verbally express all the thoughts that come to their mind during performing on the experimental task. Another 'in vivo' (Kendall & Korgeski, 1979) technique has been the use of a beeper. For this kind of assessment, trained subjects are asked to record their thoughts along with information such as duration, vividness, or controllability regarding these thoughts on the sound of a beeper that goes off during experimental tasks. Retrospective reports after the conclusion of a task has also been a method to assess cognitive activation while performing at a task where participants are asked to report their thoughts either verbally or on paper. Finally, another retrospective method to assess thought content involves the use of questionnaires after the completion of the task, where participants are required to indicate occurrence of certain thoughts that are listed on scales.

Although in vivo techniques can be said to be more accurate since they rely on 'live' transmission of thought content and are not dependent on memory, their use requires extended training. Furthermore, due to the nature of the assessment such techniques can only be used in experimental tasks. Due to the increased need for more convenient

methods to assess cognitive activity during task performance, and the desire to test hypotheses in field settings rather than in experiments, the use of questionnaires has been the most widely used method. Considering the nature of sport, the desire to study thought content in real competitive situations without interfering with performance and the need for quantitative data sets, the use of questionnaires was considered the most appropriate method for the purposes of this project.

In educational settings, Sarason and his colleagues developed instruments to assess cognitive interference (Cognitive Interference Questionnaire, Thought Occurrence Questionnaire; Sarason et al., 1986). The instruments have received adequate psychometric support and have been used extensively to assess thought content in both experimental tasks and classroom environment, such as examinations.

Because of the relatively scant attention that has been directed towards cognitive interference in sport, instruments to measure cognitive interference within the physical domain are not available. In sport, measures that have been developed to assess mental skills and coping behaviour include scales to evaluate the ability of athletes to concentrate. However, they mostly are measures of general abilities and are not focused on the content and nature of the specific thoughts that might go through athletes' minds. Such measures are the 'concentration' scale in the Psychological Skills Inventory for Sports (Mahoney, Gabriel, & Perkins, 1987; example items: "I often have trouble concentrating during my performance", "When I make a mistake, I have trouble forgetting it and concentrating on my ongoing performance"), the 'concentration' and the 'freedom from worry' scales in the Athletic Copying Skills Inventory (Smith, Schutz, Smoll, & Ptacek, 1995; example items for the 'concentration' subscale: "When I am playing sports, I can focus my attention and block out distractions", "It is easy for me to keep distracting thoughts from interfering with something I am watching or listening to"; example items for 'freedom from worry' subscale: "While competing, I worry about making mistakes or failing to come through", "I put a lot of pressure on myself by worrying how I will perform"), the 'concentration disruption' scale in the Sport Anxiety Scale (Smith, Smoll, & Schutz, 1990; example items: "During competition, I find myself thinking about unrelated things", "My mind wanders during sport competition"), and the 'negative thinking' scale in the Test of Performance Strategies (Thomas, Murphy, & Hardy, 1999; example items: "During competition I

have thoughts of failure”, “I imagine screwing up during competition”). Considering evidence in educational psychology suggesting that cognitive interference is a key issue of performance, and the lack of sport-specific instruments, the development of a questionnaire to assess cognitive interference in sports seems important and might prove useful in enhancing our understanding of how cognitive activity during sport is related to performance. The present investigation is an attempt to develop such an instrument.

Given the more extensive research into cognitive interference in educational settings, the use of the Thought Occurrence Questionnaire (TOQ; Sarason et al., 1986) modified or not, seemed warranted in sport from an exploratory viewpoint. Hatzigeorgiadis & Biddle (in press) assessed the validity of the TOQ in sport by means of confirmatory factor analysis (CFA). The TOQ (Appendix A) is a questionnaire including three subscales, namely ‘task-related worries’ (TOQ-W; example items: “*While performing I think about* what someone will think of me”, “... how difficult what I am doing is”), ‘task-irrelevant thoughts’ (TOQ-I; example items: “... members of my family”, “... personal worries”), and ‘thoughts of escape’ (TOQ-E; example items: “... quitting”, “... how I cannot stand it any more”). The analysis revealed questionable validity indicating, in particular, that the construct of ‘task-related worries’ was poorly defined. For this subscale the analysis revealed that most of the items (seven out of nine) had low loadings and relatively high errors, which in addition were correlated to each other, indicating that these items measure something else or something in addition to the construct they are supposed to measure (Joreskog, 1993). Results regarding the TOQ-I subscale were better, however not satisfactory, indicating that some items (four out of seven) had their error variance correlated. Finally, regarding the TOQ-E subscale the analysis revealed quite satisfactory structure, indicating that only one item was problematic. Therefore, modifications seemed appropriate in order to make the instrument applicable to sport situations. This led to the belief that a more thorough investigation of the measurement of cognitive interference in sport was warranted. The current investigation, therefore, involved four stages. In the first stage, interviews with athletes were conducted. In the second, the face validity of the items that emerged through the interviews was assessed by individuals from the sport psychology field using a content analytic method. Third, the factor structure of the instrument was tested by means of exploratory factor analysis and, finally, in the fourth stage, the results of

the exploratory factor analysis were re-tested through CFA, while at the same time discriminant and concurrent validity were assessed.

Stage 1: Interviews

The purpose of the interviews was to identify inappropriate items and wording of the TOQ, and to explore how the questionnaire could be modified to be more appropriate for sport.

Method

The sample consisted of seven athletes (five males and two females) who represented different sports and levels of competition. The mean age of the interviewees was 27.4 years. Five of them were individual sport athletes, while two were team sport athletes. Three athletes were competing at international level, two at national level, one at county level and one at club level.

The interviews were semi-structured, that is they were based on some specific questions, in particular regarding thought content during competition, however, athletes were allowed to talk about matters they perceived as important regarding the interests of the discussion. The duration of the interviews was between 60 and 90 minutes. Initial discussion was centered around the nature of each athlete's sport, and his/her involvement with it. Subsequently, athletes were asked to evaluate the extent to which concentration in their sport is important and why. To follow that discussion, athletes were asked to recall cognitive activation during their most recent competition, and also their most intense in terms of cognitive interference experiences in their competitive sport career. This procedure involved retrospective recall based on meta-cognitions. Finally, a detailed report on the TOQ was conducted where athletes were asked to assess each item of the TOQ and comment on its applicability in their sport. Interviews were recorded and subsequently transcribed.

Results

All the thoughts athletes quoted having during competitive sport performances were extracted from the transcripts and listed. Although athletes were asked to focus on reporting thoughts not related to the task they were performing, during the recall

process some of the athletes described in full details their thought content during competitions. As a result, a number of task related thoughts were also evident in the thought-list. Subsequently, thoughts were divided into task-related, that is thoughts related to the execution of the task, such as strategy related thoughts (e.g. “get behind that ball”, or “avoid that part of the track”), and task-unrelated, that is thoughts that were not related to the execution of the task in a constructive way. Since the interest of the investigation was focused on the latter, all the thoughts identified not to be related to the task were listed separately.

Content examination of the latest thought-list revealed that the patterns of thoughts were similar to those identified by Sarason et al. (1986). In particular, athletes admitted having thoughts that could be described as ‘performance/competition worries’, thoughts not related to the performance or the competition, and finally thoughts of withdrawing from a competition. Concerning the content of the thoughts, those listed in the ‘task-irrelevant thoughts’ and ‘thoughts of escape’ categories were quite similar compared to those in the TOQ, while thoughts concerning ‘worries’ were different in the sense that they were more competition oriented.

All thoughts that could be described as interfering with task execution, that is not task processing, not related to elements of execution, techniques or tactics, were further examined. Concerning performance worries, some statements were more specific than others to the character of the specific sport, while others were more general. However, they all were of a similar nature mostly self-evaluative, related to performance or outcome. Situation-irrelevant thoughts and thoughts of withdrawing from the task were very similar across individuals and sports. Subsequently, items that would be considered to be included in the modified questionnaire were selected. The statements that were more frequently cited were all chosen to be processed further. These statements were the ones that were applicable across sports (for example, “I am performing poorly”, “I am not going to achieve my goal”). From the statements that were more sport specific, and therefore less frequently reported, some were reworded to become applicable for most sport situations, however in a way that did not alter the meaning (for example statements like “the water is too rough” or “this hill is very steep” were changed to “the conditions are not good”). Statements that were very specific to situations were not further examined (for example “I am in pain”). The reason for dropping such items

despite their likely importance in certain sports and situations, was that the purpose of the questionnaire construction was to develop an instrument that could have broad applicability. Inclusion of such items would improve content validity, but would also hamper the construct validity and reliability of the instrument, when applied in a mixed-sport sample, since such thoughts would be relevant in a limited range of sports. From the transcription of the interviews a pool of items was selected that would be further tested in the subsequent stages of validation.

In the latest part of the interviews athletes were asked to comment on the applicability of the TOQ in sport and discuss possible shortcomings they could identify. With respect to the first subscale of the TOQ, (TOQ-W), the interviews revealed that individuals had different perceptions on whether the items (thoughts) were negative, positive or neutral in nature. Thus, some items were described as either positive or negative thoughts from different individuals (e.g. "I think about how I should be more careful", "I think about how difficult what I am doing is", "I think about the purpose of what I am doing"), while others were described as positive, negative or neutral by the same individual. This depended on the perception of the individual during the competition and the quality of the individual's performance (e.g. "I think about what someone will think of me", "I think about my level of ability", "I think about how I would feel if I were told how I performed"). Finally, some of the interviewees found certain items to be unclear in what they were asking, or 'not to make sense' (e.g. "I think about how often I feel confused"). Overall, it can be concluded that different interpretations are possible for most of the subscale items, depending on the individual's mood and perceptions at the time of the competition.

Discussion concerning the second subscale, (TOQ-I), revealed one reason for which some of the items were problematic. In general, it seemed that athletes discriminated between the items according to how 'close' or 'distant' these thoughts were in relation to the time of the competition (in terms of environment and time). Thus, athletes reported their irrelevant thoughts to be related to situations and persons that could be more easily recalled. Therefore, items such as "I think about members of my family", "... friends", "... other activities", or "... something that happened earlier in the day", were more likely to appear in individuals' minds in relation to items such as "... something that happened in the distant past", or "something that might happen in the future". In

addition, confusion emerged for some of the items (e.g. “I think about something that makes me feel angry”, “I think about something that makes me feel tense”). Individuals reported that thoughts that generate feelings of anger or tension do appear, but they are not irrelevant to the event itself.

For the last subscale (TOQ-E), the interviews revealed a satisfactory structure. In particular, with the exception of one item (“I think about how hard what I am doing is”), all the rest were identified as negative and debilitating thoughts. The item that appeared to differ was generally characterised as not so negative (in intensity), while two athletes reported that it can also be perceived as positive in the sense that such a thought might make you feel stronger or proud for being able to perform such a 'hard' task. Thus, it seemed that this particular thought was characterised as more similar to the ones in the 'task relevant worries' subscale and, moreover, as one that sometimes might be perceived differently by individuals.

After the conclusion of the interviews, possible sources of the problems were identified. For the first subscale substantial changes seemed to be required, while for the second and third subscales minor modifications seemed appropriate. For an initial preliminary analysis, therefore, some of the original items were retained, some were modified, while items which emerged from the interviews were added. In particular, for the 'task-related worries' subscale one item was retained, three were modified, and 16 were added. For the 'task-irrelevant thoughts subscale, four items from the original subscale were retained, one was modified, while one was added. Finally, for the 'thoughts of escape' subscale three items were retained, two items were slightly reworded to become more sport specific, while seven items that emerged from the interview were added. The overall list included 38 items (20 representing task-related worries, 6 representing task-irrelevant thoughts, and 12 representing thoughts of escape). These items were included in the next stage of the investigation which involved a content analytic assessment.

Stage 2: Assessment of face validity through content analysis

The 38 items that were selected through the interviews were tested for face validity through a structured content analytic method (Weber, 1990). Face validity refers to the degree to which scales appear to measure what they claim to measure (Kline, 1993). For

that purpose, items were listed in an instrument (Appendix B) and distributed to fifteen individuals from the field of sport psychology, including established academics, research students and Masters' degree students from the field of sport psychology. Individuals were asked to classify the items into three given categories of 'performance worries', 'situation-irrelevant thoughts' and 'thoughts of escape' for which definitions were provided. The categories were selected in accordance to the original TOQ, but also in relation to the interviews analysis regarding the nature of the interfering thoughts. A fourth category was labeled 'none' which would indicate whether items were not adequately described by any of the factors. The participants were also advised to include the items in more than one category if they thought this was appropriate. The purpose of this analysis was to reveal the items that would have the larger percentage of expected classification, that is classified in the expected factor and not in any other factor. A baseline of 80% was set for an item to be appropriate for further analysis.

From the 20 statements described as performance worries 11 were classified 80% or more in the respective category. Two statements were classified into both 'performance worries' and 'situation-irrelevant thoughts' ("The weather is too bad", "I am very unlucky"), while the rest were not adequately classified (most individuals classified them into more than one category). All 6 statements included in the 'situation-irrelevant thoughts' were classified above 80% in the respective category. Finally, from the 12 statements referring to 'thoughts of escape', 7 were classified in the respective category, while the remaining 5 were also classified in 'performance worries' (for example, "I hate this competition", "This is a horrible experience"). All items having 80% or more of expected classification were retained to be analysed further.

Stage 3: Test of factor structure

Method

The 24 items that were selected were subsequently factor analysed. The questionnaire (Appendix C) was distributed to 157 athletes (93 males and 64 females; mean age 21.4 SD 4.1) representing different sports and levels of competition. Ninety nine of the participants were team sport athletes, and 58 were individual sport athletes. 12 athletes were competing at international level, 21 at national level, 50 at regional or county level, 18 at university level and 56 at club level. The participants were informed that the

form they were going to complete was anonymous and they were asked to assess the frequency of interfering thoughts they experience during competitions. A seven-point scale was used from almost never (1) to very often (7).

Results

Principal components analysis was computed in order to identify the number of factors to be retained. Five factors emerged having eigenvalues greater than 1, which explained 66.5% of the variance. However, the scree test indicated that only the first three factors, which accounted for 56.4% of the variance, were meaningful and should be retained. Subsequently, factor analysis using maximum likelihood extraction and varimax and oblimin rotations were computed. These two methods of rotations yielded similar results. The factor loadings that emerged from the varimax rotation are displayed in Table 3.1.

Factor one included all items intended to form the thoughts of escape subscale, having loadings between .60 and .78. From those, items 13 and 16 also loaded on Factor two (.42 and .33, respectively). Items 4, 8, and 11 also loaded on this factor, however their loadings were relatively low (.30, .38, and .34 respectively) and in addition these items had similar loadings on Factor three. The second factor included 5 of the 6 items intended to form the situation irrelevant thoughts subscale having loadings between .60 and .90. Item 13 also loaded on this factor, however its loading was lower compared to the others (.43) and also this item had a higher loading on Factor one. Item 3, the sixth item expected to load on this factor, did not load on any of the factors above .30. Factor three included 9 of the 11 items intended to form the performance worries subscale with loadings between .35 and .65. Items 7, 12, 17, 19, 21, and 23 loaded on this and no other factor. Items 4, 8, and 11 had loadings between .35 and .37 but also loaded on Factor one. Finally, items 1 and 15 did not load on any factor above .30.

On the evidence of the factor structure and loadings, and considering our intention to minimise overlap between factors, it was decided that the cross-loading items would be dropped along with the items that had loadings lower than .30. Overall, out of the 24 items initially included in this stage of the analysis, 17 were retained. These items were tested in the next stage of the investigation.

Table 3.1 Exploratory Factor Analysis (varimax rotation). Bold characters indicate factor loadings above .30.

<i>During competitions I have thoughts</i>	F1	F2	F3
that I cannot stand it any more	.78	.23	.17
that I do not want to take part in this competition any more	.77	.19	.19
that I want to get out of here	.75	.19	.20
that I am fed-up with it	.71	.23	.29
that I want to quit	.69	.10	.00
about stopping	.67	.33	.23
that I'm not interested in this competition any more	.60	.42	.28
about what I'm going to do when I go home	.21	.91	.15
about other activities (e.g. shopping, having tea, TV)	.22	.81	.00
about what I'm going to do later in the day	.19	.75	.00
about friends	.25	.63	.19
about personal worries (e.g. school, work, relations)	.21	.60	.18
about members of my family	.12	.23	.00
that I'm not going to win	.24	.19	.66
that I'm not going to achieve my goal	.00	.00	.64
that other competitors are better than me	.28	.00	.63
that I'm having a bad day	.16	.27	.58
about previous mistakes I have made	.16	.00	.55
that I lack ability	.38	.17	.37
that the conditions (weather, temperature, pitch, atmosphere) are not good	.12	.27	.36
that I'm letting people (e.g. my coach, my parents) down	.34	.00	.36
that I am performing poorly	.30	.00	.35
that I shouldn't make a mistake	.00	.00	.24
that I shouldn't mess-up	.00	.00	.16

Stage 4: Tests of validity

Method

In the final stage of this investigation the validity of the modified instrument (TOQS; Thought Occurrence Questionnaire for Sports; Appendix D) was tested. In particular, evaluation of factorial validity, convergent validity, and discriminant validity was attempted.

Factorial validity refers to the degree to which measures hypothesised to indicate the respective factors load on the proper factor. Confirmatory factor analysis (CFA) is regarded the most rigorous method for inferring factorial validity.

Convergent validity refers to the degree to which scores of the tested instrument relate to a satisfying degree with measures of identical or similar constructs (Cohen, Montague, Nathason, & Swerdlik, 1988). In order to test the convergent validity of the scale, measures from other scales were also administered to the sample (Appendix D). These scales were the 'negative thinking' subscale from the Test of Performance Strategies (TOPS; Thomas et al., 1999), and the Sport Anxiety Scale (SAS; Smith et al., 1990) that comprises three subscales of 'cognitive anxiety', 'somatic anxiety' and 'concentration disruption'.

Two types of *discriminant* validity were assessed. First, discriminant validity (DV-I) was assessed as the degree of relationship between the tested instrument and measures of other constructs (Cohen et al., 1988). Findings of small relationships between scores of the tested instrument and variables which should not theoretically be correlated provide evidence for discriminant validity for the instrument. That is, measures of cognitive interference should be lowly or not correlated with measures of constructs that are not supposed to be related to experiencing cognitive interference. This type of validity was evaluated through examination of correlations between the TOQS and the 'enjoyment' and 'competence' subscales from the Intrinsic Motivation Inventory (IMI; McAuley, Duncan, & Tammen, 1989).

Second, discriminant validity (DV-II) was assessed as the degree to which measures of the questionnaire's subscales are unique and therefore different from each other Bagozzi

(1990). One way to assess this type of discriminant validity is through examination of the correlations between latent factors in a confirmatory factor analysis model. If these correlations are significantly less than unity, that is correlations are less than 1.00 by an amount exceeding twice their respective standard errors, discriminant validity can be supported. Further evidence regarding discriminant validity of this type was obtained through examination of the correlations between the TOQS subscales and the other measures that were administered. Findings of different correlations between a construct and the three TOQS subscales would further support this type of discriminant validity.

Finally, the internal consistency of the three subscales was assessed through the calculation of Cronbach's alpha coefficient.

The 17 items that were retained from the exploratory factor analysis were tested on a new sample. The sample consisted of 178 athletes (116 males and 62 females; mean age was 21.6 years SD 4.6). The participants were from team sports ($n = 125$) and individual sports ($n = 53$). There were 10 athletes competing at international level, 28 at national level, 53 at regional or county level, 31 at university level and 56 competing at club level.

Results

Factorial validity was tested through CFA. It has been suggested by Bentler & Bonnett (1980) that the hypothesised factor model should be compared to other models. Therefore, four different models were examined. In the first model a one factor solution was tested, that is all the items were loaded on one factor. In the second model, a three factor solution was tested. In this model the items were loaded on three factors according to the results of the exploratory factor analysis. The factors were set uncorrelated. In the third model, the three factors were free to correlate (also in order to assess discriminant validity), while in the fourth model the three factors were designed to load on a second-order factor, namely an overall cognitive interference factor. Higher-order factor models follow a structure similar to the first-order factor models, however the covariances among the first-order factors are hypothesised to be explained by a higher-order construct (in this case cognitive interference). Following Bentler's

(1995) recommendation, the loadings of the first order factors (F1, F2, F3) to the second order factor (F4) were constrained to be equal.

Preliminary analysis gave evidence of multivariate non-normality. Therefore, all models were tested using the Robust Maximum Likelihood method which has been shown to control effectively for overestimation of chi-square, underestimation of adjunct fit indices, and under-identification of errors (Hu & Bentler, 1995). Five indices were considered to evaluate the adequacy of the models: the Non-Normed Fit Index (NNFI), the Comparative Fit Index (CFI), the Robust Comparative Fit Index (R-CFI), the LISREL Goodness of Fit Index (GFI), and finally the Standardised Root Mean Squared Residual (SRMR). The fit indices for the four models are presented in Table 3.2. Chi-square difference tests were computed to examine whether the chi-square values differed significantly between the four models. It was revealed that model two was significantly better than model 1 (chi-square difference: 315.43, $p < .05$), and model three significantly better than model two (chi-square difference: 94.71, $p < .05$). Model four was also significantly better than model two (chi-square difference: 93.31, $p < .05$), but not from model three (chi-square difference: 1.4, $p > .05$).

Table 3.2 The fit indices for the four alternative CFA models.

Fit Index	Model 1	Model 2	Model 3	Model 4
Sattora Bentler scaled χ^2 / probability	427.64/.000	237.86/.000	161.25/.003	161.47/.004
NNFI	.596	.854	.927	.929
CFI	.646	.872	.938	.938
R-CFI	.682	.877	.953	.955
GFI	.644	.834	.881	.881
SRMR	.126	.210	.059	.061

Model 1: one factor solution; Model 2: three factors – uncorrelated;

Model 3: three factors - free to correlate; Model 4: three factors - second order factor

The factor loadings and the uniqueness for each item in the first-order factors and the loadings for the three first-order factors on the second-order factor in the fourth model are presented in Table 3.3. All items and factors had high loadings and relatively low errors, which in addition to the adequacy of the fit indices support the hypothesis of factorial validity.

