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SMART GOLF:
AN EXPLORATORY STUDY OF SPORT INTELLIGENCE IN GOLF

By

Kevin Blue

A DISSERTATION

Submitted to
Michigan State University
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ABSTRACT

SMART GOLF:
AN EXPLORATORY STUDY OF SPORT INTELLIGENCE IN GOLF

By

Kevin Blue

The term 'sport intelligence' was first introduced by cognitive sport psychologists (e.g., Fisher, 1984; Tenenbaum and Bar-Eli, 1993, 1995) in reference to the ability of athletes to solve problems and make decisions while taking part in competition. More recent definitions (e.g., Gould, Dieffenbach & Moffet, 2002) propose sport intelligence to include components beyond in-competition decision making. In general, despite its apparent practical and theoretical importance, sport intelligence is a relatively underexplored phenomenon.

This dissertation is an exploratory investigation of the components of 'sport intelligence' in the context of golf. In-depth, semi-structured qualitative interviews were performed with 16 experienced and expert golf coaches. The participants were prompted to create their own definitions of sport intelligence in golf based on their expertise and experiences. Also, participants assessed the suitability of components included in previous definitions of sport intelligence for the golf context. Interviews were transcribed verbatim, and data was analyzed using both inductive and deductive methods. For example, data from exploratory portions of the interview were analyzed inductively while data from portions of the interview that directly referenced components previously included in definitions of sport intelligence were analyzed deductively.

Analysis of interview data indicated that the components of sport intelligence in golf could be separated into two separate and somewhat distinct sets of cognitive and

emotional skills. "Competitive intelligence" included cognitive and emotional processes that took place on the course during competition. Themes that described the components of competitive intelligence in the golf context were (a) Self-Knowledge, (b) Self-Awareness, (c) Environmental Perception, (d) Information Processing, (e) Course Management, (f) Cognitive Control, and (g) Understanding the Nature of Golf. "Developmental intelligence" included cognitive and emotional processes that took place during training and/or preparation and influenced the long-term development of a player. The components of developmental intelligence were (a) Self-Knowledge, (b) Self-Regulation, (c) Attitude for Development, and (d) Understanding of the Elite Sport Process.

Theoretical and practical implications of these results are discussed, and future directions for research are suggested. The possible significance of developmental intelligence for talent development across sports is discussed.

This dissertation is dedicated to my parents.

Your love and support has always enabled me to try my hardest without being afraid to fail. One day I hope to be as good a parent as you all are.

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CHAPTER 1: INTRODUCTION

Introduction and Background

Competitive success in elite sport requires precision in both the physical and mental areas of performance. For example, in the physical domain, top athletes must attain mastery of their mechanical techniques and achieve the appropriate body strength and flexibility to most efficiently execute these techniques. Successful athletes must also possess a psychological ability to properly deal with the mental challenges that accompany elite competition. Many psychological demands – such as anxiety and competitive pressure – are inherent aspects of competition and performance in general, and must be overcome for success in a variety of competitive settings.

In addition to handling the general psychological demands of performance, psychologically skilled competitors are also thought to be proficient at the intellectual and strategic aspects of their particular sport. Consider the following example of Annika Sorenstam, one of the top women golfers in the world, discussing her decision-making process for selecting a strategically appropriate target on an approach shot in golf:

> My caddie gives me the yardage to the front of the green, as well as the distance from there to the pin. Then we determine how far I want to carry the ball. That's the yardage I play to - where I want to land the ball. If the green is flat and firm, I'll try to land the ball halfway between the front edge and the pin. If the green is soft, I might carry the ball the full distance. I'm not going to hit the ball perfectly straight every time, so it helps to have a little margin for error on either side of the pin. For example, if there's 15 yards of green to the right of the flag, but only five yards to the left - where a deep greenside bunker lurks - I'll "borrow" a few yards to the right of the hole and aim there (Sorenstam, 2004).

Sorenstam concludes, "Remember, golf is not just a game of great shots. It's a game of bad shots too. The champions are the ones who hit the fewest bad shots - and who are smart enough to keep their bad shots from being terrible" (Sorenstam, 2004).

In coaching parlance, an athlete thinking in the fashion demonstrated by Sorenstam would be considered a "smart player". Recently, sport psychology researchers have categorized this kind of thinking as representative of *sport intelligence,* an emerging construct that lies at the heart of this investigation.

Sport Intelligence

The term "sport intelligence" was first introduced by cognitive sport psychologists (e.g. Fisher, 1984; Tenenbaum and Bar-Eli, 1993, 1995) in reference to the ability of athletes to solve problems and make decisions while taking part in competition. These scholars proposed that athletes with a high level of sport intelligence are able to perceive the environment, anticipate the on-going activity, make a decision, and respond quickly and accurately (Tenenbaum and Bar-Eli, 1993; Singer, 2000). Research pertaining to sport intelligence has traditionally been focused on decision making skills, particularly in open-skill team ball sports such as cricket, basketball, etc. (e.g., Baker, Cote, & Abernathy, 2003; Johnson, 2006; Tenenbaum, 2003). However, more recently researchers have proposed sport intelligence to include cognitions beyond in-competition decision making. In a study of psychological characteristics and their development in Olympic champions by Gould, Dieffenbach & Moffet (2002), the characteristic "sport intelligence" emerged from open-ended interviews with Olympic medalists, their coaches and parents, and consisted of themes like the ability to analyze situations, the tendency of being innovative, being a student of the sport, understanding the nature of elite sport, and being a quick learner. Figure 1 is a diagram showing the various components of sport intelligence that have been included in previous definitions found in the literature.

Sport intelligence appears to be theoretically significant for cognitive sport psychology and practically important for athletic performance. However, despite its apparent significance, the concept of sport intelligence has not been thoroughly researched. Scholars have yet to examine the particular components of sport intelligence in sport-specific contexts. This is important because while sport intelligence most likely has components that cut across sports, aspects of these components are most likely sport-specific with some being activity-specific. For example, the decision making process in open sports where the environment is constantly changing (e.g., football) might differ in important ways from closed environment sports (e.g., vaulting in gymnastics). A purpose of the current study, then, is to identify and delineate the components of sport intelligence in the specific context of golf.

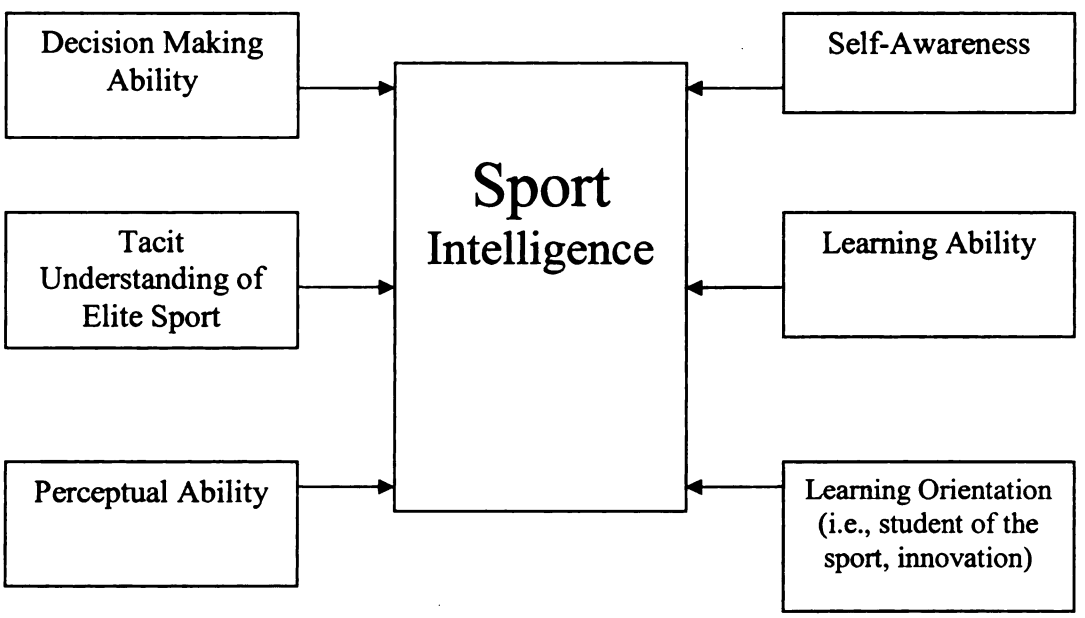

Figure 1. Components of sport intelligence that have been included in prior definitions found in the sport psychology literature.

Purposes and Significance of the Current Study

The purpose of this exploratory study is to identify the components of sport intelligence for the specific context of golf. To accomplish this objective, in-depth interviews were conducted with highly experienced expert golf coaches who have a deep understanding of how the sport is played at the highest level. Interview responses from these coaches were analyzed to produce a golf-specific definition and understanding of sport intelligence.

The current study was planned with both practical and theoretical implications in mind. From a practical point of view, it was the intent of the investigator that this investigation would produce accessible findings that could be directly used by golfers and golf coaches. Golf-specific sport intelligence is critical for the performance and development of elite players – many coaches and players believe that the very slight separation in skill level between world class PGA Tour professionals and near-elite mini-tour professionals may be due to a difference in strategy-related factors rather than a significant difference in technical skills (Rotella, 1996). A more complete understanding of the components of sport intelligence in golf should enable instructors to help players become more skilled at the critical intellectual aspects that comprise part of the mental side of golf.

On a theoretical level, Gould and colleagues (2002) called for researchers to explore the components, antecedents, and effects of sport intelligence in further detail. The present investigation answers this call by exploring the characteristics of sport intelligence in the sport-specific context of golf through qualitative interviews with expert coaches.

Summary

This exploratory investigation seeks to identify the components of sport intelligence in the context of golf. Data was collected through qualitative interviews with highly experienced expert coaches. Sport intelligence is related to several psychological concepts, including (a) decision making, (b) self-awareness, (c) perception, (d) learning ability, (e) tacit knowledge, and (f) the learning orientation. The literature review that follows elaborates on these areas.

CHAPTER 2: REVIEW OF LITERATURE

Introduction

The purpose of this study is to identify and delineate the components of sport intelligence for the specific context of golf. The review of literature presented in this chapter discusses the brief history and evolution of sport intelligence as a theoretical construct. After outlining its evolution, this chapter discusses existing conceptualizations of sport intelligence and examines the components that have been included in definitions of sport intelligence in the literature up to this point. Research pertaining to each of these components of is reviewed.

From General Intelligence to Sport Intelligence

Intelligence is perhaps the most extensively researched characteristic in psychology. Accordingly, a brief discussion of general intelligence is an appropriate starting point to an introduction of sport intelligence.

The dictionary currently defines intelligence as the capacity for learning, reasoning, understanding, and similar forms of mental activity. People who are intelligent are thought to have a high mental capacity, and possess an aptitude for grasping truths, relationships, facts, and meanings. Traditionally, the term "intelligence" has been synonymous with academic intelligence – the ability to deal with verbal and quantitative challenges.

Intelligence was introduced as a formal academic concept through the work of Alfred Binet, who examined the learning differences between psychologically normal and mentally retarded children in an effort to understand who could or could not benefit from a formal education (Carroll, 1982). As intelligence was further studied, the issue of

generality versus specificity began to arise. For example, Spearman's (1927) *g* factor represented an ability that influenced performance on all types of intelligence tests, while the *s* factor represented ability unique to a specific test of a particular component of intelligence. Other psychologists delineated the construct of intelligence to the point where defining it became conceptually challenging. For example, Guilford (1967) proposed the existence of 98 distinct components of cognitive ability. Thus, a point in the literature was reached where intelligence lost its precise theoretical definition and became conceptualized simply as the level of performance on tests designed to measure intelligence (i.e., intelligence is what intelligence tests measure) (Carroll, 1982).

As conceptualizations of intelligence continued to evolve, a growing number of theorists began to view intelligence as a function of perception. Combs (1952) proposed that intelligence depended on the richness and variety of perceptions processed at a given moment, along with the brain's capacity to encode and access information relevant to the task being performed. Intelligence was regarded as an individual's capacity to handle specific environmental demands. Thus, from the perceptual orientation, intelligence could not be logically discussed without referring to the environmental context.

This context-specific theoretical orientation of intelligence led Fisher (1984) to make initial hypotheses about intelligence in sport settings. His model of sport intelligence was based on the perceptual challenges that athletes had to deal with in their sport environments during competition. According to Fisher (1984), sport intelligence consisted of the ability to (a) have a baseline level of knowledge about the task, (b) search for and detect relevant cues, (c) identify patterns, (d) utilize effective short term memory recall, (e) utilize effective long term memory recall, and (f) make proper

decisions. Fisher (1984) thought that a baseline level of knowledge was necessary for an athlete to understand the basic nature of the task. The ability to detect relevant cues allowed athletes to separate stimuli that were relevant for performance from irrelevant stimuli. The identification of patterns, both internally and in the environment, was critical for making proper adjustments during competition. Short term memory was important for formulating action plans based on events that occurred earlier in the contest, while long term memory was thought to be important for utilizing previously learned skills. Finally, skilled decision making was considered a fundamental requirement for making proper strategy decisions.

Beyond this initial conceptualization, the construct of sport intelligence did not appear again in the literature until a discussion of decision making by Tenenbaum and Bar-Eli (1993). These scholars regarded sport intelligence as the proficiency of an athlete's cognitive processes during competition, as indicated by the decision making ability and overall athletic performance of an athlete. Tenenbaum and Bar-Eli (1993) argued that skilled athletes select, process, and retrieve information during competition differently than inexperienced athletes and that a difference in decision making capability was suggestive of a difference in overall in-game cognition patterns between experts and novices. Similarly, they proposed that overall sports proficiency could be considered an index of sport intelligence because expert performance required proper encoding of relevant environmental cues, efficient processing of these cues, and the selection of an appropriate response (Tenenbaum & Bar-Eli, 1993).

The potential relationship between sport intelligence and expert performance was further indicated by Helesen and Starkes (1999). Although they did not explicitly link

their work to the idea of sport intelligence, these researchers focused on a set of domain-specific cognitive skills that is similar in composition to the conceptualizations of sport intelligence put forth by Fisher (1984) and Tenenbaum and Bar-Eli (1993). Specifically, Helsen and Starkes (1999) examined the relative importance of attributes determined by the processing efficiency of the visual/central nervous system (e.g., simple reaction time, peripheral reaction time, visual acuity, and horizontal and vertical range) versus domain-specific cognitive skills (e.g., complex decision speed and accuracy, visual fixation in solving game problems, and recall of game information) in the determination of expertise in soccer. Expert and intermediate soccer players were tested for efficiency of the visual/central nervous system with a variety of reaction time tests and visual acuity tests. No significant differences were found between the experts and intermediates with respect to processing efficiency of the visual/central nervous system. On the other hand, when the domain-specific cognitive skills were assessed through eye-tracking protocols and other visual search data, experts were found to perform significantly better than intermediates. The investigators concluded that a set of domain-specific cognitive skills – similar to the existing conceptualizations (e.g., Fisher, 1984; Tenenbaum & Bar-Eli, 1993) of sport intelligence – was important for expert performance.

While Fisher (1984) and Tenenbaum and Bar-Eli (1993) offered the initial conceptualizations of the sport intelligence construct, these theorists discussed the construct on theoretical grounds only. Sport intelligence first explicitly emerged empirically in a study by Gould, Dieffenbach, and Moffett (2002) that profiled the psychological characteristics of Olympic champions, and examined how these psychological characteristics were developed. The investigators interviewed 10 U.S.

Olympic champions (winners of 32 Olympic medals), along with a coach of each athlete, and a parent, guardian, or significant other of each athlete. A battery of psychological inventories was also administered to the athletes. The athletes were found to be characterized by (a) the ability to cope with and control anxiety; (b) confidence; (c) mental toughness/resiliency; (d) sport intelligence; (e) the ability to focus and block out distractions; (f) competitiveness; (g) a hard-work ethic; (h) the ability to set and achieve goals; (i) coachability; (j) high levels of dispositional hope; (k) optimism; and (l) adaptive perfectionism.

While many of the findings of their study paralleled previous research on the psychological characteristics of elite athletes (e,g., Williams & Krane, 2001), sport intelligence was a new characteristic that emerged. It was categorized separately from general intelligence, and consisted of themes such as the ability to analyze, being innovative relative to one's sport technique, being a student of the sport, making good decisions, understanding the nature of elite sport, and being a quick learner. In the discussion of their findings Gould and colleagues (2002) called for further exploratory interviews with athletes and coaches about sport intelligence and its components, antecedents, and potential effects on performance.

The results of Gould et al. (2002) extended the conceptualization of sport intelligence to include elements beyond the cognitive abilities of athletes during in-game competitive situations. For example, sport intelligence was defined to include components relating to cognitive tasks outside of competition, such as learning ability, being a student of the sport, and having a tacit knowledge about the nature of elite sport.

Following its initial empirical emergence in Gould et al. (2002) as a serendipitous finding, the in-competition aspects of sport intelligence were assessed in a subsequent talent development study by Falk and colleagues (2004). Young Israeli water-polo players were observed and evaluated throughout a 2-year period as they participated in a selection and development program for the junior national team. The aim of this study was to evaluate the motor ability, physical ability and sport intelligence of young water-polo players who were eventually selected to the junior national team in comparison to those players who were not selected as part of the final team. Falk et al. (2004) returned to a definition of sport intelligence that included only in-game cognitive processes – in their investigation, sport intelligence was reflective of the players' ability to utilize thought processes during games when they had to execute a game plan against the other team, their ability to understand the game, their ability to anticipate on-going activities, and their ability to make appropriate decisions during the game. Specifically, the players were evaluated by coaches on their ability to (a) pass the ball to the appropriate player; (b) make the right move without the ball on offence; (c) get into position so that his teammates could pass him the ball; (d) assist teammates to create a 'fast break'; (e) anticipate in advance offensive procedures made by the opposing team; and (f) steal the ball from an opposing player. The investigators found that players who were eventually selected to the team were rated significantly higher on sport intelligence than non-selected players. However, the selected players were also rated higher on sport intelligence upon entrance to the selection camp, thus calling into question how much the sport intelligence abilities of the selected players actually developed over the course of the camp.

The construct of sport intelligence has only recently emerged in the sport psychology literature. Consequently, it has received little attention from sport psychology researchers. The current study seeks to answer the call of Gould and colleagues (2002) by exploring the components of sport intelligence in a sport-specific context.

Components of Sport Intelligence

Only a small number of studies have been conducted on the topic of sport intelligence and few systematic lines of research exist. Importantly, in a golf-specific context it is possible that some of the components of sport intelligence identified in previous research may not apply – the precise conceptualization of sport intelligence in a golf-specific context is not currently known and is the primary matter of investigation in this study. The components of sport intelligence referred to in this literature review are shown in Figure 1. Previous definitions of sport intelligence have included components such as (a) perceptual ability, (b) decision making ability, (c) self-awareness, (d) tacit understanding of the nature of elite sport, (e) the orientation towards learning and being innovative, and (f) learning ability. Literature pertaining to each of these concepts is discussed below.

Perceptual Ability

Experts vs. novices. A substantial amount of research has been performed that both describes the nature of perceptual expertise in sport and establishes the perceptual superiority of expert performers over novices (Jackson & Morgan, 2007; for a complete review, see Williams & Ward, 2003). For example, Jones and Miles (1978) showed video clips of tennis serves to expert and novice tennis players. The clips were occluded 42ms before racquet-ball contact. Compared to novices, the experts were better able to perceive

cues from the motion of the serving player before impact to predict the direction of serves.

The perceptual advantage of experts is the result of a more refined and easily accessible sport-specific knowledge base that has been developed through years of deliberate practice (Ericsson, 1996; Vaeyens et al., 2007). For example, when compared to novices, expert performers demonstrate (a) superior recall and recognition of sport-specific patterns of play; (b) faster detection and recognition of objects in the visual field; (c) more efficient and accurate visual search behaviors; (d) enhanced ability to identify visual cues, especially from an opponent's postural orientation; (e) more accurate expectations of likely events based on the use of situational probabilities; (f) and perceptual processes more impervious to changes in emotional states, such as anxiety (Williams & Elliot, 1999).

