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Psychological Skills Training in Golf: The Role of Individual Differences in Cognitive Preferences

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Individual differences in cognitive preferences were examined in analyzing the effects of imagery and self-talk training on the psychological skills and performance levels of amateur golfers. Thirty-two men and women participated in a series of four counterbalanced training workshops and activities conducted over 2 months at two golf clubs. A repeated measures MANOVA revealed significant improvement on five psychological and psychomotor skills measured by the Golf Performance Survey: negative emotions and cognitions, mental preparation, automaticity, putting skill, and seeking improvement. Participants' responses to the Sport Imagery Questionnaire and ratings of their imagery and self-talk techniques increased significantly after training. Players also lowered their handicaps and performed significantly better on a Golf Skills Test after training. Imagery and self-talk training benefits were not linked to participants' cognitive preferences. The cognitive flexibility displayed by these golfers signals the need for more research on processing preferences and has implications for practitioners working with athletes.

Much of the research in applied sport psychology during the past decade has focused on the psychological skills of athletes (Vealey, 1994). Whereas previous research tended to focus on the personality characteristics that differentiated successful from unsuccessful athletes, that difference is now viewed largely in terms of the psychological skills athletes have acquired and used. Thus, for example, relative to other competitors, successful athletes have been shown to make more use of goal-setting and postcompetition evaluations, to have better developed plans for concentrating during competitions and refocusing after distractions, to have better control over thoughts and emotions, and to make more use of imagery techniques (Gould, Eklund, & Jackson, 1992a, 1992b; Orlick & Partington, 1988; Williams & Krane, 1993).

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Recent studies of expert performance support the proposition that acquired psychological skills differentiate successful athletes from other competitors. In contrast to the widely held view that expertise stems from inherited talent, Ericsson and Charness (1994) provide convincing evidence that expert performance is mediated by complex cognitive structures and skills acquired over extended periods of time. Expertise, thus, reflects the knowledge and skills developed through adaptation to the demands of naturally occurring situations, but more particularly through extended periods of deliberate practice (Ericsson, Krampe, & Tesch-Romer, 1993). What also is clear from this research, however, is that superior performance is often restricted to relevant tasks within the specific domain of expertise. The knowledge and skills acquired by expert performers are thus domain specific.

Differences in Psychological Skills

Those seeking to improve athletic performance, therefore, need to develop the specific skills demanded in particular sports. McCaffrey and Orlick's (1989) study on excellence in golf revealed a number of psychological skills that differentiated elite performers from others. Successful touring professionals set clearly defined goals, were more systematic in planning practice sessions and tournament play, and were more regular in self-evaluating their performances after playing in competitions. Both touring professionals and club professionals had plans for focusing attention during a round, but the former were more likely to implement their strategies and achieved greater concentration during a tournament. Both groups acknowledged the need to handle distractions on the course, but the touring professionals coped better with these distractions and were more able to refocus on the task. Touring professionals used imagery techniques more often and in more aspects of the game than club professionals and were generally more highly committed to achieving excellence in performance.

In a study of peak performance in golf, Cohn (1991) interviewed a sample comprising touring and club professionals as well as successful collegiate players. All participants reported that when performing at their peak, the golf swing was effortless and automatic, requiring little if any conscious thought to control movement. Peak performance also was characterized by a narrowly defined focus of attention and total immersion in the task at hand. All felt in control of themselves, their emotions, thoughts, level of arousal, and their performance. More than 80% of the sample reported a high level of self-confidence during peak performance. They played without fear, unconcerned by the negative consequences of poor shots. They felt physically and mentally relaxed and enjoyed the experience of playing well and achieving their goals. Other characteristics of peak performance, including the use of clear and vivid imagery, were reported less frequently by this sample of elite golfers.