Table 3.3 Confirmatory Factor Analysis: The second order factor model. Standardised factor loadings (first column) and uniqueness (second column).

	Factor 1	Factor 2	Factor 3	Factor 4
<i>During competitions I have thoughts</i>				
that I am fed-up with it	.859	.512		
that I do not want to do this competition any more	.826	.564		
that I cannot stand it any more about stopping	.805	.593		
that I want to get out of here	.748	.663		
that I want to quit	.678	.735		
about what I'm going to do when I go home		.852	.523	
about what I'm going to do later in the day		.811	.586	
about other activities (e.g. shopping, having tea, TV)		.800	.601	
about friends		.639	.769	
about personal worries (e.g. school, work, relations)		.628	.778	
that I'm not going to win			.823	.569
that other competitors are better than me			.688	.726
that I'm having a bad day			.597	.802
about previous mistakes I have made			.524	.852
that the conditions (weather, temperature, pitch, atmosphere) are not good			.524	.852
that I'm not going to achieve my goal			.467	.884
Factor 1				.746 .666
Factor 2				.647 .763
Factor 3				.758 .656

Factor 1: thoughts of escape; Factor 2: situation-irrelevant thoughts;
 Factor 3: performance worries; Factor 4: cognitive interference

Table 3.4 Mean scores for all items.

Item / (Scale)	Content	Mean
<i>During competitions I have thoughts</i>		
TOQS 9	(W) that the conditions (weather, temperature, pitch) are not good	3.599
TOQS 12	(W) that I'm not going to achieve my goal	3.548
TOQS 3	(W) about previous mistakes I have made	3.362
TOQS 15	(W) that I'm not going to win this competition	3.350
TOQS 17	(W) that other competitors are better than me	3.318
TOQS 6	(W) that I'm having a bad day	3.147
TOQS 5	(I) about what I'm going to do later in the day	2.446
TOQS 13	(E) that I am fed-up with it	2.305
TOQS 4	(E) that I do not want to take part in this competition any more	2.226
TOQS 8	(I) about personal worries (e.g. school, work, relations)	2.215
TOQS 14	(I) about what I'm going to do when I go home	2.175
TOQS 11	(I) about friends	2.124
TOQS 7	(E) that I want to get out of here	2.028
TOQS 10	(E) about stopping	1.879
TOQS 1	(E) that I want to quit	1.859
TOQS 16	(E) that I cannot stand it any more	1.814
TOQS 2	(I) about other activities (e.g. shopping, having tea, TV)	1.768

W: performance worries; I: situation irrelevant thoughts; E: thoughts of escape

Table 3.5 Means, standard deviations and correlations for the TOQS subscales.

	Descriptive statistics		Correlations		
	Mean	S.D.	TOQS-E	TOQS-I	TOQS-W
Thoughts of escape (TOQS-E)	2.02	1.01			
Situation-irrelevant thoughts (TOQS-I)	2.15	1.08	.39 **		
Performance worries (TOQS-W)	3.39	1.04	.47 **	.39 **	
Cognitive interference (total)	2.52	.81	.79 **	.77 **	.79 **

*p < .05, ** p < .01

Convergent and Discriminant (DV-I) validity. Convergent and discriminant (DV-I) validity was assessed through examination of the correlations of the three subscales as well as the total cognitive interference scores with other scales. The correlations that emerged are presented in Table 3.6.

Table 3.6 Correlations between the cognitive interference subscales and other scales.

	TOPS	SAS 1	SAS 2	SAS 3	IMI 1	IMI 2
	Negative thinking	Cognitive anxiety	Somatic anxiety	Concentration disruption	Competence	Enjoyment
TOQS-E	.32 **	.35 **	.20**	.45 **	-.18 *	-.27 **
TOQS-I	.13	.20**	-.03	.51 **	-.16 *	-.22**
TOQS-W	.43 **	.40 **	.11	.38 **	-.01	-.09
TOQS	.38 **	.40 **	.12	.56 **	-.15	-.25 **

* $p < .05$, ** $p < .01$

TOQS-W, TOQS-E and total interference correlated relatively highly with the ‘negative thinking’ subscale of the TOPS, while the correlation between this particular subscale and TOQS-I was low. The correlation between total interference and its three subscales with the ‘concentration disruption’ scale were relatively high, while correlations between cognitive anxiety and cognitive interference were higher, compared to those between somatic anxiety and cognitive interference. Finally, TOQS-E, TOQS-I, and total interference were lowly negatively correlated with ‘enjoyment’ and ‘competence’, while the correlations between TOQS-W and ‘competence’ and ‘enjoyment’ were close to zero. Overall, the patterns of correlations that emerged were as expected, thus providing support for convergent and discriminant (DV-I) validity.

Discriminant validity (DV-II). Correlations between the three latent factors were obtained from the third confirmatory factor analysis model. Standard error for each correlation was used to compute confidence intervals. Accordingly, the correlation between TOQS-E and TOQS-I was .451 (standard error .064, upper bound confidence interval .579), between TOQS-E and the TOQS-W was .591 (standard error .081, upper bound confidence interval .753), and finally, between TOQS-I and TOQS-I was .469 (standard error .079, upper bound confidence interval .625). Thus, the inter-correlations between the three latent factors were significantly less than unity, supporting the

hypothesis of discriminant validity (the correlations between latent factors in a CFA models are different from Pearson's coefficients, since they are corrected for measurement error).

Further evidence regarding discriminant validity (DV-II) for the TOQS subscales emerged from their correlations (Pearson's coefficients) with other constructs. TOQS-W and TOQS-E correlated with 'negative thinking' from TOPS, and cognitive anxiety from SAS, higher than TOQS-I, whereas all three TOQS subscales had similar correlations with 'somatic anxiety' and 'concentration disruption' from SAS. Furthermore, TOQS-E and TOQS-I had higher correlations with 'competence' and 'enjoyment' from IMI than TOQS-W. Such indications that the three subscales correlate differently to other measures further support this type of discriminant validity.

Reliability. Finally, calculation of the Cronbach's alpha coefficient revealed satisfactory internal consistency for the three subscales. Cronbach's alpha was .90 for TOQS-E, .85 for TOQS-I, and .78 for TOQS-W.

Discussion

The present investigation attempted to develop an instrument to assess cognitive interference in sport. In the initial stages of the investigation, including interviews with athletes and evaluation of items by individuals from the sport psychology field, it was revealed that the types of thoughts sports performers experience seem to be similar to those experienced in evaluative situations in educational environments, such as examinations. In particular, three categories were identified as described by Sarason et al. (1986). The first category included statements that refer to worry and negative self-evaluation over performance and competition. The second category was characterised by statements irrelevant to the performance or competition, while the third included statements of withdrawing from the competition. However, the content of the statements characterising the first category was relatively different compared to those comprising the original TOQ. Considering that an academic examination and a competitive performance are similar in that they both include the element of evaluation (that can be perceived as difficult, challenging, or threatening, depending on the individual's perceived adequacy and effectiveness), but differ in the nature of the task and the

structure of the competition, the above findings seem reasonable. Thus, concerning performance worries, there were statements that were quite specific to the nature of sport competition, for example, the conditions of the competition, previous mistakes of the performer, the opposition. These are elements that cannot be found in test situations. The content of the statements characterised as irrelevant thoughts and thoughts of withdrawal were similar to those included in the TOQ, and therefore only minor modifications were made.

The stages that followed involved quantitative methods of instrument evaluation. In particular, exploratory and confirmatory factor analysis was used to assess the psychometric properties of the TOQS. Although there were specific hypotheses concerning the structure of the questionnaire, which would suggest that confirmatory analysis could be directly applied, exploratory analysis was preferred at first, since the questionnaire included items that had not been tested before. In addition, since the questionnaire had not yet reached its final form, exploratory factor analysis would help identify items that could possibly be problematic, therefore resulting in further item reduction.

According to expectations, exploratory factor analysis revealed three meaningful factors. Furthermore, it indicated that in order to obtain a more statistically sound structure some items should be dropped. All 7 items referring to thoughts of escape loaded on the first factor. One item which crossloaded ('... I am not interested in this competition any more') was dropped, hence six items were retained for further analysis. From the six items referring to situation-irrelevant thoughts, five loaded on the second factor, while one item ('... about members of my family) did not load on any factor and therefore was dropped from the subscale. From the 11 items referring to performance worries, six loaded uniquely on factor three, and these were the items that were retained. Three items from the ones referring to performance worries ('... that I lack ability', '... that I am letting people down', '... that I am performing poorly') loaded on more than one factor. Because the loadings of these three items were moderate to low on any of the factors they were also dropped. Finally, two items ('... that I shouldn't make a mistake now', '... that I shouldn't mess-up now') did not load on any factor higher than .30 and were dropped. Overall, the factor structure of the questionnaire reflected that of

the original TOQ, which indicates that patterns of interfering thoughts under evaluative situations are similar.

Further evidence for the validity of the TOQS emerged from the CFA. From the four models testing for factorial validity, the two models which accounted for the relationship between the three factors best fitted the data. These models seem to be in line with the assumptions of cognitive interference since, in combination with the evidence concerning discriminant validity (DV-II), they indicate that each factor measures a different aspect of cognitive activity. This, in turn, is the construct that explains the association between the factors, that is, it shows that the factors have common characteristics as they all include non-task-processing cognitions, therefore distractions.

Evidence to support the psychometric properties of the instrument were finally provided through examination of convergent and discriminant (DV-I) validity. Correlations between the 'negative thinking' subscale from the TOPS and TOQS-W and TOQS-E subscales were relatively high, while the correlation for TOQS-I was lower.

Considering that this particular subscale comprises distracting thoughts which, however, are not negative in nature, the pattern of correlations seems satisfactory. In accordance with research in educational settings (Hunsley, 1987; Sarason, 1984; Sarason et al., 1986) correlations between cognitive anxiety and cognitive interference were higher compared to those of somatic anxiety. From the three interference subscales, TOQS-I had the lower correlation with cognitive anxiety, which is also in line with the theory's assumptions that under evaluative situations cognitive anxiety is related to self-preoccupying and self-evaluating tendencies (Sarason, 1984). Finally, high correlations were revealed between the TOQS subscales and the SAS 'concentration' subscale which is a measure of concentrating ability. Overall, the patterns of correlations that emerged provide adequate support for convergent and discriminant (DV-I) validity.

Conclusion

There is agreement that cognitive activity during sport has a significant influence on performance. In order to better understand the role of cognitive interference, the factors that generate it, and its effects on performance, measurement instruments are required.

This investigation has described the modification of an instrument developed and used for purposes of educational research, so that it can be applicable for sport situations. The adoption of a multidimensional model might prove useful in examining under what circumstances and why different types of thoughts appear in athletes' minds, and what their effects are on performance. Overall, the TOQS, an instrument to identify the nature and frequency of various thoughts athletes experience during sport performance, appears to have promise as a research tool.

Having established an instrument appropriate to use for sport settings, the investigation can progress towards the assessment of the research questions regarding cognitive interference. The first issue to be examined involves examination of situational antecedents of cognitive interference.

Chapter 4. Predicting Cognitive Interference: Situational Factors

Study II: Pre-competition anxiety and discrepancies between performance goals and performance as antecedents of cognitive interference

Introduction

As already described in the review of literature, research in education has proposed an attentional interpretation of the detrimental effects of test anxiety on academic performance (Sarason, 1984; Wine, 1971). In particular, cognitive interference, described as task-irrelevant, self-preoccupying thoughts individuals experience while performing a task, i.e. thoughts which are not related to the execution of the task, have been hypothesised to mediate the relationship between test anxiety and performance. According to the cognitive interference interpretation, interfering thoughts being a result of anxiety impair performance by diverting attention from the task and using up resources that otherwise could be applied for task-processing purposes. Attempting to provide support for the model researchers investigated relationships between test anxiety and cognitive interference and also cognitive interference and performance.

Sarason & Stoops (1978) examined the relationship between test anxiety and cognitive interference on a task presented as an intelligence test. Results indicated that highly test anxious individuals experienced higher levels of cognitive interference than lowly anxious individuals, being more preoccupied about how poorly they were doing, how other people could cope and what the examiners would think of them. Zatz & Chassin (1983, 1985) reported that during analogue tasks children high in test anxiety experienced more task-debilitating cognitions than children low in test anxiety. Similarly to research with adults (Gallassi et al., 1981) such thoughts included unfavourable social comparisons, inability to concentrate, and desires to leave the situation. Similar results have been reported in a number of other studies (e.g. Bruch et al., 1983; Hollandsworth et al., 1979).

Having established this relationship researchers tried to identify other factors related to the appearance of cognitive interference during task performance. Arkin et al. (1982) examined the relation between test anxiety, task difficulty and interference. They found that irrespective of difficulty highly anxious individuals reported experiencing more

interference than lowly anxious ones. In addition, they reported that the more difficult tasks aroused more interfering thoughts than the easier ones, and that the interaction of highly anxious individuals working on the difficult tasks elicited the most interference. Zatz & Chassin (1985), examining the effects of classroom environment in relation to cognitive interference, reported that highly evaluative conditions were related to greater levels of interference. Finally, Hunsley (1987), reported cognitive interference to be related to previous experiences, importance of examination, perceived preparation, and grade expectation.

Progressively, research in the area tried to establish the relationship between cognitive interference and task performance. Sarason & Stoops (1978), using a digit symbol task, reported that individuals experiencing greater amounts of interfering thoughts performed more poorly compared to those reporting lower levels of interference. Hoffman (1993) reported that in a computer based task, worries related to the task were a significant predictor of performance. Similar results have been reported from studies examining cognitive interference and performance in examination situations (e.g. Paulman & Kennelly, 1984; Zatz & Chassin, 1985).

However, Klinger (1985) suggested that the direction of the causality in the relationship between cognitive interference and performance might be the opposite to the one supported, proposing that cognitive interference is a 'reaction to performance'. He supported that during the course of an examination and when individuals encounter unexpected difficulties, anxiety rises and thoughts about poor performance and adequacy to complete successfully the test come to the fore, while task-related problem-solving thoughts become fewer. Klinger's proposition seems to be well accommodated in Carver & Scheier's (1988) control process model of anxiety described in the literature review. In brief, Carver and Scheier suggested that human behaviour follows the self-regulatory principle of feedback control. Actions and behaviour are compared to salient reference values, and observed discrepancies are countered by adjusting behaviour in line with the behavioural standards. In more practical terms, when during the execution of a task people encounter difficulties, they temporarily 'interrupt' their action and assess the likelihood of being able to complete the intended behaviour. In the context of this process, if discrepancies between goals and behaviour are identified individuals are likely to experience worry. This particular approach seems of great interest and

applicability in a sport context where individuals are very likely to have and strive for specific goals (Jones & Hanton, 1996). Adapting this hypothesis for a sport environment, it can be suggested that while competing athletes compare their performance progress to existing standards, and most importantly to their expectancies and goals regarding their performance and when discrepancies are identified, worries regarding performance and goal achievement are generated.

Given the theoretical framework provided by anxiety research in education the first purpose of this study was to identify situational factors related to the appearance of cognitive interference athletes experience while performing. Considering that cognitive interference has been introduced as an effect of test anxiety, competitive anxiety was the first factor hypothesised to predict cognitive interference. Furthermore, considering Klinger's (1985) interpretation and Carver & Scheier's (1988) theoretical propositions regarding the relationship between cognitive interference and performance, the study also examined the degree to which cognitive interference athletes experience is a function of discrepancies between goals and performance.

Within the sport psychology literature, anxiety has attracted remarkable amounts of interest. In particular, the relationship between competitive anxiety and performance has been the research question that dominates the field. Several theories have been developed and tackled throughout the years, however results have failed to provide conclusive results. Thus, cognitive and somatic anxiety, the two components of anxiety within the multidimensional anxiety approach, have been found to be positively, negatively, or not at all related to performance (see Review of Literature). The lack of consistency in the relationship between anxiety and performance led Parfitt et al. (1990) to suggest that anxiety is not necessarily detrimental to performance. Subsequently, they proposed that apart from intensity researchers should consider another dimension of anxiety, namely the direction of anxiety. This dimension refers to the way athletes perceive anxiety symptoms, in particular whether athletes perceive these symptoms as facilitative (helpful to performance) or debilitating (detrimental to performance).

Initial investigation has provided support for the distinction between intensity and direction of anxiety, indicating that anxiety can be perceived by athletes either as facilitative or debilitating (e.g. Jones & Swain, 1992). Furthermore, research examining

the relationship between anxiety direction and performance seems to stress the importance of considering further the dimension of anxiety direction. Jones et al. (1993) divided a sample of gymnasts into two groups according to performance on the beam. Good and poor performers did not differ in the intensity of cognitive and somatic anxiety, however the good performance group reported their anxiety symptoms as more facilitative and less debilitating than the poor performance group. Swain & Jones (1996) examined the contribution of anxiety intensity and direction as predictors of basketball performance. They reported that cognitive and somatic anxiety direction were better predictors of performance than cognitive and somatic anxiety intensity respectively. Considering these results it could be speculated that direction of anxiety might be equally important to intensity in relation to cognitive interference athletes experience during competition. Therefore, despite criticism that this development in sport anxiety research has received (Burton, 1998; Burton & Naylor, 1997), direction of anxiety was considered along with intensity to explore further the usefulness of this dimension.

Based on these advances regarding competitive anxiety, arguing the importance of anxiety direction, the second aim of the study was to identify the role of subjective interpretations of anxiety symptoms in relation to pre-competition anxiety intensity and cognitive interference athletes experience during sport performance.

Hypotheses

Based on the theoretical framework on which cognitive interference theory was developed, anxiety was hypothesised to be an important predictor of cognitive interference. In accordance with research in educational settings (Sarason, 1984; Sarason et al., 1986) it was expected that cognitive anxiety intensity will be more strongly related to interference than somatic anxiety. Moreover, stemming from the propositions of Klinger (1985) and Carver & Scheier (1988) it was hypothesised that cognitive interference would be better predicted by discrepancies between expected and actual performance, than from pre-competition anxiety. Finally, in relation to anxiety direction, it was hypothesised that irrespective of anxiety intensity, individuals experiencing anxiety symptoms as facilitative would experience less interference than those interpreting the symptoms as debilitating.

Method

Sample

The sample consisted of 36 athletes (24 males, 12 females) who took part in a middle-distance (2.7 miles) cross-country relay event. The mean age of the sample was 23.14 years (S.D. 6.46), with an average competitive experience of 6.7 years (S.D. 3.6).

Instruments

Anxiety. The CSAI-2 (Martens et al., 1990) was used to measure anxiety. The CSAI-2 comprises 27 items in three subscales assessing intensity of cognitive anxiety (e.g. "I have self-doubts", "I am concerned about performing poorly"), somatic anxiety (e.g. "I feel nervous", "My body feels tense") and self-confidence (e.g. "I feel at ease", "I am confident about performing well"). Participants were asked to rate on a 4-point scale the intensity of each of the listed symptoms (1 = not at all, 4 = very much so). Along with the scale assessing intensity of anxiety components, Jones & Swain's (1992) direction scale for cognitive and somatic anxiety was administered. Participants were asked to indicate on a seven-point scale the degree to which the intensity of cognitive and somatic anxiety symptoms they were experiencing was perceived as facilitative or debilitating to performance (-3 = debilitating, 0 = neutral, 3 = facilitative).

Cognitive interference. The TOQS was used to assess frequency of interfering thoughts (for details see Chapter 3).

Time discrepancy. Athletes' time-goal and final time were recorded and discrepancies between them were calculated.

The instruments used in this study are displayed in Appendix E.

Procedure

After the registration for the race athletes were informed about the research project and were asked to volunteer. Eight teams comprising four athletes each and four individual runners agreed to participate and instructions on how to complete the questionnaire were subsequently given. The CSAI-2 along with demographic characteristics and time-goal estimations were completed approximately 30 minutes before the start of the event, while the TOQS was completed immediately after each runner completed his/her race.

Results

Descriptive statistics, reliability coefficients and correlations of the variables are presented in Table 4.1. The three cognitive interference subscales were moderately correlated to each other. Cognitive and somatic anxiety were moderately intercorrelated and they were both negatively correlated to self-confidence. The correlation between intensity and direction of cognitive anxiety was negative, while intensity and direction of somatic anxiety were uncorrelated. Both cognitive and somatic anxiety direction were positively correlated to self-confidence. From the three interference subscales 'performance worries' correlated to anxiety components higher than 'situation-irrelevant thoughts' and 'thoughts of escape'.

Predicting cognitive interference

Hierarchical regression analysis was subsequently calculated to reveal the degree to which cognitive interference could be predicted from intensity of anxiety and time discrepancy (bigger discrepancy scores indicating larger distance from goal). This particular type of analysis was preferred because it would allow to investigate the relative contribution in explaining cognitive interference variance after accounting for variance explained by each set of independent variables. Three separate regression models were calculated each one having one of the cognitive interference subscales (TOQS-W, TOQS-I, and TOQS-E) as the dependent variable.

In the first model TOQS-W was the dependent variable (Table 4.2). When anxiety components entered the regression before discrepancy cognitive anxiety was a significant predictor of interference (adjusted $R^2 = .10$), while somatic anxiety and self-confidence were not. The addition of time discrepancy in the second step raised the prediction significantly (total-adjusted $R^2 = .41$). When discrepancy was entered first in the regression (adjusted $R^2 = .33$), cognitive anxiety could still account for a significant amount of interference variance (total-adjusted $R^2 = .41$).

Table 4.1 Descriptive statistics, internal consistency and correlations for all measured variables.