Development of perceptual skills. Relevant to the current study is the process by which perceptual skills are developed. Goldstone (1998) proposed that perceptual ability is developed through four cognitive processes: (a) attention weighting, (b) stimulus imprinting, (c) differentiation, and (d) unitization. Attention weighting is the first step in perceptual learning, and involves an increase in attention paid to relevant stimuli, and/or a decrease in attention given to irrelevant factors. Stimulus imprinting is the second cognitive process, involving the development of neural receptors that are specialized for specific stimuli. Third, differentiation is the process by which stimuli that were once psychologically fused together become separated through experience with the environment. Once separated, discriminations can be made between perceptions that were previously indistinguishable. The final cognitive process is unitization, which involves

the construction of single functional units that are triggered when a complex environmental configuration arises. Thus, as the differentiation process divides wholes into discrete elements, unitization integrates these parts into more efficient wholes or "chunks".

Researchers generally agree that this developmental process occurs as a result of task-specific practice rather than through a general maturation or growth process (Ward & Williams, 2004) and have turned their attention to studying how the acquisition of perceptual skills can be facilitated through various methods of training and instruction, such as video simulations and training drills in the field. For instance, a study by Farrow and Abernathy (2002) examined the effectiveness of two video-based perceptual training approaches designed to improve the anticipatory skills of junior tennis players. The researchers found that an "implicit" video training approach – where players tried to predict the serve speed and direction while viewing a partially occluded video clip of the serve – was the most effective method of training anticipatory skills. The "explicit" approach – where players were given direct instruction about cues to look for – was not as effective. Similarly, the "implicit" video training condition was more effective than either the placebo or control condition. However, despite the initial positive effect of "implicit" video training, gains in anticipatory skills among these junior tennis players were found to diminish after 30 days.

In general, support has been found for the efficacy of various perceptual training methods in open-skill sports such as field hockey, tennis, volleyball, squash, football (Christina et al., 1990), basketball, and soccer (see Williams & Ward, 2003). Notably, however, researchers have yet to examine the training or development of perceptual

ability in closed-skill sports such as golf. This gap in the literature is significant because of the potential differences in perceptual processes required in closed-skill sports. For example, perceptual processes in open-skill sports are primarily focused on the actions of opponents and teammates, while perceptual processes in closed-skill sports are primarily focused on the self (e.g., perception of current physical capabilities) or other features and conditions of the environment (e.g., wind, hole location, firmness of the green, etc.) that may influence subsequent actions.

Regarding the efficacy of various perceptual skill training methods, many researchers advocate a "guided discovery" approach rather than the traditional directed approach to instruction. For example, Williams, Ward, Knowles and Smeeton (2002) compared various approaches of training novices to perceive forehand and backhand tennis shots. One group of players was trained by a conventional and explicit instructional approach, where the key visual cues and relationships were directly highlighted by the instructors. Another group was trained using an implicit technique, where the players were guided to look at potentially informative aspects of the display (e.g., the hip or trunk of the opponent) and encouraged to discover on their own the meaningful relationships between postural positions and shot outcomes. Players in both groups significantly enhanced their ability to anticipate shot outcomes, prompting the investigators to conclude that the "implicit" style of training was at least as effective as the traditional explicit method. Williams et al. (2002) further speculated that training players implicitly led to a more powerful ownership of perceptual skills, and hypothesized that the implicitly trained players may maintain their improvements for longer periods of time and under a wider range of emotional states.

The current study explores the importance of perceptual skills as a component of sport intelligence in golf.

Decision Making Ability

Tactical decision making in sport. Successful decision making in sport involves the knowledge of what action to take in any given competitive situation. Scholars have long emphasized the importance of decision making for expert sports performance (Crossman, 1953; Knapp, 1963; Lawther, 1968). However, in-depth study of decision making in sport psychology is both sparse and relatively recent, beginning in earnest in the 1980's (Bar-Eli, 2006). Much of the existing decision making research is focused on processes behind judgment-related decisions of coaches, referees and officials rather than on the tactical decisions made by athletes during competition. Also, little is known about how tactical knowledge and decision making skills are developed, and the role of decision making in overall player development is not well understood (McPherson & Kernodle, 2003).

Nature of tactical decision making in sport. Research performed by McPherson, French and their colleagues (French & McPherson, 1999, 2004) has provided the most insight into the tactical decision making processes of athletes. Tactical decision making involves the selection of a strategic response from a range of possible alternatives (French & McPherson, 1999). Tactical decisions are thought to be the product of an interaction between a players' sport-specific knowledge base and various processes of memory adaptation (McPherson & Kernodle, 2003). An athlete's knowledge base contains sport-specific memory structures, such as game situation prototypes, scripts for competition, and sport-related strategies that are stored in long-term memory. This

knowledge base is accessed by processes of memory adaptation that are determined by the "action plan profiles" and "current event profiles" of an athlete.

Action plan profiles are memory structures that activate rule-based behavioral responses based on environmental cues. For example, decisions to apply a previously learned standard game strategy – such as coming to the net in tennis after a short shot – are applied by action plan profiles. Current event profiles are memory structures used to merge active relevant information with past, current, and possible future events. For example, if prior knowledge or experience provides a tennis player with the insight that that her opponent is exceptionally skilled at passing shots, the current event profile may influence the tactical decision to adjust normal strategy based on this knowledge and prompt the player to resist coming to the net. Thus, according to McPherson & Kernodle (2003), decisions are based on the interaction between an athlete's sport-specific knowledge base and processes of memory adaptation used to access this knowledge base.

A similar, cognitively-oriented model of the decision making process in sport was also proposed by Tenenbaum (2003). This model includes eight components. First, visual strategies and attention allocation determine where the athlete gazes and to what the athlete attends. Secondly, a "selection process" occurs where the athlete determines what is relevant and what is not. "Anticipation" is the next step, where the athlete attempts to decide what may happen next. A tentative decision about the subsequent action is then made, and the athlete evaluates this pending decision with long-term working memory assessments of their experience and knowledge of the situation based on the information available. The next step is to make a final decision about what action to take. This is followed by "action initiation", where the athlete starts to perform the chosen action.

Alternative actions are kept in mind. The final step of the decision making process is action evaluation, where the athlete assesses if the chosen course of action was correct.

The models of the decision making process proposed by McPherson and Kernodle (2003) and Tenenbaum (2003) suggest that an athlete's sport-specific knowledge base is a significant determinant of the eventual decision. Accordingly, considering the vast difference in their respective knowledge bases, it is reasonable to expect that the decision making styles of experts and novices differ greatly.

Experts vs novices. Research comparing experts and novices has clearly indicated that the decision making capability of expert athletes is superior to that of novices in speed, accuracy, and complexity (for a complete review, see Williams & Ward, 2007; Abernathy, 1991). More relevant to the current study is research that examines the specific differences in the cognitive processes of experts and novices that serve as the source of the disparity in decision making skill.

One study that sought to compare the cognitive processes used for decision making amongst novice, intermediate, and expert athletes was performed by McPherson (2000). Data was collected using a variety of interviewing techniques, including a "situation interview", where the decision making accuracy of players was evaluated through their responses to questions about particular game situations while viewing diagrams. Also, players were interviewed between points to elicit what they had thought about during the previous point, and what they were planning for the next point. Responses were analyzed for complexity and accuracy. Novices were found to make very simplistic decisions that were often tactically incorrect (e.g., coming to the net at the wrong time). Their cognitive decision making processes were hampered by an

underdeveloped and incomplete interpretation of the task situation. Intermediate players more accurately represented the task situation, but referred only to static action plans while making decisions (e.g., coming to the net after a deep ball to the corner, but without regard for the particular tendencies of the opponent for hitting a backhand passing shot). Advanced players demonstrated the most complex cognitive decision making processes: they made accurate tactical decisions based on sophisticated interpretations of conditions, and planned for tactical actions by making adjustments based on continually updating current event profiles (e.g., recognized and exploited a tendency during the course of a point).

McPherson and Kernodle (2003) later replicated the findings of McPherson (2000) by comparing male adult professional tennis players with novice tennis players. As expected, the professionals generated significantly more varied and sophisticated representations of the task situation compared to novices. Novice players exhibited a more limited diagnosis of game events and attended to fewer pertinent environmental features. McPherson (2000) and McPherson and Kernodle (2003) were able to describe the cognitive differences between expert and novice decision-making. However, they fell short of describing the processes by which decision making skills are developed.

Development of decision making skills. While expert superiority in decision-making has been consistently demonstrated, little attention has been paid to precisely how decision making capabilities in athletes are developed and how they should be taught at various ages (McMorris, 1999).

A few studies have identified differences in the decision making capabilities of young athletes based on age and experience level. For example, Thiffault (1980)

examined hockey players of ages 9-10, 11-12, 13-14, 15-16, and 17+ years, using a visually based test in which participants had to state what the player in possession of the puck should do (i.e., skate, shoot, or pass). The dependent variable in this study was the speed of the decision. Thiffault (1980) found that 8-10 year olds responded significantly slower than the other age groups, 11-12 year olds responded slightly slower, while the remaining age groups did not differ significantly from one another. Thiffault (1980) believed an increased ability to process information – the consequence of a general cognitive maturation process – was the mechanism that increased the speed of decision making.

Other researchers measured the accuracy of decisions, rather than speed, as the dependent variable. Yaaron, Tenenbaum, Zakay, & Bar-Eli (1997) used video presentations of typical game situations to assess the accuracy of decision making for high skilled and low skilled basketball players of various age groups (7-9, 12-15, and 20-30). They found significant differences in decision making capability based on skill level along with age. The low skilled performers in each age group were significantly worse than the high skilled performers, but the low skilled performers in the two higher age groups were significantly better than the high skilled performers in the 7-9 year old age group. These results suggested an interaction in between chronological age and skill level in influencing the development of decision making capability.

Another study examined the contribution of practice activities to the development of expert decision makers. Baker, Cote, and Abernathy (2003) interviewed 15 international athletes who were considered expert decision makers and 13 experienced non-expert athletes to obtain detailed information about the quantity and type of sport-

specific and other related practice activities they had undertaken throughout their careers. The expert decision makers were found to have accumulated more hours of sport-specific practice from age 12 years onwards than did non-experts, spending on average 13 years and 4,000 hours on concentrated sport-specific practice before reaching an international standard of performance. The investigators also found a significant negative correlation between the number of additional sporting activities (e.g., sport activities outside of the primary sport) undertaken during childhood and the hours of sport-specific training required before attaining expertise and reaching national team competition. Baker et al. (2003) interpreted their findings to suggest that childhood participation in sport activities other than training in the primary sport may have played a functional role in the development of expert decision making in the primary sport.

Although these studies showed decision making skills to increase with age, levels of expertise, and through continual engagement in various types of practice activities, research has yet to suggest the precise mechanisms by which decision making skills are acquired and refined. Several theorists propose that the development of decision making in sport does not occur in isolation of motor skill and physiological development (McMorris, 1999). This type of reasoning is representative of the dynamic systems view of development proposed by Bronfenbrenner (1989) and van Geert (1993). Dynamic systems theorists believe that it is not possible to separate the cognitive, socioemotional, and physical aspects of many facets of human development because of their constant interactions. With respect to the development of decision making skills in sport, dynamic systems theorists would propose that an increase in the range of an athlete's physical techniques or a change in their physical capabilities would inevitably trigger an evolution

of their decision making patterns since the factors being evaluated in the decision making process have thus been modified. The development of decision making skill may potentially be regarded as a dynamically evolving process resulting from interactions among several contributing factors.

The current study explores the importance of decision making ability as a component of golf-specific sport intelligence.

Self-Awareness

Self-awareness in sport. In general psychology, self-awareness is the explicit understanding that one exists. Humans are thought to develop self-awareness early in childhood (Piaget, 1952). Self-awareness in sport is more narrowly defined. In sport, self-awareness is the ability to be cognizant of the internal states (e.g., thoughts, feeling, sensations) and external states (e.g. bodily movement and environment) that influence athletic performance (Ravizza, 2006). Athletes who possess high levels of self-awareness are believed to be at a competitive advantage over others because awareness is thought to enable further control of performance states and permit facilitative interpretations of performance states (Weinberg & Gould, 2007; Hays et al., 2007).

From a theoretical perspective, self-awareness has rarely been directly researched in sport psychology. One exception is a study by Gould and colleagues (2002) where a handful of Olympic champion athletes and their coaches considered self-awareness to be an important psychological trait of elite performers. The construct of self-awareness is conceptually related to Nideffer's (1981) model of attentional styles – by definition, athletes who have a highly developed internal focus of attention are considered as highly self-aware. However, research pertaining to attentional style is more focused on the

relationship between dimensions of attention (i.e., broad internal, narrow internal, broad external, or narrow external) with respect to a changing situation or environment, rather than the in-depth examination of any particular individual dimension. Self-awareness is also theoretically related to the concept of self-monitoring, which refers to the means by which people are self-aware. For example, high self-monitors use cues from the external environment as information to trigger self-awareness, while low self-monitors use internal indicators to form their self-awareness (Behncke, 2005).

Although researchers have yet to produce comprehensive evidence in support of their beliefs, many applied consultants believe that self-awareness is important for achieving and maintaining high levels of performance (e.g., Ravizza, 2006). Self-aware athletes are able to accurately evaluate their own strengths and weaknesses, enabling truthful decisions about the type of practice that needs to be done to produce improvement. These athletes are also able to accurately monitor the state of their physical and mental capabilities on a particular day, enabling them to make necessary adjustments to their strategy to produce the best possible results (Ravizza, 2006). Self-awareness may also help athletes perform optimally by increasing their overall sport confidence. For example, Hays and colleagues (2007) interviewed 14 successful world-class athletes from England and found self-awareness to be an important precursor to performance confidence.

Development of self-awareness. Many applied consultants have also made practical suggestions to their athletes regarding how to develop self-awareness. For example, Weinberg and Gould (2007) recommend the use of various awareness self-assessments, such as the "checklist of performance states", prompting the athlete to

reflect upon and compare their thoughts and feelings during both optimal and below-average performances. Ravizza (2006) suggests a similar exercise, recommending that athletes should write daily performance journals and a "scouting report" about themselves. Exercises and techniques prescribed by applied consultants appear to be one way that self-awareness is developed in some athletes, although hypotheses regarding the development of self-awareness have yet to be tested empirically.

The current study seeks to explore the importance of self-awareness as a component of golf-specific sport intelligence.

Tacit Understanding of Elite Sport

Tacit knowledge and practical intelligence. Gould and colleagues (2002) reported "having an understanding of the nature of elite sport" to be a feature that described the sport intelligence of the Olympic champions they interviewed. Having an understanding about the nature of elite sport involves being familiar with the inner-workings and nuances of career management and competition at the elite levels. In theoretical terms, "having an understanding of elite sport" is related to the concepts of tacit knowledge (Cianciolo et al., 2006) and practical intelligence (Wagner & Sternberg, 1985). Tacit knowledge is defined as an understanding or comprehension that is not articulated and arises without explicit attempt to link environmental stimulation to experience (Cianciolo et al., 2006). Related to tacit knowledge is the concept of practical intelligence, defined by Wagner and Sternberg (1985) as the ability to acquire tacit knowledge from everyday experience and to apply this knowledge in handling everyday practical problems.

Tacit knowledge and performance. Presumably, expert performance requires more than mere implementation of skills learned in formal training. Performance is also

facilitated by domain-related tacit knowledge that serves to bridge the gap between learned skills and acquired experience (Cianciolo et al., 2006). The relationship between tacit knowledge and performance has been studied using tacit knowledge inventories that feature a situational-judgment testing format to assess highly domain specific tacit knowledge (McDaniel & Nguyen, 2001). For example, a series of brief vignettes is presented to participants which depict practical problems that must be solved and provide a set of solution alternatives that must be rated according to potential effectiveness of quality. Using this assessment technique, research has shown tacit knowledge to be associated with increased levels of expertise among managers in business (Wagner & Sternberg, 1985) and financial auditors (Tan & Libby, 1997).

The relationship between tacit knowledge and expertise has not been explicitly studied in sport. Presumably, however, tacit knowledge about the nature of elite sport is helpful for performance because such knowledge allows athletes to effectively deal with the unique challenges that accompany a career of competition at elite levels. These challenges have been identified in studies of elite athlete development (e.g., Durand-Bush & Salmela, 2002) and include dealing with pressure to perform, understanding and managing the media, effectively handling agents and endorsement opportunities while ensuring sufficient time for training, and acknowledging the extreme competitiveness, complicated organizational politics and frequent personnel turnover associated with elite sport. Athletes lacking appropriate tacit knowledge may be affected by these challenges and experience subsequent performance decrements.

Development of tacit knowledge. Researchers have not directly studied the process by which tacit knowledge develops. Wagner and Sternberg (1990) suggested that

tacit knowledge could be enhanced by (a) making tacit knowledge explicit and sharing it with others, and (b) by improving the ability by which people engage with their environments and learn from their experience. In sport, it is likely that athletes gain tacit knowledge largely through first-hand experience and trial and error – however, the precise means by which athletes learn about the inner-workings of elite sport have not been researched.

The current study explores the importance of having tacit knowledge about elite sport as a component of sport intelligence in golf.

Learning Orientation

The learning orientation of an athlete is reflected by the tendency to be a "student of the sport", i.e. having openness to experience and a positive attitude towards learning, and the tendency to be innovative with respect to training methods and technique. The learning orientation of an athlete is thought to be a characteristic of sport intelligence (Gould et al., 2002).

Attitudes about learning and expertise. Although researchers in sport psychology have yet to directly examine the relationship between attitudes held about learning and the development of expertise, a positive attitude toward learning is likely a prerequisite for the successful development of expertise. Researchers such as Ericsson (1996) have proposed that expert performers must possess a certain willingness to engage in the learning process considering the extensive amounts of deliberate practice necessary to achieve expertise. The regularity and intensity of this deliberate practice is thought to be a function of motivational and self-regulatory abilities (Ericsson, Krampe, & Tesch-Romer, 1993). Scholars in other fields, such as medicine, have found correlations

between openness to experience and the rate of developing expertise (King et al., 2007). For example, King and colleagues (2007) found that medical professionals who scored higher on measures of openness to experience acquired expertise faster than others.

Innovation and expertise. Similarly, sport psychology researchers have yet to examine the antecedents or consequences of being innovative with respect to training methods and techniques, and how this tendency for innovation may influence the development of expertise. Existing sport psychology research examines innovation with respect to decision making during competition rather than innovation with respect to training methods and techniques. For example, Memmert (2007) and Roth and Memmert (2007) demonstrated that creativity-enhancing training programs involving sport situations could increase tactical innovation during play in team ball sports.

The current study intends to explore the role of learning orientation in golf-specific sport intelligence.

Learning Ability

Many models of intelligence include learning ability as a component of overall intelligence (e.g., Thurstone, 1938; Guilford, 1967; Sternberg, 1999). Similarly, Gould and colleagues (2002) considered sport-specific learning ability to be a characteristic of sport intelligence.

Processes and types of learning. Learning is the acquisition and development of memories and behaviors, including skills, knowledge, understanding, values, and wisdom (Martinez, 2000). Learning occurs by several processes and in several forms, including non-associative processes of learning such as habituation and sensitization, and

associative process such as operant conditioning, classical conditioning, observational learning, and unstructured play (for complete review, see Martinez, 2000).

Habituation is an example of non-associative learning in which there is a progressive diminution of a behavioral response with repetition of a stimulus – such as the tendency to ignore irrelevant stimuli as accumulated experience indicates the irrelevance of these stimuli. For example, an athlete will eventually habituate to the stimulus of playing in front of large crowds of people.

Sensitization is an example of non-associative learning in which the progressive amplification of a response follows repeated administrations of a stimulus. For example, an intelligent golfer will learn to adjust club selection according to cold weather conditions after playing in those conditions repeatedly.

Observational learning (i.e., vicarious learning, social learning or modeling) is learning that occurs as a function of observing, retaining, and replicating the behavior of others (Bandura, 1977). For example, an intelligent golfer is able to observe the decisions, shots and results of other players in his group in order to learn about current course conditions and inform his or her own tactical choices.