Data collected from amateur golfers performing in club competitions enabled Thomas and Over (1994) to identify significant differences in the psychological and psychomotor skills of lower and higher handicap players. Skilled golfers (those with lower handicaps) reported greater mental preparation characterized by pregame and preshot planning, rehearsal, and visualization. They also were found to have a higher level of concentration when playing golf, greater psychomotor automaticity and consistency in the various facets of the game, and higher levels of commitment to performing well in the sport. The better golfers in this sample were less troubled by negative emotions and cognitions. They were less

likely to be nervous or anxious, frustrated or angry, and were less inclined to think of past mistakes, missed opportunities, or other negative thoughts when performing in competitions.

Psychological Skills Training

As well as describing the psychological skills of successful athletes, much of the recent research in applied sport psychology has been directed at attempts to train these skills (Vealey, 1994). Morris and Thomas (1995) provide an extensive account of various approaches to psychological skills training, including a model proposed by Thomas (1990) based on earlier work by Vealey (1988) and Boutcher and Rotella (1987). This model identifies psychological skills training as one of 7 phases involved in performance enhancement. Prior to the commencement of skills training, there are 4 phases in which the purpose and nature of the task are determined, the athlete's current skill level is assessed, and the profile of strengths and weaknesses is considered in relation to the particular demands of the sport. Various techniques then are employed to develop the psychological skills being targeted. These skills are developed at practice prior to implementation in competition, and the final phase involves evaluating the effectiveness of the training program.

The issue of whether golfers would benefit simply by receiving feedback on their profile of psychological skills was investigated by Thomas (1993). Feedback on the skills assessed by the Golf Performance Survey (GPS) was provided to three groups of golfers randomly formed from the Thomas and Over (1994) sample. In an interrupted time-series design with switching replications (Brewer & Shillinglaw, 1992), the groups of participants completed the GPS once, twice, or three times, each following a monthly medal or single-stroke event for which performance data were recorded. Participants then attended one of three feedback sessions in which they received their own skills profile, as well as comparative profiles for groups of highly skilled and less-skilled golfers. The players subsequently completed the GPS subscales in the months after their feedback session, and their performances in competitions were monitored. Multivariate analyses of the data revealed a short-term gain in mental-preparation skills and an improvement in automaticity that was maintained over time. There were no other changes over time in psychological or psychomotor skills, nor was there any discernible improvement in performance following the feedback session. Thomas (1993) concluded that training in psychological and psychomotor skills is needed to improve these skills and enhance golf performance.

Kirschenbaum and Bale (1980) outlined an early cognitive-behavioral skills training program for golf. This program consisted of deep muscle relaxation, developing a planning checklist for each shot, picturing the shot to be hit after selecting the club, monitoring the effective use of each club during a round, and developing a list of positive instructional statements that could be referred to when needed. Performance data from three participants in a multiple-baseline design provided some evidence of the training program's effectiveness that was corroborated by self-report data. Moreover, significant correlations were reported between golf performance scores and several subscales on the Test of Attentional and Interpersonal Style (Nideffer, 1976). However, as these data were available for only nine participants, Kirschenbaum and Bale (1980) concluded that further research was needed on golf-specific attentional skills and styles.

In a study of college undergraduates, Murphy and Woolfolk (1987) manipulated arousal levels through cognitive-behavioral interventions and examined subsequent performance on a golf putting task. In the stress-reduction condition, one group of participants listened to a 25-minute instructional audiotape providing training in success imagery techniques, positive self-talk, cue-controlled relaxation via paced respiration, and suggestions for using performance feedback to evaluate and correct ongoing performance. In the arousal-inducing condition, a second group of participants listened to a tape of very exciting sport broadcasts, pep-talk exhortations, and stirring music. Participants' tension and anxiety levels were significantly lowered by the stress-reduction intervention, but were not significantly increased by the psych-up intervention. Neither form of training produced a significant effect on putting performance over and above the practice effect demonstrated by participants in a control group. Murphy and Woolfolk (1987) concluded further research was needed to systematically investigate the relationship between cognitions, arousal, and performance.