	Descriptive statistics		Cronbach's alpha	Correlations								
	Mean	S.D.		1	2	3	4	5	6	7		
1. Cognitive anxiety intensity	18.53	3.07	.70									
2. Somatic anxiety intensity	16.86	3.13	.71	.37*								
3. Self-confidence	24.06	4.52	.81	-.35*	-.23							
4. Cognitive anxiety direction	5.42	7.97	.84	-.24	-.14	.44**						
5. Somatic anxiety direction	5.11	7.99	.89	-.25	.07	.32	.64**					
6. Performance worries	12.39	5.03	.70	.34*	.28	-.32	-.24	-.24				
7. Situation-irrelevant thoughts	9.08	5.55	.83	.19	-.03	-.12	-.25	-.11	.32			
8. Thoughts of escape	9.47	5.08	.89	.15	.16	-.10	-.29	-.30	.39*	.32		

* $p < .05$, ** $p < .01$

Table 4.2 Hierarchical regression analyses for performance worries.

Predictor	F	Beta	Adjusted R ²
step 1			
cognitive anxiety intensity	4.88 *	.36	.10
somatic anxiety intensity	did not reach the .05 criterion		
self-confidence	did not reach the .05 criterion		
step 2			
performance discrepancies	12.40 **	.56	.41
step 1			
performance discrepancies	17.05 **	.59	.33
step 2			
cognitive anxiety intensity	12.40**	.31	.41
somatic anxiety intensity	did not reach the .05 criterion		
self-confidence	did not reach the .05 criterion		

* p < .05, ** p < .01

In the next model where TOQS-I was the dependent variable (Table 4.3) anxiety components when entered first in the equation were not a significant predictor. Time discrepancy accounted for a significant amount of variance, but was much lower compared to the variance predicted for performance worries (adjusted R² = .14).

Table 4.3 Hierarchical regression analysis for situation-irrelevant thoughts.

Predictor	F	Beta	Adjusted R ²
step 1			
cognitive anxiety intensity	did not reach the .05 criterion		
somatic anxiety intensity	did not reach the .05 criterion		
self-confidence	did not reach the .05 criterion		
step 2			
performance discrepancies	5.09 *	.37	.14

p < .05, * p < .01, **

Finally, when TOQS-E was the dependent variable (Table 4.4), anxiety components were not a significant predictor when entered into the regression first, whereas time discrepancy was (adjusted $R^2 = .29$).

Table 4.4 Hierarchical regression analyses for thoughts of escape.

Predictor	F	Beta	Adjusted R^2
step 1			
cognitive anxiety intensity	did not reach the .05 criterion		
somatic anxiety intensity	did not reach the .05 criterion		
self-confidence	did not reach the .05 criterion		
step 2			
performance discrepancies	14.22 **	.55	.29

$p < .05$, * $p < .01$ **

Direction of anxiety

In the second part of the analysis the sample was divided into anxiety direction groups. Specifically, following the recommendations of Jones & Swain (1995) athletes having positive scores in both cognitive and somatic anxiety direction were included in the facilitative group (N=20), while those having negative scores in both cognitive and somatic anxiety were included in the debilitating group (N= 11). Subsequently, multivariate analyses of variance was calculated to test for differences in cognitive and somatic anxiety intensity, and also in the three cognitive interference subscales. Regarding anxiety intensity both the multivariate and the univariate effects were non-significant, with the two groups having similar mean scores (Table 4.5).

For the three cognitive interference subscales, the multivariate effect was not significant although did show a trend ($F= 2.46$, $p= .08$). Estimates of effect size (eta squared: .21 for the multivariate effect) encouraged examination of the univariate tests. These indicated important trends. In particular, there was a significant univariate effect for 'performance worries' ($F= 6.14$, $p<.05$). Moreover, in all three subscales the debilitating group had higher mean scores than the facilitative group (Table 4.5).

Table 4.5 Mean scores in anxiety intensity and cognitive interference for the two anxiety direction groups.

	Anxiety direction		F	p	η^2
	Facilitative	Debilitative			
Cognitive anxiety intensity	18.00	19.55	1.68	.20	.05
Somatic anxiety intensity	16.95	17.36	.12	.73	.01
Performance worries	11.25	15.73	6.14	.02	.18
Situation-irrelevant thoughts	8.05	11.18	2.04	.16	.07
Thoughts of escape	8.30	11.73	3.59	.07	.11

Discussion

The correlations between the anxiety intensity components were in accordance with findings from previous research (e.g. Edwards & Hardy, 1996; Gould et al., 1984). Cognitive and somatic anxiety were moderately positively correlated, and they were both negatively correlated to self-confidence. Also in accordance with research examining relationships between intensity and direction of anxiety (e.g. Edwards & Hardy, 1996; Jones et al., 1993), self-confidence was positively correlated with cognitive and somatic anxiety direction, that is the higher the confidence the more facilitative the anxiety symptoms and vice versa.

The relationship between cognitive anxiety intensity and direction was moderately negative. Previous research has not revealed consistent results concerning this particular relation. Jones et al. (1993) found a low positive correlation (.19) between cognitive anxiety intensity and direction, Swain & Jones (1996) reported the two dimensions to be uncorrelated (-.06), while Edwards & Hardy (1996) found a low negative correlation (-.10), which seems to suggest that there are other factors moderating the relationship.

Finally, somatic anxiety intensity and direction were found to be uncorrelated. Edwards & Hardy (1996), Jones et al. (1993), and Swain & Jones (1996), found negative

relationships that ranged from $-.29$ to $-.57$, with the largest reported in a sample of gymnasts. Considering the type of samples in these studies compared to the present sample it could be argued that the result seems interpretable. In particular, the biggest correlation was found in a sample of gymnasts, while the two others were reported in basketball and netball samples. Basketball, netball and in particular gymnastics are sports that involve finer skills compared to running which is a gross skill. Somatic symptoms in such sports can be perceived by athletes as more detrimental to the execution of fine movements, whereas in running athletes are more likely to desire higher levels of physiological arousal which is to a degree related to somatic anxiety. Therefore, the fact that somatic anxiety intensity was not negatively correlated to its own direction scale is not surprising.

Anxiety and performance discrepancies as predictors of cognitive interference

Regression analysis tested the degree to which anxiety intensity and discrepancy between goals and performance could predict frequency of cognitive interference athletes experienced during the race. Separate analysis for each subscale, rather than an analysis involving total interference scores, would give a better insight into whether different types of thoughts have different antecedents. In support of this kind of analysis evidence from the study examining the psychometric properties of the TOQS, supported the discriminant validity of the three subscales.

Hierarchical regression analysis was calculated with anxiety intensity and performance discrepancy entering the equation first interchangeably in order to examine the relative contribution of the predictors. In the case of performance worries, cognitive anxiety, when entered first, explained a significant amount of variance. The addition of discrepancy in the second step raised the predicted variance. When discrepancy was entered first, cognitive anxiety could still add significantly to the prediction. Somatic anxiety and self-confidence did not account for significant amounts of variance in any of the cases. In accordance with the hypothesis, discrepancy between expectancies and performance was a stronger predictor of performance worries than cognitive anxiety. However, it is important to note that despite the large amount of variance explained by performance discrepancies, cognitive anxiety could contribute to the prediction, which means that the two predictors accounted for different parts of performance worries.

Attempting to interpret this result, it could be suggested that regardless of performance quality, cognitive anxiety before the race is translated to worries during the race. Furthermore, considering that some of the predicted variance was shared between the predictors, it appears that in accordance with theoretical conceptualisations of anxiety (Martens et al., 1990) cognitive anxiety reflects some anticipation of poor performance. Nevertheless, the quality of performance in relation to the expectations is the factor that mainly determines the levels of performance worries athletes experience, which seems to support Carver & Scheier's (1988) model. In particular, it could be suggested that when athletes' performance does not reflect their expectations, or when during the competition unexpected difficulties arise, athletes tend to ruminate over performance-related, self-evaluative thoughts.

Somatic anxiety and self-confidence, despite being moderately correlated to performance worries, did not contribute to the prediction, which suggests that the variance of performance worries explained by these two variables was part of the variance explained by cognitive anxiety. However, the relationship between somatic anxiety and performance worries was of noticeable magnitude suggesting that in contrast to literature in educational settings (e.g. Sarason et al., 1986), in sport, physiological condition is of greater importance in influencing cognitive activation during performance.

In subsequent analyses, in contrast to the results obtained for performance worries, discrepancies between expected and actual performance was the only significant predictor of situation-irrelevant thoughts and thoughts of escape. From these analyses two important points can be made. First, that cognitive anxiety is mostly related to 'performance worries' and, second, that performance discrepancies could account for relatively large amounts of variance in 'performance worries' and 'thoughts of escape', compared to 'situation-irrelevant thoughts'.

Concerning the first point, results are in line with findings in the test anxiety/cognitive interference literature. Sarason (1984) found test anxiety to be significantly more related to 'worry' than 'test-irrelevant thinking'. Subsequently, he suggested that in an evaluative situation anxiety symptoms are more likely to be related to thoughts that reflect fears of failure and comparison with others than thoughts irrelevant to the

situation. Furthermore, in the sport domain, in the initial stage of the investigation where the psychometric properties of the TOQS were tested, it was found that cognitive anxiety was more strongly related to 'performance worries' than to 'situation-irrelevant thoughts'.

Concerning the second point, similar reasoning can be supported. When discrepancies between expected and actual performance are detected it is reasonable that thought content would involve matters related to the competition such as worries, consequences of failure and frustration which also might result in withdrawing thoughts rather than to thoughts not relevant to the event.

The role of anxiety direction

Subsequently, the sample was divided into groups according to their interpretation of cognitive and somatic anxiety symptoms. The analysis revealed that the facilitative and debilitating anxiety direction groups did not differ significantly in levels of anxiety intensity. However, fairly strong trends were identified showing differences in the levels of cognitive interference, and in particular performance worries, the two anxiety direction groups reported. The fact that the two cognitive anxiety direction groups did not differ in anxiety intensity, but did appear to differ in performance worries suggests that for athletes perceiving their anxiety states as debilitating, anxiety before the competition was translated into cognitive interference during the event, whereas this was not the case for those perceiving their anxiety states as facilitative.

Increases in anxiety levels can be considered a normal reaction to a competitive situation. However, as supported in the literature (e.g. Jones et al., 1994; Jones & Swain 1992; Jones et al., 1993) for some athletes sensations of anxiety are perceived as helpful, while for others as detrimental to performance, depending on the interpretation of the individual in each situation. Thus, similar levels of anxiety can be regarded as facilitative or debilitating by different athletes, but also by the same athlete in different situations (Edwards & Hardy, 1996). It can be speculated that when pre-competition anxiety is perceived as facilitative, once the competition starts symptoms such as the occurrence of worrying thoughts cease. However, when anxiety is perceived as debilitating the symptoms persist and might become threatening to performance.

Moreover, it can be suggested that perceiving anxiety symptoms as debilitating might be by itself a source of worry while competing. Considering these findings in relation to the assumption that cognitive interference might be detrimental to performance, the results seem to support and justify the view that direction can be equally important to intensity in predicting performance.

Methodological considerations

Considering recent criticism that the CSAI-2 has received (Burton 1998; Lane et al. 1999), results involving measures of anxiety using this instrument should be cautiously interpreted. One result that should be considered under the light of such criticism is the magnitude of the relationship between cognitive anxiety and cognitive interference, and in particular performance worries which can be said to be the cognitive element of anxiety during competition. In the present study, this relationship was moderate. As already speculated, one reason for this might be the fact that once competition has started, the cognitive state of individuals may change due to events occurring during the game. However, it has to be stressed that Burton (1988) and Lane et al. (1999) argue that whether the cognitive anxiety subscale of CSAI-2 is actually assessing anxiety is questionable. Based on evidence that cognitive anxiety can be perceived as facilitative and considering the content of the subscale which asks athletes to report concern regarding upcoming events, they argue that CSAI-2 is not really measuring anxiety, but possibly other affective states such as excitement, which therefore explains why anxiety as measured through the CSAI-2 can be perceived as facilitative. So, the moderate relationship identified between cognitive anxiety and performance worries might be due to the limited adequacy of CSAI-2 to assess pre-competition cognitive anxiety.

Based on the above arguments regarding the operationalisation of anxiety, findings regarding the directional interpretations of anxiety, are meaningful only to the degree to which CSAI-2 measures anxiety, or in relation to whatever it is that CSAI-2 measures. So, it can be speculated, that athletes perceiving the symptoms described by CSAI-2 as debilitating, actually experience anxiety which translates into higher levels of cognitive interference during competition, whereas those perceiving the symptoms as facilitative may experience excitement which is related to lower levels of cognitive interference.

Further consideration of anxiety measurement is necessary for the advancement of sport anxiety research, however interpretation of the present results in the light of such criticism is meaningful and can also contribute to a better understanding of anxiety processes before and during competition. Finally, replication of the present results is essential before firm conclusions can be drawn due to sample limitation (size), which however are due to the demanding research design necessary to examine such hypotheses.

Conclusion

In accordance with findings in educational psychology, pre-competition anxiety was found to be related to cognitive interference during competition. However, the magnitude of the relationship was moderate, indicating that between cognitions before and during the event, performance feedback information becomes an important determinant of cognitive activation. Therefore, that anxiety fails to predict performance consistently might be due to alterations of anxiety states during competition as a result of performance and other possible incidents that occur during competition. Much remains to be explored regarding cognitive interference, however, it becomes evident that expanding anxiety research into what is 'going on' while performing might prove to be a fertile research area with important implications for the field of applied sport psychology.

Having found that the relationship between pre-competition anxiety and cognitive activation during performance is only moderate, thus partly explaining why the literature examining relationships between anxiety and performance has been equivocal, in the next chapter an attempt is made to identify how cognitive interference athletes experience is linked to performance.

Chapter 5. Cognitive Interference and Performance Features

Study III: Athletes' perceptions of how cognitive interference during competition influences concentration and effort.

Introduction

Within research focusing on sport performance a great deal of attention has been directed at the pre-competition state of athletes. Within this literature, anxiety, which describes the somatic and cognitive condition of athletes before the competition, has been the dominant research focus. Psychologists have tried to find and explain associations between these pre-competition states and performance and, as already discussed, results so far have not been consistent. One possible reason for this inconsistency is that cognitive and somatic states of athletes can change during competition. A single moment of good or bad luck, a crucial mistake, an official's decision, or unexpected events can alter athletes' feelings and cognitions dramatically. Indeed, the results of the previous study revealed only moderate relationships between pre-competition anxiety states and cognitive interference while performing. It is therefore quite understandable that pre-competition conditions sometimes fail to predict performance.

Furthermore, the inconsistency of findings exploring the anxiety/performance relationship has been attributed to several methodological limitations. Among them, Parfitt et al. (1990) identified that anxiety research in sports has mostly focused on global performance measures which might be insufficiently sensitive to anxiety effects. They therefore suggested that research should examine effects of anxiety on subcomponents of performance.

Therefore, the importance of studying athletes' cognitions during competition and their likely effects on features of performance becomes evident. In one of the few attempts to examine the relationship between cognitive content during competition and performance in sports, Gould, Ecklund, & Jackson (1992) used qualitative methods of inquiry to examine patterns of thought occurrence in elite wrestlers, comparing between athletes, but also within athletes (successful/unsuccessful performances). Successful performances were characterised by absence of thoughts for some of the athletes while

others reported their only thoughts to be related to focusing on strategies and techniques that should be applied. In contrast, during unsuccessful performances athletes admitted having thoughts that were not related to the task, as well as self-defeating negative thoughts.

As already acknowledged in previous chapters, a great deal of research concerning cognitive interference during task performance has been conducted in educational psychology, where cognitive interference has been described as task-irrelevant, self-preoccupying thinking, including components of worry about performance (Sarason et al., 1990). The interest of psychologists in cognitive interference initiated when researchers tried to explain the relationship between test anxiety and cognitive task performance. Cognitive interference was introduced as a product of test anxiety which was responsible for performance decrements observed in test anxious individuals (Wine, 1971). Research evidence supported the relationship between test anxiety and cognitive interference (e.g. Gallassi et al., 1981; Zatz & Chassin, 1983). On these grounds, three theories have been developed to explain the relationship between cognitive interference, with particular emphasis on worry, and performance, namely the cognitive interference theory (Sarason, 1984, 1988), the processing efficiency theory (Eysenck, 1992; Eysenck & Calvo, 1992), and the control process theory (Carver & Scheier, 1984, 1988). These three theories, presented in details in the review of literature, will be now briefly reminded.

The cognitive interference theory suggests a linear negative relationship between intrusive thinking and performance. Interfering thoughts have the effect of lessening the individual's effective behaviour by diverting attention from task relevant cues and using cognitive resources which otherwise could be used for task-processing activities (Sarason, 1984).

Although considerable evidence has supported the theory's predictions, Eysenck & Calvo (1992) suggested that in some cases results have been equivocal. In particular, research (e.g. Blankstein, Toner, & Flett 1989; Calvo & Ramos, 1989) has shown that although highly anxious individuals report having more interference than those with low anxiety, performance in some cases has been shown not to be different. Thus, they proposed the processing efficiency theory which postulates that worrying thoughts limit

processing efficiency, but not necessarily performance effectiveness. In particular they suggested that worry is detrimental to the quality of information processing but not necessarily to performance, because it might serve a motivational function. In order to cope with threat and consequences of poor performance, individuals experiencing worry might be led to the allocation of additional processing resources such as effort or different strategies which, if successful, increase processing capacity and possibly performance. So, in comparison to the cognitive interference assumptions, the processing efficiency hypothesis explains how worry might facilitate performance, which is a topic that in recent years has received increased attention in the sport psychology literature.

Finally, Carver & Scheier (1984, 1988) proposed the control process theory. They suggest that human behaviour is regulated in a system of feedback control. People establish goals in relation to certain values and use these goals as reference points. When intentional behaviour is displayed they monitor themselves with regard to the goals and accordingly adjust their actions in the direction of the reference value, i.e. the behavioural standard. When, during this process, discrepancies between intended and actual behaviour are detected and worries regarding performance and task completion are generated, whether the individual's response will be adaptive or not depends on the expectancies of the individual of being able to complete the intended action. Carver & Scheier (1984) suggested that under evaluative situations whether the worry experienced leads to renewal of efforts or to disengagement in terms of effort withdrawal depends on the expectancies of individuals to attain their goal. In particular, for individuals holding high goal attainment expectancies, worry results in continued and renewed efforts, whereas for those holding unfavourable expectancies worry is associated with impulses to disengage from the activity. In summary, Carver and Scheier's model added the notion of goal attainment expectancies as a moderator of whether worry might be facilitative or debilitating, through the effects worry might have on subsequent effort.

The purpose of the present study, therefore, was to explore in a real competition situation athletes' perceptions on how different types of thoughts they experience during competition, in relation to their goal attainment expectancies, are associated with aspects of performance. Once more, it has to be stressed that since the study focuses on

a real competition situation the aim was not to interfere with the athletes' environment and concentration while performing. Therefore, real effects of such cognitive activation were not possible to observe or assess objectively. Subsequently, it was considered that the most appropriate and accurate way to assess such effects was through athletes' perceptions of the effects of such thoughts. Thus, where in the text references are made to effects, these refer to perceived effects according to participants' assessment. In particular, the study focuses on the perceived effects of cognitive interference on concentration and subsequent effort input.

Hypotheses

In relation to the findings from the TOQS development study and the literature reviewed above, hypotheses regarding the relationships between the three types of thoughts identified in TOQS and performance features were made. In particular, concerning performance worries, based on Sarason's (1984), Wine's (1971) and Eysenck & Calvo's (1992) propositions it was hypothesised that effects on concentration will be negative, while considering Carver & Scheier's (1988) suggestions, effects on effort will be moderated by athletes' goal attainment expectancies. More specifically, it was hypothesised that for athletes holding high goal attainment expectancies worries would be connected to increased effort, whereas for athletes holding low goal attainment expectancies these thoughts would be related to decreased effort. Concerning situation-irrelevant thoughts and thoughts of escape, considering that they both are cognitions unrelated to task execution, it was also hypothesised that effects on concentration will be negative, while no theoretical basis existed to hypothesise what the effects of such thoughts on effort might be. However, a negative association between thoughts of escape and effort was expected due to the withdrawing nature of these kinds of thoughts.

Method

Sample

The sample comprised 115 volleyball players (58 males and 57 females) who took part in a British Universities Sports Association tournament. The mean age of the sample was 21.5 years (standard deviation: 2.78).

Instruments

The Thought Occurrence Questionnaire for Sports was used to assess cognitive interference and its effects on concentration and effort (see Appendix F). For each of the listed items participants were asked to answer three questions (columns) regarding 'frequency' of thought occurrence, perceived effects on concentration ('distraction'), and perceived effects on 'effort'.

Frequency. To assess frequency of thought occurrence athletes were asked to report on a seven-point scale how frequently they experienced the listed thoughts during the game (1 = never, 7 = very often).

Distraction. To assess the effects on concentration athletes were asked to indicate, for the thoughts they reported experiencing in the previous column (i.e. 'frequency' higher than 1), the degree to which these thoughts distracted their concentration (1 = not at all distracting, 7 = very distracting).

Effort. To assess effects on subsequent effort athletes were asked to indicate, for the thoughts they reported experiencing in the initial column (i.e. 'frequency' higher than 1), the degree to which these thoughts affected subsequent effort input (-3 = made me give up trying, 0 = neutral, 3 = made me try harder).

An option labeled 'not applicable' was included in the columns inquiring about how athletes perceived the effects of their thoughts on concentration and effort for athletes reporting not having the listed thoughts. Participants were instructed to complete 'not applicable' if they had scored 1 (i.e. never) in the 'frequency' column.

Three items were used to assess goal attainment expectancies ('how well do you expect to do in this game?', 'to what extent do you think you can achieve your goals?', 'how confident do you feel that you can achieve your goals?'). Goal attainment expectancies were self-reported on seven-point scales (1 = unfavourable expectancies, 7 = favourable expectancies).

Procedures

After the teams had registered and before the start of the tournament, participants were informed about the research project and were asked to volunteer. Nineteen teams (10 male and 9 female) agreed to participate and instructions on how to complete the questionnaire were given to each team separately. Finally, participants were informed that the forms were anonymous. The pre-game questionnaire, including demographic characteristics and assessment of goal attainment expectancies, was completed approximately 30 minutes before the game, while the post-game questionnaire including the TOQS was completed immediately after the conclusion of the game.