Operant conditioning is the use of consequences (i.e., reinforcement and punishment) to modify the occurrence and form of behavior. Classical conditioning involves repeatedly pairing an unconditioned stimulus that provokes a certain response with another stimulus that does not normally evoke that response.

Unstructured or "free" play generally describes behavior which has no particular end in itself (Cote, 1999), but may cause performance improvements in similar situations in the future. For example, golfers who informally juggle the ball on the face of the club

are able to indirectly learn cues about the feel and hand-eye control of the club at impact. These cues may transfer to situations which call for delicate pitches or chips.

Approaches to learning. Approaches to learning can be either formal or informal. Formal learning occurs within the context of an official student-teacher relationship (e.g., direct golf instruction), while informal learning occurs through the experience of day-to-day situations (Martinez, 2000).

Expert speed and efficiency of learning. Learning ability is presumably represented by speed and efficiency of the learning process. Researchers have concluded that experts are superior to novices in the speed at which they learn domain-specific tasks (e.g., Chase & Simon, 1973; Allard & Starkes, 1991). It is also likely that experts possess stronger metacognition – i.e., awareness of their own cognitive processes – with respect to the learning process (Sternberg, 1985) that enables learning to be optimally efficient. For example, one coach interviewed by Gould and colleagues (2002) commented on his athlete's exceptional ability to be selective and learn by focusing only on useful information:

> The greatest thing about her was she could really filter out what would work for her and what would not. So she could take input from everybody and she would only take 5% from one person and 95% from another. (Gould et al., 2002, pp. 186)

The current study explores learning ability as a possible component of golf-specific sport intelligence.

Summary

The previous section of this literature review introduced the concept of sport intelligence. Prior definitions have proposed sport intelligence to be composed of components related to (a) decision making ability, (b) perceptual ability, (c) self-

awareness, (d) learning ability, (e) the orientation of the athlete towards learning, and (f) the tacit knowledge an athlete has about elite sport. In order to identify the characteristics of sport intelligence in a golf-specific context, the current study assesses the golf-specific applicability of these components and explores whether new golf-specific components of sport intelligence may emerge (e.g., emotional intelligence).

CHAPTER 3: RESEACRH DESIGN AND METHOD

Introduction

The purpose of the current study is to identify the components of sport intelligence in a golf-specific context. The present chapter discusses the method of this study with respect to the research design, participants, data collection procedures, data analysis process, and measures taken to increase trustworthiness of data. This chapter concludes with comments about the investigator and the role of the researcher in this qualitative study.

Research Design

To identify the components of sport intelligence in a golf-specific context this study relied on the qualitative interview responses of expert golf coaches. Each interview progressed from a broad semi-structured conversation to a specific, structured, and more focused data collection. In particular, the beginnings of the interviews were exploratory and somewhat unstructured, encouraging participants to freely discuss and construct their own conceptualizations of golf-specific sport intelligence. However, as the interview progressed the investigator asked more specific questions (many coming from a structured interview guide) that directly assessed the golf-specific suitability of components drawn from previous conceptualizations of sport intelligence (see Figure 1). Thus, this study combined an inductive approach that sought to uncover new characteristics of sport intelligence in a golf-specific context, while also working from the definitional frameworks previously established by Gould et al. (2002), Fisher (1984) and others.

Participants

Highly experienced expert coaches were chosen as participants for this investigation. In light of the goals of this exploratory study, expert coaches were appropriate participants since they had worked with and been exposed to a wide variety of players and thinking styles. Their extensive professional coaching experience makes them "insiders" who have a deep understanding of how the sport of golf is played at the highest level. Compared to elite players – who are primarily concerned with improving their own individual method of playing and thinking – it is the job of expert coaches to be thoroughly familiar with the thinking styles and playing tendencies of the numerous players they are responsible for instructing. Thus, expert coaches should be in a great position to be able to accurately describe a smart player, and their collective interview responses should produce data that will allow for a reliable conceptualization of golf-specific of sport intelligence to be constructed. This type of "purposeful sampling" is appropriate when the investigator seeks to discover, understand, and gain insight about a phenomenon (Merriam, 1998) and therefore attempts to select a sample from which the most can be learned.

Inclusion Criteria

Inclusion criteria for coach participation in this study were as follows: Participants must have (a) had at least 15 years of full time golf coaching experience and (b) instructed at least 15 players who have competed at the collegiate or touring professional level. These inclusion criteria ensured that the golf coaches being interviewed had significant experience interacting with a variety of elite players,

providing further insurance that their responses would produce data from which a valid conceptualization of golf-specific sport intelligence could be constructed.

Sampling Technique

The author recruited participants through his personal network of contacts made from playing collegiate golf at one of the most respected programs in the country, from contacts he made from playing junior golf in Canada, from coaches he has met while playing professional and elite amateur events, and from individuals he has interacted with as a sport psychology consultant in professional golf.

Participants were selected by a snowball convenience sampling technique. The coaches first contacted by the investigator were interviewed and subsequently asked to recommend other expert coaches who met the inclusion criteria. The first three coaches interviewed by the investigator were especially credentialed, experienced, and extensively networked in the profession of elite golf coaching. For example, these individuals had approximately 70 years of combined coaching experience, extensive playing experience on the PGA Tour, had earned numerous PGA teaching awards, had received recognition as a worldwide "Top 100 Teacher" by Golf Magazine, and had national team head coaching experience. Thus, these individuals were in a strong position to nominate other coaches who fit the inclusion criteria and would be suitable participants for this study.

This snowball convenience sampling technique may be considered a limitation from a positivistic perspective. However, the investigator subscribes to an interpretive research paradigm and performed this study from a naturalistic perspective which does not consider the generalization of findings in the traditional positivistic sense. Thus, in

light of the rigorous criteria for participant inclusion, the significant time required for participating in the interview, and the naturalistic epistemological orientation of this study, the snowball convenience sampling process was considered an appropriate technique for recruiting subjects.

Demographic Information

The 16 coaches whose responses were included in the final analysis had a mean of 20.5 years of full time coaching experience (SD=3.25). A precise figure representing the average number of professional or collegiate players coached could not be determined because several participants reported coaching an extremely high number of elite players over their careers (e.g., over 150) and could not provide a reasonable approximation. All of the coaches interviewed were male and primarily coached male golfers. However, a few of the coaches also currently or previously worked with female golfers. All coaches were residents of either the United States or Canada.

The sample of golf coaches in this study was composed of exceptionally qualified individuals. For example, the sample included 2 national team head coaches, 1 recipient of the NCAA Coach of the Year award, 5 individuals who had received PGA Teacher of the Year honors in their region, and 7 individuals with previous PGA Tour playing experience in addition to their coaching accomplishments. Each of the coaches included in the study currently or previously coached at the PGA Tour level.

Data Collection

Nineteen participants were interviewed over a 7 month period at various locations in the United States and Canada. Interviews were performed in the homes of participants, at office locations, at golf tournaments, and over the phone when an in-person meeting

was not possible. For 3 participants it was only possible to conduct their interviews in the clubhouse area at major golf tournament sites. During these interviews, participants were repeatedly interrupted by phone calls and visits from players and other individuals. Consequently, these participants were unable to provide a sufficient number of in-depth responses to many of the questions in the allotted time they had budgeted from their busy schedules to accommodate the researcher. It was also the investigator's opinion that it was very difficult for them to fully concentrate on their responses. In light of these issues and to ensure the most conservative interpretation of the data, these 3 interviews were not included in the final analysis – even though the responses provided were very similar in content to other participants and would not likely have changed any conclusions drawn from the analysis.

The final analysis included interviews with 16 coaches, which lasted on average an hour in length. The estimated number of participants at the start of this investigation was 20, but the precise number of participants was determined by the point at which thematic saturation was reached in the interviews. Thematic saturation occurs when the researchers determine that themes suggested by participant interviews begin to repeat themselves and subsequent participants' interviews yield no new themes (Morse, 1994). In this study thematic saturation was reached after approximately the 12th interview, but 7 additional interviews were carried out to make absolute certain no new themes would arise and to further raise the level of confidence in any findings that emerged.

Interview Format

The purpose of data collection in this study was to produce detailed qualitative data that could be used to propose the components of sport intelligence in a golf-specific

context. The first step in data collection was to obtain informed consent. Each participant was asked to sign a form indicating their informed consent to participate in the study. This form explained what was asked of the participants, made clear the right of the participants to withdraw from the study at any time, and provided assurance of anonymity of the participant's data (see Appendix C). Prior to beginning the investigation the consent form was approved by the Human Subjects Committee at the author's university. Due to logistical and scheduling constraints two interviews were performed over the telephone. Before beginning these phone interviews the researcher explained to the participant the conditions of their participation and orally obtained their informed consent, as per the directions specified by the Human Subjects Committee at the author's university.

Based on Spradley's (1979) suggestions regarding semi-structured interviews, the investigator began the interviews by asking broad and general questions to give the participants an opportunity to get acquainted with the interview process and to speak in a relaxed atmosphere. It also allowed them to address the topic of sport intelligence from their own unique perspective with minimal direction from the interviewer. As the interviews evolved and salient information emerged, probes and direct cues were used to follow interesting leads, explore further points, and to ensure sufficient depth and clarity of responses.

Appendix A contains the interview guide used in this investigation. At the beginning of each interview a standardized preamble introduced the concept of sport intelligence to the participant, and the participant was prompted to freely discuss how sport intelligence might be applied in a golf context. For example, coaches were asked to

describe the behavior of an individual whom they feel is representative of an intelligent player. Coaches were also asked to describe specifically what an intelligent player does during a competition that may create a competitive advantage over others.

As the interview progressed the investigator asked questions that more specifically referred to the components of sport intelligence that had been included in previous conceptualizations (Figure 1). The participant was asked if each of these characteristics – such as "perceptual ability" and "self-awareness" – applied in a golf-specific context. The participant was then prompted to explain their reasoning as to whether or not each characteristic should be considered as part of a golf-specific definition of sport intelligence. This interviewing protocol permitted the interview to start in an exploratory fashion, while subsequently referring to previously existing definitional frameworks of sport intelligence. The technique of progressively shifting an interview from open-ended questions to more specific probes is a feature of a qualitative research approach called Interpretative Phenomenological Analysis (Smith & Osborn, 2003) that has previously been used in qualitative sport psychology research (e.g., Nicholls et al., 2005).

The interviews in this study were conducted by the author. This individual is trained in qualitative research methods, including reading several qualitative research interviewing technique books and articles (e.g., Berg, 2007; Rubin & Rubin, 1995; Spradley, 1979; Patton, 2002), conducting and audio-taping qualitative interviews for previous research projects, and successfully completing a qualitative research design course during his graduate studies. The interviewer was also a competitive golfer who played high level collegiate golf and competed in several elite tournaments after college.

While the investigator's elite golf background helped build his credibility with participants and provided an excellent understanding of the golf context, his qualitative research training made him cognizant to be aware of any preconceived notions and the importance of not asking leading questions based on his own biases.

Each interview was audio recorded and a full verbatim transcript of each interview was prepared to aide an accurate qualitative analysis.

Data Analysis

The goal of data analysis in this investigation was to identify the characteristics of sport intelligence in a golf-specific context. Accomplishing this goal involved (a) exploring the data for new characteristics of sport intelligence that may uniquely emerge in a golf-specific setting, (b) determining the golf-specific applicability of characteristics that were included in previous conceptualizations of sport intelligence, and (c) interpreting and organizing the data to build a golf-specific definition of sport intelligence.

The semi-structured interview format used to gather data in this exploratory study started by encouraging participants to freely construct their own representations of golf-specific sport intelligence. In light of the opening format of the interviews, the investigator expected that an inductive analysis of the data would best reveal emerging characterizations of golf-specific sport intelligence.

Later interview questions referred directly to components of sport intelligence drawn from existing definitions, and participants were asked to assess the applicability of these characteristics in a golf context. A deductive data analysis framework was the most

appropriate approach for evaluating participant responses that judged the golf-specific applicability of certain sport intelligence characteristics.

To accommodate both of these objectives, the data in this study were analyzed using both inductive and deductive methods. The strategy of combining inductive and deductive methods to analyze qualitative data has previously been used in sport psychology research by Edwards, Kingston, Hardy and Gould (2002).

The initial inductive approach utilized a method of hierarchical content analysis outlined by Cote et al. (1993). Interview transcripts were read several times to gain an overall appreciation for the data. The data from the semi-structured, exploratory portion of the interviews were first coded into meaning units through an open coding process. Next, coded meaning units were compared and organized into subthemes that emerged from the data. These subthemes were further grouped into higher-order themes based on their similarity. Finally, higher-order themes were organized into overarching categories. Themes and categories that emerged from the data are represented and supported by quotations in the results section of this dissertation.

The subsequent deductive analysis used a pre-determined set of themes and categories to organize the data (Patton, 2002). In particular, the deductive analysis assessed the suitability of specific components of sport intelligence (Figure 1) for describing sport intelligence in a golf-specific context. Interview responses pertaining to these characteristics were analyzed to assess the degree to which the respondent supported the applicability of each component of general sport intelligence (e.g., decision making, self-awareness, perceptual ability, learning orientation, learning ability, and tacit knowledge of elite sport) to a golf-specific context. Specifically, responses were

organized into the following categories: "Yes", meaning that the respondent felt that the component being discussed was definitely relevant for a golf-specific definition of sport intelligence; "Conditional", meaning that the respondent believed the component could be relevant for a golf-specific context under certain conditions, but that it didn't necessarily apply in all circumstances and was not critical to sport intelligence in a golf context; and "No", meaning that the respondent did not believe the component of general sport intelligence being discussed was a component of sport intelligence in a golf-specific context. The golf-specific applicability of components drawn from previous conceptualizations of sport intelligence was evaluated by the frequency with which interview responses fit into these categories.

Rationale for Method Choice

The method used in any sport psychology research study should be determined by the particular research question being considered (Hardy et al., 1996). At times it is best to use a quantitative approach while for other research questions a qualitative approach is more appropriate.

The current study is an exploratory examination of sport intelligence in a golf-specific context. This study seeks to obtain in-depth and detailed information about the nature of sport intelligence in elite golf from a group of knowledgeable insiders (i.e., the sample of expert coaches). Qualitative methods – such as the Interpretative Phenomenological Analysis approach to interviewing utilized in this study – are recommended when the goal of research is to understand relatively unexplored phenomena (Berg, 2007).

Another significant factor influencing methodology is the paradigmatic approach to scientific knowledge adopted by the investigator. The epistemological paradigmatic orientation of a researcher may fall on a spectrum between logical positivism and interpretative naturalism (Lincoln & Guba, 1985). Positivists believe that a single truth or reality exists, that the researcher must be independent of the research process, and that generalizability of findings beyond the research context is both possible and desirable. Positivists strive to eliminate bias and subjectivity from research by taking methodological steps such as random sampling for participants and by utilizing quantitative analyses to make conclusion about their findings. The overall goal of researchers who subscribe to a positivistic view of science is to identify generalizable causal relationships between variables through experimental research designs.

On the other hand, researchers who adopt a naturalistic paradigm of science believe that multiple truths exist, that it is not possible to separate the values of the investigator from the research process, and that the generalizability of findings beyond the research context is not necessarily the primary criterion for defining useful research. Thus, researchers who subscribe to a naturalistic paradigm of science do not necessarily employ research designs that are intended to produce generalizable findings. Rather, naturalistic researchers study the particular sample of interest in a rich, detailed, and descriptive fashion and allow the reader to make judgments regarding how the findings may be generalized to other contexts.

The author of the current study subscribes to a more naturalistic view of scientific knowledge. The author has an interest in understanding the development, experiences, and cognitive patterns of elite athletes. Considering the relatively idiosyncratic nature of

elite performers, and the limited sample sizes available for research, some of the most useful knowledge about elite performers has been gained using a naturalistic approach to investigation.

The author of this dissertation believes that a naturalistic approach to science is appropriate for studying elite sport and generating usable findings. For example, it is safe to assume that research which examined the behaviors and cognitions of Tiger Woods would be considered extremely useful by most developing golfers even though the particular findings about Tiger's experience may not be directly applicable to all developing players.

The method of the current study features qualitative interviews with a sample of expert coaches who meet stringent inclusion criteria and are recruited through a snowball convenience sampling process. Considering the exploratory nature of this investigation and the naturalistic paradigm of science adopted by the investigator, the method employed is believed to be the most effective and practical method for an initial exploratory examination of golf-specific sport intelligence.

The Investigator

The author of this dissertation has an extensive background of competition and coaching in elite golf. Consequently, the investigator possesses a great deal of tacit knowledge about the subject matter of this study, and has made some a priori considerations of how sport intelligence may appear in elite golf and what the current study may conclude. In an effort to increase the trustworthiness of data in this study – and to ensure that the investigator's a priori considerations do not inappropriately influence interpretation of the data – the following section will discuss what the investigator

expects to find in this study based on his previously acquired tacit knowledge about the context of elite golf. The following section was also read by a peer debriefer, who was specifically instructed to examine the analyzed data and the raw interview transcripts to ensure investigator biases did not influence data analysis or prompt leading questions during the interviews.

Investigator Beliefs about Self-Awareness in Intelligent Golfers

Self-awareness is likely an important characteristic of sport intelligence in the context of elite golf. Players who are highly self-aware are able to accurately interpret their physical, technical, and emotional capabilities, both on any particular day and over a long term period. Highly intelligent players recognize the importance of accurately assessing these factors, and are able to use these accurate self-assessments to modify their strategic approach to help them shoot a lower score on that day. Also, their accurate long term self-evaluations help highly self-aware players to identify the aspects of their skill set they must work on in order to make long term improvements.

Golfers who are highly self-aware are closely in tune with the state of their technical, physical, and emotional capabilities. For example, these players are able to interpret their ball flight in order to diagnose mechanical flaws in their technique. Importantly, highly self-aware players are able to engage in this process of self-diagnosis quickly and efficiently, without allow a large portion of a competitive round to pass before gaining an understanding of their technical or mechanical tendencies on that particular day. Self-aware players are also able to identify the quality of their own swing mechanics through their feels and kinesthetic awareness. Other players who are less self-

aware must rely on visual feedback or verbal feedback from coaches in order to identify their mechanical tendencies.

Highly self-aware players are also able to make an accurate assessment of their physical state with respect to strength, flexibility, alertness, and overall fatigue. For example, these players know when they are feeling physically worn down from the demands of travel and they are able to make appropriate adjustments to their practice or training schedules. Expectations for both intensity and productivity in a particular practice session or workout can be modified according to the current physical state of a player. Players who are highly self-aware in the physical sense are able to "listen to what their body is telling them" more capably than those who lack physical self-awareness.

Emotional self-awareness is also a contributor to an elite players' overall level of self-awareness. Emotional self-awareness is closely linked to the concept of emotional intelligence (Goleman, 1995). Players who are emotionally self-aware are able to accurately assess their own emotional state and how this emotional state may affect both decision-making and overall performance. For example, a highly self-aware player may detect that he is feeling emotionally flat and may then take the proper steps to either correct this feeling or alter their strategy to accommodate this feeling. If a player detects that he may have a difficult time responding to adversity on a particular day due to his emotional state, he may alter his strategic approach to play more conservatively in order to maintain an even keeled approach to the day. Emotionally self-aware players also understand what particular competitive situations serve as emotional "hot buttons" for them, and strive to avoid those situations.

Over time, highly self-aware players are able to make honest and accurate assessments of their skills in various areas. Accurate self-evaluation is critical, as it informs the long term steps a player must take to make permanent performance gains. Players who are less self-aware are prone to neglecting areas of their performance which need the most attention in order to produce efficient improvement.

In addition to being highly self-aware and able to perform accurate self-assessments in the technical, physical, and emotional domains, highly intelligent players recognize the importance of their self-awareness. These players know that their self-awareness is critical for being able to make adjustments to either technique or strategy, and they know the adjustments that need to be made in particular situations based on their accurate self-assessments. Intelligent players highly value their ability to be self-aware, and they know that it provides them with an advantage over other players.