Several studies have examined the effects on golf performance of preshot routines that incorporate cognitive-behavioral strategies, such as attentional focus, imagery, self-talk, and decision-making. Crews and Boutcher (1986) trained beginning college golfers in a preshot routine that included visualizing an imaginary line from the target to the ball in addition to taking practice swings and setting-up consistently. More skillful male golfers benefited most from learning the preshot routine, leading Crews and Boutcher (1986) to suggest that basic shot-making skills must be attained before training in a preshot routine would enhance performance. Boutcher and Crews (1987) trained skilled collegiate golfers in a putting routine that included focusing attention on specific cue words and thoughts as well as standardizing the number and timing of practice strokes and glances at the hole. In this study, only the less skillful female golfers showed significant improvement in putting performance, although both males and females became more consistent in their preshot routines after training. Cohn, Rotella, and Lloyd (1990) used a multiple-baseline design in conducting a cognitive-behavioral intervention with three male collegiate golfers. The cognitive component of the intervention emphasized the need for strong decision-making and total commitment to the club selected and type of shot to be played. The golfers in this study showed an increased adherence to their preshot routine. All three believed the training program had been beneficial, but only one participant showed an immediate improvement in performance. All participants improved in performance after 4 months, although other factors may have contributed to this improvement.

In reviewing the efficacy of cognitive and behavioral preperformance strategies, Cohn (1990) concluded that "research on such strategies shows that athletes can learn to develop consistent, highly systematic preparatory routines and also that routines benefit performance, but the findings of the effects of routines on performance have been erratic" (p. 306). He cites two problems associated with this research. First, the time frames used in the studies make it difficult to determine whether performance improvements result from the cognitive-behavioral interventions, physical practice, or a combination of both. Second, the studies have often been conducted with high-level athletes where ceiling effects may minimize the impact of interventions on performance.

Individual Differences in Processing Preference

There is a third issue that warrants further attention. In most of these intervention studies, no consideration has been given to the role of individual differences, especially regarding such potentially important background factors as preference for using one form of psychological training over another. One obvious area where such differences might occur is in preference for either imagery or self-talk techniques. We say "obvious" because the verbal-imaginal distinction forms the basis of Paivio's (1971) well-known "dual code" theory of information processing. This theory states there are two fundamental ways of representing knowledge: (a) a spatial form associated with the visual modality, and (b) a verbal form associated with the auditory modality. According to this theory, any given stimulus can be encoded using one of two symbolic systems: (a) the verbal system, which is essentially linear and most suitable for dealing with language and abstract, sequential relationships; and (b) the imaginal system, which specializes in dealing with nonverbal and concrete, parallel relationships.

The recognition of individual differences in preference for processing mode led to the development of scales to measure this tendency among individuals. Among the first of these scales were the Ways of Thinking (WOT) questionnaire (Paivio, 1971) and the Individual Differences Questionnaire (IDQ) (Ernest & Paivio, 1971; Paivio & Harshman, 1983), a self-report instrument that yielded scores on a verbal subscale and a separate imagery subscale. Moran (1993) commented that scales based on Paivio's dual-code theory have not been widely used in sport research. Rather, research seems to have focused on the imagery system and on questions such as whether those with high-imagery ability do in fact benefit more from imagery training than those with low ability (e.g., McCullagh, 1993). This area of inquiry has led to the development of sport-specific imagery tests such as Martens' (1982) Sport Imagery Questionnaire (SIQ). The SIQ asks people to imagine themselves in a number of sporting situations and then to rate the visual, auditory, and kinaesthetic qualities of the images they formed. Ratings also are made of the extent to which the images aroused emotions associated with the scenes. Thus, four separate subscale scores can be obtained from this instrument. Vealey and Walter (1993) added a fifth subscale when they included a rating of the controllability of the images. Another popular test is the Movement Imagery Questionnaire (MIQ; Hall & Pongrac, 1983), which extends the operational definition of imagery to include broader cognitive and emotional dimensions.