Analysis

Because the focus was on how each type of thoughts was related to performance features, athletes reporting not having a particular kind of thoughts at all (i.e. scoring 'never' in all items of the subscale) had to be excluded from the respective analysis. Therefore, separate analysis for each TOQS subscale had to be performed. In each analysis only those players who reported having the certain types of thoughts could be included. The fact that not all athletes reported having all kind of thoughts, resulted in different sample sizes for each analysis depending on the number of athletes who reported having 'performance worries' (N = 108), 'situation-irrelevant thoughts' (N = 63), and 'thoughts of escape' (N = 59). Calculation of scores for 'distraction' and 'effort' involved only items for which participants had reported experiencing (i.e. 'not applicable' items were excluded).

Results

Descriptive statistics and correlations were calculated, where appropriate for the whole sample (Table 5.1). The three cognitive interference subscales revealed satisfactory internal consistency coefficients (see Table 5.2), and so did the measures of goal attainment expectancies ($\alpha = .72$). Performance worries were the kind of thoughts that most of the athletes reported having (108 out of 115), compared to situation-irrelevant thoughts (63 out of 115) and thoughts of escape (59 out of 115). Moreover, it was the kind of thoughts that appeared most frequently in athletes' minds (mean = 2.60 within those athletes who reported experiencing performance worries), compared to situation-irrelevant thoughts (mean = 2.11 within those athletes who reported having

such thoughts); and thoughts of escape (mean = 1.86 for those athletes who reported having thoughts of escape). The three cognitive interference subscales were moderately high correlated.

Table 5.1 Descriptive statistics and correlations for the whole sample.

	Descriptive statistics		Correlations (Pearson's coefficients)		
	Mean	S.D.	1	2	3
1. TOQS-W (frequency)	2.50	1.03			
2. TOQS-I (frequency)	1.61	.99	.41**		
3. TOQS-E (frequency)	1.44	.81	.52**	.53**	
4. Goal attainment expectancies	4.67	1.03	-.13	-.04	-.20*

* $p < .05$, ** $p < .01$

Table 5.2 Internal consistency coefficients for the TOQS subscales.

	Frequency	Distraction	Effort
Performance worries	.73	.79	.68
Situation-irrelevant thoughts	.86	.84	.82
Thoughts of escape	.85	.81	.73

Performance worries

As already identified, analysis regarding the perceived effects of each type of thoughts on concentration and effort could only include participants who reported experiencing such thoughts. One hundred and eight athletes reported having performance worries. Descriptive statistics for the variables of interest in this sub-sample are displayed in Table 5.3.

Table 5.3. Descriptive statistics for performance worries.

TOQS-W	Mean	Standard deviation
Frequency	2.60	.98
Distraction	2.66	1.14
Effort	- 0.09	1.25

Regarding TOQS-W, the hypothesis was that for the high expectancy group participants would report worries leading to increased effort, whereas for the low expectancy group participants would report worries leading to decreased effort. The sample was divided into high (N = 51) and low (N = 57) expectancy groups according to median split. Subsequently, path analysis was calculated to test the moderation hypotheses. The hypothesised model was initially tested separately for the two groups. In both analyses ‘frequency’ was introduced as the independent variable, while ‘distraction’ and ‘effort’ as the dependent variables. For the high expectancy group (Figure 5.1, regular characters), ‘frequency’ was positively associated to ‘distraction’ and ‘effort’. For the low expectancy group (Figure 5.1, bold characters), ‘frequency’ was positively associated to ‘distraction’, however the path connecting ‘frequency’ and ‘effort’ was negative.

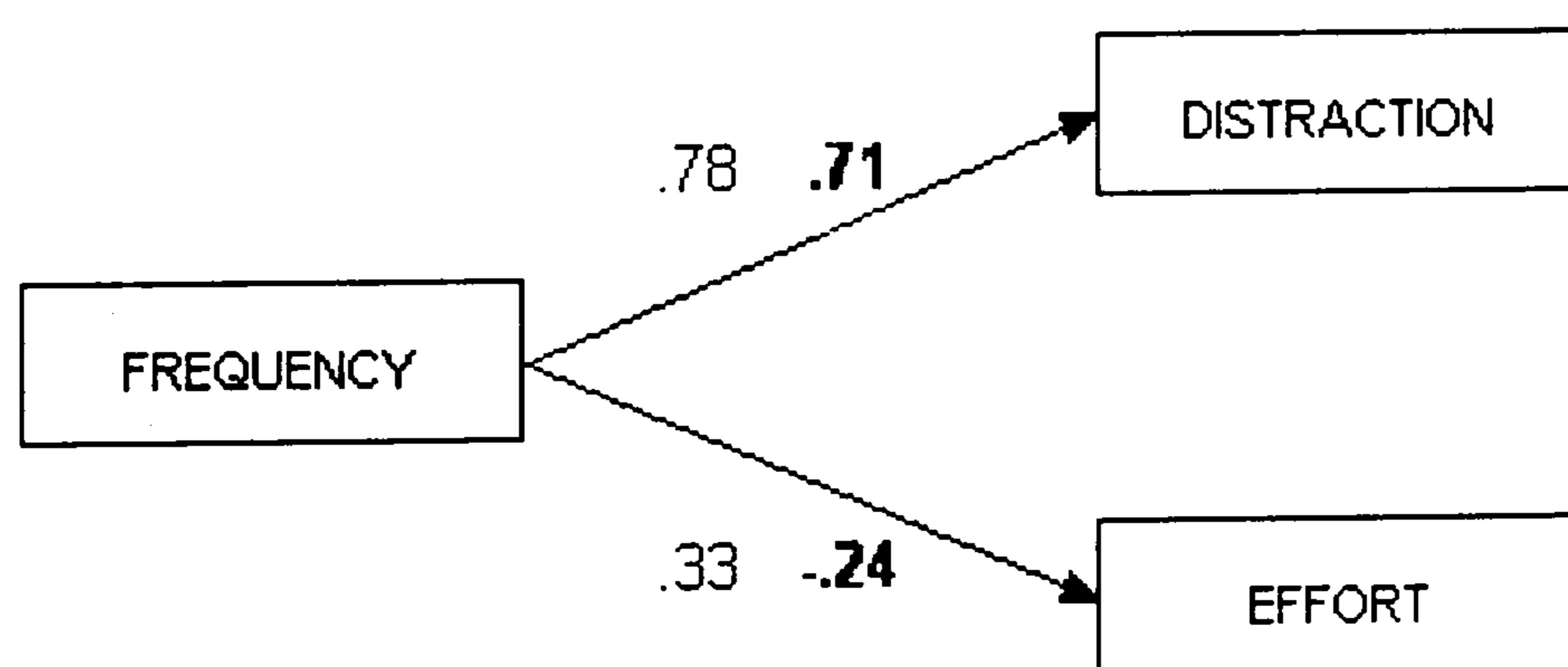


Figure 5.1 The path model for performance worries. The regular characters represent the path coefficients for the high expectancy group and the bold characters represent the path coefficients for the low expectancy group.

The fit indices for the two models (Table 5.3) revealed good fit. Subsequently, multiple-group analysis was conducted to test for invariance of regression weights across the two groups. The paths of the two models were constrained to be equal. The LM-test, which in the case of multiple-group analysis tests whether improvement of fit can be achieved if the equality constraints are released, indicated that the constraint for the ‘frequency’/

'effort' path should be dropped (chi-square increment: 8.79, $p < .05$); that is, these paths were not equal. Finally, the multiple-group model was tested again after dropping the constraint for the 'frequency'/'effort' path. The fit indices revealed a much better fit (Table 5.3). Thus, the moderation hypothesis was confirmed.

Table 5.4 The fit indices for the path models: Performance worries.

Fit Index	High expectancy group	Low expectancy group	Multi-sample 1	Multi-sample 2
Chi –Square/probability	0.143 / 0.70	1.254 / .26	11.82 / 0.02	2.69 / 0.44
NNFI	1.050	.982	.874	1.007
CFI	1.000	.994	.916	1.000
GFI	.998	.985	.937	.984
SRMR	.013	.041	.165	.059

* Multi-sample 1: paths constrained; Multi-sample 2: frequency/effort path constrain released.

Situation irrelevant thoughts

Sixty three athletes reported having situation irrelevant thoughts. Descriptive statistics for this sub-sample are displayed in Table 5.5. The same model was tested for TOQS-I, only this time no moderating effects were hypothesised. Therefore a single model was tested (Figure 5.2). The fit indices indicated satisfactory fit (Table 5.4), however only the path connecting 'frequency' to 'distraction' was significant, indicating that these kinds of thoughts were not related to subsequent effort.

Table 5.5. Descriptive statistics for situation irrelevant thoughts.

TOQS-I	Mean	Standard deviation
Frequency	2.11	1.11
Distraction	2.39	1.26
Effort	.23	1.04

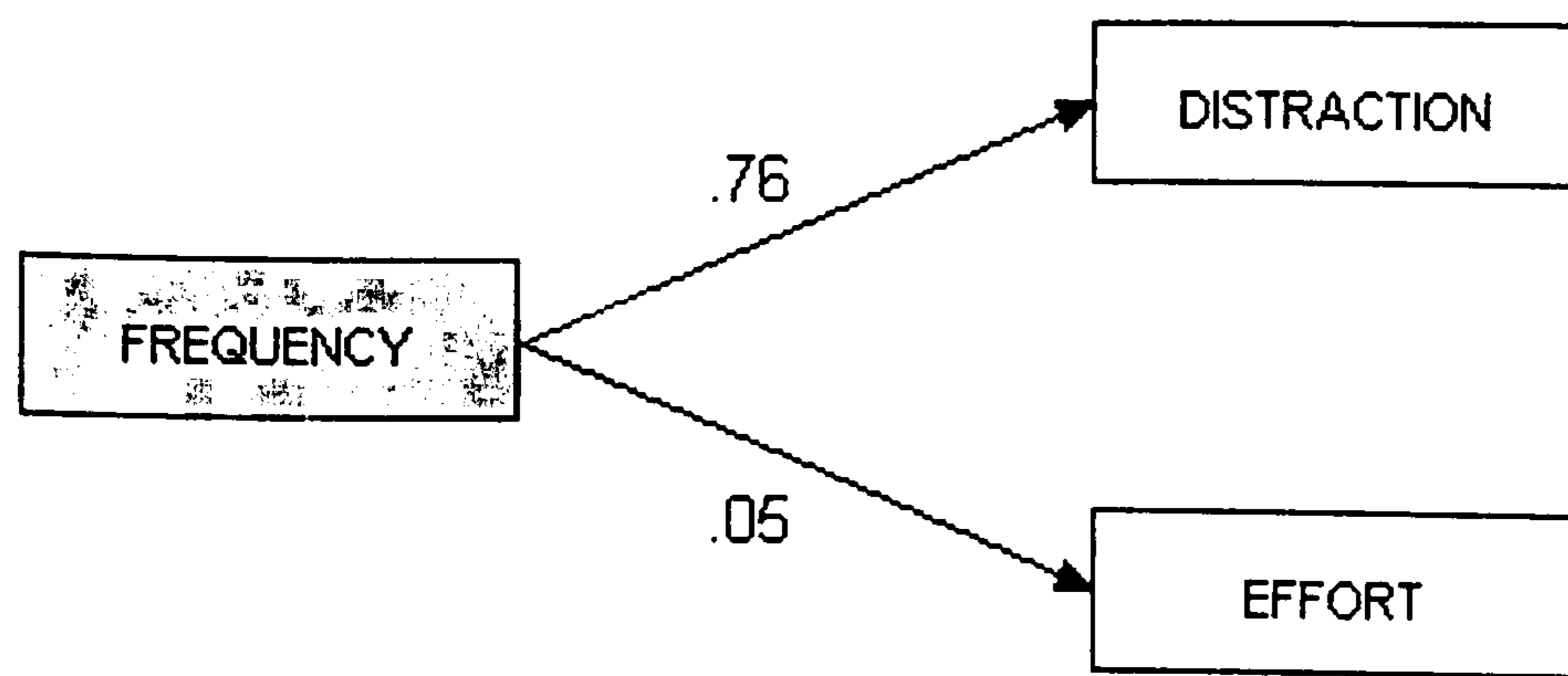


Figure 5.2 The path model for situation irrelevant thoughts.

Table 5.6 The fit indices for the path models: Situational-irrelevant thoughts and thoughts of escape.

Fit Index	Situation-irrelevant thoughts	Thoughts of escape
Chi –Square/probability	2.173 / 0.14	1.157 / 0.28
NNFI	.935	.992
CFI	.978	.997
GFI	.978	.987
SRMR	.049	.034

Thoughts of escape

As for the TOQS-I, a single model was tested for TOQS-E (Figure 5.3). Once again the fit indices indicated that the model fit the data well (Table 5.4). The path connecting ‘frequency’ to ‘distraction’ was positive, whereas the path connecting ‘frequency’ to ‘effort’ was negative. Fifty nine athletes reported having thoughts of escape. Descriptive statistics for this sub-sample are displayed in Table 5.7.

Table 5.7. Descriptive statistics for thoughts of escape.

TOQS-E	Mean	Standard deviation
Frequency	1.86	.96
Distraction	2.65	1.30
Effort	-.28	.96

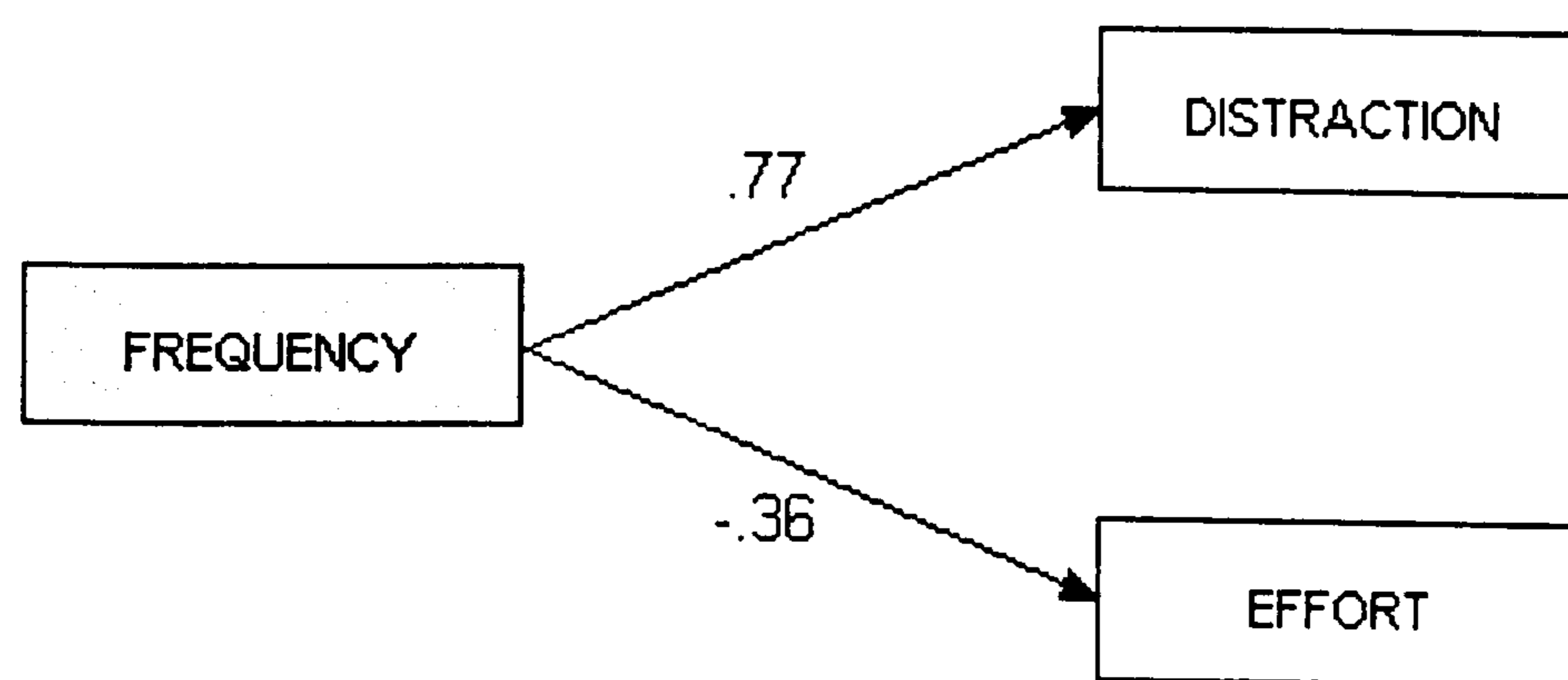


Figure 5.3 The path model for thoughts of escape.

Structural models to examine moderating effects of goal attainment expectancies for situation-irrelevant thoughts and thoughts of escape were also tested. Even though such effects were not hypothesised, the models were tested in order to examine whether it is the kind of thoughts in relation to the expectancies or merely the expectancies that affect subsequent effort (if moderating effects were found for all kinds of thoughts it could be speculated that it is the goal attainment expectancies that determines effort during sport performance, irrespective of the different thoughts individuals experience). The results did not support any moderating effects, thus suggesting that the kind of thoughts athletes experience is also important in determining effects on effort. However it should be mentioned that due to the small number of athletes who reported experiencing situation-irrelevant thoughts ($N=63$) and thoughts of escape ($N=59$), the size of the groups that emerged after splitting the samples was rather small. Thus, the interpretation of this result should be cautious.

Discussion

The study explored athletes' perceptions of how various thoughts they experience during competition influence their concentration and subsequent effort input. In order to investigate whether different kinds of thoughts, as assessed by the TOQS, affect aspects of performance in different ways separate analyses were calculated for each of the questionnaire's subscales. This was because not all participants reported experiencing all different types of thoughts. Therefore, only athletes who reported having each type of thoughts were included in each analysis.

To test the hypothesised relationships structural equation modeling was chosen. One limitation of the models that were tested was that they only had one degree of freedom (apart from the multiple-group model). As McCallum (1995) suggests models with few degrees of freedom tend not to be disconfirmable, that is there is a small possibility that the model can be rejected from the data, i.e. to have bad fit. Subsequently, for a model with minimum degrees of freedom finding a good fit is not so meaningful.

However, it should be stressed that the major aim was to identify whether different associations would emerge for the high and low expectancy groups regarding 'performance worries', and whether different types of thoughts would have different relationships to aspects of performance. Given that the models would probably fit because of the restriction in the degrees of freedom, the focus was on how the paths would differ. Furthermore, the existence of multiple dependent variables necessitated the use of structural equation modeling, since regression analysis cannot account for the effects of independent variables on more than one dependent variable in each analysis. In that respect, structural analysis, which is a recommended method when testing moderation hypotheses (Baron & Kenny, 1986), was considered the most robust method, and therefore was preferred.

Performance worries

Performance worries were found to have different effects on athletes' subsequent effort depending on the expectancies of the athletes. Thus, for those having higher expectancies towards goal attainment, worry was related to increases in effort, while for those having lower expectancies, worry was related to decreases in effort. As Carver & Scheier (1988) indicate, giving up effort reflects beliefs whether effort can possibly lead to positive outcomes. Carver et al. (1979) conducting an experiment involving anagrams, during which participants' self-attention was enhanced, reported that the group provided with poor outcome expectancies withdrew from attempts to solve the anagram more quickly than the group which had been provided with positive outcome expectancies. Subsequently, they suggested that, given a state of self-awareness, which is evident in achievement situations involving evaluation (Carver & Scheier, 1984), individuals having favourable expectancies perceive that more effort can result in accomplishment of the attained goal and therefore more effort is applied. In contrast,

when expectancies are not favourable and individuals perceive they have no control over the outcome, worry discourages further effort and is connected with disengagement from the activity either physically or mentally, depending on the value placed on continuing or discontinuing.

The relationship between performance worries and subsequent effort that was revealed for athletes holding unfavourable expectancies resembles findings in the area of helplessness. Abramson, Seligman, & Teasdale (1978) proposed that helpless behaviour can result from lack of perceived control over outcome. Furthermore, they suggested that the impact of uncontrollability on subsequent performance depends on expectations of future non-contingency. Similarly, Wortman & Brehm (1975) argued that helpless behaviour is displayed when individuals have expectancies of no control for the action. Both these approaches are similar to what Carver & Scheier (1988) presents as unfavourable outcome expectancies. In the present investigation it was revealed that for athletes with lower expectancies towards goal attainment, worrying thoughts were related to impulses to disengage from the activity in the form of effort withdrawal. In recent research conducted in sport, Jones & Hanton (1996) reported that for athletes having high expectancies of accomplishing their goals, anxiety symptoms were interpreted as facilitative, while for those having low expectancies anxiety symptoms were experienced as debilitating to performance. Considering these results in combination with the present study it could be suggested that athletes holding high expectancies of goal attainment, thus anticipating 'success', interpret anxiety symptoms as facilitative and subsequently perceive worrying thoughts as warnings that trigger more effort (part of the facilitation perception), while for those experiencing anxiety as debilitating, worry represents signs of anticipated 'failure' (which is the way anxiety was initially perceived) resulting in withdrawal of effort.

Performance worries were also positively related to how distracting these thoughts were. Research in educational settings has repeatedly shown cognitive interference to be negatively related to performance. Thoughts that are not related to the execution of the task have been considered to be detrimental to performance because cognitive resources are misused. Instead of thinking how a situation can be faced and a task successfully executed, individuals ruminate over self-evaluative thoughts that are not helpful towards

task completion. Eysenck (1992) supported that interfering thoughts occupy part of the working memory, thus deteriorating the processing efficiency of the individual. Performance worries were found, for athletes holding high expectancies of goal attainment, to have both positive and negative effects on performance features, thereby supporting Eysenck's (1992) proposition that worry lessens individuals' processing efficiency, but might also serve a motivational function. However, this result raises a number of questions for which the answers are yet clear. What is the overall effect for athletes experiencing worries as a motivational boost, at the cost of concentration disruption? Is it possible that increases in effort can balance or overcome performance deficits due to decreased attention, and if so in which cases and under what circumstances? One possible factor determining whether it is the positive motivational effects or the negative attentional effects that are more influential is the nature of the specific sport. One would expect the impact of attentional disruption and additional effort to depend on the demands of the sport.