Investigator Beliefs Regarding Tacit Knowledge Possessed by Intelligent Players about the Career Demands of Elite Golf

Highly intelligent golfers also possess a tacit understanding of the demands of elite golf. These demands include challenges related to travel, challenges related to the business aspects of a professional golf career, and challenges related to high-profile tournament golf.

Professional golfers are required to travel on a regular basis, whether it is travelling to tournaments, corporate events, or to see their coaches. At the elite levels of competition – where players compete globally – the travel demands are extensive. These players often travel across several time zones to reach tournament destinations. Highly intelligent players understand how travel affects their physical and mental capabilities,

and take measures to mitigate the negative performance impact of travel. For example, these players schedule the appropriate amount of rest needed to recover from travel and strive to maintain proper hydration and nutrition in order to keep the body and mind as close to a normal state as possible. Furthermore, intelligent players understand the amount of travel they can manage before negative performance effects begin to appear, and will turn down endorsement opportunities or corporate events if they feel that these outings cause travel demands that may lead to performance decrements.

There is also a significant business component to a career in elite professional golf. The lucrative amount of money at stake in professional golf combined with the popularity of golf among high income earners in the United States creates an economic situation where players are able to earn large amounts of money for themselves and for others who are associated with them. Player representatives (i.e., player agents) are hired to maximize the endorsement opportunities available to each player. The representative is compensated for generating endorsement opportunities by keeping a percentage of the endorsement money received by each player. Thus, player representatives are motivated to generate as many endorsement opportunities for their players as possible. Highly intelligent players are able to capitalize on these opportunities in a selective way, such that their corporate responsibilities aren't interfering with their preparation and on-course performance. Players with less golf-specific sport intelligence are not as skilled at dealing with their agents and the endorsement opportunities presented, and may suffer subsequent performance decrements from over-scheduling themselves.

Finally, intelligent players understand the unique circumstances of high-profile tournament golf. The nature of the PGA Tour is such that golfers are in a different city

each week of the season. The PGA Tour only visits each location once per year, so the experience of a PGA Tour event for fans, tournament volunteers, and the local media is relatively new each year. The relative inexperience of these individuals with high-profile golf often leads to mistakes that can be distracting for the player. For example, tournament marshals responsible for quieting and controlling the gallery during play are often unwittingly the most distracting part of the crowd for the players. Similarly, photographers from the local media who aren't used to covering golf tournaments often make distracting mistakes such as taking photos at the improper time. Highly intelligent players are familiar with these aspects of high-profile tournament golf, and deal with these challenges as best they can. Players with less golf-specific sport intelligence may not recognize that these distractions are inherent to high-profile tournament golf, and become distracted and frustrated with these challenges.

Investigator Beliefs about the Perceptual Ability of Intelligent Golfers

Players who possess high amounts of golf-specific sport intelligence are also expected to have an advanced ability to perceive the environment in order to gather relevant information. In particular, highly intelligent players are proficient at (a) gathering strategically relevant information effectively and efficiently in a practice round, (b) reading greens, and (c) detecting wind direction.

An important element of forming strategy in golf is the practice round. Players use the opportunity of the practice round to test various aspects of how the course is playing, such as evaluating the firmness and speed of the greens, testing the depth and texture of the rough, testing the depth and texture of sand in the bunkers, evaluating the firmness and speed of the fairways, identifying potential hole location areas and

evaluating strategic options for each likely hole location, and identifying prevailing and opposite wind directions and formulating a strategic approach for each possible wind condition. Players with strong perceptual abilities are able to more comprehensively gather this information, which provides them with a strategic advantage for in-competition decision making.

During competition, one of the most significant perceptual requirements of a tournament player is the ability to read greens. Players must analyze the slope of the green, the grain direction of the grass, and rate at which certain types of grass grow throughout the day, the moisture of the green at particular points in the day, and the wind direction in order to accurately predict the line and speed of a putt. Players with highly developed perceptual abilities are able to read greens more accurately than players with weaker perceptual ability.

A third component of golf-specific perceptual skill is the ability to accurately detect wind direction. Wind is the strongest external influence on the flight of the ball, and it must be correctly factored into shot selection before each shot. Players with high golf-specific sport intelligence are able to determine the direction of the wind more accurately than other players – especially when required to identify the direction of a "quartering" wind (i.e., identifying if a crosswind is also blowing slightly against the player or towards the target).

Investigator Beliefs about Decision Making by Intelligent Golfers

Players with high levels of golf-specific sport intelligence are excellent decision makers. Specifically, these players are able to (a) pick the correct strategic option for the particular situation and (b) pick the correct option based on their current capabilities.

Intelligent decision makers are able to choose the best strategic option for the particular situation they are in. An example of situational strategy in golf is the decision of whether to go for the green on the second shot on a par five or lay up. Also, players must weigh the risks and reward for selecting various targets on their approach shots (i.e., aim for the flag or aim towards the middle of the green) and for selecting clubs for tee shots (i.e., use driver for more distance or a fairway wood for more accuracy). Highly intelligent players are able to select the option that provides the best chance of making the lowest score on the hole while minimizing risk.

Importantly, accurate decision making is dependent on matching the situational demands with the current capabilities of the player. Good decision makers understand this and choose their strategy based on their current capabilities and limitations. For example, a highly intelligent player who has a dominant tendency of shaping the ball right-to-left on his approach shots knows that his ball flight is more easily able to access pins located on the left side of the green. Therefore, because of his high skill level at shaping the ball right-to-left, the best strategy choice is often to be aggressive to left pins – even though the best choice for most players would be to play more conservatively to the center of the green. However, if the flag is located on the right side of the green, this player knows that his right-to-left shot does not suit the hole location, and will choose a more conservative target – even if the correct choice for the majority of players is to play aggressively.

Investigator Beliefs about the Learning Ability of Intelligent Golfers

Players with a high level of golf-specific sport intelligence are believed to have an advanced ability to learn. From a technical perspective, highly intelligent players are

expected to be able to learn new techniques in an efficient manner. From a strategic perspective, highly intelligent players are able to interpret the outcome of shots to efficiently learn about the course conditions of that day and make strategic adjustments if necessary.

The techniques used in the full swing, short game, and putting must be precise and refined in order for a player to have the shot making capability to compete at the highest level. When developing or refining their technique, players are instructed under the guidance of a coach who provides feedback regarding the accuracy of their technique and makes recommendations for technique adjustments. Intelligent players are able to make the recommended technical adjustments faster and more efficiently than others.

Similarly, players often must make strategic adjustments during the course of a tournament. For example, if a strong overnight wind dries out the greens before the first round of a tournament, the ball will react with a much larger-than-expected first bounce when it hits the green. Compared to most players, intelligent players are able to learn from the reactions of their shots early in the day and make the necessary strategic adjustments quickly and efficiently.

Investigator Beliefs about the Learning Orientation of Intelligent Golfers

Previous research on sport intelligence suggests that aspects related to the learning orientation of an athlete, such as innovation with regard to technique and the tendency to be a student of the sport, were contributors to sport intelligence. In the context of elite golf, the contribution of these aspects is believed to be less significant.

Golf technique has changed very little as the game has evolved. Proper fundamentals such as grip, alignment, tempo, posture, ball position, and swing plane

continue to be the basis of golf instruction even at the highest levels of competition. Players have been innovative with respect to putting technique by inventing new ways to hold the club (e.g., claw grip, belly putter, long putter etc) but these innovations did not improve on previous methods in a technical sense – they simply provided an alternative for those who were psychologically struggling with traditional methods. Thus, technical innovation is not likely to be an indicator or component of sport intelligence for golf.

Being a student of the sport may be related to golf-specific sport intelligence. However, rather than necessarily being a student of the sport in general, a highly intelligent player is more likely "a student of his own technique". For example, an intelligent player strives to understand everything about the theory behind his technique and the idiosyncratic tendencies that he has while applying it. Highly intelligent players study their own method so they can fully understand the cause and effect of ball flights they produce, and so they are able to self-diagnose any technical problems based on the ball flights that they observe.

Trustworthiness of Data

A degree of subjectivity is unavoidable when engaging in any type of research. Authors who subscribe to a naturalistic paradigm of science have suggested that all researchers are prone to favoring one particular viewpoint over another, therefore making impossible the existence of interpretive research that is bias free (Berg, 2007). Thus, steps should be taken to increase the trustworthiness of data by striving to mitigate the influence of bias on research, and to recognize biases when it is not possible to eliminate them.

Lincoln and Guba (1985) proposed several methods for increasing the trustworthiness of qualitative data, such as triangulation of data, peer debriefing, negative case analysis, member checking, persistent observation, investigator journaling, and prolonged engagement in the subject area on the part of the investigator. This study included several of these trustworthiness checks.

For example, after the interviews were transcribed and closely read, a 2 to 3 page case summarizing the interview responses of each coach was created and sent to participants by email to allow them to verify that their responses were interpreted accurately. This process of member checking is considered an important step for establishing credibility of qualitative data (Miles & Huberman, 1994). These summaries were created and emailed to participants within two weeks of the interview date to ensure that participants would be able to accurately remember the interview and provide feedback about their summary. The investigator received one reply from a coach who requested clarification of a point that was raised during the interview but did not change the content of their responses or the subsequent analysis. Several other coaches replied to simply express interest in the findings of the study or to solicit practical suggestions from the investigator regarding ideas for training sport intelligence in their players.

After the data was coded and analyzed, an undergraduate research assistant independently coded a randomly selected portion of the data from each transcript (i.e., a minimum if 3 single spaced pages of transcription, approximately 15% of the total interview) into meaning units in order to evaluate the degree of inter-rater reliability. Importantly, the second reviewer had very little experience or familiarity with golf, thus providing an alternate perspective from which to view the data. Comparison of these

independently produced sets of meaning units yielded a high rate of agreement (e.g., approximately 85%) between the investigator and the second reviewer, providing further confidence that the background experiences and previously held beliefs of the investigator were not inappropriately influencing his interpreting of the data. The few differences in how the data were interpreted were discussed until consensus was reached.

Also, the primary author and the research assistant engaged in a collaborative debriefing process after analysis. During this debriefing process, the few negative cases (i.e., cases that are significantly different from predominant patterns in the data) were discussed extensively and reconciled with respect to the general patterns found in the data.

Furthermore, the author took additional significant steps to ensure that his tacit knowledge and beliefs did not bias the interview process or the interpretation of the data. The research assistant read the previous section of this chapter which outlined the investigator's tacit knowledge regarding sport intelligence in golf and inspected the interview transcripts to ensure that the author's tacit knowledge did not produce inappropriately leading interview questions or bias the interpretation of interview data. In addition, the investigator recorded reflexive journal memos in an effort to document the influence of personally held values on the interpretive decisions made during the research process.

Finally, the credibility of participant responses was closely monitored by the author, who has acquired an informed perspective from spending prolonged periods of time (i.e., many years) in the context of elite golf. The author's interest in the subject matter of this study stems from a background of playing, teaching, and coaching elite

competitive golf. Thus, the author brought an informed perspective to interpretative decisions made regarding data in the study.

CHAPTER 4: RESULTS

Results of Inductive Qualitative Analysis

The 16 participants included in the study produced a total of 800 raw data responses that were tagged and coded into 174 distinct meaning units. For example, participant responses such as "knowing what shots are your weaknesses" and "understanding what shots aren't very high percentage for you" were coded into the meaning unit "understanding weaknesses". Like meaning units were coded into subthemes, which were then sorted into higher-order themes. This data analysis procedure resulted in 32 subthemes that were grouped into 11 higher order themes that represented the components of golf-specific sport intelligence (see Table 1).

During analysis an interesting pattern emerged from the data that ultimately led to the decision to organize higher-order themes further into two overarching umbrella categories (see Table 1). As the investigator read the transcripts, it appeared that participants were describing characteristics of golf-specific sport intelligence that would pertain either to cognitive and emotional processes occurring on the golf course during competition or to a set of cognitive and emotional patterns that influenced the player outside of competition during training and the long-term developmental process.

The responses given by many coaches also suggested that the in-competition aspects of sport intelligence may not be related to the beyond-competition aspects of sport intelligence in golf. Although this could not be proven in a positivistic sense, the data seemingly indicated that these two sets of cognitive skills were independent. For example, coaches often discussed players who had a poor understanding of the processes that would lead to efficient performance improvements and sustained high performance

(such as practice habits, physical training, etc.) but were still able to compete intelligently on the golf course in tournaments (i.e., high golf intelligence during competition):

> Like we talked about earlier, thinking about your technique and mechanics is a portion of that, paying attention to all of the other factors that equal good golf shots also, whether that is your physical fitness or your nutrition or your strength level or your endurance level, you know, all of that stuff I think is indicative of smart golfers. I say that though with an asterisk, because I think there are people that don't pay attention to (the off-course factors), but they are still able to understand what their game dictates and what shots they can hit consistently, and then apply that to the risk and reward calculation that each shot presents. (C9, Page 3, Tag 7D)

Another coach (C2) further reinforced that the in-competition and beyond-competition aspects of sport intelligence could be considered relatively independent. He described how most senior professional players did not adopt many of the modern training methods and philosophies now available to them (i.e., presumably indicating that these players demonstrated low off-course sport intelligence), but still demonstrated high sport intelligence on the golf course during competition:

> If you talk to Senior Tour players about it – I've talked to a player who used to be around my home club a lot. He's won on many tours, won around the world, in the golf hall of fame, so asked him how he used to work on his swing. He'd say, 'Oh, I don't know, just make sure I'm lined up straight and then swing.' I asked him, 'wasn't there anything that you worked on to get better?' He'd say, 'Yeah, I decided to shorten my swing and then I'd play a bit better.' I said 'well, what would you eat late in the round so you could maintain your concentration'. He said, 'Well, not much, just a Mars bar at the turn.' He clearly had a different way of doing it than someone like Peter Thompson, who was a lot more sophisticated with how he went about it, you know. (C2, Page 11, Tag 7R)

Coach 9 even went so far as to explicitly suggest the existence of two separate sets of cognitive skills that made up distinct dimensions of golf-specific sport intelligence:

> I think that there are two types of golf IQ that we are actually talking about. There is the actual on-course IQ, like how do I get it from point A to point B most effectively. And then there is the golf IQ of, 'how do I do this for a prolonged period of time?' So I think that the knowledge areas and having knowledge is separate, but could be somewhat tied in because they both feed on each other. (C9, Page 5, Tag 7D)

Considering the clear patterns that emerged from the data, the investigator decided to further organize the higher-order themes into two overarching umbrella categories representing the two emergent dimensions of golf-specific sport intelligence. The "competitive intelligence" dimension of golf-specific sport intelligence (i.e., "game intelligence") was an umbrella category that included themes relating to cognitive skills and emotional processes that occurred during competition. The "developmental intelligence" dimension of golf-specific sport intelligence was an umbrella category that included themes relating to cognitive skills and emotional processes that took place outside of the competitive situation. Themes and subthemes from each of these umbrella categories are presented below and depicted in Table 1 (next page).

Table 1
Results of Inductive Qualitative Analysis of Interview Response Data

Umbrella Category	Higher Order Theme	Subtheme
On-Course Cognitions	Self-Knowledge	Understand physical capabilities
		Comfort with self
		Knowing what mental approach works best
	Self-Awareness	Awareness of current capabilities
		Awareness of situational influences
		Awareness of cognitions
	Environmental Perception	Environmental Perception
	Information Processing	Risk vs. reward assessment
		Interpretations of awareness
		Interpretations of environmental perceptions
		Improvisational skills
	Course Management	Planning
		Strategy heuristics
		Understanding the logic of decisions
	Cognitive Control	Staying focused on each shot
		Playing shots independent of extraneous influences
		Intentionally regulating arousal
		Controlling emotional reactions
		Mental discipline and patience
	Understanding the Nature of Golf	Knowing how to win and lose
		Understanding that golf is fickle
		Understanding scoring is about minimizing mistakes
Off-Course Cognitions	Self-Knowledge	Knowledge of own learning style
		Understanding of own technique
		Knowledge of own recipe for optimal preparation
	Attitudinal factors	Resistance to social norms
		Thinking in confidence-building ways
	Understanding the Elite Sport Process	Understanding elite golf training demands
		Planning for development
	Self-Regulation	Ability to evaluate developmental progress
		Ability to address weaknesses
		Ability to discover tendencies

Competitive Intelligence in Golf

Competitive intelligence (i.e., "game intelligence") referred to a set of cognitive and emotional skills that occurred *during the course of play*, and was reported by participants to provide players with several competitive advantages. According to the interviewed coaches, golfers with high amounts of competitive intelligence are able to play the course in the most efficient way possible, shoot the lowest score that their skills will permit on a particular day, and play well under pressure. Participants provided insight into how these competitive advantages are gained by discussing and outlining the characteristics of sport intelligence. Specifically, participant responses yielded 7 higher order themes that were organized into the "competitive intelligence" umbrella category. These themes were: (a) Self-Knowledge, (b) Self-Awareness, (c) Environmental Perception, (d) Information Processing, (e) Course Management, (f) Cognitive Control, and (g) Understanding of the Nature of Golf. These themes and their subthemes are discussed below.

Self-Knowledge

The degree to which a player knows themselves and their own capabilities (e.g., strengths and weaknesses) was repeatedly mentioned by all 16 coaches as a fundamental and significant component of golf-related cognitions, and was considered as perhaps the foundation of golf-specific sport intelligence. The higher-order theme *Self-Knowledge* contained 3 subthemes. Demonstrating sport intelligence during competition meant that a player is able to (a) understand their own physical capabilities, (b) be comfortable with themselves as a golfer, and (c) know what mental approach worked best for them. These subthemes are explained below.

Understanding of own physical capabilities. All 16 coaches reported that a significant aspect of sport intelligence in golf is being able to accurately and honestly assess one's own capabilities, strengths, weaknesses, and tendencies. Highly intelligent players characteristically know what shots they hit well or poorly, they know their most effective style of play (e.g., power player, accuracy player, or great short game player etc.), they know precisely how far they can hit each club, and they understand what happens to their capabilities under competitive pressure. According to participants, detailed knowledge of one's own physical capabilities is a critical characteristic of sport intelligence because accurate self-knowledge gives a player a valid starting point from which to make intelligent on-course decisions.

Comfort with self. Another characteristic of competitive intelligence in golf that was mentioned directly by 4 coaches and indirectly by 4 others is the ability of players to be satisfied and comfortable with "whom they are as a golfer". Highly intelligent golfers are comfortable with their own style of play, and do not feel the need to try to exceed their own capabilities when attempting shots (e.g., an accuracy player trying to play like a power player). Coach 8 reinforced the significance of being comfortable with one's own skill set:

> I think probably the most important thing would be to understand your own abilities and to be satisfied with what you can do personally on the course, whether you are a medium length hitter, a short hitter, a long hitter, and play the course intelligently. (C8, Page 11, Tag: JJJ)

Later in the interview, Coach 8 continued by saying "those who know themselves the best, are most comfortable in their own skin, seem to be the best in my experience. They know their own personalities, they know their own selves. They seem to be the people who are at ease and are able to achieve no matter what their physical abilities, if

that makes sense." Participants further reinforced this point by explaining how golfers with low sport intelligence are less clear about their style of play and less able to be comfortable playing the game within their own capabilities.

Knowing what mental approach works best. The responses of 8 coaches also indicated that sport intelligence involves knowing what mental approach works best. Smart players understand under what temperament (i.e., quiet, outgoing, emotional, or even-keeled, etc.) they perform their best. Also, intelligent players understand their own risk tolerance, which allows them to make decisions in accordance with that risk tolerance.

Self-Awareness

Self-awareness also emerged as a significant characteristic of golf-specific sport intelligence. All 16 coaches in the study mentioned self-awareness or a pertinent subtheme as being a part of competitive intelligence in golf. Self-awareness was described as the ability of a player to monitor their own capabilities and feelings in order to detect any slight changes that may occur during competition. Thus, in addition to having a detailed self-knowledge of one's capabilities, competitive intelligence also involves being aware of changes in these capabilities over time and under varying circumstances. Coach 3 reinforced the importance of self-awareness for golf-specific sport intelligence:

> It's a big piece of the equation for sure. Huge piece of the equation. I think in the sport of golf, that it is such an individual game, and there are many different games within the game. You think of being aware of your body, being aware of your mental state is all important, all of the little pieces of the equation. (C3, Page 7, Tag KK)

Subthemes of self-awareness were (a) awareness of current capabilities, (b) awareness of situational influences, and (c) awareness of cognitions.

Awareness of current capabilities. Eleven participants specified that sport intelligence includes being able to maintain an awareness of how one's skill level is changing during the course of competition. Coach 1 explained how intelligent players characteristically maintain close touch with their own skill level and how it is changing, stating that "you've got to be able to assess your own abilities, and you have to do that on the fly. It's not just about starting out, it's got to be in course or in round." (C1, Page 13, Tag LL)

Awareness of situational influences. Similarly, 9 coaches explained that sport intelligence in competition also includes being aware of the current situation (e.g., beginning of the round, pressure situation, end of the round etc.) and how the characteristics of that situation influence the player or match with the skill set of a player. Coach 10 described how an important aspect of sport intelligence on the course is having an awareness of situational influences:

> A lot of it is understanding your situation on the course and what that situation is doing to you. I've talked to a lot of students where they say they blew up on their last four holes and I ask well why did you blow up on your last four holes and they don't really know why. You've got to figure that out, when you start getting to the end of your round you've got to understand what's going on with your mind, what are you thinking, what's physically happening, are you breathing faster, is your heart rate going, are your palms sweating, being aware of that. It doesn't necessarily mean you're going to stop it but you can begin to control it if you're aware of it. Don't wait till it's over, it's too late. So yeah, it's a big part. (C10, Page 10, Tag 6C)

Awareness of cognitions. Another characteristic of sport intelligence described by 4 participants is the ability to maintain an awareness of cognitive processes (i.e., the ability to demonstrate meta-cognition). For example, Coach 10 suggested that a players' awareness of their decision making processes is a critical part of on-course sport intelligence. Also, 3 additional coaches explained that highly sport intelligent golfers

characteristically maintain awareness of their confidence level on certain shots and in various situations, which was reported to be critical for selecting the proper shot.

Environmental Perception

Perceptual skill was also cited by all 16 coaches in the sample as being a characteristic of sport intelligence in competition. For example, coaches proposed that sport intelligence includes the ability to accurately perceive environmental factors such as wind speed and direction, firmness of the ground, grain of the grass, and slope of terrain. Coach 2 explained how highly intelligent players are more skilled at gathering environmental information:

> I think they are better at selecting accurate information to begin with. I think they are better at reading the environment. So reading wind strength and direction I think is a real art, and I find that is a part of it. And reading lies, so I think that is definitely a part of it. Reading the lie, reading the wind in the beginning. (C2, Page 3, Tag WW)

Sport intelligence during competition involves having a keen perceptual sense. Accurately perceiving the environment provides a player with competitive advantages in making judgments in areas such as in green reading, anticipating how the ball will react when it lands, and predicting the influence of wind on each shot.

Information Processing

The ability to process relevant golf information was also cited by coaches as a characteristic of sport intelligence during competition. Once the appropriate information is gathered from the self, the situation, and the environment, highly intelligent golfers are characteristically able to process the information effectively in order to arrive at an accurate decision. Participant responses generated 4 subthemes that were organized into this category: (a) Risk vs. reward assessment, (b) interpretation of awareness, (c) interpretation of environmental perception, and (d) improvisational skills.

Risk vs. reward assessment. The ability to properly assess relative risks and possible rewards was described as a characteristic of competitive intelligence for golfers by 10 coaches. For example, Coach 9 stated: "I think, I guess my first reaction would be, being a smart golfer would be someone who is very good at assessing risk and reward." (C9, pp 1, Tag YYY) After gathering all relevant information, the highly intelligent player is able to decide on the most suitable strategy option based on an assessment of the relative risks and rewards of all possible options.

Interpretation of awareness. For 4 participants, sport intelligence during competition also includes the ability to interpret one's awareness. In addition to being closely aware of their internal states, highly intelligent players also are able to interpret and appropriately act on the cues they derive from their awareness during the decision making process.

Interpretation of environmental perceptions. Similarly, 6 participants reported competitive intelligence to include properly interpreting environmental perceptions in order to make decisions and manage expectations. For example, Coach 6 explained that highly intelligent players understand how to moderate their expectations when they perceive poor weather conditions:

> Well I think it starts before a round. I mean, if I go to the first tee, and it's cold and rainy and windy, my expectations are affected by what the environment is. I don't expect to go shoot 65. I don't expect anyone else to also. So I think you have to put it in perspective, that everyone else is in that same boat. The intelligent golfer is going to say, hey listen, this is an ugly day, but we're all playing in it, and I'm better when it is ugly than somebody else. So that is in general. In a specific way, it is going to affect the shots that you are trying to hit and what you are doing on the golf course. You are not going to try and carry the lake on the last hole that is a normal 250 carry if you've got 40 degree weather, or in the wind you would not try that. (C6, Page 12, Tag G)

Improvisational skills. Four coaches also mentioned that advanced improvisational skills (i.e., being able to create a shot in novel circumstances) is characteristic of sport intelligence in competition. Coach 10 suggested that the ability to "manufacture shots" that aren't routine – such as escapes from the woods or interpretive short game shots – is a skill which is common among highly intelligent players:

> I would certainly say that the other part is the ability to manufacture the shot that the situation calls for. I mean you know that you can have a multitude of shots that you can hit on the golf course but being able to figure out what shot you need to hit and being able to figure out how to hit it. Sometimes you can get into a situation and kind of go "I've never hit this shot before," but now, they have to at least get into a frame of mind where they can figure that out. And we talked about some players earlier that I think could do that. You know they didn't go to the range or the short game area and hit that shot 100,000 times but they could look at the situation, they could picture it in their mind, and they could manufacture the shot that was necessary to hit it that time. I think a smart player is able to figure that out, not only strategically, but they're able to figure out how to move the golf club to make that shot happen. And I think a smart player can figure that shot out, and maybe that's somewhat instinctive but it also has to be partially the thought process to go into that, so part of it's just execution, being able to execute, think through the shot well enough to execute it the way it needs to be executed. We've seen it with great players hit shots, "like how the hell did they do that?" But they figured it out; it wasn't something they rehearsed 100,000 times. (C10, Page 5, Tag BBB)

Course Management

Sport intelligence in competition also includes course management. All 16 participants in the study mentioned course management or a pertinent subtheme as being an important aspect of competitive intelligence for golf. This category was composed of subthemes such as (a) planning, (b) strategy heuristics, and (c) understanding the logic of decisions.

Planning. For 14 participants, the ability to plan was considered a skill that characterizes on-course golf intelligence. Highly intelligent players make a plan for each

round they are to play. In addition, they have a plan for how they will approach each hole and each shot.

Strategy heuristics. Demonstrating competitive intelligence in golf meant that a player adheres to several basic heuristics of on-course strategy (i.e., basic rules of thumb that are regarded as universal principles of golf strategy). These heuristics include "missing shots in the correct spots" (C7), "not short-siding the golf ball" (C12), "playing the percentage shots" (C5), "playing to your strengths" (C6), "making decisions that hide your weaknesses" (C6), and "choosing only to play shots that you know you can execute" (C8).

Understanding the logic of decisions. Understanding the logic behind strategic decisions was also reported to be a characteristic of sport intelligence by 6 coaches. Highly intelligent players have a comprehensive logical understanding as to why the decisions they make are correct for the design of a particular hole rather than blindly following decision rules that they have been trained to follow. For example, consider the comments of Coach 7 as he explained the difference in competitive intelligence between a player who understands the logic behind their decisions versus a player who makes decisions based on memorized decision rules:

> I think a smart golfer understands the reason behind doing it, and knows for example why you would hit the ball fifteen feet behind and right of a pin that is tucked on the left. Whereas someone who is not as smart just does it because you tell them to do it, as opposed to someone- you can talk to someone, but I think when you get feedback from that person that shows you that they understand why they are doing it, I think that would indicate to me that they are a smart player. (C7, Page 2, Tag 7A)

Cognitive Control

The ability to control cognitions and emotions also emerged as a characteristic of competitive intelligence for golf. Subthemes organized into this category included (a)

staying focused on each shot, (b) playing shots independent of extraneous influences, (c) intentionally regulating arousal, (d) controlling emotional reactions, and (e) having mental discipline and patience.

Staying focused on each shot. Being able to maintain focus during the entire process of executing each shot was described as a part of sport intelligence by 5 participants. Coaches reported that intelligent players are able to stay focused on each shot, while less intelligent players do not demonstrate the cognitive control required to maintain their focus during shot execution.

Playing shots independent of extraneous influences. Several participants reported that extraneous influences can sometimes be a distraction towards a player's ability to plan and execute shots. These extraneous influences include distracters such as the results of previous shots, the score of the player relative to par at that time, the situation in the competition (e.g., at the end of a tournament), or the particular score on a hole that the player is attempting to record with a given stroke. The ability to play shots independent of these influences was described as a characteristic of sport intelligence by 6 coaches.

Intentionally regulating arousal. The ability to purposefully regulate and alter arousal levels was also considered an aspect of competitive intelligence by 9 participants. Coach 14 described how Tiger Woods is able to intentionally manipulate his level of arousal to help his performance:

> It's not only to be aware of what you are doing, it's also that you have to have an element of control. You need to know when to act on it, to be able to discipline it. I think there are times when Tiger gets pissed just to get pissed. I think sometimes he's really not that pissed – like he almost pulls off a shot – but he gets pissed because he needs to get himself fired up. Or at a major, he will walk very slow when he needs to settle himself down. (C14, Page 9, Tag CCCC)

The ability to intentionally regulate arousal levels based on the situation was regarded as a characteristic of competitive intelligence for golf.

Controlling emotional reactions. The ability to control emotional reactions during competition was also reported to be a part of sport intelligence by 12 participants. According to coaches, highly intelligent players are better able to prevent emotional outbursts – especially after poor shots – from becoming a negative factor in their ability to perform.

Mental discipline and patience. The ability to maintain mental discipline and patience during competition was considered reflective of sport intelligence by 5 participants. For example, Coach 9 explained that "there is a tie between being a smart golfer and being patient. I think that patience is a huge asset in our sport". He suggested that highly intelligent players are able to "not get ahead of themselves" and "not think about the outcome and remain focused on the process". Furthermore, coaches reported that highly intelligent players possess the cognitive control to exercise mental discipline during decision making, while less intelligent golfers are more likely to be reckless and impatient in their course strategy and shot selection. Golfers with less sport intelligence lack the mental discipline to resist trying a high-risk shot even if they know that it is the wrong choice.

Understanding the Nature of Golf

"Understanding the unique nature of golf" is the final higher-order competitive intelligence theme that emerged from participant descriptions of sport intelligence. Coach 9 explained how golf poses a set of unique challenges, and that intelligent players "need to have an understanding" of these challenges:

> So you have to deal with far more things in golf than you do in any other sport. There are no timeouts. The coach doesn't say "here's the next play". . . . So when I go back to the word "understanding", that is where I think golf differs. . . You really have to have an understanding that golf is a lot bigger than we are from the standpoint of we're going to make some mistakes, we're going to have things we are going to have to deal with. (C9, Page 15, Tag QQQQQ)

Subthemes organized into this category included a) knowing how to win and lose, b) understanding that golf is fickle, and c) understanding that scoring is about minimizing mistakes.

Knowing how to win and lose. Understanding how to win and lose in golf was regarded as characteristic of competitive intelligence by 3 coaches. Specifically, coaches explained that smart players know how to manage themselves and the situation at the end of tournaments in order to create the best chance of winning. Similarly, intelligent players know how to minimize the negative impacts on their confidence when they don't win.

Understanding that golf is fickle. Participants repeatedly mentioned that golf poses a set of challenges which create a unique series of cognitive and emotional demands for the golfer that may not be faced by athletes in many other sports. For example, Coach 9 stressed how performance inconsistencies are uniquely unavoidable in golf regardless of effort consistency:

> Like I say, I'm going to use the word "understanding". You know, good smart players to me have always understood that golf is- to borrow from Rotella- is not a perfect game. There are no perfect shots, there is not a perfect round of golf. It isn't going to occur. (C9, Page 14, Tag EE)

Being able to recognize this reality – and moderate expectations and levels of frustration accordingly – was regarded as characteristic of competitive intelligence for golfers by 6 participants.

Understanding that scoring is about minimizing mistakes. Several participants (9 coaches) also repeatedly emphasized how highly intelligent players understand that

efficient scoring in golf is the consequence of being able to minimize mistakes. According to the coaches, players with less sport intelligence do not understand this reality.

Developmental Intelligence in Golf

While competitive intelligence in golf is comprised of cognitive and emotional skills that are utilized during actual play, the coaches also stressed the importance of other cognitive and emotional skills that take place outside of competition. These beyond-competition aspects of sport intelligence enable players to create a sustainable career at the elite level, demonstrate continued development over the long term, maximize their talent, practice efficiently, and be prepared for competition. The off-course (i.e., beyond competition) aspects of sport intelligence in golf represent a sort of "developmental intelligence" – a set of cognitive and emotional skills employed outside of the actual competitive situation that affects the rate at which a player experiences skill development over the long term. Participant responses yielded 4 themes that were organized into the "developmental intelligence" overarching umbrella category. These themes were (a) Self-Knowledge, (b) Self-Regulation, (c) Attitude for Development, and (d) Understanding of the Elite Sport Process. These themes and their subthemes are discussed below.

Self-Knowledge

Self-knowledge emerged as a higher-order theme that also describes developmental intelligence. Self-knowledge subthemes pertaining to the beyond-competition aspects of sport intelligence included (a) knowledge of optimal learning

style, (b) understanding of own technique, and (c) knowledge of own recipe for optimal preparation.

Knowledge of optimal learning style. A player's ability to understand how he or she most effectively learns was regarded as indicative of sport intelligence by 13 coaches. Participants reported that intelligent players characteristically know whether they are a visual, kinesthetic, or auditory learner. Similarly, coaches explained how intelligent players know the amount of technical swing information they can handle effectively while receiving instruction. Coach 14 discussed how intelligent players understand the importance of seeking out and working with an instructor who fits their learning style:

> Take a Payne Stewart, whose swing mechanics were just naturally excellent. You know, he wasn't the type of guy to get all complicated by thinking things like 'I need to take it back a little inside, round it off, shallow it out.' His teacher would say things like 'put it back in your stance two inches.' His golf IQ was much more instinctual, it wasn't a left brained detail-oriented thing. It was right brained, artistic feel. So in order to be smart with yourself and your fundamentals, you need to know what you can and can't handle. Like my wife, even though I know why she can hit good shots, I can't help her because I know we aren't speaking the same language. So a smart golf IQ person won't work with someone or won't talk in a language that they don't understand. If it feels one way, and the mechanics say another thing, they will talk in mechanics or they will talk in feel, but they won't do the one that they don't understand. (C14, Page 5, Tag HH)

Having the self-knowledge to understand how one most efficiently learns was considered a characteristic of developmental intelligence by participants.

Understanding of own technique. Part of developmental sport intelligence in golf is having an understanding of the technical ins and outs of your own swing and its progression over time. Coach 3 explained how highly intelligent players understand their own technique intimately, recognize the reoccurrence of certain ball-flight patterns over time, and understand what they need to do to keep their mechanics sharp:

> The high intellect or high IQ golf person knows their tendencies, they know their own swing, they sort of have a library of things that they check and recheck and

> keep polished and know their tendencies when things go awry. They know how to keep themselves sharp, and they stay on that course. (C3, Page 5, Tag FFFF)

Coach 9 also explained how intelligent players have a working knowledge of their own swing from a "feel perspective" as well as a "technical perspective":

> Yeah, well there is a difference there. I think that understanding your own swing might not necessarily mean mechanical understanding. It's understanding feels, it's understanding positions, it's understanding 'oh, if I hit this shot, this is how my body feels when I do that'. And I think that Freddy Couples, as an example, he might not know the percentage of the degree of the swing plane, or how much wrist hinge has to happen, like a guy like Bernhard Langer or Tom Kite might know. But he knows how his body has to feel when he plays well and hits good shots. (C9, Page 5, Tag FFFF)

Importantly, coaches were specific in suggesting that it is knowledge of the players' *own method* and "how their own swing works" (C15) that is important for golf intelligence – they repeatedly asserted that knowledge of general swing theory is not related to golf intelligence.

Knowledge of own recipe for optimal preparation. Knowing how to best prepare for competition was reported to be characteristic of developmental golf intelligence by 7 participants. Along with understanding the basics of proper preparation, highly sport intelligent golfers have an "intimate knowledge" of how they individually best prepare for competition – in terms of what they eat, how much they rest, how they arrange their physical training, and how much technique practice they can handle before competition. Thus, the degree to which a player understands their own "recipe for success" (C2) was regarded as characteristic of sport intelligence.

Self-Regulation

Self-regulation is the degree to which an individual is motivationally, meta-cognitively and behaviorally involved in their own learning process (Kitsantas & Zimmerman, 2002). Participant responses indicated that the ability to self-regulate (i.e.,

be involved in one's own learning process) is characteristic of sport intelligence in golf. Subthemes organized into this higher-order theme included (a) the ability to evaluate one's own developmental progress, (b) the ability to identify areas of weakness, and (c) the ability to learn and discover tendencies during preparation.

Ability to evaluate one's own developmental progress. The ability to make accurate and honest evaluations of one's current abilities was described as a part of developmental intelligence for golfers by 8 participants. Highly intelligent golfers have an accurate understanding of their ability level – both relative to other competitors and relative to the standard of play that they aspire to. Golfers who lack sport intelligence are not able to make accurate assessments of their skills, and do not understand how their ability compares with others or certain standards of play.

Ability to address weaknesses. Identifying what skills needed to be improved – and knowing what changes are required to make these skill improvements – was reported to be a part of developmental intelligence for golfers by 5 coaches.

Ability to discover tendencies. Highly intelligent players are characteristically able to efficiently discover their tendencies in practice, thus efficiently providing themselves with information about what areas they need to improve. Coach 10 emphasized the importance of discovery as a part of golf intelligence:

> You know, not only learning but actually discovering new techniques. I always tell people, golf is a game discovery as much as it is a game of learning; you have to be able to discover what works for you and understand it. Sometimes the best thing to do is hit a club and see what it does, don't try to make the ball do something with that club, take a swing this far back and this far forward and see what happens to the ball when you do that. Discover what's taking place rather than trying to figure it out and make it do something it's not capable of, you don't know what it can do. . . . You've got to know that, you've got to be able to discover that, it's part of your game. (C10, Page 10, Tag T)

Attitude for Development

Having an attitude conducive to talent development was also reported by 6 participants to be a characteristic of sport intelligence for golfers. Specifically, coaches mentioned that highly intelligent golfers (a) demonstrate resistance to social norms, and (b) try consciously to think in confidence-building ways.

Resistance to social norms. Four coaches made an explicit association between highly intelligent players and unconventional social behavior. For example, Coach 7 described how highly intelligent players could be perceived as selfish:

> I really believe in golf that good players, and probably high golf IQ players, are a little bit selfish. And not in a bad way, I just think that they know what they need to do for themselves and they do it. (C7, Page 6, Tag PPP)

Coach 14 characterized intelligent players as "very detail oriented, almost to the point where they irritate other people", while he described less sport intelligent golfers as "generally more well-rounded, no sharp things about them. Probably very socially intelligent and get along well with other people." Coach 15 even referred to highly intelligent players as "aloof and goofy".

Thinking in confidence-building ways. Choosing to think in a fashion that would build confidence was reported as a behavior indicative of golf intelligence by 5 coaches. Specifically, highly intelligent players engage in self-talk that is confidence-building, surround themselves with optimistic and confidence-enhancing people, and interact with the media in ways that reflect self-confidence.