Another factor influencing how detrimental cognitive interference can be to performance is the performance level of the athletes. When the fine skills involved in the game are mastered and athletes can execute them relatively automatically, it would be expected that cognitive interference effects on performance are less compared to athletes who need to devote part of their attention to successfully executing such skills. In this study no measure of athletes' expertise was included and therefore no indications concerning this assumption can be made. However, future research should examine the degree to which this parameter is important in determining the magnitude of the effects cognitive interference has on performance.

Situation-irrelevant thoughts

The same model was applied to test the relationship between situation-irrelevant thoughts and performance. Situation-irrelevant thoughts were found not to be related to athletes' subsequent effort input. The relationship between frequency of thoughts and concentration disruption was strong, which once again showed that how distracting thoughts that athletes experience during competition are to performance is a matter of how frequently such thoughts are experienced.

Research in educational psychology examining the relationship between cognitive interference and performance has mostly focused on total interference scores rather than examining each type of thoughts separately. Such analysis gives an overall picture regarding the relationship, but fails to show whether different kind of thoughts have different relationships with performance. However, in the few studies examining the effects separately, it has been found that performance worries and thoughts of escape are more predictive of performance than situation-irrelevant thoughts (Bruch, Kaflowitz, & Kuethe, 1986; Hoffman, 1993; Miculiner, 1989). Researchers have concluded that self-deprecatory thoughts are more influential in terms of performance. However, the present results indicate the need to further explore the role of such thoughts. Once again it can be suggested that the occurrence of such thoughts and subsequent effects on performance is likely to depend on the demands of the activity. Thus, for example, in sports where concentration is not highly important, such as long distance running, these thoughts might be usefully distracting by shifting attention from unpleasant bodily sensations which might hamper performance (Sachs & Sachs, 1981).

Thoughts of escape

From all the athletes who participated in this study, 59 reported having thoughts of escape. These athletes were included in the analysis exploring how such thoughts may affect performance. The relation between frequency of thoughts of escape and subsequent effort was negative. The more the athletes experienced thoughts of escape the more effort was abandoned.

Carver & Scheier (1986) argues that when individuals experience impulses to disengage from an activity, whether withdrawal will be behavioural or mental depends on the context of the activity. Thus, when the environment allows for overt withdrawal individuals will disengage from the activity, however when the environment is such that actual withdrawal is negatively valued and criticised withdrawal will occur at a mental level and can also take the form of abandoned efforts. In the social context of sport, which was the setting of this study, participation for its own sake is highly valued. Furthermore, within higher levels of competition withdrawal is often punished as an act of disrespect to the purpose of sport. Therefore, overt withdrawal is not socially acceptable. In accordance to this reasoning, the findings of the investigation suggest that

when athletes experience cognitive impulses to disengage from an event, such impulses are expressed in the form of effort abandonment.

Finally, as was the case for performance worries, frequency of thoughts of escape were also related to concentration disruption, which once more confirms the hypothesis that off-task thinking might be responsible for performance decrements by diverting attention from the task to be performed and using resources that could be applied for task-related constructive purposes.

To date, research in sport has ignored the role of such thoughts which seem to be a serious threat to performance. Further research to explore why individuals come to a state where they want to escape a situation, and whether there are trait characteristics that make athletes prone to such cognitions looks very appealing and might also prove to be very useful in enhancing our understanding of dysfunctional sport behaviour.

Conclusion

Researchers (e.g. Klinger, 1985) have occasionally argued that the direction of causality in the relationship between cognitive interference and performance is not from interference to performance, but from performance to interference. However, the results of the present study, having examined athletes' perceptions of effects of cognitive interference to aspects of performance, indicate that cognitive interference influences performance suggesting that a bi-directional relationship is more likely. Moreover, it was indicated that different kinds of thoughts can have different effects on performance features. Further research is required to support the present findings and to explore whether the relationship between cognitive interference and performance varies, as one would expect, according to the attentional demands of the specific sport.

Chapter 6. Cognitive Interference and Motivational Orientations

Study IV: Cognitive interference during competition among athletes with different goal orientation profiles.

Introduction

Findings from Chapter 4, where possible situational antecedents of cognitive interference were examined, revealed that discrepancies between the goals athletes set and performance are major determinants of intrusive thoughts athletes experience, therefore suggesting that cognitive interference is a goal-related process or experience. The degree to which the goals individuals establish are controllable or achievable, and therefore the degree to which discrepancies between goals and performance may occur, is likely to depend on the nature of the goals. In this study a goal perspectives approach to cognitive interference will therefore be attempted.

Goal perspectives in sport

To explain differences in behaviour a vast amount of research in sport psychology has been devoted to the examination of motivational processes. Within this body of research achievement motivation has been given considerable attention. One of the main theories in this domain is the 'goal perspectives theory' (Nicholls, 1984, 1989), which has proved to be valuable in explaining cognitions, affect and behaviour individuals display in achievement settings (Dweck, 1992). According to the theory, two main kinds of achievement orientation have been identified in terms of the way people define success. One concentrates on learning, mastery and self-improvement, where the task is the major focus (*task orientation*), whereas the other focuses on normatively-based accomplishment and social comparison, where the self and the presentation of the self are the points of reference (*ego orientation*). Furthermore, according to the theory, perceptions of competence are of particular importance for individuals displaying a high ego orientation (Nicholls, 1984, 1989). In general, task orientation, in comparison with ego orientation, especially in the case of low perceived competence, has been shown to be connected with more adaptive patterns of cognitions (Duda & Nicholls, 1992; Hom, Duda, & Miller, 1993; Walling & Duda, 1995), affect (Boyd, Callaghan, & Yin, 1991; Duda, Chi, Newton, Walling,

& Catley, 1995; Duda & Nicholls, 1992), and behaviour (Graham & Nolan, 1991; Solmon & Boone, 1993).

In the sport psychology literature one of the performance aspects that has been related to achievement motivation is anxiety. According to the goal orientations theory predictions, task orientation/task oriented individuals should relate negatively with anxiety, whereas ego orientation/ego oriented individuals (in particular those with low perceptions of competence) should relate positively to anxiety. However, results have not been consistent. As Hall & Kerr (1997) indicate, the reason might lie in the different ways researchers have conceptualised and measured the two constructs of goals and anxiety. Vealey & Campbell (1988) examined relationships between achievement goals and anxiety in relation to competition using a uni-dimensional measure of anxiety (SCAT) and Ewing's (1981) technique to assess goals, which requires participants to recall the meaning of success on a previous occasion of their own choosing. They found a negative association between task orientation and anxiety, and no relation between anxiety and ego orientation. Gould, Ecklund, Petlichkoff, Peterson, & Bump (1991), using the same technique to assess goals, but a multidimensional measure of anxiety (CSAI, children version) reported that achievement goals failed to predict pre- or post-task state anxiety. However, the results of these studies can be criticised for evaluating achievement goals in relation to past competitive experiences rather than to the upcoming competition, which led Gould et al. (1991) to highlight the need for more accurate assessment of goal orientations.

Swain & Jones (1992), using the Sport Orientation Questionnaire (SOQ), reported a negative relation between pre-competition cognitive anxiety and orientation towards 'goal' (focus on personal standards), as compared to orientation towards 'win' (focus on winning). However, Martin & Gill (1991) did not support any relations between the SOQ subscales and cognitive anxiety.

A possible justification for the lack of consistency for the above findings is provided by advancements in goal orientation theory and assessment (Duda & Nicholls, 1992; Duda & Whitehead, 1998) that provides a more sound conceptualisation of goal orientation and highlights the importance of perceived competence as an

important moderator between goals and cognitions, affect and behaviour. In relation to these advancements, Hall & Kerr (1997) found that, for low perceived competence athletes, ego orientation (measured 30 minutes prior to competition) was positively related to cognitive state anxiety two days, one day and 30 minutes prior to competition, whereas the relation between task orientation and cognitive anxiety (measured with the same temporal pattern) was negative. However, for the high competence group the results did not show consistent patterns. Overall, what is of more interest is that from all studies examining goal orientation in relation to anxiety only the latter (Hall & Kerr, 1997) has tested the hypothesis that perceived competence moderates the relationship between ego orientation and anxiety.

Integrating cognitive interference and goal orientation

Considering the self-centered character of ego orientation in comparison to the task-centered character of task orientation, and the self-preoccupying nature of cognitive interference as opposed to a task-related focus, a link between achievement goal orientation and cognitive interference seems plausible and worthy of testing.

Dweck (1989) and Kanfer & Ackerman (1989) have proposed that an ego orientation, through increasing the likelihood that individuals focus too much attention on developing attributions regarding ability, detracts from task performance. Cognitive activities of ego oriented individuals use up resources that otherwise could be applied to the task, therefore hindering task performance. Moreover, taking into consideration the way perceived competence influences ego oriented individuals' cognitions, it might be suggested that performance of ego oriented individuals with low perceived ability, compared to those with high perceived ability, would be more negatively affected by the cognitive activities brought about by an ego goal orientation.

Diener & Dweck (1980), experimenting using paper and pencil tests, asked participants to verbalise their thoughts during task performance. Ego oriented children, contrary to task oriented ones, engaged in task irrelevant verbalisations, usually of a self-aggrandising nature. Hoffman (1993) examined the relationship

between ego orientations, cognitive interference and performance. Ego orientation was found to be related to task-relevant worries, but no effect was indicated for thoughts irrelevant to the task. However, measures of task orientation were not included, and thus comparisons were not possible. In addition, perceived competence was not tested as a moderator of the relationship.

In the sport context, Newton & Duda (1993), experimenting with students across three bowling games, examined the relationship between goal orientation and performance cognitive content. The only significant result that emerged was that in one of the three games task orientation was found to be negatively correlated with performance worry, and positively correlated with keeping one's concentration. The lack of consistency across the three games was attributed to the small sample size and the non-competitive environment in which the games took place. Furthermore, it should be noted that the measures of cognitive content were based on single-item responses.

Finally, in relation to the content of this project, Hatzigeorgiadis and Biddle (in press) examined relationships between dispositional goal orientations, perceived competence, and tendencies to experience cognitive interference in sports based on a retrospective measure of tendencies to experience cognitive interference (asking how often during competitions athletes generally experience certain thoughts). The results revealed that within participants with lesser perceived competence ego orientation was positively associated with thoughts of escape, whereas task orientation was negatively related to such thoughts. Furthermore, within athletes with higher perceptions of competence, task orientation was negatively related to thoughts of escape, while the relationship between thoughts of escape and ego orientation was also negative, though small in magnitude and non-significant. However, in this particular study cognitive interference was assessed through the original TOQ (Sarason et al., 1986). Psychometric evaluation of the instrument revealed limited validity thus allowing further analysis regarding only the two of the three instrument subscales ('task-irrelevant thoughts' and 'thoughts of escape').

Based on the modified instrument a similar study was designed for the purposes of this investigation. In contrast to Hatzigeorgiadis and Biddle (in press), where cognitive interference tendencies were assessed based on past experiences, the present study

involved evaluation of cognitive interference in relation to events just completed. Furthermore, because of the immediate responses related to cognitive interference it was decided to replace measurements of general perceived competence with competition outcome, a more situationally relevant variable, whose importance in relation to fluctuation in cognitive patterns ego oriented individuals display have been supported (e.g. Diener & Dweck, 1978; Diener & Dweck, 1980). As Duda (1993) points out regardless of whether a task or an ego orientation prevails, highly task or ego oriented individuals can be considered competitive. However, task in contrast to ego oriented athletes would probably differ in the way they approach competitive situations and also in terms of the objective of the competitive experience. Despite the fact that they both are interested in winning, it is the relevant importance of the competitive outcome in relation to the competitive process, and the psychological devastation associated with losing that possibly discriminates psychological responses between task and ego oriented individuals.

Factor analytic studies on the TEOSQ have supported the orthogonality, in contrast to the bipolarity, of task and ego orientations (Duda & Nicholls, 1992). Subsequently, as Hardy (1997) suggests, studies are required to examine the interactive effects of task and ego orientations. As Hardy (1997, p. 283) argues, “making comparisons between subjects who are ostensibly high in task orientation against subjects who are ostensibly high in ego orientation ... does not make a lot of sense theoretically”. Considering Hardy’s proposition, but also manifestations regarding the importance of outcome within ego orientation, an attempt was made to account for the interactive effects between goal orientations and outcome.

Thus, with regard to goal orientations profiles, self-referenced and comparative goal groups were created. The self-referenced goal group was operationalised as comprising participants with high task and low ego orientations, whereas the comparative goal group comprised participants with low task and high ego orientations. Subsequently, cognitive interference scores from the groups were compared under conditions of different game outcomes, i.e. winning and losing.

Hypotheses

In accordance with the predictions of goal orientations theory it was hypothesised that:

- (a) the comparative group in the losing situation will experience higher levels of cognitive interference than the comparative group in the winning situation and the self-referenced group in either the winning or the losing situation,
- (b) there will be no differences in cognitive interference between the comparative group in the winning situation and the self-referenced group in either the winning or the losing situation, and
- (c) there will be no differences in cognitive interference between the self-referenced group in the winning and losing situation.

Method

Sample

The sample consisted of 71 volleyball players (50 males and 21 females) who took part in the finals of the British Universities Sport Association league. Each team would play at least four games within a period of three days. The mean age of the sample was 23.07 years (standard deviation 2.98).

Instruments

Cognitive interference. The Thought Occurrence Questionnaire for Sport was used to measure frequency of interfering thoughts (see Chapter 3 for details).

Goal orientations. The Task and Ego Orientation in Sport Questionnaire (TEOSQ; Duda & Nicholls, 1992) was used to assess dispositional goal orientations. The TEOSQ is one of the most widely used instruments in the field of sport psychology the last few years, and has shown remarkable psychometric properties. Duda & Whitehead (1998) in a review of studies using the questionnaire report over 50 published studies in which internal consistency coefficients for the task and ego subscales were over .70. Furthermore, the factorial validity of the instrument has been supported in a number of studies (e.g. Duda, 1989; Duda, Olson, & Templin, 1991), through exploratory and confirmatory factor analysis.

The TEOSQ comprises 13 items and two subscales measuring 'task orientation' (e.g. '*I feel most successful in volleyball when I do my very best*', '*... I learn a new skill by trying hard*'), and 'ego orientation' (e.g. '*...I am the best*', '*...I am the only one who can perform a skill*'). Ratings were made on five point scales (1= strongly disagree, 5= strongly agree).

The instruments used in this study are displayed in Appendix G.

Procedures

In order to increase the possibility that reasonably balanced winning and losing conditions could be obtained, but also in order to test the consistency of the results, cognitive interference was assessed over three games. Therefore, athletes were asked to complete the TOQS immediately after the conclusion of three games. The TEOSQ was completed independently of the competition context. In particular, the questionnaire was distributed to the team captains who were instructed to administer them to the players during that evening at the team residency. This was deemed appropriate in order to minimise possible bias in the questionnaire completion from events (e.g. team performance, outcome) during the first day of the competition. Even though it has to be acknowledged that such effects could not be controlled, the structure of the competition did not allow for the questionnaire to be completed before the start of the games.

Analysis

In order to test the hypotheses MANOVA with planned comparisons was used. This particular analysis was preferred since specific hypotheses regarding differences between the groups existed, in which case planned comparisons is the most appropriate analysis (Tabachnick & Fidell, 1996).

Results

Descriptive statistics

Means, standard deviations and Cronbach's alpha internal consistency coefficients for all variables are presented in Table 6.1. In accordance to previous research (e.g. Duda & Nicholls, 1992; Fox, Goudas, Biddle, Duda, & Armstrong, 1994; Goudas, Biddle, & Fox, 1994) task and ego orientations were essentially orthogonal ($r = .08$). Correlations between the three measures of cognitive interference are presented in Table 6.2.

Table 6.1 Descriptive statistics for all variables.

Variable	Descriptive statistics		Internal consistency
	Mean	Standard deviation	Cronbach's alpha
Task orientation	2.87	1.03	.72
Ego orientation	3.93	.51	.86
TOQS-W game 1	2.51	1.03	.71
TOQS-W game 2	2.52	.94	.78
TOQS-W game 3	2.54	.98	.74
TOQS-I game 1	1.62	.69	.70
TOQS-I game 2	1.42	.55	.69
TOQS-I game 3	1.40	.62	.81
TOQS-E game 1	1.55	.83	.86
TOQS-E game 2	1.54	.87	.90
TOQS-E game 3	1.55	.83	.85

Table 6.2 Correlations between the three cognitive interference measures.

	game 1 to game 2	game 1 to game 3	game 2 to game 3
TOQS-W	.23	.19	.17
TOQS-I	.42**	.53**	.60**
TOQS-E	.60**	.64**	.67**

* $p < .05$, ** $p < .01$

The three TOQS-W measures were lowly inter-correlated indicating that frequency of performance worries during the three games fluctuated considerably within individuals. The three TOQS-I and TOQS-E measures revealed high inter-correlations suggesting that frequency of situation irrelevant thoughts and thoughts of escape remained relatively stable across the three games.

Finally, correlations between goal orientations and cognitive interference scores in the three games are presented in Table 6.3. Task orientation correlated negatively with TOQS-W in all three games (although the magnitude of the correlation in game 2 was

very small), was lowly negatively correlated to TOQS-I in game 1, but uncorrelated in games 2 and 3, and was also negatively correlated to TOQS-E in all three games. Ego orientation was positively, but rather lowly, correlated to TOQS-W in games 1 and 3 and uncorrelated in game 2, negatively, but again lowly, correlated to TOQS-I in game 1 and uncorrelated in games 2 and 3, and finally positively correlated to TOQS-E in all three games (once more the relationship was rather weak in two out of the three games).

Table 6.3 Correlations between dispositional variables (N = 71).

	Ego	Task
TOQS-W 1	.11	-.23*
TOQS-W 2	-.01	-.08
TOQS-W 3	.17	-.28*
TOQS-I 1	.29*	-.11
TOQS-I 2	.02	-.01
TOQS-I 3	-.06	-.01
TOQS-E 1	.22	-.34**
TOQS-E 2	.15	-.29*
TOQS-E 3	.16	-.26*

* $p < .05$, ** $p < .01$

Planned comparisons

Subsequently, in relation to the hypotheses and based on participants' scores on task and ego orientations, self-referenced and comparative groups were created by median split. The self-referenced group comprised athletes scoring high on task orientation and low on ego orientation (N= 21), whereas the comparative group comprised athletes scoring low on task orientation and high on ego orientation (N= 18). The two sub-samples were further divided in relation to the outcome of the three games. In order to test the specific hypotheses, MANOVA with orthogonal planned comparisons were calculated for each of the three games. The design for the planned comparisons is presented in Table 6.4.

Table 6.4 The planned comparisons design.

Comparison	Conditions				Total
	Group 1 High task/low ego Win	Group 2 High task/low ego Lose	Group 3 Low task/high ego Win	Group 4 Low task/high ego Lose	
(1)	-1	-1	-1	3	0
(2)	-1	-1	2	0	0
(3)	1	-1	0	0	0
(1) x (2)	1	1	-2	0	0
(1) x (3)	-1	1	0	0	0
(2) x (3)	-1	1	0	0	0

* Numbers in parentheses identify three planned comparisons:

(1) Low task/high ego - Lose vs High task/low ego - Win, High task/low ego - Lose, Low task/high ego - Win;

(2) Low task/high ego - Win vs High task/low ego - Win, High task/low ego - Lose;

(3) High task/low ego - Win vs High task/low ego - Lose.

The first analysis involved TOQS scores obtained after the first game. The results revealed a significant multivariate effect ($F= 2.15, p<.05$). The univariate tests showed significant effects for TOQS-E ($F= 6.18, p<.05$), but non-significant effects for TOQS-W ($F= 1.69$) and TOQS-I ($F= .55$). Planned comparisons confirmed the hypothesised differences for TOQS-E indicating that the comparative group in the losing condition reported higher levels of thoughts of escape than the comparative group in the winning condition and the self-referenced groups in the winning and losing conditions, and also that among the latter three groups no significant differences existed. The results from the first planned comparisons are presented in Table 6.5.

The analysis regarding the second game revealed a multivariate effect that approached significance ($F= 1.81, p= .07$), however estimation of effect size was such that further examination of the analysis was considered appropriate ($\eta^2 = .14$). The univariate tests revealed significant effects for TOQS-W ($F= 3.02, p<.05$) and TOQS-E ($F= 2.98, p<.05$), but not for TOQS-I ($F= .85$). The planned comparisons confirmed the hypothesised differences for TOQS-E, but not for TOQS-W where the comparative group in the losing condition did not differ from the rest of the groups. Furthermore, the comparative group in the winning condition reported higher levels of worry than the self-referenced group in the winning and losing condition, and the self-referenced group in the losing condition reported higher levels of worry than the self-referenced group in the winning condition. The results for the second game are presented in Table 6.6.

Table 6. 5 Planned comparisons for game 1.

	Multivariate F	Effect size	Univariate F	Eta square	Group 4 to groups 1, 2, 3.	Group 3 to groups 1, 2.	Group 2 to groups 1.
	2.15*	.16					
TOQS-W			1.69	.13	t= .98	t= .25	t= -1.92
TOQS-I			.55	.04	t= .72	t= .86	t= -.47
TOQS-E			6.18**	.34	t= 4.14**	t= .76	t= -.49

* p<.05; ** p<.01;

Group 1: High task/low ego - Win: N= 12.

Group 2: High task/low ego - Lose: N= 9.

Group 3: Low task/high ego - Win: N: 9.

Group 4: Low task/high ego - Lose: N= 9.

Table 6. 6 Planned comparisons for game 2.