Understanding of the Elite Sport Process

Understanding of the elite sport process was also considered part of developmental intelligence for golf. Note that all participants in this study were experienced coaches of players at the collegiate and/or professional level, so their

responses frequently referred to the elite golf context. Subthemes organized into this category include (a) understanding of elite golf training demands, and (b) planning for development.

Understanding of elite golf training demands. The ability to understand the scope and quantity of training required to achieve success was considered a part of sport intelligence by 12 participants. According to the coaches, highly intelligent players characteristically understand the importance of a fitness regimen and proper nutrition for golf training. For example, when asked what factors he would consider to judge the sport intelligence of a golfer, Coach 1 answered with the following:

> Maybe I'm going too far when I tell you that I'd want to know what he does for all things to give himself the chance to be the best that he can be. Not only what does he do golf wise, but what does he do fitness wise, what does he do nutritionally do give himself a chance? For that matter I would say that Tiger is the most intelligent because he's done the most. There was a burger and fries guy when he first went on the tour and I don't know if he would do that at all now. He always believed in training, but he also did a lot of running and stuff like that. I think he's weaned off that, he went pretty heavy on the weights for a while, but now he's backed off the weight and more on the reps. His programs from what I understand have a lot of core stuff, I think you have to add all of that as opposed to just saying does the guy hit the right shot, does he think about the right shot. . . All that stuff, like are they eating every hour and a half, are they snacking on something throughout the round to keep there metabolism going and fueling and therefore their brain on an even keel the whole way through. (C1, Page 7, Tag X)

Planning for development. Five coaches also considered the ability to plan for development as a characteristic of sport intelligence. Highly intelligent players are able to "plan out the year properly and periodize the year for certain types of training at certain points" (C4) and maintain a perspective conducive for long term development. For example, Coach 11 discussed how being able to maintain a long-term view is representative of highly intelligent behavior for developing players:

> I think they are probably good at keeping things in proper perspective and seeing the bigger picture. And not getting too caught up in the moment. I think they need to know where they are in the big picture. It is helpful to know where they

> are in their stage of development. If they realize, 'okay, listen, I'm a fifteen year old playing in the Ontario Junior Championship, and my goal is ultimately to make the PGA Tour by age 26. Then they are going to ultimately be able to put their goal in the proper developmental context. (C11, Page 12, Tag WWWW)

Results of Deductive Qualitative Analysis

The second portion of the interview made explicit reference to components of sport intelligence that were drawn from its previous conceptualizations (Figure 1). The deductive portion of data analysis assessed participant responses from portions of the interview that made direct reference to these components. The goal of analysis was to determine whether or not components specified in previous sport-general definitions of sport intelligence also applied in the golf context. Participants were directly asked if a particular component (e.g., decision-making) was also applicable in a golf-specific definition of sport intelligence. Participant responses were classified into three groups. A response was classified into the "Yes" category if the participant indicated clear support for inclusion of the component into a golf-specific definition of sport intelligence. A response was classified into the "Conditional" category if the participant only considered a component applicable to the golf-specific definition of sport intelligence under certain conditions (such as: "applicable only for elite ability levels" or "applicable only under unique circumstances"). Finally, a response was classified into the "No" category if the participant clearly did not consider a component applicable to a golf-specific definition of sport intelligence. Results from the deductive portion of the analysis are included in Table 2 below:

Table 2

Results of Deductive Qualitative Analysis of Interview Response Data

Coach	Decision Making	Self-Awareness	Perceptual Ability	Learning Orientation		Learning Ability		Tacit Understanding of Elite Sport
				Innovation	Student of Sport	Comprehension	Technique Changes	
1	Yes	Yes	Yes	Yes	Yes	Yes	No	Conditional
2	Yes	Yes	Yes	No	No	Yes	No	Conditional
3	Yes	Yes	Yes	No	No	Yes	Yes	Yes
4	Yes	Yes	Yes	Conditional	Conditional	Yes	No	Conditional
5	Yes	Yes	Yes	No	No	Yes	No	Conditional
6	Yes	Yes	Yes	Conditional	Conditional	Yes	Yes	No
7	Yes	Yes	Yes	Yes	Conditional	Yes	No	Conditional
8	Yes	Yes	Yes	Yes	Conditional	Yes	No	Conditional
9	Yes	Yes	Yes	Conditional	Conditional	Yes	No	Conditional
10	Yes	Yes	Yes	Conditional	Conditional	Yes	Yes	Yes
11	Yes	Yes	Yes	No	Conditional	Yes	No	Yes
12	Yes	Yes	Yes	Yes	Yes	Yes	No	Conditional
13	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Conditional
14	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
15	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
16	Yes	Yes	Yes	Conditional	Conditional	Yes	No	Conditional

As shown in Table 2, there was unanimous support for "self-awareness", "decision making", and "perceptual ability" to be included as part of a golf-specific definition of sport intelligence. All coaches believed that these were important components of a golf-specific definition, with either "self-awareness" or "decision making" being considered as the most important.

The importance of the characteristic "learning orientation" for golf-specific sport intelligence was mixed. Participants believed that the learning orientation of the golfer played some role in the performance of the golfer over the long term, but the coaches expressed differing opinions regarding its specific relevance to sport intelligence. For example, some coaches believed that innovation was a characteristic of highly intelligent behavior, but a lack of innovation did not disqualify a player from being considered intelligent since useful innovations in golf were relatively infrequent. Other coaches proposed that a tendency to innovate "actually was reflective of low golf intelligence" (C11) because this showed that a player was often too quick to change methods.

Being a student of the sport was also considered useful for the overall performance and development of the golfer, but the coaches did not agree on whether it should be considered a part of golf specific sport intelligence. Some coaches believed that being a student of the sport exposed the player to more information which could prove useful during the course of development. However, other coaches repeatedly cited players whom they believed to possess very high amounts of sport intelligence (especially on the golf course in competition) who certainly were not students of golf.

In general, the coaches thought the characteristic "learning ability" should be included as a component of golf-specific sport intelligence. However, most coaches

specifically mentioned that sport intelligence had more to do with comprehension of various aspects of the game rather than with the actual physical learning of techniques. According to most coaches, the ease with which players made technical changes was dependent on factors such as the teaching skill of the instructor rather than the sport intelligence of the player. Interestingly, the few coaches who believed that the ability to make technical changes was related to sport intelligence (C3, C6, C10, and C13) were the least accomplished "technique instructors" included in the sample – i.e., the skill-sets of these coaches were primarily focused on the strategic and psychological aspects of golf.

Finally, all coaches thought having a "tacit understanding of elite sport" was relevant for building and maintaining a sustainable elite career, but there was some disagreement as to whether this should be regarded as a part of sport intelligence. For example, Coach 6 believed that understanding and handling the demands of a career in elite sport was "a personality issue" rather than being relevant to sport intelligence. However, most other coaches believed that having a tacit understanding of career demands could be considered part of sport intelligence at elite levels of competition.

CHAPTER 5: DISCUSSION

Introduction

The goal of this dissertation was to extend upon the work of the few authors who initially introduced the relatively unexplored concept of sport intelligence (Fisher, 1984; Tenenbaum & Bar-Eli, 1993, Gould et al., 2002; Falk et al., 2004). In particular, this exploratory study sought to identify components of sport intelligence in a golf-specific environment by gathering data from highly experienced expert coaches who – because of their familiarity with the tendencies and cognitive patterns of elite players – could provide in-depth characterizations of sport intelligence in a golf context. A framework for golf-specific sport intelligence that is based on participant responses and relevant literature is proposed and discussed below.

Golf-Specific Sport Intelligence

Results of this investigation demonstrated that golf-specific sport intelligence is uniquely shaped by the sport-specific demands of golf. Inductive data analysis produced components of golf-specific sport intelligence that had not previously been included in definitions of sport intelligence in other contexts (e.g., self-knowledge). Deductive analysis indicated how some components that were included in previous definitions of sport intelligence were highly applicable to the golf context while others were not.

Perhaps the most interesting and noteworthy finding in this study was the emergence of two apparently distinct and relatively independent sets of intellectual skills in golf. Participant responses could be sorted along dimensions related to either in-competition or beyond-competition cognitive and emotional skills – one coach (Coach 9)

even specifically proposed the existence of two separate and distinct "golf IQs" (i.e., competitive intelligence and developmental intelligence).

Although the independence of competitive golf intelligence and developmental golf intelligence cannot be demonstrated in a positivistic sense, participant responses supported the suggestion that these dimensions of golf-specific sport intelligence are orthogonal (i.e., a player can be highly intelligent on the course during competition without having a high developmental golf IQ, and vice versa). For example, coaches suggested that being effective in aspects of golf that are important for long-term development such as practice or having a strong comprehension of techniques is indicative of high sport intelligence, but they also raised examples of players who aren't considered developmentally intelligent but are still able to compete intelligently (e.g., Fred Couples, Boo Weekly, and John Daly). In practice, it is probable that competitive intelligence and developmental intelligence interact to a certain degree. However, for illustrative purposes in this dissertation the proposed conceptualizations of competitive intelligence for golf and developmental intelligence for golf are each outlined and discussed separately in the following sections.

Competitive Intelligence for Golf

Competitive golf intelligence is the capacity to play golf as efficiently as possible and maximize the scoring potential of one's own physical ability. Competitive intelligence allows golfers to make effective strategic decisions, shoot the lowest score their physical skills permit on a given day, and play well in pressure situations. Based on the responses of the highly experienced coaches, this investigation proposes competitive intelligence in golf to be comprised of the following components: (a) Self-Knowledge,

(b) Self-Awareness, (c) Environmental Perception, (d) Information Processing, (e) Course Management, (f) Cognitive Control, and (g) Understanding the Nature of Golf. The subcomponents of each of these categories are listed in Figure 2 (next page).

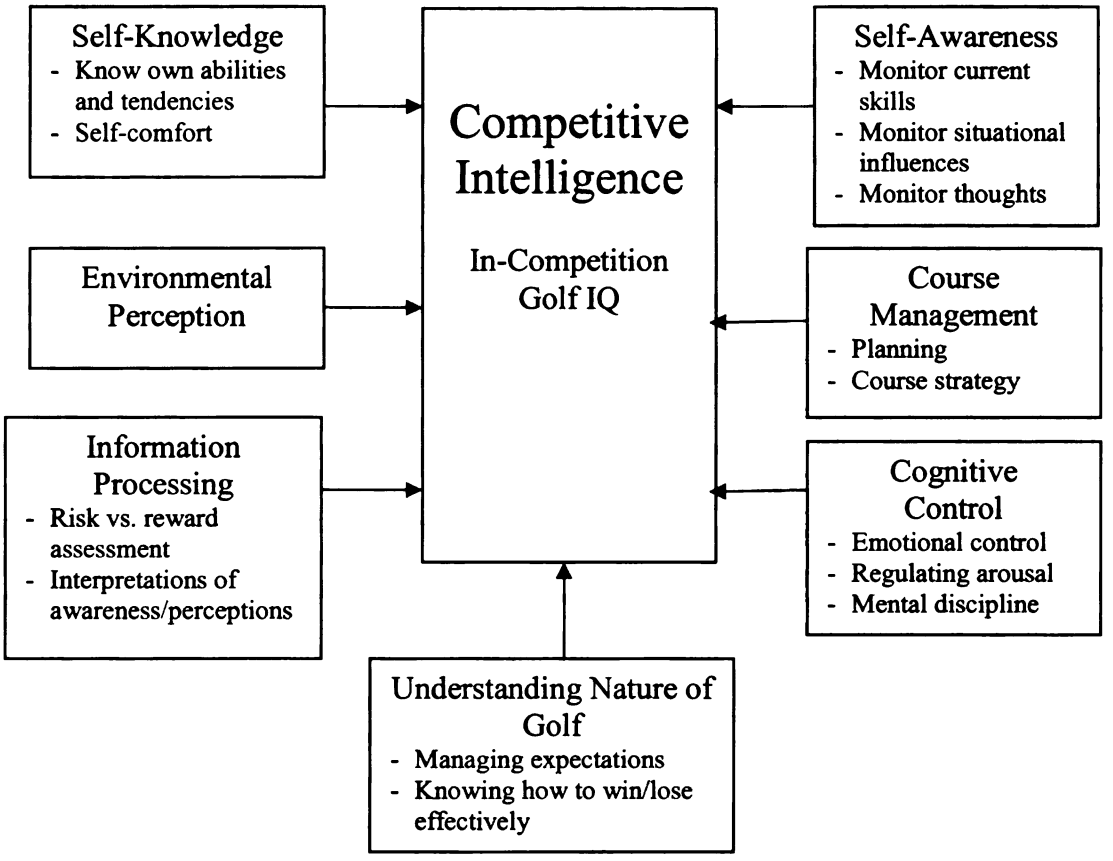

Figure 2. A proposed conceptualization of "competitive intelligence" for golf.

Competitive golf intelligence (or "golf IQ", the term the coaches liked to use) is theoretically similar in many ways to a few previous definitions of sport intelligence that had appeared in the literature from others sports. Components of the in-competition golf IQ such as course management, environmental perception, and information processing are conceptually related to the in-game perceptual-cognitive processes that characterize prior definitions of sport intelligence. For example, competitive intelligence in golf is conceptually similar to the Falk et al. (2004) version of the concept in water polo where

the sport intelligence of players was judged based their ability to execute in-game cognitive processes like reading the defensive formation correctly and make appropriate decisions about where to pass the ball. In-competition golf IQ is also theoretically similar to the notion of "game intelligence" which is referred to by Williams (2008) in his research on perceptual-cognitive processing in soccer (for a review see Williams & Ward, 2007). Williams' "game intelligence" is based on the ability of the player to perform in-game cognitive tasks such as anticipating the play, making decisions about where to pass the ball, and identifying what defensive tactics should be used.

Importantly, however, competitive intelligence in golf differs from these other "in-game" conceptualizations of sport intelligence in several ways. The makeup of competitive intelligence for golf is considerably shaped by the particular set of cognitive and emotional demands that the sport of golf presents. For example, cognitive processes like anticipation that are critical for open-skill ball sports such as basketball and soccer are not similarly emphasized in golf. Instead, golfers are confronted with the challenge of selecting the proper course of action from a variety of options – many of which are outside the normal capabilities of the player. Making sound strategic decisions requires golfers to be especially adept at making explicit reference to their own skill level and being able to do so in highly emotional situations where they have ample time to second guess themselves. The accurate judgment of one's own capabilities – and the ability to detect slight changes in these capabilities – is of absolute importance in golf for efficient scoring. For example, if a hole is located just over a greenside bunker on the edge of the green, strategy selection in this situation depends on the ability of a player to correctly judge if he or she will be able to achieve the required height and backspin on the shot to

carry over the bunker and stop the ball before it bounces over the green. If the player fails to accurately assess his or her own current skill level (e.g., the player mistakenly believes they can hit the ball high and soft enough to carry the bunker and stop it on the green) then the player may select a strategy option that has absolutely no chance of success (e.g., the player chooses to aim directly over the bunker at the flag rather than avoiding the bunker by aiming towards a more forgiving target at center of the green). Perhaps expectedly then, this investigation found self-knowledge and self-awareness to be critical components of game intelligence in the golf context. The specific cognitive demands of golf dictate that a player must have both accurate baseline knowledge of their capabilities and the ability to track small fluctuations in these capabilities during the course of competition.

Another demand presented by the sport of golf is the amount of idle time inherent in golf competition and the tendency for this time to be filled with task-irrelevant thoughts and unwanted emotions. Coach 14 explained how this particular demand also shapes the makeup of competitive intelligence in golf:

> In golf, there is too much time. There is too much time in the middle of the competition. You know, Michael Phelps has to wait fifty seconds to swim two lengths of the pool. You've got to wait fifteen to twenty minutes on every shot sometimes. So there is a real big part of the golf IQ that is much different than the general sport IQ, because there is all of this downtime. That's why I think something like self-awareness and emotional control are important. Hey, if Michael Phelps gets pissed in a fifty second race he's probably going to get pissed and go hard, or whatever. He might get tired at the end, or whatever, but if you get pissed on the course and you've got four hours left out there it will make a big difference. (C14, Page 10, Tag 6Y)

Being able to exercise cognitive and emotional control (i.e., control emotions, regulate arousal, maintain focus etc.) on the course was considered by coaches as a characteristic of game intelligence – perhaps because of the large amount of time that golfers spend

during competition. Sport psychology researchers may not typically consider skills related to cognitive and emotional control as representative of "sport intelligence" per se – instead perhaps classifying them as coping skills – but the participants in this study believed that cognitive and emotional control was related to game intelligence in the context of golf.

The inherently fickle nature of golf is another demand of the sport that poignantly shapes the composition of golf intelligence. All competitive players aspire to perform at a consistently high level, but the complexity of techniques used in golf and the unavoidable influence of uncontrollable environmental factors on shot outcomes (e.g., a drive down the center of the fairway ends up in a divot) cause inevitable fluctuations in performance for all players. In many other sports, the consistency of an athlete's performance is largely dependent on the athlete being able to maintain a consistently high level of physical effort. For example, the performance of hockey players and distance runners is closely correlated with the level of physical exertion put forth. Athletes in these sports who are able to maintain consistently high levels of physical exertion will likely be able to perform on a relatively consistent basis. Participants in this study expressed that competitive intelligence in golf involves understanding the unique nature of golf – that performance inconsistencies in golf are unavoidable and that increasing intensity or effort does not usually help increase performance in golf. Although they work to eliminate errors and are dissatisfied when mistakes occur, highly intelligent players understand that "golf is not a game of perfect" and they are able to effectively manage their expectations and how they respond to mistakes.

Golf IQ and Emotional Intelligence

Participants considered emotional control to be a characteristic of golf intelligence, and many coaches even described intelligent players as "emotionally intelligent". Emotional intelligence is defined in varying ways depending on the source of the definition (Salovey & Meyer, 1990; Goleman, 1995). The degree to which emotional intelligence fits neatly as a component of the golf IQ is dependent on the particular definition of the term being used. For example, Salovey and Meyer (1990) defined emotional intelligence as the ability to monitor one's own and others' feelings and emotions, to discriminate among them and to use this information to guide one's thinking and actions. Goleman's (1995) definition suggests that emotional intelligence also includes "relationship management" – the ability to inspire, influence, and develop others while managing conflict.

In this investigation sport intelligence in golf is shown include the ability to understand your own temperament, the ability to detect any changes in your emotional state, and the ability to control your emotional state. These aspects of golf IQ are related to self-knowledge, self-awareness, and cognitive/emotional control, and they partially meet the Salovey and Meyer (1990) criteria defining emotional intelligence. However, in this investigation golf IQ does not include any aspects of interpersonal interaction as defined by Goleman (1995). In fact, high golf IQ players were considered to be somewhat "aloof" and "selfish" – two terms that certainly do not describe emotionally intelligent people. Interestingly, the Salovey and Meyer (1990) definition is based on their empirical work on emotional intelligence while the Goleman's (1995) writings are based on his integration and interpretation of the literature and not empirical studies

designed to test his notions. Therefore, in light of this investigation Goleman's contentions should be further examined by emotional intelligence researchers.

The data appear to indicate that highly sport intelligent golfers demonstrate emotional intelligence with respect to themselves but do not necessarily meet the full criteria of emotional intelligence. However, it is possible that emotional intelligence plays a role in the quality of relationships a player develops with his caddie, agent, and coaches. Although participants in this investigation did not suggest that the quality of these relationships is relevant to sport intelligence, in retrospect the investigator would like to have further probed participants about the relationships highly intelligent players develop with their supporters.

In the proposed conceptual framework of competitive intelligence for golf, emotional intelligence is not included as a distinct component. Rather, the more specific subcomponent "emotional control" is included under the broader category of "cognitive and emotional control".

Developmental Intelligence for Golf

Participants also identified characteristics of developmental golf intelligence. Developmental intelligence is the capacity to do things and make decisions that help make sustainable improvements in one's playing ability over time. Developmental intelligence enables players to develop their skills more efficiently, maximize their talent over the long term, and ultimately achieve sustainably high levels of performance. In other words, players with a high developmental IQ possess a "developmental" advantage.

The suggestion of a possible developmental intelligence for golfers (Figure 3) builds on the serendipitous findings of Gould et al. (2002), who were the first to identify

characteristics from outside the competitive situation (e.g., learning ability, tacit understanding of elite sport) as being relevant for sport intelligence. This investigation proposes developmental intelligence in golf to include the ability of the player to know themselves very well with respect to the idiosyncrasies of their own technique, their own individual learning style, and how they best prepare to perform optimally. Developmental golf IQ is also proposed to include a player's ability to self-regulate their training – i.e., their ability to accurately evaluate their own skills, identify areas of weakness, and discover tendencies during practice sessions. Also, this investigation proposes developmental sport intelligence to include attitudinal factors such as the ability to think in confidence-building ways and resist the social norms of the sport. Finally, the current study suggests that developmental golf IQ includes the ability of a player to understand of the elite sport process – i.e., highly intelligent golfers realize the intensity and comprehensiveness of training required to achieve high performance, and follow a systematic plan for development.

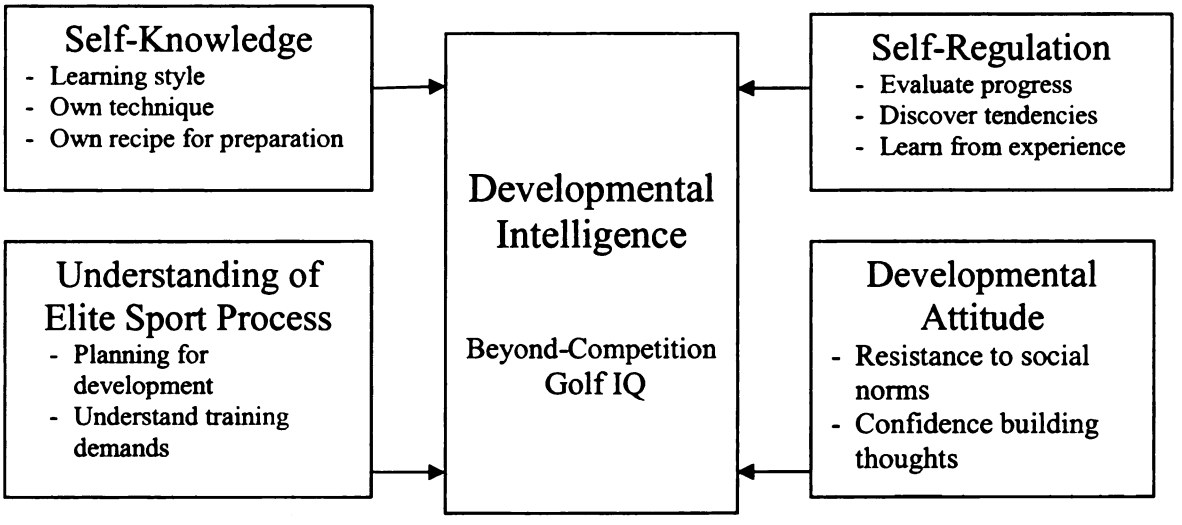

Figure 3. A proposed conceptualization of "developmental intelligence" for golf.

Developmental intelligence is a concept emerging from this study that has not been suggested by other scholars. Participant responses in this study directly supported the existence of developmental intelligence in the golf context. However, from both intuitive and evidence-based perspectives, it is possible that the concept of developmental intelligence could apply across sporting contexts.

Intuitively, we know that athletes develop skill at varying rates. Environmental factors such as the availability of resources and the quality of coaching are responsible for a portion of differences in the rate of skill development. Similarly, genetic factors such as the predisposition for height or muscle fiber composition (i.e., proportion of fast twitch and slow twitch muscles) impose physical constraints which also influence skill development. However, we still see cases where athletes from very similar training environments with similar physical attributes experience significantly different rates of skill improvement. A further explanation for these differences could be that some athletes are *cognitively better at the process of talent development* than others – that is, athletes who experience the most efficient rates of skill development are better at figuring out how to train properly in a particular domain, better at cognitively engaging in deliberate practice, better at self-regulating their training, they know how they learn most efficiently, they are better at understanding the type of commitment that is required to reach high levels of performance, and they are better at creating and following a plan to reach higher performance standards. In other words, it's possible that a set of cognitive skills (i.e., developmental sport intelligence) may moderate the efficiency by which athletes develop their talent. Existing literature provides some preliminary support for

how developmental sport intelligence is proposed and conceptualized in this investigation. This research is outlined below.

Developmental Sport Intelligence and Self-Regulation

The current study proposes self-regulation to be a significant component of developmental sport intelligence in golf. Self-regulation has been defined by researchers as the processes by which people manage their own goal-directed behaviors (Kirschenbaum, 1984) and the degree to which individuals are involved in their own learning process (Kitsantas & Zimmerman, 2002). Kirschenbaum (1984) proposed the self-regulation process to include the following components: First, the athlete must have the ability to identify a problem, determine that change is possible, and accept responsibility for its solution. The athlete must then commit to making the change. Next, the athlete must execute the change by engaging in self-monitoring and self-evaluation, developing strategies for self-reinforcement and punishment, and demonstrating sustained effort through setbacks. During the change process the athlete must also formulate strategies to manage the social and physical environment (e.g., seek necessary assistance from coaches). Finally, the athlete must sustain these behaviors over long periods of time.

Of interest to the current investigation is the relationship between self-regulation and the learning process. Education researchers have studied the influence of self-regulation on learning in school situations, and their findings demonstrate the importance of self-regulation for efficient and sustainable learning. For example, Schunk and Zimmerman (1994, 1998) found that the level of learning attained by students varied depending the presence or absence of self-regulation skills such as (a) setting specific

proximal goals for oneself, (b) adopting powerful strategies for attaining the goals, (c) monitoring one's performance selectively for signs of progress, (d) restructuring one's physical and social context to make it compatible with one's goals, (e) managing one's time use efficiently, (f) self-evaluating one's methods, (g) attributing causation to results, and (h) adapting future methods (Schunk & Zimmerman, 1994; 1998).

Presumably, then, individuals who are able to adopt self-regulation skills would also be able to demonstrate more efficient learning in sport. However, the specific relationship between self-regulation and athletic talent development has not been extensively researched. A review of self-regulation literature in sport psychology (Gould & Chung, 2004) indicated that most sport psychology research pertaining to self-regulation either (a) examines the processes by which self-regulation skills such as goal setting and imagery can be most effectively taught to athletes, or (b) tests the immediate impact that these newly acquired self-regulation skills have on a small number of subsequent performances. In general, few studies in sport psychology explore the influence of self-regulation on learning in sport over an extended period of time (Gould & Chung, 2004).

One exception is a study by Kirschenbaum, Owens, and O'Connor (1998) that tested the effectiveness of a self-regulation training program called "Smart Golf" on the performance of 5 experienced recreational golfers. The training program included an 8 hour seminar that was designed to teach players skills such as mental preparation, planning, and positive focusing. Also, the training program included a process-oriented scorecard that helped golfers track their self-regulation skills during play. Upon completion of the training program each of the golfers showed improvements in

performance as indicated by handicap and stroke average data that was collected 3 months later. It should be noted, however, that the operational definition of "self-regulation" used by Kirschenbaum et al. (1998) focused on in-competition cognitive skills without considering cognitive skills that occurred outside of competitive play during practice or preparation. For example, many of the skills taught in the training program were designed to improve competitive intelligence (e.g., in-competition cognitive skills such as focusing before the shot). The subsequent performance gains experienced by these recreational participants were most likely due to improvements in the competitive intelligence area. Kirschenbaum et al. (1998) demonstrated an initial link between self-regulation and performance in golf, but their study did not assess how self-regulation impacts the long-term developmental intelligence skills referred to by participants in the current study (e.g., self-monitoring during training, understanding own technique, etc.).

Although researchers have yet to study the relationship between self-regulation and long term athletic talent development directly, preliminary evidence suggests that self-regulation may discriminate between more and less successful athletes. For example, a study by Anshel and Porter (1996) examined the degree to which elite young adult and non elite young adult swimmers engaged in Kirschenbaum's (1984) processes of self-regulation. They found that the elite swimmers engaged in self-regulatory behaviors more often than the non-elite swimmers before and during competition. Also, Cleary and Zimmerman (2000) compared the self-regulation habits of expert, non-expert, and novice basketball players during practice activities. Compared to the other players, researchers found that the expert basketball players engaged in the most self-regulation during

practice. However, their study did not determine whether basketball players acquired expertise because of a tendency to self-regulate or if the presence of their expertise triggered more self-regulation during practice.

Direct investigation into the relationship between self-regulation and long term talent development would provide valuable insight about the importance of self-regulation for talent development and developmental sport intelligence.

Developmental Sport Intelligence and the Theory of Deliberate Practice

Based on extensive research, Ericsson et al. (1993) introduced the theory of deliberate practice as a means to explain the particular causal mechanisms generating improved performance and the acquisition of expertise. "Deliberate practice" refers to training activities that are specifically intended to improve the performance of an individual. According to Ericsson and colleagues (1993), deliberate practice is characterized by an active attempt to improve beyond current capabilities, intense concentration during training, the presence of feedback, and a potential lack of intrinsic pleasure involved in the activity. Numerous researchers have demonstrated a correlation between hours of deliberate practice and level of performance in several domains (see Starkes & Ericsson, 2003 for a review). Thus, deliberate practice is widely regarded as the key to acquiring expertise in skill-based activities.

Ericsson (2008) proposed that a primary differentiator in separating those who reach elite levels of performance from those who do not is the willingness and ability to engage in sufficient amounts of deliberate practice. In order for practice activities to truly qualify as "deliberate" several stringent requirements must be met. To meet these deliberate practice requirements effectively there are certain cognitive skills that an

athlete must possess. For example, since most deliberate practice occurs alone, athletes must be able to self-regulate and self-monitor during training. Also, since deliberate practice is highly dependent on feedback, athletes must be able to create and interpret self-generated feedback during training. Additionally, athletes must be able to identify correct methods and modes of practice that will most efficiently lead to skill improvements.

The degree to which athletes are able to meet the cognitive requirements necessary to properly engage in deliberate practice may be a function of developmental sport intelligence. Some athletes are able to meet these cognitive prerequisites more effectively than others. For example, participants in this study explained how intelligent golfers are better able to monitor the intensity of their focus while on the practice range, better able to create and interpret self-generated feedback while practicing their chipping, and better able to choose the correct putting drill for correcting a particular flaw in their stroke. Accordingly, these "high developmental IQ players" will experience more efficient and more sustainable skill development than their counterparts.

Developmental Sport Intelligence and Motor Learning Theory

Contemporary research in motor learning suggests that "skill acquisition is highly cognitive" (Lee et al., 1994). In order for learning to be most efficient, the learner must be an active participant in the learning process rather than a passive recipient of information (Schmidt & Lee, 2005). For example, while learning a novel motor task, students who actively engaged cognitively and experimented with techniques while receiving minimal feedback learned motor skills more permanently than students who learned passively and received feedback after each attempt (Schmidt & Lee, 2005). Thus,

motor learning theorists assert that the effectiveness of the learning process is dependent on cognitive factors having to do with the learner in addition to being dependent on environmental factors such as the quality of instruction. This assertion implies the existence of a cognitive individual-difference variable – such as developmental sport intelligence – that affects the rate at which individuals may develop motor skills in sport. The concept of developmental sport intelligence may explain why some athletes are able to engage in the learning process in optimal ways while other athletes remain passively disengaged.

Developmental Sport Intelligence and Socialization

Possessing an "attitude for development" is proposed to be a component of developmental sport intelligence by this investigation. In particular, the current study suggests that high developmental IQ golfers are able to think in confidence-building ways and resist the social and behavioral norms created by those involved in the sport which inevitably pull the athlete towards average performance – such as the habit of complaining about bad breaks or the desire to "over train" in an effort to break out of a slump. Participants in this investigation suggested that highly intelligent golfers could sometimes be socially awkward and resistant to social norms. They were described as "selfish" – not in a malicious way, but rather in a way that would "allow them to do what was necessary to perform well even if it meant going against the grain" (C7). Although seemingly counterintuitive, this finding is partially supported by Rotella (1990) who writing from a professional practice perspective discussed that athletes must "avoid being socialized" into mediocre or average habits if it was the desire of the athlete to achieve elite (i.e., abnormal) levels of performance. Rotella (1990) explained that the social

norms and standards of particular sporting environments are established by the attitudes held by the majority of participants, most of whom do not reach extraordinary levels of performance. Therefore, Rotella (1990) proposed that athletes who wish to attain levels of performance beyond "normal" must be comfortable behaving in ways that may not fully align with social norms.

Limitations and Epistemological Considerations

A Conceptual Limitation of Intelligence Research

Investigations pertaining to the study of intelligence are inevitably subject to a conceptual limitation that must always frame discussions of intelligence research findings: Intelligence is an abstract concept that cannot be defined or discussed in concrete terms (Martinez, 2000). Qualitative descriptions of intelligence do not actually describe intelligence itself, but rather are descriptions of the products or "outputs" of that intelligence. Similarly, IQ tests don't measure intelligence directly in the same way that a ruler measures length or a beaker measures volume. Rather, IQ tests assess performance on certain tasks that are presumed to indicate the level of intelligence a person may have.

This conceptual limitation in the larger field of intelligence research influences how the results of the current study are interpreted and discussed. Qualitative interviews in the current study primarily consisted of practical discussions that referenced the outputs of sport intelligence rather than the precise conceptual makeup of sport intelligence. Participants gave elaborate characterizations of sport intelligence when they discussed real-life examples of intelligent players (e.g. "He always knew what type of shot to play in any situation") or spoke using directives as if they were coaching the interviewer to become an intelligent player (e.g., "You've got to know what you can or

cannot do in that situation"). They were far less articulate when they attempted to speak about the components of sport intelligence on an abstract conceptual level. In other words, in this study the coaches frequently discussed examples of *what highly sport intelligent golfers do* (i.e. the products or outputs of sport intelligence) rather than *what sport intelligence conceptually is.* Their preference for speaking in concrete terms was hardly surprising considering the extensive practical experience that characterized the background of these coaches and the nature of their position which requires them to convey practical information to players.

In light of this conceptual limitation, it should be noted that the conceptualization of golf-specific sport intelligence proposed and discussed in this investigation could not be constructed based solely on verbatim participant interview responses without a degree of interpretation of these responses during analysis. Participant responses were comprised of detailed descriptions of the concrete *characteristics* of golf-specific sport intelligence (e.g., "intelligent players are able to perceive the environment better than other players") which required interpretation by the investigator to produce findings regarding the conceptual *components* of golf-specific sport intelligence (e.g., the ability to perceive the environment is a component of golf-specific sport intelligence).

Positivists may question the validity or generalizability of a conceptual framework that is dependent on investigator interpretations of qualitative data. However, the naturalistic epistemological orientation that guides this investigation – and a great deal of exploratory qualitative research – does not consider investigator interpretation of data as a limitation that diminishes the usefulness of findings, provided that the investigator is very clear and transparent relative to the process of analyzing and

interpreting the data and that the data is characterized by detailed description of the subjects responses.

Limitations to Transferability

As is normally the case in naturalistic qualitative inquiry, the extent to which the findings of this investigation should be generalized or transferred to other contexts and individuals is for the reader to decide. A few possible limitations of generalizability – or transferability, as it is called in the qualitative literature – should be acknowledged. First, the participants included in this study were all male, and primarily coached male golfers. It is possible that female coaches, or coaches who had more experience instructing female players, may have provided a different conceptualization of golf-specific sport intelligence. Also, it should be noted that the influence of culture was held constant in this study – the coaching and life experience of all participants had occurred primarily under the influence of North American cultural norms. It is possible that the conceptualization of golf intelligence could vary to some degree across cultural contexts. Golf coaches who operate under different cultural norms (e.g., Asian) may view golf intelligence somewhat differently than the participants of this study.

Epistemological Considerations

The naturalistic epistemological orientation of the current study should be considered when making an interpretation of the findings. From a conceptual point of view, the proposed frameworks of "competitive intelligence" and "developmental intelligence" cannot necessarily be validated in a positivistic sense. The investigator of this study recognizes the long-standing debate in the larger field of intelligence centered around the existence of a single general intelligence or separate multiple intelligences,

and acknowledges that the ideas proposed in this investigation are complicated by this debate.

From a methodological point of view, the fact that the responses of only 16 coaches were included and that these coaches were selected by a snowball convenience sampling technique could be considered limitations of this study by a positivistic standard. Also, due to funding constraints the undergraduate research assistant was only able to independently code and assess inter-rater reliability for 15% of the interview data, thus leaving a possibility that that some bias might be involved because 85% of the data was not checked. Ideally, the investigator would have preferred 100% of the data to have been coded and independently verified but this was not logistically and financially possible.

Importantly, however, making claims about the structure of intelligence according to the guidelines of traditional positivistic science was not the goal of this study. Rather, researching sport intelligence from a naturalistic paradigmatic view enabled the use of an exploratory methodology most suitable for taking a first-step toward establishing a systematic line of inquiry in this relatively unexplored area.

The exploratory design of this dissertation featured a number of strengths that should increase confidence in the findings – not the least of which was the extraordinarily qualified and experienced group of expert coaches, who can most assuredly be considered an appropriate group with whom to discuss the makeup and importance of golf intelligence in an exploratory fashion. Additionally, several measures were taken to ensure the trustworthiness of data in this study, including (a) member checks, (b) independent data coding to assess inter-rater reliability, (c) peer debriefing, (d) disclosure

of investigator a prior considerations, and (e) reflexive journaling by the investigator during the research process.

Practical Implications

This dissertation raises several practical implications, both for golf coaching and the practice of talent development more generally. These implications are outlined below.

Training golf-specific sport intelligence. This study proposes a conceptual framework that specifies the particular components of "competitive intelligence" for golf. This framework helps to eliminate the ambiguity faced by coaches when attempting to teach players to "play smart", and should be used as a tool to train the components of golf intelligence in a structured and targeted fashion. Perhaps a golf IQ assessment instrument could be developed to help coaches assess their players on each component of golf intelligence, further enabling targeted and efficient feedback.

Training developmental sport intelligence. The potential existence of a cognitive skill set that facilitates skill acquisition and performance improvements in golf implies that this skill set could be trained. In addition to being taught the skills and techniques of golf, young players should also be "taught how to develop". For example, they should be taught about learning styles and be challenged to explore how they best learn; they should be taught how to self-regulate their training; and they should be taught about the type of commitment required to achieve high performance. Explicitly training developmental sport intelligence should enable young players to make sustainable skill improvements more rapidly.

Customizing talent development programs for varying levels of developmental intelligence. Different developmental strategies are appropriate for golfers with different

levels of developmental sport IQ. Coaches should structure training and talent development programs based on the level of developmental sport intelligence they feel an athlete may possess. For example, a golfer with a tremendously high level of developmental sport intelligence has very different needs than someone who doesn't know how they best learn and isn't able to self-regulate their training.

Developmental intelligence may explain the transfer of skills between sports. The concept of developmental sport intelligence may in part add to the conversation regarding the notion of skill transfer between sports. Although existing evidence that suggests that the actual transfer of skills between sports that share few common elements is relatively low (Schmidt & Wrisberg, 2008) many coaches intuitively know of people who are able to pick up new sports and perform them at a relatively advanced level fairly easily. Coaches often explain this apparent ease of learning by attributing it to "natural athletic ability".

However, extensive research performed by Ericsson and colleagues has repeatedly proven that proficiency in *skill-based activities* is primarily dependent on the amount deliberate practice performed by an individual (Ericsson, 1996; 2001; 2008; Ericsson et al., 1993) and not on any sort of "natural talent". Even in the most extreme cases of apparently precocious talent – such as the cases of Mozart, Tiger Woods, and Bobby Fisher – the extraordinary levels of performance reached by these individuals can be attributed to the fact that they engaged in extensive amounts of deliberate practice at a very young age rather than having a mysterious "natural ability" for the skill (Colvin, 2008).