	Multivariate F	Effect size	Univariate F	Eta square	Group 4 to groups 1, 2, 3.	Group 3 to groups 1, 2.	Group 2 to groups 1.
	F= 1.81 (p=.07)	.14					
TOQS-W			F= 3.02*	.21	t= .46	t= 2.29*	t= -2.02*
TOQS-I			F= .85	.07	t= 1.55	t= .04	t= -.40
TOQS-E			F= 2.98*	.20	t= 2.51*	t= 1.28	t= -.75

* p<.05; ** p<.01

Group 1: High task/low ego - Win: N= 9.

Group 2: High task/low ego - Lose: N= 12.

Group 3: Low task/high ego - Win: N: 7.

Group 4: Low task/high ego - Lose: N= 11.

Table 6. 7 Planned comparisons for game 3.

	Multivariate effect	Effect size	Univariate effect	Eta square	Group 4 to groups 1, 2, 3.	Group 3 to groups 1, 2.	Group 2 to groups 1.
	F= 1.99*	.15					
TOQS-W			F= 2.68 (p=.06)	.19	t= 2.26*	t= 1.47	t= -.46
TOQS-I			F= .56	.05	t= -.28	t= .12	t= -1.25
TOQS-E			F= 5.15**	.31	t= 3.52**	t= 1.39	t= -.57

* p<.05; ** p<.01

Group 1: High task/low ego - Win: N= 9.

Group 2: High task/low ego - Lose: N= 12.

Group 3: Low task/high ego - Win: N: 7.

Group 4: Low task/high ego - Lose: N= 11.

The analysis regarding the third game revealed a significant multivariate effect ($F=1.99, p<.05$). The univariate tests revealed significant effects for TOQS-E ($F=5.15, p<.05$), effects that approached significance for TOQS-W ($F=2.69, p=.06$), and non-significant effects for TOQS-I ($F=.57$). The planned comparisons confirmed the hypothesis for TOQS-E and TOQS-W indicating that the comparative goal group in the losing situation scored higher than all the other groups in TOQS-E and TOQS-W. At the same time no differences emerged between the rest of the groups. Despite the fact that the univariate effect for TOQS-W only approached significance the results of the planned comparisons were considered due to the magnitude of the effect size ($\eta^2 = .19$). However, this particular result should be interpreted cautiously and also in relation to the results of the previous analyses. The results of the third analysis are displayed in Table 6.7. Mean scores for all groups in all games are displayed in Table 6.8.

Table 6.8 Cognitive interference scores for goal groups in each of the three games.

<i>Game 1</i>	Group 1	Group 2	Group 3	Group 4
TOQS-W	12.61	17.64	14.57	17.56
TOQS-I	6.98	8.36	8.79	8.69
TOQS-E	7.22	8.73	9.07	13.09
<i>Game 2</i>				
TOQS-W	14.33	15.75	15.50	14.88
TOQS-I	6.61	7.94	6.42	7.71
TOQS-E	7.06	8.50	8.55	13.12
<i>Game 3</i>				
TOQS-W	12.06	15.06	16.35	17.59
TOQS-I	6.56	7.69	7.55	6.23
TOQS-E	7.89	8.37	8.95	12.00

* Group 1: High task/low ego – Win; Group 2: High task/low ego – Lose; Group 3: Low task/high ego – Win; Group 4: Low task/high ego – Lose.

Discussion

Stemming from findings obtained when situational antecedents of cognitive interference were considered, which suggested that cognitive interference is a goal-related experience, the present study attempted to identify whether goal orientations are connected to tendencies to experience interfering thoughts. Consistent and at the same

time strong correlations for the three games were revealed only between task orientation and thoughts of escape (negative relationship). Thus, further analysis considering the interactive effects between goal orientations and game outcome could give a better insight into the relationships between goal orientations and cognitive interference, but also to examine the importance of outcome in influencing these relationships.

Performance worries

Only in one of the three analyses were the predictions regarding performance worries confirmed. A possible explanation for this finding is that performance worries are a function of the specific goals individuals establish. Indeed, in Chapter 4 it was found that discrepancies between goals and performance was the best predictor of interfering thoughts. Thus, individuals adopting different goals may experience similar levels of worries, however the source of these worries can be different. For example, for individuals adopting self-referenced goals worries might be the result of discrepancies between targeted and actual performance levels, whereas for individuals adopting comparative goals worries might be the result of discrepancies between targeted and actual result/outcome. In this study athletes' perceptions of performance quality were not included, therefore it is not possible to speculate further on this point.

Nevertheless, having found that performance worries are not necessarily detrimental to performance, depending on expectancies of goal attainment (Chapter 5), it could be argued that it is the response to such worries that might differ between individuals adopting different goals. Within task orientation goal attainment is more controllable in comparison to ego orientation. This is due to task goals being related to one's individual performance, whereas ego goals also depend on performance of others. According to Carver & Scheier (1984) the response to worry depends on perceptions of control over outcome. Therefore, within task orientation, where goals are more controllable individuals might respond to worry with increased effort, whereas within ego orientation, where goals are less controllable, individuals' response to worry might be effort withdrawal.

Situation-irrelevant thoughts

The predicted patterns regarding situation-irrelevant thoughts were not confirmed in any of the analyses. In most of the research in educational psychology total cognitive

interference scores have been the focus of attention. Thus, there are few indications as to whether different kinds of thoughts are related to different personality dispositions. The few studies reporting results separately for each of the TOQ's subscales have examined cognitive interference relationships with situational variables and performance (e.g. Miculiner, 1989). Considering that such thoughts have not been previously studied it remains of interest to further explore their role in sport performance.

Considering that situation irrelevant thoughts might be detrimental to performance in some sports, especially those involving maximum concentration and continuous attention to external stimulus (e.g. tennis), but might also be neutral or even helpful in others (e.g. running; Sachs & Sachs 1981), it is likely that such thoughts might either be unintentionally emerging and therefore not wanted, or deliberately recalled and used as coping strategies in difficult situations (Sachs & Sachs, 1981). In the first case the occurrence of such thoughts might be related to characteristics like the tendency to experience 'cognitive failures' (Broadbent, Cooper, Fitzgerald, & Parkes, 1982), a personality characteristic referring to lapses of attention and processing, such as absent-mindedness, that was not included in the present study, whereas in the second case it is a matter of psychological skill training.

Thoughts of escape

Analysis regarding thoughts of escape confirmed the predicted relationships with remarkable consistency. In particular, it was shown that when game outcome was unfavourable individuals holding comparative goals suffered significantly more thoughts of escape than those holding self-referenced goals, whereas when game outcome was favourable, no differences between individuals with comparative and self-referenced goals emerged.

In accordance to these findings, research in educational settings has shown that for ego orientation outcome is an important determinant of cognitions and behaviour (Dweck, 1992). Diener & Dweck (1978, 1980), in experiments involving cognitive tasks, examined thought content under conditions of success and failure in relation to goal orientation. Under the success condition all participants reported their thoughts to be

related to problem-solving strategies. Under the failure condition ego oriented participants engaged in negative self-evaluative cognitions, whereas task oriented participants focused again on problem-solving strategies and instructions to sustain effort and concentration to the task.

Carver & Scheier (1986) argued that when goal attainment appears unlikely and individuals perceive they have no control over behavioural outcome, they tend to withdraw from further efforts towards the goal. They went on to suggest that when physical withdrawal from the setting is not socially sanctioned, i.e. when withdrawal is negatively valued as it is the case in sport, disengagement impulses are likely to be expressed psychologically, rather than overtly. In research conducted to examine these hypotheses mental disengagement was indicated through performance decrements (e.g. Carver & Scheier, 1982), but also off-task thinking (e.g. Diener & Dweck, 1978). Furthermore, consistent with this reasoning and the results of the present study, Gallassi et al. (1981) found that during a test situation mental disengagement was expressed, as reported retrospectively, in the form of frequent thoughts concerned with escaping from the situation.

Previous research (Hatzigeorgiadis & Biddle, in press) examining relationships between goal orientations and tendencies to experience cognitive interference in sports based on a retrospective measure (asking how often during competitions athletes generally experience certain thoughts) revealed that within individuals with lesser perceived competence ego orientation was positively related to tendencies to experience thoughts of escape (in contrast to task orientation which was negatively related to such tendencies), whereas within individuals with higher perceptions of competence ego orientation was not related to E-thoughts (task orientation was again negatively related to such thoughts). However, the present results provide further insight regarding cognitive patterns of ego oriented individuals. Competence within an ego orientation is judged in terms of outcome, which justifies the similar results of the two studies. However, despite the high relationship that should exist between judgements of one's competence within an ego orientation and normative evaluation of outcomes, feeling competent does not guarantee achieving your goal in all situations. Based on this assumption, it could be suggested that even for individuals with high competence, negative patterns of cognitions are likely to occur when having a bad day, or when the opposition is better and the outcome does not match the goals of the individual.

From a broader perspective, the above results support the notion that task orientation is associated with cognitive stability, while ego orientation has been described as more 'fragile'. These differences in cognitive patterns could be attributed to the way individuals with different goals understand achievement. For task orientation, where achievement is defined in terms of effort, learning, personal improvement and mastery, individuals can have greater control over their goals. In contrast, for ego orientation, where achievement is defined in terms of normative comparison and outperforming others, individuals' control over goals is less. Outcome, when judged in a winning/losing distinction depends on factors outside the individual, such as the performance of the opposition and, in the case of team sports as in the present investigation, on the performance of other individuals within the team, and the team as a whole. The lack of control over outcome denotes that within ego orientation discrepancies between goals and outcomes are more likely to occur. Such discrepancies were found in the previous study (Chapter 4) to be the major determinant of withdrawing thoughts individuals experience while performing.

Conclusion

As one would expect, and the research as presented in Chapter 4 has demonstrated, interfering thoughts during competition are mostly a function of what is going on in the competition. It is not the dispositional characteristics of individuals that trigger such thoughts, but the cognitive frame of mind of the individual during competition and quality of performance that generate them. However, the findings from this study suggest that goal orientations play an important role in determining whether thoughts of escape are likely to be experienced, indicating that under unfavourable situational conditions individuals with lower task and higher ego orientation are more prone to experiencing withdrawal cognitions. Despite the absence of a consistent association between goal orientations and performance worries and situation-irrelevant thoughts, results regarding the relationships between ego orientation and thoughts of escape are in line with literature suggesting that individuals adopting comparative goals are more inclined to motivationally maladaptive cognitions due to dependency on uncontrollable factors such as competition outcome.

Chapter 7. General Discussion

Thoughts that athletes experience while performing have been identified by athletes and psychologists working in sport as an important feature of performance. Despite its significance cognitive content during sport performance has not attracted much attention in the sport psychology literature. The purpose of the present investigation was to explore the role of thoughts athletes experience while performing which are not related to the execution of the task to be performed. Stemming from literature in test anxiety, cognitive interference in educational settings, and sport anxiety, key research questions were formulated. In the initial stages of the inquiry an instrument to assess cognitive interference in sport was developed. Subsequently, based on the instrument that emerged, relationships between cognitive interference, sport anxiety, performance, and motivational orientations were examined.

The results revealed significant associations between pre-competition anxiety and cognitive interference. However, it was found that the best predictor of cognitive interference is what is 'going on' during competition, that is quality of performance in relation to goals athletes have. Furthermore, according to athletes' perceptions, it was identified that thought content while performing influences concentration levels and subsequent effort. Finally, relationships between goal orientations and tendencies to experience withdrawing thoughts were revealed. An overview of the results of the individual studies is presented in Table 7.1. Overall, the findings suggest that cognitive interference is a topic worthy of investigation which requires further attention and research directed towards it within sport psychology.

In this final chapter of the thesis the results of the individual studies are revisited. In an attempt to integrate these results, and guided from the existing literature in cognitive interference, a conceptual model regarding the role of thoughts athletes experience during sport performance is proposed.

Table 7. 1 Overview of the findings from the individual studies.

	Purpose	Analysis	Sample	Instruments	Findings
Study 1	Instrument development for the assessment of cognitive interference in sport.	Stage 1: Interviews Stage 2: content analysis Stage 3: Exploratory factor analysis Stage 4: Validation	7 athletes (various sports) 15 sport psychology academics / scholars 157 athletes (various sports) 177 athletes (various sports)	TOQ. Item-list 1. Item list 2. TOQS, TOPS, SAS, IMI.	The pattern of thoughts athletes experience while performing were identified. Items from the original TOQ were modified to become appropriate for sport settings. New items for instrument development emerged. The most appropriate items to be included in the first version of the modified questionnaire were selected. Exploratory factor analysis revealed three meaningful factors, namely 'performance worries', 'situation irrelevant thoughts', and 'thoughts of escape'. The second version of the modified questionnaire comprised 17 items. Psychometric support for the modified instrument (TOQS) was provided through examination of convergent, concurrent, and discriminant validity.
Study 2	Situational antecedents of cognitive interference; anxiety, performance discrepancies.	Regression analysis	36 athletes (runners)	TOQS, modified CSAI-2.	Discrepancies between expected and actual performance was identified as the best predictor of cognitive interference. Cognitive anxiety moderately related to cognitive interference. Athletes experiencing their anxiety states as facilitative reported less cognitive interference than athletes experiencing their anxiety states as debilitating.

Table 7. 1 (continued). Overview of the findings from the individual studies.

Study 3	Relationships between cognitive interference and performance features (concentration, effort) in relation to goal attainment expectancies	Path analysis – Structural Equation modeling.	115 athletes (volleyball players)	TOQS, Goal-attainment expectancies scale.	Athletes reported cognitive interference to be detrimental to concentration. Performance worries relation to effort depended on goal attainment expectancies. Athletes holding higher expectancies reported that their worries resulted in increased effort, whereas athletes holding lower expectancies reported their worries to result in decreased performance. Situation irrelevant thoughts were reported not to have any effects on subsequent effort. Thoughts of escape were associated with decreases in effort.
Study 4	Relationships between cognitive interference and goal orientation in relation to outcome.	Correlations, MANOVA / planned comparisons.	71 athletes (volleyball players)	TOQS, TEOSQ.	A negative relationship between task orientation and thoughts of escape was the only strong and consistent association that emerged through analysis of correlations. Goal profiles analysis revealed that, in contrast to athletes holding self-referenced goals, for those holding comparative goals outcome is an important determinant of withdrawal thoughts. The hypothesised patterns were not confirmed for performance worries and situation irrelevant thoughts.

A conceptual model for cognitive interference and performance

The most interesting and possibly important aspect of the investigation involved examination of the relationship between cognitive interference and performance. Since the interest in cognitive interference grew out of research on test anxiety it is not surprising that a focus on worry, the cognitive element of anxiety during task performance, can be detected in the literature (McLeod, 1996). Even though other thoughts athletes experience might also be important, this focus seems justifiable to a degree since, as it was revealed in all of the studies of the present investigation, worries about performance are the most common type of thoughts individuals experience while performing. Given that focus, theories regarding relationships between cognitive interference and performance are mostly related to these particular type of thoughts individuals experience while performing. Consequently, the hypotheses of the investigation based on these theories were more suitable and applicable to performance worries rather than to the other kinds of thoughts under investigation, i.e. situation irrelevant thoughts and thoughts of escape. Subsequently, the nature of the investigation regarding these latter kinds of thoughts was mostly exploratory.

Early research in educational settings focused on the relationship between worry and performance in cognitive tasks and findings supported the hypothesised relationship. The demonstration of such an association does not provide direct evidence that interfering thoughts cause performance deficits. Indeed, it was argued (Klinger, 1996) that the causal nature of the association might even be in the reverse direction, with individuals experiencing difficulties to complete a task tending to worry as a consequence of poor performance. However, later research (e.g. Naveh-Benjamin, 1991) gave evidence that worry does affect performance through findings that direct manipulation of the former could serve to modify the latter. Nevertheless, Carver & Scheier (1988), in their control process model of anxiety, suggested that human behaviour is regulated in a system of feedback control. They argued that cognitive interference is generated due to performance deficits individuals identify while working on a task, that is cognitive interference is fundamentally a function of performance. Based on the above propositions the investigation attempted to explore how cognitive interference and performance are related in the sport context. On one hand, performance was found to be the best predictor of cognitive interference, and in particular performance worries athletes experience during competition. On the other hand, based

on athletes' perceptions it was revealed that worry affects important aspects of performance, such as concentration and effort. In an attempt to account for the present findings, but also based on existing literature and theories, a conceptual model representing the relationship between performance worries and sport performance will be presented.

At this point it is important to note that the proposed model is not solely a product of the studies conducted within the present investigation, but rather a hypothesised model of the relationships between worry and performance that can account for the findings, and also a conceptual representation of hypotheses which can help create new research questions. The model that will be described is relevant to this particular type of intrusive thinking, namely performance worries. Additional considerations regarding the two other types of thoughts that were investigated are presented in a later section of the discussion.

Stemming from the findings in cognitive interference (e.g. Klinger, 1985; Sarason, 1984) and the control process model of anxiety (Carver & Scheier, 1988), and in accordance to the results of the present investigation, it seems that the relationship between performance worries and performance is reciprocal, that is performance levels determines thought content and thought content affects performance. However, rather than suggesting that one can cause the other, it seems more appropriate to hypothesise that the relationship between performance worries and performance can be presented in 'closed system' (Figure 7.1).

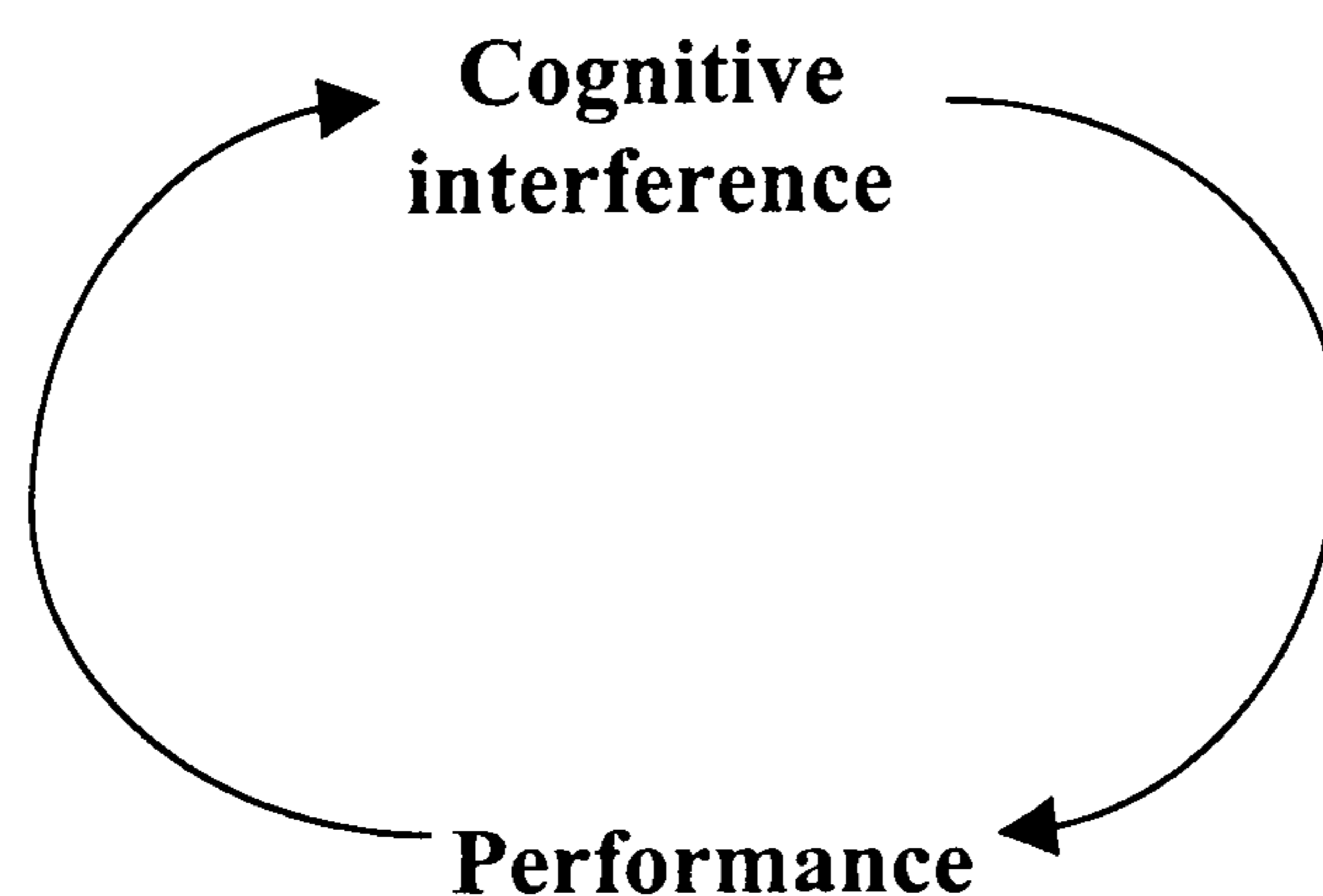


Figure 7.1 A closed model of cognitive interference and performance.

Having examined the role of variables that proved crucial in determining this relationship a more comprehensive model is proposed. This model is presented in Figure 7.2 and a description will now be attempted (numbers in parentheses refer to text and paths in Figure 7.2). If it is assumed that athletes enter a competition with specific goals (0a), as identified by Jones & Hanton (1996), during the process of performing (0b) they automatically evaluate their progress towards, and their chances to reach, these goals (even if specific targets are not set, athletes intuitively know their capabilities and therefore performance standards exist to which present performance can be compared; Carver & Scheier, 1988). When such comparisons take place (0) the distance between desirable/expected and actual performance is identified, i.e. possible discrepancies are detected. If no discrepancies are found (1a), according to Carver & Scheier, 1988), the comparative process is interrupted until a later occasion or terminated (1aI). If discrepancies from goals are identified (1b), thoughts, essentially of a self-evaluative nature (as identified in Chapter 4), regarding such deficits occur (1bI). Such thoughts (2), being unproductive in terms of the task processes were found in Chapter 5 to be detrimental to concentration (2a). Such effects have been attributed to the fact that cognitive resources that could be used for task-processing purposes are misused (Sarason, 1988). That is what Eysenck & Calvo (1992) in their cognitive approach to interference described as reductions in storage and processing capacity of the working memory devoted to the task. In addition, the occurrence of such thoughts is likely to influence subsequent effort input of the individuals (Chapter 5). In this instance, the expectancies of athletes to attain the pursued goals can be considered crucial. Thus, when goal attainment expectancies are relatively high (2bI), efforts will be renewed or even increased (2cI) in order to reduce the identified deficits and reach the desired goals. In contrast, when goal attainment expectancies are low (2bII), and individuals feel they have little or no control over behavioural outcome (Carver 1988), efforts will be reduced or abandoned (2cII).