It is possible that the "transfer" of skill between sports that some athletes demonstrate is actually the product of high developmental sport intelligence – that is, regardless of the context, these athletes are able to effectively engage in deliberate practice, self-regulate their training, learn efficiently, and understand what they have to do to get to higher levels of performance. Actual skills do not transfer from sport to sport but the *ability to learn and develop skill* (i.e., developmental sport intelligence) does transfer across sporting contexts.

Future Research Directions

Exploration of developmental sport intelligence. The emergence of "developmental golf intelligence" as a set of cognitive and emotional characteristics that is related to the ability of an individual to developing sustainable competence in golf is a serendipitous finding of this study. Further exploratory research should be performed to investigate the existence, components, and antecedents of "developmental sport intelligence". The extent to which developmental sport intelligence may be transferable or generalizable across contexts should also be investigated. As a starting point for exploratory research, scholars should investigate the proposed components of developmental sport intelligence within a talent development framework. For example, researchers should directly evaluate the impact of self-regulation on the efficiency of the long term athletic talent development process.

Exploratory sport intelligence research in other sport-specific contexts. The unique cognitive demands of golf shaped the components of sport intelligence in the golf context. It is likely that sport intelligence in other contexts is also shaped by the specific

demands of those particular sports. Thus, future studies of sport intelligence should also be sport-specific in order to take into consideration the unique demands that a particular sport presents. Another option would be compare sport intelligence across selected sports so that its more general versus sport-specific components could be identified.

Development of sport intelligence. Understanding the components of golf intelligence raises the important question of how sport intelligence in golf is acquired and developed. Researchers should investigate this question from both theoretical and practical perspectives.

Given the apparently complex and multidimensional nature of sport intelligence, the dynamical systems approach could be a useful theoretical framework for considering its development. Dynamic systems theory is a general approach to scientific theorizing that originated in mathematics and physics as a way to describe the behavior and development of complex physical and biological systems. Over time, dynamic systems theory began to emerge in other disciplines and became associated with other non-linear theories like Complexity Theory, Chaos Theory, and Pattern Theory (Ulrich, 2007). Recently, dynamic systems theory has been applied to research in motor development (Kelso, 1995) and cognitive development (Thelen & Smith, 1994).

According to dynamic systems theory, the behavior of a complex system is thought to emerge from the confluence of multiple, highly interactive subsystems (Ulrich, 2007). The overall behavior of a system changes over time as subsystems evolve, and change is often non-linear, shifting from one distinct pattern to another when the level of one particularly relevant subsystem reaches a sufficient threshold. For example, Thelen and Ulrich (1991) proposed that the natural development of walking behavior in infants

was the product of dynamic interactions among several factors, including (a) the flexor-extensor balance of the leg muscles, (b) arousal, (c) general motor maturation, and (d) leg posture during stepping. The researchers were able to prematurely induce a walk-like stepping response in infants by modifying a critical subsystem – infants were placed on a moving treadmill, which modified the flexor-extensor balance of the leg muscles by stretching the leg to a threshold point where it could be recoiled, subsequently inducing a walk-like stepping response. Thus, the development of infant walking was shown to be a dynamically emerging system, with the flexor-extensor balance of the leg muscles serving as a critical subsystem that needed to reach a particular threshold for walking behavior to develop.

Previous studies have provided evidence that supports the notion that the development of psychological characteristics in elite athletes is also likely the result of a dynamic interaction among several factors, such as sport experiences and the influence of peers, coaches, and parents (e.g., Hanton & Jones, 1999; Gould et al., 2002; Durand-Bush & Salmela, 2002; Connaughton et al., 2008). Thus, it is probable that the development of sport intelligence in particular is also a product of a complex set of interactions among a multitude of factors – such as the physical ability of the athlete, the emotional maturity of the athlete, and the coaching experiences the athlete has been exposed to. For example, players who develop superior physical technique may have a wider range of strategic options to choose from, thus influencing the development of their decision making processes. Similarly, emotionally mature athletes may have the mental discipline required to correctly and objectively perceive a particular situation while the perceptual abilities of less mature athletes may be skewed by emotion. Furthermore, it is likely that the

idiosyncrasies of coaching styles in particular sporting contexts may uniquely influence how sport intelligence is developed in those contexts.

Researchers should explore the relationships among the interacting factors that may influence the acquisition of sport intelligence, and examine which of these factors are most critical for its development. The dynamic systems theory may provide a useful framework for understanding the development of sport intelligence.

Trainability of sport intelligence. The methods for training sport intelligence and the degree to which sport intelligence can be trained in athletes should be examined. Researchers should identify the most efficient ways for training sport intelligence in athletes, and explore the appropriate chronological age, physical age, and stage of development at which to introduce sport intelligence training programs.

How this Study Contributes to Sport Science Knowledge

Fundamentally, this dissertation adds to knowledge about the role that the capacity one has for thought plays in sports. It provides a new way to think about the influence of cognition in both athletic performance and talent development. In particular, the identification and conceptualization of "competitive intelligence" and "developmental intelligence" as distinct sets of intellectual and emotional skills advances how researchers and practitioners should view performance enhancement and long term talent development. Competitive intelligence is a factor that must be taken into account when analyzing athletic performance. Developmental intelligence is a factor that must be considered when thinking about athletic talent development. Developmental intelligence may perhaps serve as a conceptual explanation as to why some athletes are able to properly engage in and benefit from "deliberate practice" while others are not. The

concept of developmental intelligence adds clarity and logic to "deliberate practice" accounts of talent development, which have often been subject to criticism as being overly simplistic and reductionistic (Simonton, 1999).

Conclusion

This exploratory study served as an important first step towards gaining a greater understanding of sport intelligence and how it may apply in golf. The findings are thought provoking in both theoretical and practical ways. From a theoretical perspective, this investigation proposed the possible existence of developmental sport intelligence – a set of cognitive abilities which may influence the rate and efficiency by which individuals develop their athletic talent. On a practical level, this study proposed a framework outlining the particular components of sport intelligence in golf that will help coaches to evaluate and train golf intelligence in their players. It is the hope of the author that this dissertation will help players of all abilities to both perform at a higher level and derive more enjoyment from this great sport of golf.

APPENDIX A

Interview Guide

Preamble:
I'm interested in the idea of sport intelligence and how it is developed in athletes. For example, we often hear announcers talk about a player having a "high basketball IQ" or being a very intelligent player. In golf we sometimes hear announcers describe players as expert tacticians and being very good at managing their games. We're often told as golfers that we need to be smart, and that playing intelligent golf is a way to save shots. I'm interested in looking at the idea of "smart golf" and "intelligent golf" more closely, and identifying specifically what it means to be a smart player. For example, in golf, specifically what behaviors and tendencies differentiate an intelligent player from a not-so-smart player? In other words, I'm interested in identifying exactly what an intelligent player does that gives him or her a competitive advantage over other players, both on the course in competition and also in their general approach to the game. Are you clear about what we are going to talk about? One thing that we know about interviewing is that in order for us to fully understand the subject we are discussing, we are sometimes redundant and may ask questions that appear similar or repetitive. This is for our understanding and to make sure we can capture all of your knowledge, so don't let that frustrate you. Do you have any questions?

Semi-structured/exploratory questions:

1. To start, I'd like you to think generally about what it means to be an intelligent player, and to have a high golf IQ. What do you think it means to be a "smart player"?

2. If you would, could you think about 2 or 3 specific players who you believe to be very smart players? What struck you about these players that made you feel they were smart?

3. Also, can you think about 2 or 3 players who you feel aren't very smart or intelligent players? What did these players do that made you feel that they didn't approach the game in a smart way?

4. Now I'm going to ask you a bit of a conceptual question. If you had two people, let's say students in school, that you were evaluating for general IQ, you would measure particular components like math ability, verbal ability, and writing ability to get an overall picture of their IQ. The individual scores on those components would sort of total up to equal their overall IQ. Now let's say you had two players, and you had to study them and determine which player had a higher "golf IQ", what are some of the specific things in golf that you would consider in order to get an idea of the overall "golf IQ" of these players?

5. Specifically, what does an intelligent player do on the golf course that gives him a competitive advantage over other players in the field? What about off the course?

6. In addition to on-course differences during competition, can you think of the differences that may exist between an intelligent player and a not-so-smart player in other aspects of the game out of competition?

    - Does golf intelligence have anything to do with swing mechanics?
    - Does golf intelligence have anything to do with practicing?
    - Does golf intelligence have anything to do with understanding equipment?
    - Does golf intelligence have anything to do with taking advantage of sport science?
    - Does golf intelligence have anything to do with making changes to technique and other things?

Questions referring to definitional diagram:

In sport psychology there exists an intellectual ability called "sport intelligence" that is made up of several components, similar to how general intelligence is made up of areas like math ability and verbal ability. Previous research with Olympic athletes has proposed that this idea of sport intelligence is related to the following components (list these-give picture of model). You've already mentioned several of these ideas in the context of golf.

Show model that includes a sentence description of what each component is.

For each component:

- Does _____ have anything to do with golf intelligence?

- Are we missing any possible components from this diagram that we don't see here?

For each component that the subject believes is important:

1. What does _____ mean in context of competitive golf?
2. Do you think _____ contributes an elite players' sport-intelligence?
3. If so, in what way does_____ contribute to the sport-intelligence of a player?

At the end:

- Now that we've discussed golf-specific sport intelligence in more detail, do you feel like there are any additional components or factors that should be included?

APPENDIX B

Investigator Self-Reflection Journal

May 15th, 2008

As the first few interviews have been gathered I'm really trying not to lead the respondents in any particular way. It's a little difficult to get them to articulate fully on some of the more obvious aspects of golf IQ, since they know that I have an extensive background in the game and that they feel they don't need to fully explain certain things (like course management and decision making).

May 20th, 2008

I'm starting to hear the same things from several different people. For example, most people have emphasized the importance of self-awareness for the golf IQ. Everyone has obviously talked about decision making and course management.

May 31st, 2008

As interviews progress I now have a great feel for how the respondents are interpreting my questions. Sometimes how they interpret my questions determines the content of their answer. For example, when I ask them about the importance of having a tacit understanding of elite golf for golf IQ, it often depends on which examples I use (or which example they latch onto) for determining their response. When they latch onto the example of 'players handling the demands of fame and their agents', most people don't feel this is a golf IQ related example. However, when they latch onto something like 'handling career demands' and think of time management or making responsible decisions off the course, they do feel like it is a part of golf IQ.

June 6th, 2008

Some interviews aren't lasting as long as others. I do probe properly, but the really smart coaches have clearly already thought about this topic and have some fairly concise but complete answers.

June 12th, 2008

Another thing I've noticed about the coaches and their answers is that they are most comfortable giving feedback to me in an instructive form. They don't articulate or think very well in abstract or theoretical terms. They do much better if they talk about this topic as if they are instructing me, or if they are talking about what a great player should be like. For example, when building the model of sport intelligence in golf, they are less likely to say something like "I feel that perceptual ability is important for the model of golf IQ." Instead, they will say "Oh, yeah, that's really important, all smart players have

that", or "You've got to pay attention to what is going on around you. You have to be perceptive if you want to play smart".

July 1st, 2008

Doing an interview over the phone is slightly difficult because I cannot hand the interviewee the chart that I use at the end of the interview. The person who I interviewed over the phone was very smart, and understood what I was saying as I described the chart, but if I have to do any more phone interviews then I will have to make sure that the person clearly understands what I am saying.

July 23rd, 2008

Some of the interviews have been complicated by the interviewee being interrupted several times because of phone calls from players. While this is inconvenient and unfortunate, I suppose that is what happens when trying to interview very busy people. I'm not sure if the interviews are of high enough quality to be included as data.

July 27th, 2008

I have to make sure that some of the participants clearly distinguish playing ability from golf IQ. We are trying to identify the set of cognitive abilities used to enhance playing ability, so there is a relationship between playing ability and golf IQ, but it's sometimes difficult for them to separate the two ideas. I use the example that caddies can have a high golf IQ to make clear the idea that we are talking about a cognitive skill set – not necessarily the ability to execute a golf shot.

August 15th, 2008

Sometimes I have to give concrete examples of abstract terms (that I hope aren't leading the interviewee) because I feel that they are better able to think about the issues in concrete terms. For example, rather than thinking in terms like "perceptual ability" and thinking about whether this is a golf IQ skill, they are better able to think about "green reading" or "determining the direction of the wind" while discussing the importance of perceptual ability to golf IQ. Hopefully these concrete examples aren't leading the interviewee.

August 17th, 2008

Many respondents are making a distinction between learning strategies and learning techniques when they discuss golf IQ. Most are saying that learning strategies is a golf IQ related skill, while learning techniques is not. Instead, they feel that learning techniques involves other factors like instructor skill, teaching style, and the learning style of the student rather than the golf IQ of the student (this is probably because they are teachers, I bet if I asked players they would thing physical learning is related to golf IQ). However, they do say that the *understanding of the change and understanding of the need for the*

change is related to golf IQ, and that this understanding may help accelerate a change. I will have to consider this when I complete the analysis. Also, I should look up research that examines the importance of fully understanding a motor skill change as a variable influencing the speed of the motor skill change.

October 13th, 2008:

After finishing an interview with a coach, I am beginning to reconsider how I'm thinking about this topic. This coach raised a great point about how it is likely that there are 2 distinct 'golf IQ's'. There is the set of skills and abilities to perform the on-course, in-the-present-moment tasks to get the ball from point A to point B during the round. This "in-competition" or "on-course" IQ involves good decision making, an awareness of your own abilities at any point in time, perceptual ability to determine wind and other environmental conditions, mental processing of risk and reward, mental control skills to focus the mind on the task at hand, and then learning ability to learn from one shot to the next. This is different from the "off-course" or "developmental IQ", which is more related to the ability to improve and maintain a sustainable career at the highest level. The "developmental IQ" includes an awareness of what you need to do to get better, your learning ability for making changes, your understanding of fitness and nutritional aspects of high performance, your understanding of your own learning style, your ability to practice and prepare properly, and other things that don't pertain to on-course success. It is possible that there is some carry-over between these two IQ's (e.g., if you understand the importance of fitness and nutrition, then you will be better able to make clear decisions at the end of the round) but there are many examples of players who have high on-course IQ's and relatively poor developmental IQ's (e.g., John Daly, Fred Couples). I will have to think about how the data represent this idea.

October 30th, 2008:

As I've started to analyze the data, many patterns are emerging. One notable pattern is the idea that self awareness is mentioned as being very important by every respondent. As I read the transcripts, I'm beginning to think that each of the factors related to golf IQ is not equal, and that they are in some way sequential. For example, which every coach has said that decision making is a critical element of golf IQ, it's clear that there are other factors that influence decision making. For example, using highly developed self-awareness and perceptual abilities is crucial for providing the right information to make the decision. Also, the ability to weigh risk and reward (in any given situation) also directly affects the accuracy of decisions. I will have to consider how these factors are related to each other when coming up with the model or definition of golf IQ.

November 17, 2008

Sam (the undergraduate research assistant) is independently coding 3 pages of each transcript. The random sections were selected by him randomly selecting a name from the list of participants and coding pages 1-3 for that interview. Then, for the next person on the list, he coded pages 2-4. He followed this pattern- starting again from the beginning

of the transcript when he reached the end. We will compare our codes as a check to ensure trustworthiness of my analysis. In addition, we will look over all of the codes from all of the transcripts in order to reach consensus on subthemes, themes, and overall categories.

November 24, 2008

Today Sam and I sat down and checked my coding for bias by examining how his 3 page sections of codes matched up with my codes in those sections. In almost all cases we saw the data exactly the same – this provides me with further confidence that I am not letting my golf background bias my interpretation of the data, as Sam doesn't really have any golf background beyond that of a casual recreational player. There were a few statements that he didn't tag where I did, and vice versa. We handled these situations by coming to consensus from rereading the sections of text and agreeing about what the interviewee was trying to say.

APPENDIX C

Research Participant Information and Consent Form

You are being asked to participate in a research project. Researchers are required to provide a consent form to inform you about the study, to convey that participation is voluntary, to explain risks and benefits of participation, and to empower you to make an informed decision. You should feel free to ask the researchers any questions you may have.

Smart Golf: Sport intelligence and its development in elite golfers.
Dan Gould, Ph.D., and Kevin Blue
Department of Kinesiology, Michigan State University
205 IM Sports Circle, Michigan State University, East Lansing, MI 48824

PURPOSE OF RESEARCH:
You are being asked to participate in a research study of about sport intelligence and its development in elite golfers by researchers from Michigan State University. You have been selected as a possible participant in this study because you have been identified as an expert golf coach. From this study, the researchers hope to learn the components of sport intelligence in the context of elite golf. For example, we are interested in the particular intellectual skills that are possessed by elite golfers who are known as smart players. In the entire study, approximately 15 expert coaches and 15 elite players are being asked to participate. Your participation in this study will take about 2 hours. You must be at least 19 years of age to participate in this study.

WHAT YOU WILL DO:
If you choose to participate as a subject in this research, you will be interviewed by the researcher regarding sport intelligence in the context of elite golf. First, the investigator will explain the interview process to you, along with the particular topics that will be discussed. Next, you will participate in an interview that will be audio-recorded. Finally, after your interview responses have been reviewed by the researchers, you will be sent a summary of your responses in order to verify that your answers were interpreted accurately. Once the entire project is completed you will receive a summary of its findings.

POTENTIAL BENEFITS:
The primary benefit to you for taking part in this study is the opportunity to reflect in detail about the strategic and intellectual aspects of elite golf. Many people find that participating in interviews is an opportunity to think in depth about aspects of their expertise that they haven't considered for a while, and find the exercise to provide them with new ideas. In addition, your participation in this study may contribute to the understanding sport intelligence and its development in elite golfers.

POTENTIAL RISKS:
There are no foreseeable risks associated with participation in this study. However, please remember that responses will be audio recorded for analysis.

PRIVACY AND CONFIDENTIALITY:
All interviews will be audio recorded. If you do not wish for your interview to be audio recorded, you will not be eligible for this study. Although your responses will be audio recorded, the data for this project will be kept confidential. Your confidentiality will be protected to the maximum extent allowable by law. When your responses are analyzed, all potentially identifying

information (such as all names and identifiable accomplishments) will be replaced with coded names. Your recorded interview responses will be transferred from the recording device to an audio file which will be stored privately by the investigators. The only people who will have access to the data are the primary and secondary investigators, and two undergraduate research assistants. The results of this study may be published or presented at professional meetings, but the identities of all research participants will remain anonymous. Once the project is completed, all recordings of interviews will be erased.

YOUR RIGHTS TO PARTICIPATE, SAY NO, OR WITHDRAW

Participation in this research project is completely voluntary. You have the right to say no. You may change your mind at any time and withdraw, and your responses up to that point will be erased from audio recordings. You may choose not to answer specific questions or to stop participating at any time.

COSTS AND COMPENSATION FOR BEING IN THE STUDY

There are no direct costs to you for participating in this study. As a token of our appreciation for your participation, you will receive a summary of the findings once the project is completed. We believe this summary will be useful for continuing your education about performance in elite golf. You will not receive money or any other similar forms of compensation for participating in this study.

CONTACT INFORMATION FOR QUESTIONS AND CONCERNS

If you have any questions about this study, such as scientific issues, how to do any part of it, or to report an injury, please contact the principle investigator Dr. Daniel Gould at (517) 432-0175 or drgould@msu.edu or Kevin Blue at (517) 449-7731 or kblue@msu.edu. The investigators may also be reached by mail at 205 IM Sports Circle, Michigan State University, East Lansing, MI 48824.

If you have any questions about your role and rights as a research participant, or would like to register a complaint about this study, you may contact, anonymously if you wish, the Director of MSU's Human Research Protection Programs, Dr. Peter Vasilenko, at 517-355-2180, FAX 517-432-4503, or e-mail irb@msu.edu, or regular mail at: 202 Olds Hall, MSU, East Lansing, MI 48824.

DOCUMENTATION OF INFORMED CONSENT

Your signature below means that you voluntarily agree to participate in this research study.

_____ _____

Signature Date

You will be given a copy of this form to keep.

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