In the case of low expectancies the effects of worry are detrimental to both concentration (3a) and effort (3b) and consequently to performance. However, in the case of high expectancies, effects of worry are detrimental to concentration (3a) but beneficial to effort (3b). Subsequently, the effects on performance depend on the demands of the activity (Eysenck 1992), that is the nature of the sport (4), but also on the abilities of the individual (4) in terms of effort (capacity) and concentration (skill).

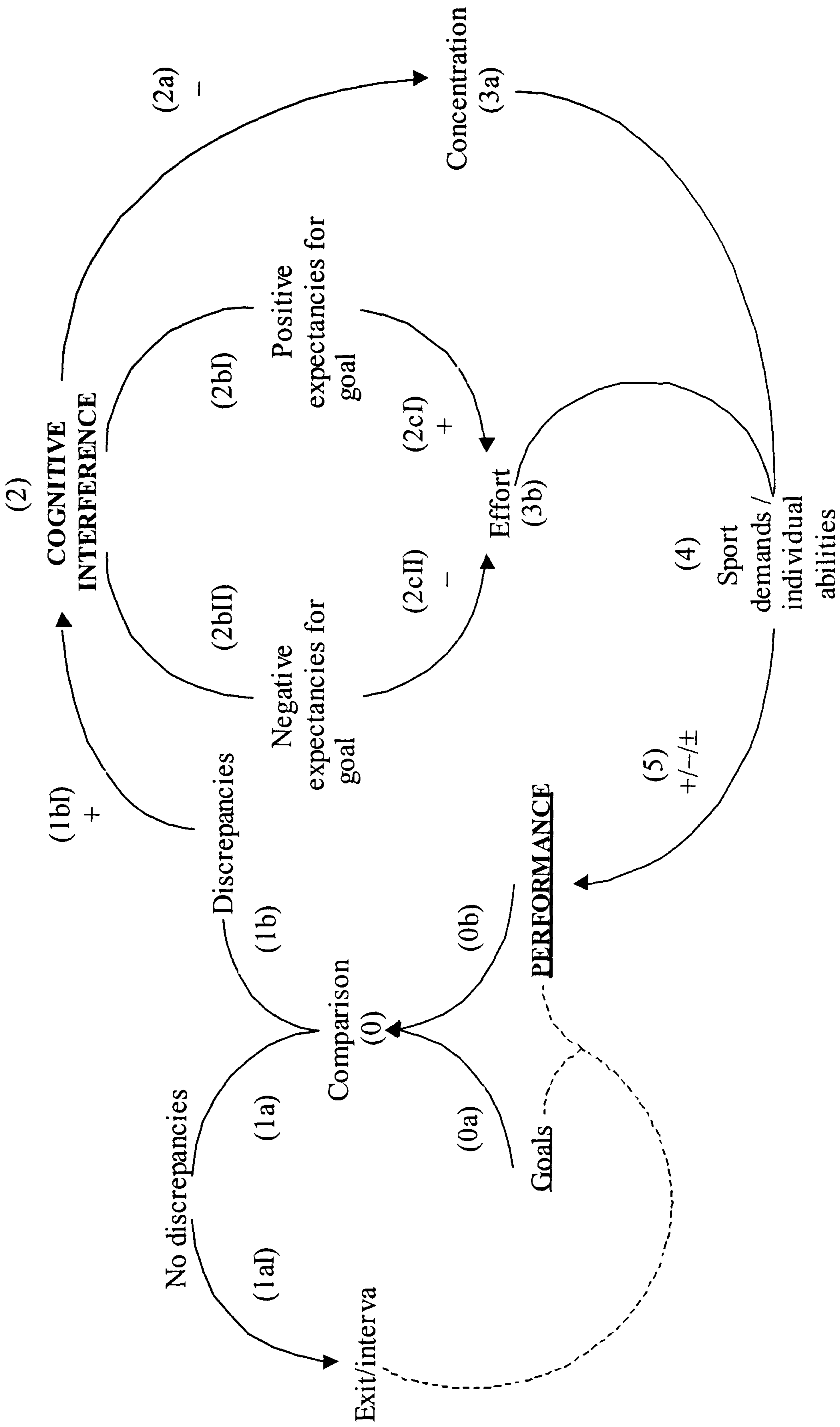


Figure 7.1 A conceptual model of the relationship between cognitive interference and performance in sport.

For example, in team sports increases in individual effort do not necessarily result in increased performance because that also depends on the performance of the rest of the team. Furthermore, in some sports concentration is more important than in others and therefore the beneficial effects of additional effort can be overpowered by the detrimental effects on concentration. Finally, in sports involving direct competition performance of the opposition might not allow for improvements. Thus, depending on such factors performance (5) might improve, decrease or remain unaffected.

Subsequently, the cycle might repeat itself (0, 0a, 0b) until the goal is reached or abandoned, or when the event is completed.

Additional considerations

A first issue that should be considered is the possible relation between the size of discrepancies between desirable and actual performance, goal attainment expectancies, and subsequent effort. Duval et al. (1992) argues that important determinants of these relationships are the size of the identified discrepancies and the perceived rate of progress towards the goal. Specifically, they argued that when the rate of actual-to-desirable discrepancy reduction is adequate relative to the size of the discrepancy, efforts to reach the desirable goal will be renewed. In contrast, when the rate of progress towards the goal is inadequate in relation to the size of the discrepancy the dominant behavioural response will be withdrawal of effort. Thus, it can be argued that large discrepancies might lead to greater effort increases than small discrepancies, when progress towards the goal is satisfactory. In contrast, lack of progress in a large discrepancy situation will result in effort abandonment, but this might not be necessarily the case in a small discrepancy situation, where the goal is still visible, i.e. can be still perceived as attainable.

As it becomes apparent, expectancy of goal attainment is a process rather than a fixed/stable characteristic. Despite the fact that in the respective study (Chapter 5) goal attainment expectancies due to practical difficulties were measured before the competition, they could still account for differences in responses to performance deficits and subsequent worries. Possible explanations for this finding might be (a) that athletes' perceptions before the game were accurate and based on knowledge of their own and their opponents' capacity, (b) that pre-game perceptions in some cases might be strong

enough to overpower the progress of the game (an explanation that appears very adaptive in the case of positive expectancies, but maladaptive in the case of negative expectancies), or (c) that the actual size of the relationships that emerged may be larger when expectancies during the process of the game could be assessed. Overall, even though the role of the magnitude of discrepancies and the rate of progress towards the goal are not possible to evaluate during real competition situations, alternative methodologies can be employed to further investigate their role.

The role of anxiety intensity and direction

Another issue to consider is the role of pre-competition anxiety in such a model. Relationships between anxiety and performance worries were moderate. On the one hand, the relationship can be described as large enough to suggest that pre-competition anxiety leads to worry. Stemming from the results of the study investigating the relationship between pre-competition anxiety and cognitive interference during performance (Chapter 5), it could be suggested that cognitive anxiety is probably the most important pre-competition predictor of cognitive interference and in particular worry. Based on these findings, anxiety could be placed in the model as an exogenous variable contributing to the generation (prediction) of cognitive interference. However, this was not considered appropriate since it is quite likely that anxiety might be related to, or interact with, several other constructs included in the model (e.g. goal attainment expectancies; Jones & Hanton, 1996), a possibility that was not examined in the present investigation.

On the other hand, the relationship can be described as small enough to justify inconsistencies in the anxiety/performance relationship. Considering that the strongest predictor of cognitive interference was performance deficits identified by athletes, it is likely that anxiety states are subject to changes once competition has started. Therefore, it is not surprising that anxiety research focusing on pre-competition states of athletes has failed to come up with reliable results in the anxiety/performance relationship. This of course does not mean that pre-competition anxiety research should be underestimated, however more emphasis should be placed on how anxiety translates to cognitions during competition.

The relationship between somatic anxiety and performance worries was smaller compared to cognitive anxiety, however it was larger than the magnitude of the relationship that has been identified in educational research (e.g. Sarason, 1984; Sarason et al., 1986). Considering the nature of sport this is not surprising. Test situations involve almost exclusively cognitive processes and abilities, whereas sport is a combination of cognitive and somatic skills. The somatic state of the athlete is important in the process of performing and therefore athletes' thoughts are also concerned with bodily sensations, since these might be crucial in determining performance. Even though originally multidimensional anxiety theory predicted that relationships between somatic anxiety and performance are weaker than those between cognitive anxiety and performance, contemporary research has in some, although few, instances revealed somatic anxiety to be a better predictor of performance (e.g. Edwards & Hardy, 1996; Gould et al., 1987). In relation to the present findings, an important research question arises regarding what happens to somatic anxiety symptoms once performance has been initiated and how such symptoms influence thought content during performance.

In congruence with previous studies, highlighting the need to incorporate the dimension of anxiety direction into sport anxiety research, this dimension was of some importance in predicting levels of cognitive interference. In particular, it was revealed that athletes perceiving their anxiety symptoms as facilitative reported less interfering thoughts than those perceiving their symptoms as debilitating. Burton (1998) questions whether anxiety can really be facilitative and argues that if by definition anxiety should be considered as negative affect, it is likely that researchers are simply mislabeling as anxiety other positive emotions such as challenge and excitement. Thus, the problem seems to lie in the conceptualisation of anxiety.

Considering the recent criticism anxiety measurement in the form of CSAI-2 has received (Burton, 1998; Burton & Naylor, 1997; Lane et al., 1999; see review of literature for a more detailed presentation), the above results should be cautiously interpreted. Further research in the field should reconsider the conceptualisation of anxiety and clearly discriminate between components and correlates of sport anxiety. Based on such advances, relationships between pre-competition anxiety, cognitive

interference and its effects on athletes' effort/performance can be further explored and better understood.

Searching beyond 'worry'

As already noticed, in relation to the present findings, the above model can only account for the type of thoughts described as performance worries. However, as Sarason et al. (1996b) argues, while much research has been devoted to worries and the worrying process, cognitive interference may be a superordinate category of cognitions of which worries are an important but not the sole part.

Situation irrelevant thoughts. Relationships involving situation-irrelevant thoughts were weaker in all studies. One possible reason for the lack of magnitude in these relationships is the distributional characteristics that were obtained in measures of frequency of situation-irrelevant thoughts. Generally, the range of responses in these measures was quite restricted (low means and small standard deviations), which according to Tabachnick & Fidell (1996) can deflate relationships with other measures. It could be argued that this does not seem a very reliable explanation, since the thoughts of escape subscale, for which similar distributional characteristics were revealed, related significantly higher to other measures. However, this does not reject the above argument since it is possible that the relationships that emerged for thoughts of escape, despite their magnitude, were also deflated.

Thus, regarding situation irrelevant thoughts it can only be stated that according to athletes' perceptions they are detrimental to concentration. The moderate to high correlations that were revealed between this and the two remaining TOQS subscales can be attributed to the fact that they all are thoughts not related to performance processes.

Thoughts of escape. The patterns of relationships that emerged for thoughts of escape were closer to those of performance worries than to situation irrelevant thoughts. Thoughts of escape can be said to be generated when unrecoverable discrepancies between goals and performance are identified and the individuals feel they have little or no control over the outcome. Such thoughts were found to be detrimental to concentration and effort. Performance worries and thoughts of escape correlated highly.

As with situation irrelevant thoughts one reason is that they both are non-task related. However, it can also be suggested that worry can lead to escape. Continuous reminders of deficits and constant worry (i.e. rumination) might result in perceptions of loss of control and mental withdrawal (Miculiner, 1996). Considering the lack of research regarding such thoughts, Sarason et al. (1996b) questions whether thoughts of escape are merely correlates or products of worry, and argues for the need to broaden the concept of cognitive interference beyond worry so that such seemingly important aspects of cognitive content can be further investigated.

The role of goal orientation

Goal orientations have been hypothesised to be related to different patterns of cognitions, behaviour, and affect (Duda, 1993). Attempting to fit goal orientations into an integrating model it could be hypothesised that when ego orientations prevail larger discrepancies between goals and performance, and consequently worries about performance, are more likely to occur. This is because, according to the theoretical framework, goals are normatively evaluated and therefore are less controllable. This prediction was not confirmed by the present data. A possible explanation is that discrepancies from goals can also be large when task orientation is highly salient because task oriented individuals have been shown to choose more challenging goals (Nicholls, 1984, 1989). Therefore, the source of worry might differ, however the frequency can be similar. However, research on goals has shown that task orientation is related to more effort and persistence compared to an ego orientation (Duda, 1993). Therefore, it can be argued that it is the response to such worries in terms of effort that might differ since within a task orientation goal attainment expectancies can be higher because goals are more controllable. In that respect, it would be interesting to investigate the role of goal orientations in relation to performance discrepancies and goal attainment expectancies.

The finding that under unfavourable situational conditions (losing) athletes holding comparative goals experienced significantly more thoughts of escape than athletes holding self-referenced goals, appears to provide indirect support for the above proposition, indicating that maladaptive cognitive responses are more likely to occur within ego oriented athletes.

Conclusion

The present investigation expands sport performance research. The topics of the investigation are not new in psychology but have been largely ignored in sport psychology. Considering the lack of previous research on this specific topic methodological choices that were made can be criticised and limitations can be identified. Furthermore, it is understandable that a single investigation cannot establish clear conclusions.

Limitations

Measurement restrictions. One limitation of the present investigation involves the assessment of thought content, the major issue under examination. This limitation is not specific to this project, but rather global when it comes to assessing cognitive activation since all possible thought sampling methods have in common a reliance on self-reports (Klinger, 1978). Furthermore, in field studies, when thoughts individuals have during task performance need assessing, memory and the ability of individuals to be aware of the several thoughts they experience also become part of the problem. Attempting to reduce the effects of the above limitation, thought content was assessed as close to the conclusion of the competition as possible.

Lack of evidence for causality inferences. Another important shortcoming is the lack of methodological strength to support direction of causality in the identified relationships. However, once more it should be emphasised that since the purpose of the investigation was to explore relationships in field, without interfering with the competitive environment, methodological designs to examine causality were not applicable. Thus, within the frame of the present investigation, inferences regarding causality can only be supported theoretically.

Sample limitations. Finally, the results of the present investigation need replicating and expanding due to sample limitations. On the one hand the samples that were employed were quite specific in that all participants were university students. On the other hand, it can also be argued that samples were not homogeneous, since athletes representing different competition levels, and in some cases different sports, participated in the studies. Considering that the nature of the different sports might play a crucial role in

determining some of the identified relationships, the above issues limit the generalisability of the findings to the specific samples that were used. Finally, in some of the analyses sample sizes were rather small. Nevertheless, it has to be stressed that all of the identified limitations are common in sport psychology. Access to sport samples is a major problem researchers face when the research designs involve assessment pre/post-competition (or both as in the case of this investigation).

Contribution to the literature

Despite the above limitations, such an investigation could give a preliminary insight and stimulate further research and debate, into the role of cognitive content during sport performance. Summarising how the present investigation contributes to the sport psychology literature, it is argued that:

- It provides a new instrument to retrospectively assess thought content during sport performance.
- It contributes to the transition from pre-competition anxiety research to research investigating cognitive states of athletes while performing.
- It identifies possible reasons for the inconsistency in the anxiety/performance relationship.
- It identifies possible mechanisms through which thought content during competition affects performance.
- It proposes a conceptual model that promotes further research that can be fruitful both on theoretical and applied levels.

Future directions

Future research directions can evolve through examination of the identified limitations. First, regarding the assessment of thought content during competition, alternative methodologies can be employed to strengthen the results obtained from post-competition questionnaires. Such designs could employ a more ideographic approach, which may involve stimulated recall through the use of videos and in-depth interviews.

Second, regarding methodological inadequacy to infer causality, it is suggested that once relationships in field studies have been established, experimental research can contribute to explore issues of causality. Such research may not take place in the real

competition environment but could help identify whether theoretically based propositions hold, and will also contribute to a better understanding of mechanisms through which various effects take place.

Third, regarding sample characteristics, studies to replicate and confirm the identified relationships are also essential. Considering that in the proposed conceptual model the nature of the specific sport is crucial in determining relationships between cognitive interference and performance, sport specific research is necessary. Such research can help identifying how relationships differ in relation to sport context and enhance our understanding of links between the investigated constructs.

Finally, future research could consider relationships between constructs that were included in this investigation, which however were not examined in relation to each other (e.g. anxiety and goal orientations in relation to goal attainment expectancies and (effects of interfering thoughts on effort) responses to interfering thoughts; see section on additional considerations for more details). Examinations of such relationships could result in a more comprehensive understanding, but also in further extensions (improvements), of the proposed model.

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Appendices

APPENDIX A

The original Thought Occurrence Questionnaire (TOQ).

While performing I think about:		never							very often
1.	how poorly I am doing	1	2	3	4	5	6	7	
2.	what someone will think of me	1	2	3	4	5	6	7	
3.	how I should be more careful	1	2	3	4	5	6	7	
4.	how well others can do on what I am trying to do	1	2	3	4	5	6	7	
5.	difficult what I am doing is	1	2	3	4	5	6	7	
6.	level of ability	1	2	3	4	5	6	7	
7.	the purpose of what I am doing	1	2	3	4	5	6	7	
8.	how I would feel if I were told how I performed	1	2	3	4	5	6	7	
9.	how often I feel confused	1	2	3	4	5	6	7	
10.	other activities	1	2	3	4	5	6	7	
11.	members of my family	1	2	3	4	5	6	7	
12.	friends	1	2	3	4	5	6	7	
13.	something that makes me feel guilty	1	2	3	4	5	6	7	
14.	personal worries	1	2	3	4	5	6	7	
15.	something that makes me feel tense	1	2	3	4	5	6	7	
16.	something that makes me feel angry	1	2	3	4	5	6	7	
17.	something that happened earlier in the day	1	2	3	4	5	6	7	
18.	something that happened in the recent past (e.g. in the last few days)	1	2	3	4	5	6	7	
19.	something that happened in the distant past	1	2	3	4	5	6	7	
20.	something that might happen in the future	1	2	3	4	5	6	7	
21.	stopping	1	2	3	4	5	6	7	
22.	how unhappy I am	1	2	3	4	5	6	7	
23.	how hard it is	1	2	3	4	5	6	7	
24.	how I cannot stand it any more	1	2	3	4	5	6	7	
25.	about quitting	1	2	3	4	5	6	7	
26.	running away	1	2	3	4	5	6	7	
27.	taking something (e.g., pills, a drink) to make it easier	1	2	3	4	5	6	7	
28.	going to bed or to sleep	1	2	3	4	5	6	7	

APPENDIX B

Instrument used in Stage 2 (content analysis) of the TOQS development.

QUESTIONNAIRE DEVELOPMENT

We are trying to construct a questionnaire regarding thoughts athletes experience during competitions. Please complete the following form after reading the instructions provided below. Your help will be greatly appreciated.

INSTRUCTIONS

This is a list of thoughts that might go through athletes' minds during sport performance.

- Please categorise the items that follow into the four given categories according to their nature by ticking the appropriate cell.
- **If you think that some items do not fall in any of the categories tick the column labeled 'none'.**
- **If you think that some items fit to more than one category, please indicate so by ticking more than one columns.**

CATEGORIES	Thoughts related to the competition (performance, outcome).	Thoughts not related to the competition.	Thoughts of withdrawing from the competition.	None
ITEMS During sport performance I have thoughts ...				
1. that I shouldn't mess-up now				
2. that this is a horrible experience				
3. about other activities (e.g. shopping, TV, having tea)				
4. that everyone is passing me				
5. that some competitors look really strong today				
6. that I'm not interested in this anymore				
7. that I'm not going to achieve my goal today				
8. about personal worries				
9. that I cannot stand it anymore				
10. that I'm performing poorly				
11. that I want to get out of here				
12. that the conditions (e.g. temperature, pitch, atmosphere) are not good				
13. that I'm letting people (e.g. coach, parents) down				
14. that I'm going to finish way down the field				

	Thoughts related to the competition (performance, outcome).	Thoughts not related to the competition.	Thoughts of withdrawing from the competition.	None
15. about members of my family				
16. that I'm having a bad day				
17. that I will not bother trying anymore				
18. that I shouldn't make a mistake now				
19. about stopping				
20. about what I'm going to do later in the day				
21. that I'm disappointing everyone				
22. about previous mistakes I have made				
23. that I'm fed-up with it				
24. that I'm not in a position to beat them today				
25. about friends				
26. that I'm not going to do this competition anymore				
27. that the weather is really bad				
27. that other competitors are better than me today				
28 that I want to quit				
29. that I'm very unlucky				
30. about what I'm going to do when I go home				
31. that it's getting too hard				
32. that I'm in agony				
33. that the last time I tried I failed				
34. that there is not much I can do				
35. that I hate this competition				
36. that I lack ability				
37. that I'm not going to win today				

Thank you very much for your co-operation.

APPENDIX C

Instrument used in Stage 3 (Exploratory Factor Analysis) of the TOQS development.

SPORTS QUESTIONNAIRE

- A number of statements that athletes have used to describe their thoughts during competition are listed in the following page. Read each statement and then circle the appropriate number to the right of the statement to indicate how often you experience such thoughts during competition.
- Some athletes feel they should not admit such thoughts, but such thoughts are actually quite common, even among professional athletes. To help us better understand these reactions we ask you to share your true reactions with us. There are, therefore, no right and wrong answers. Do not spend too much time on any of the statements, but choose the answer which represents how you usually react.
- You may find some of the statements quite similar. Please do not let this disturb you, and treat each one individually.

Thank you very much for your co-operation.

I agree to participate in this research project.

After reading the above statement please tick this box

gender (circle appropriately):

male

female

sport:

date of birth:

years participating in sport:

current level (circle appropriately):

international

national

university

regional

club

recreational

During competition I have thoughts ...

		almost					never		very
								often	
1.	that I shouldn't mess-up now	1	2	3	4	5	6	7	
2.	that I want to quit	1	2	3	4	5	6	7	
3.	about members of my family	1	2	3	4	5	6	7	
4.	that I am performing poorly	1	2	3	4	5	6	7	
5.	that I do not want to do this competition any more	1	2	3	4	5	6	7	
6.	about personal worries (e.g. school, work, relations)	1	2	3	4	5	6	7	
7.	that I'm not going to achieve my goal today	1	2	3	4	5	6	7	
8.	that I lack ability	1	2	3	4	5	6	7	
9.	that I want to get out of here	1	2	3	4	5	6	7	
10.	about what I'm going to do later in the day	1	2	3	4	5	6	7	
11.	that I'm letting people (e.g. my coach, my parents) down	1	2	3	4	5	6	7	
12.	that the conditions (weather, temperature, pitch, atmosphere) are not good	1	2	3	4	5	6	7	
13.	that I'm not interested in this competition anymore	1	2	3	4	5	6	7	
14.	about other activities (e.g. shopping, having tea, TV)	1	2	3	4	5	6	7	
15.	that I shouldn't make a mistake now	1	2	3	4	5	6	7	
16.	about stopping	1	2	3	4	5	6	7	
17.	about previous mistakes I have made	1	2	3	4	5	6	7	
18.	about friends	1	2	3	4	5	6	7	
19.	that I'm having a bad day	1	2	3	4	5	6	7	
20.	that I am fed-up with it	1	2	3	4	5	6	7	
21.	that I'm not going to win today	1	2	3	4	5	6	7	
22.	about what I'm going to do when I'll go home	1	2	3	4	5	6	7	
23.	that other competitors are better than me today	1	2	3	4	5	6	7	
24.	that I cannot stand it any more	1	2	3	4	5	6	7	

Thank you very much for your co-operation.

APPENDIX D

Instruments used in Stage 4 (Validation) of the TOQS development.

SPORTS QUESTIONNAIRE

- A number of statements that athletes have used to describe their thoughts and reactions before or during competition are listed in the following pages. Read each statement and then circle the appropriate number to the right of the statement to indicate how often you usually experience such thoughts or reactions before or during competition.
- Some athletes feel they should not admit such reactions to competition, but such reactions are actually quite common, even among professional athletes. To help us better understand these reactions we ask you to share your true reactions with us. There are, therefore, no right and wrong answers. Do not spend too much time on any of the statements, but choose the answer which represents how you usually react.
- You may find some of the statements quite similar. Please do not let this disturb you, and treat each one individually.

Thank you very much for your co-operation.

I agree to participate in this research project.

After reading the above statement please tick this box

gender (circle appropriately):

male

female

sport:

date of birth:

years participating in sport:

current level (circle appropriately):

international

national

university

regional

club

recreational

During competition I have thoughts ...		never							very often
1.	that I want to quit	1	2	3	4	5	6	7	
2.	about other activities (e.g. shopping, having tea, TV)	1	2	3	4	5	6	7	
3.	about previous mistakes I have made	1	2	3	4	5	6	7	
4.	that I do not want to take part in this competition any more	1	2	3	4	5	6	7	
5.	about what I'm going to do later in the day	1	2	3	4	5	6	7	
6.	that I'm having a bad day	1	2	3	4	5	6	7	
7.	that I want to get out of here	1	2	3	4	5	6	7	
8.	about personal worries (e.g. school, work, relations)	1	2	3	4	5	6	7	
9.	that the conditions (whether, temperature, pitch, atmosphere) are not good	1	2	3	4	5	6	7	
10.	about stopping	1	2	3	4	5	6	7	
11.	about friends	1	2	3	4	5	6	7	
12.	that I am not going to achieve my goals today	1	2	3	4	5	6	7	
13.	that I am fed-up with it	1	2	3	4	5	6	7	
14.	about what I'm going to do when I'll go home	1	2	3	4	5	6	7	
15.	that I am not going to win this competition	1	2	3	4	5	6	7	
16.	that I cannot stand it any more	1	2	3	4	5	6	7	
17.	that other competitors are better than me	1	2	3	4	5	6	7	

	n o t a t a l l	s o m e w h a t	m o d e r a t e l y s o	v e r y m u c h s o
1. While competing, I worry about making mistakes or failing to come through	1	2	3	4
2. I put a lot of pressure on myself by worrying how I will perform	1	2	3	4
3. I think about and imagine what will happen if I fail or screw-up	1	2	3	4
4. I worry quite a bit about what others think about my performance	1	2	3	4

<i>Before or during competition ...</i>	a l m o s t	s o m e t i m e s	o f t e n	a l m o s t	a l w a y s
1. I feel nervous	1	2	3	4	4
2. During competition, I find myself thinking about unrelated things	1	2	3	4	4
3. I have self-doubts	1	2	3	4	4
4. my body feels tense	1	2	3	4	4
5. I am concerned that I might not do as well as I could	1	2	3	4	4
6. My mind wanders during competition	1	2	3	4	4
7. While performing, I often do not pay attention to what is going on	1	2	3	4	4
8. I feel tense in my stomach	1	2	3	4	4
9. Thoughts of doing poorly interfere with my concentration during competition	1	2	3	4	4
10. I am concerned about choking under pressure	1	2	3	4	4
11. my heart races	1	2	3	4	4
12. I feel my stomach shrinking	1	2	3	4	4
13. I am concerned about performing poorly	1	2	3	4	4
14. I have lapses of concentration during competition because of nervousness	1	2	3	4	4
15. I sometimes find myself trembling	1	2	3	4	4
16. I am worried about reaching my goal	1	2	3	4	4
17. my body feels tight	1	2	3	4	4
18. I am concerned that others will be disappointed in my performance	1	2	3	4	4
19. my stomach gets upset	1	2	3	4	4
20. I'm concerned I will not be able to concentrate	1	2	3	4	4
21. my heart pounds	1	2	3	4	4

In this part of the questionnaire you are asked to indicate to what degree you agree or disagree with the statements listed below.

	strongly disagree					strongly agree	
1. I am pretty skilled in my sport	1	2	3	4	5	6	7
2. I enjoy my sport very much	1	2	3	4	5	6	7
3. I am not very happy with my level of competence	1	2	3	4	5	6	7
4. After playing my sport for a while I felt pretty competent	1	2	3	4	5	6	7
5. My sport is fun	1	2	3	4	5	6	7
6. I would describe my sport as very interesting	1	2	3	4	5	6	7
7. I am satisfied with how good I am in my sport	1	2	3	4	5	6	7
8. I think I am pretty good in my sport	1	2	3	4	5	6	7
9. While playing, I think about how much I enjoy it	1	2	3	4	5	6	7

Thank you very much for your co-operation.

APPENDIX E

The instruments used in Study II of the investigation.

SPORTS QUESTIONNAIRE

- You are about to complete a set of questionnaires concerning sport competitions. You will be asked to answer some questions before the race starts (**pre-race**) and some after the race is completed (**post-race**).
- The questions involve statements that athletes have used to describe their thoughts and reactions before or during competition. Some athletes feel they should not admit such reactions to competition, but such reactions are actually quite common, even among professional athletes. To help us better understand these reactions we ask you to share your true reactions with us. There are, therefore, no right and wrong answers.
- **It is important for us to have your registration number on all of the questionnaire pages**, so that we can match the information we get from the pre-race questionnaire with those of the post-race questionnaire. However, we would like to assure you that all the information will be kept confidential. So please feel free to answer the questions in the most honest way possible.

Thank you very much for your co-operation.

I agree to participate in this research project.

After reading the above statement please tick this box

PRE-RACE

- Please complete the first page of the form, and read carefully the instructions before completing the questionnaire in the second/third page.

REGISTRATION NUMBER:

gender (circle appropriately):	male	female	
date of birth:			
years of competitive experience:			
current level (circle appropriately):	international	national	university
	regional	club	recreational

What is your personal **time-goal** for the upcoming competition:

PRE-RACE

A number of statements that athletes have used to describe their feelings and thoughts before competition are given below. Please complete the questionnaire after reading carefully the instructions:

- **Column one:** In this column you are asked to indicate the degree to which you **experience** such feelings or thoughts **right now – at this moment**.

1 = not at all; 2 = somewhat; 3 = moderately so; 4 = very much so

- **Column two:** In this column you are asked to indicate whether you regard these feelings and thoughts stated at the left as **positive or negative** in relation to your upcoming performance.

-3 = very negative, 0 = unimportant/neutral, +3 = very positive

		COLUMN ONE				COLUMN TWO						
		not at all	somewhat	moderately so	very much so	very negative			unimportant neutral			very positive
1.	I am concerned about this competition	1	2	3	4	-3	-2	-1	0	+1	+2	+3
2.	I feel nervous	1	2	3	4	-3	-2	-1	0	+1	+2	+3
3.	I feel at ease	1	2	3	4	-3	-2	-1	0	+1	+2	+3
4.	I have self-doubts	1	2	3	4	-3	-2	-1	0	+1	+2	+3
5.	I feel jittery	1	2	3	4	-3	-2	-1	0	+1	+2	+3
6.	I feel comfortable	1	2	3	4	-3	-2	-1	0	+1	+2	+3
7.	I am concerned that I may not do as well in this competition as I could	1	2	3	4	-3	-2	-1	0	+1	+2	+3
8.	My body feels tense	1	2	3	4	-3	-2	-1	0	+1	+2	+3
9.	I feel self-confident	1	2	3	4	-3	-2	-1	0	+1	+2	+3
10.	I am concerned about losing	1	2	3	4	-3	-2	-1	0	+1	+2	+3
11.	I feel tense in my stomach	1	2	3	4	-3	-2	-1	0	+1	+2	+3
12.	I feel secure	1	2	3	4	-3	-2	-1	0	+1	+2	+3
13.	I am concerned about choking under pressure	1	2	3	4	-3	-2	-1	0	+1	+2	+3

		COLUMN ONE					COLUMN TWO						
		not at all	somewhat	moderately so	very much so		very negative		unimportant neutral				very positive
14.	My body feels relaxed	1	2	3	4		-3	-2	-1	0	+1	+2	+3
15.	I am confident I can meet the challenge	1	2	3	4		-3	-2	-1	0	+1	+2	+3
16.	I am concerned about performing poorly	1	2	3	4		-3	-2	-1	0	+1	+2	+3
17.	My heart is racing	1	2	3	4		-3	-2	-1	0	+1	+2	+3
18.	I am confident about performing well	1	2	3	4		-3	-2	-1	0	+1	+2	+3
19.	I am concerned about reaching my goal	1	2	3	4		-3	-2	-1	0	+1	+2	+3
20.	I feel my stomach sinking	1	2	3	4		-3	-2	-1	0	+1	+2	+3
21.	I feel mentally relaxed	1	2	3	4		-3	-2	-1	0	+1	+2	+3
22.	I am concerned that others will be disappointed with my performance	1	2	3	4		-3	-2	-1	0	+1	+2	+3
23.	My hands are clammy	1	2	3	4		-3	-2	-1	0	+1	+2	+3
24.	I am confident because I mentally picture myself reaching my goal	1	2	3	4		-3	-2	-1	0	+1	+2	+3
25.	I am concerned I won't be able to concentrate	1	2	3	4		-3	-2	-1	0	+1	+2	+3
26.	My body feels tight	1	2	3	4		-3	-2	-1	0	+1	+2	+3
27.	I am confident of coming through under pressure	1	2	3	4		-3	-2	-1	0	+1	+2	+3

POST-RACE

Please remember to complete your registration number.

REGISTRATION NUMBER:

- A number of statements that athletes have used to describe their thoughts during competition are listed in this page. Read each statement and then circle the appropriate number to the right of the statement to indicate how often you experienced such thoughts during this race.

During the race I had thoughts ...		never							very often
1.	that I want to quit	1	2	3	4	5	6	7	
2.	about other activities (e.g. shopping, having tea, TV)	1	2	3	4	5	6	7	
3.	about previous mistakes I have made	1	2	3	4	5	6	7	
4.	that I do not want to take part in this race any more	1	2	3	4	5	6	7	
5.	about what I'm going to do later in the day	1	2	3	4	5	6	7	
6.	that I'm having a bad day	1	2	3	4	5	6	7	
7.	that I want to get out of here	1	2	3	4	5	6	7	
8.	about personal worries (e.g. school, work, relations)	1	2	3	4	5	6	7	
9.	that the conditions (whether, temperature, pitch, atmosphere) are not good	1	2	3	4	5	6	7	
10.	about stopping	1	2	3	4	5	6	7	
11.	about friends	1	2	3	4	5	6	7	
12.	that I am not going to achieve my goals today	1	2	3	4	5	6	7	
13.	that I am fed-up with it	1	2	3	4	5	6	7	
14.	about what I'm going to do when I'll go home	1	2	3	4	5	6	7	
15.	that we are not going to win this race	1	2	3	4	5	6	7	
16.	that I cannot stand it any more	1	2	3	4	5	6	7	
17.	that other runners are better than me	1	2	3	4	5	6	7	

Thank you very much for your co-operation.

APPENDIX F

The instruments used in Study III of the investigation.

SPORTS QUESTIONNAIRE

- You are about to complete a set of questionnaires concerning sport competitions. You will be asked to answer some questions before the game starts (**pre-game**) and some after the game is completed (**post-game**).
- The questions involve statements that athletes have used to describe their thoughts and reactions before or during competition. Some athletes feel they should not admit such reactions to competition, but such reactions are actually quite common, even among professional athletes. To help us better understand these reactions we ask you to share your true reactions with us. There are, therefore, no right and wrong answers.
- **It is important for us to have your date of birth on all of the questionnaire pages**, so that we can match the information we get from the pre-race questionnaire with those of the post-race questionnaire. All the questionnaires you are going to complete are anonymous, so please feel free to answer the questions in the most honest way possible.

Thank you very much for your co-operation.

I agree to participate in this research project.

After reading the above statement please tick this box

PRE-GAME

GENDER:

DATE OF BIRTH:

YEARS PARTICIPATING IN COMPETITIONS:

1. How well do you expect to do in this game
not at all well

very well

1

2

3

4

5

6

7

2. To what extent you think you can achieve your goals
to a small extent

to a great extent

1

2

3

4

5

6

7

3. How confident do you feel that you can achieve your goals
not at all confident

very confident

COLUMN ONE			COLUMN TWO			COLUMN THREE				
	never	very often	N / A	not at all distracting	distracting	very distracting	N / A	made me give up trying	neutral	made me try harder
During the game I had thoughts										
5. about what I'm going to do later in the day	1 2 3 4 5 6 7	7 6 5 4 3 2 1	N	1 2 3 4 5 6 7	7 6 5 4 3 2 1	7 6 5 4 3 2 1	N	-3 -2 -1 0 1 2 3	0 1 2 3	3 2 1 0 -1 -2 -3
6. that I'm having a bad day	1 2 3 4 5 6 7	7 6 5 4 3 2 1	N	1 2 3 4 5 6 7	7 6 5 4 3 2 1	7 6 5 4 3 2 1	N	-3 -2 -1 0 1 2 3	0 1 2 3	3 2 1 0 -1 -2 -3
7. that I want to get out of here	1 2 3 4 5 6 7	7 6 5 4 3 2 1	N	1 2 3 4 5 6 7	7 6 5 4 3 2 1	7 6 5 4 3 2 1	N	-3 -2 -1 0 1 2 3	0 1 2 3	3 2 1 0 -1 -2 -3
8. about personal worries (e.g. school, work, relations)	1 2 3 4 5 6 7	7 6 5 4 3 2 1	N	1 2 3 4 5 6 7	7 6 5 4 3 2 1	7 6 5 4 3 2 1	N	-3 -2 -1 0 1 2 3	0 1 2 3	3 2 1 0 -1 -2 -3
9. that the conditions (temperature, pitch, atmosphere) are not good	1 2 3 4 5 6 7	7 6 5 4 3 2 1	N	1 2 3 4 5 6 7	7 6 5 4 3 2 1	7 6 5 4 3 2 1	N	-3 -2 -1 0 1 2 3	0 1 2 3	3 2 1 0 -1 -2 -3
10. about stopping	1 2 3 4 5 6 7	7 6 5 4 3 2 1	N	1 2 3 4 5 6 7	7 6 5 4 3 2 1	7 6 5 4 3 2 1	N	-3 -2 -1 0 1 2 3	0 1 2 3	3 2 1 0 -1 -2 -3
11. about friends	1 2 3 4 5 6 7	7 6 5 4 3 2 1	N	1 2 3 4 5 6 7	7 6 5 4 3 2 1	7 6 5 4 3 2 1	N	-3 -2 -1 0 1 2 3	0 1 2 3	3 2 1 0 -1 -2 -3
12. that we are not going to achieve our goals today	1 2 3 4 5 6 7	7 6 5 4 3 2 1	N	1 2 3 4 5 6 7	7 6 5 4 3 2 1	7 6 5 4 3 2 1	N	-3 -2 -1 0 1 2 3	0 1 2 3	3 2 1 0 -1 -2 -3
13. that I am fed-up with it	1 2 3 4 5 6 7	7 6 5 4 3 2 1	N	1 2 3 4 5 6 7	7 6 5 4 3 2 1	7 6 5 4 3 2 1	N	-3 -2 -1 0 1 2 3	0 1 2 3	3 2 1 0 -1 -2 -3
14. about what I'm going to do when I'll go home	1 2 3 4 5 6 7	7 6 5 4 3 2 1	N	1 2 3 4 5 6 7	7 6 5 4 3 2 1	7 6 5 4 3 2 1	N	-3 -2 -1 0 1 2 3	0 1 2 3	3 2 1 0 -1 -2 -3
15. that we are not going to win this game	1 2 3 4 5 6 7	7 6 5 4 3 2 1	N	1 2 3 4 5 6 7	7 6 5 4 3 2 1	7 6 5 4 3 2 1	N	-3 -2 -1 0 1 2 3	0 1 2 3	3 2 1 0 -1 -2 -3
16. that I cannot stand it any more	1 2 3 4 5 6 7	7 6 5 4 3 2 1	N	1 2 3 4 5 6 7	7 6 5 4 3 2 1	7 6 5 4 3 2 1	N	-3 -2 -1 0 1 2 3	0 1 2 3	3 2 1 0 -1 -2 -3
17. that other teams are better than us	1 2 3 4 5 6 7	7 6 5 4 3 2 1	N	1 2 3 4 5 6 7	7 6 5 4 3 2 1	7 6 5 4 3 2 1	N	-3 -2 -1 0 1 2 3	0 1 2 3	3 2 1 0 -1 -2 -3

Thank you very much for your co-operation.

APPENDIX G

The instruments used in Study IV of the investigation.

SPORTS QUESTIONNAIRE

- You are about to complete a set of questionnaires. You will be asked to complete a form three times after the conclusion of games (**post-game**) , and another one independently of competition time (**form A**).
- It is important for us to match the information we get from all the questionnaire, **so please do not forget to complete your date of birth on all the forms you complete.**
- The questionnaires are anonymous and therefore confidential. So we would like to ask you to answer the questions in the most honest way possible. Remember that there are not right or wrong answers. Do not spend much time on any of the questions and simply choose the answer that better represents you.

We count on your help, thank you very much for your co-operation.

I agree to participate in this research project.

After reading the above statement please tick this box

FORM A

- Please remember to complete your **DATE OF BIRTH**

DATE OF BIRTH:	
GENDER:	

- Please read each of the following statements listed below and indicate how much you agree with each statement by circling the appropriate number.

1= strongly disagree, 2= disagree, 3= neutral, 4= agree, 5= strongly agree

I feel most successful in volleyball when:

1. I am the only one who can perform a skill	1	2	3	4	5
2. I learn a new skill and it makes me want to practice more	1	2	3	4	5
3. I can do better than my team-mates	1	2	3	4	5
4. Other players cannot do as well as me	1	2	3	4	5
5. I learn something that is fun to do	1	2	3	4	5
6. Other mess up and I do not	1	2	3	4	5
7. I learn a new skill by trying hard	1	2	3	4	5
8. I work really hard	1	2	3	4	5
9. I score the most points	1	2	3	4	5
10. Something I learn makes me want to go and practice more	1	2	3	4	5
11. I am the best	1	2	3	4	5
12. A skill I learn really feels right	1	2	3	4	5
13. I do my very best	1	2	3	4	5

POST-GAME

- Please remember to complete your **DATE OF BIRTH**

DATE OF BIRTH:

- A number of statements that athletes have used to describe their thoughts during competition are listed in the following page. Read each statement and then circle the appropriate number to the right of the statement to indicate how often you experienced such thoughts during this game.

During the game I had thoughts ...	never							very often
1. that I want to quit	1	2	3	4	5	6	7	
2. about other activities (e.g. shopping, having tea, TV)	1	2	3	4	5	6	7	
3. about previous mistakes I have made	1	2	3	4	5	6	7	
4. that I do not want to take part in this game any more	1	2	3	4	5	6	7	
5. about what I'm going to do later in the day	1	2	3	4	5	6	7	
6. that I'm having a bad day	1	2	3	4	5	6	7	
7. that I want to get out of here	1	2	3	4	5	6	7	
8. about personal worries (e.g. school, work, relations)	1	2	3	4	5	6	7	
9. that the conditions (temperature, pitch, atmosphere) are not good	1	2	3	4	5	6	7	
10. about stopping	1	2	3	4	5	6	7	
11. about friends	1	2	3	4	5	6	7	
12. that we are not going to achieve our goals today	1	2	3	4	5	6	7	
13. that I am fed-up with it	1	2	3	4	5	6	7	
14. about what I'm going to do when I'll go home	1	2	3	4	5	6	7	
15. that we are not going to win this game	1	2	3	4	5	6	7	
16. that I cannot stand it any more	1	2	3	4	5	6	7	
17. that other teams are better than us	1	2	3	4	5	6	7	