There has not been a parallel development of what one might call self-talk scales, probably because we take this for granted. Not everyone can form clear images, but we can all engage in self-talk. When one considers the importance attached to self-talk techniques in sport, however, there are ample grounds for measuring this tendency. It may be that people with high verbalizing tendencies respond better to self-talk training techniques and high visualizers respond better to imagery and modeling training. Such tendencies have been noted in marketing research (Childers, Houston, & Heckler, 1985). In one of the few studies that has used a processing-preferences scale in a sports-related context, O'Halloran and Gavin (1994) administered Isaacs' (1982) Preferred Imagic Cognitive Style (PICS) to a group of female undergraduate students performing a motor-skill task. They found that students who preferred an "imagic" form of thinking benefited more from imagery training. They made no use of the verbal preference score except as a basis for selecting "verbal" students.

There is no doubt that both self-talk and imagery are key components of what might be called the cognitive aspects of sporting performance. Most psychological-skills training programs contain segments on both of these. Overall, however, there has been very little research on the role of processing preferences with athletes. It might be that there is some interaction between the techniques and different sports, so that one technique is better suited to a particular sport, or perhaps, more important in a particular stage of skill acquisition. The present study sought to extend what is known about this area by measuring individual differences in processing preference of a group of golfers and exposing them to two different training techniques—an imagery training program and a self-talk training program—and noting whether processing preferences predisposed the golfers to favor one training technique over the other. It was hypothesized that visualizers would favor the imagery training and verbalizers the self-talk training sessions. An equally important concern of the present study was the effect of the training interventions on both the self-ratings of mastery of psychological skills and on actual performance measures. It was hypothesized that after undergoing both forms of training, the golfers in this study would not only rate their psychological skills more highly, but also demonstrate improved levels of performance.

Method

Participants

Participants in the study were recruited from two golf clubs: one based in Brisbane, the other in the neighboring city of Toowoomba. Club members responded to notices posted in the clubhouses advising that a series of four free psychological skills training workshops were to be held. An initial meeting was held in each of these clubs to explain the format of the workshops and administer some baseline measures. A total of 52 people attended this first session, although some realized they could not attend all the remaining sessions, so they withdrew at this point and their data discarded. The second session marked the commencement of the training period. It was held one week later and was attended by 13 adults from the Toowoomba Club (6 male, 7 female) and 20 adults from the Pacific Club in Brisbane (11 male, 9 female). One player subsequently suffered an injury, but continued with the sessions. Because she could not complete some of the tasks or participate in weekly competitions, her data also were discarded, leaving 32 cases in the final data set. The youngest golfer was 29, the oldest 59 (M = 43.95; SD = 9.5). The participants were a mixture of skilled and unskilled golfers with handicaps ranging from 4 to 26 for the men (M = 13.00; SD = 7.32), and from 14 to 43 for the women (M = 27.67; SD = 9.86).

Measures Used in the Study

The nature of the study required the use of many different measures, some of which were collected on three different occasions. These measures fell into two broad categories: (a) self-report questionnaires, and (b) actual performance data. The self-report instruments were as follows:

Golf Performance Survey (GPS). The GPS is a 68-item questionnaire that has been designed to measure nine different dimensions of psychological and psychomotor skill (Thomas & Over, 1994). The dimensions are defined within a golf

context and include: negative emotions and cognitions (e.g., "I get nervous when playing golf competitively"); mental preparation (e.g., "I mentally rehearse each shot before I play it"); conservative approach (e.g., "I usually lay up if I'm unsure whether I can clear a hazard"); concentration (e.g., "I am not easily distracted when playing a shot"); striving for maximum distance (e.g., "When driving off the tee, I usually try to hit the ball as far as I can"); automaticity (e.g., "My actions seem automatic when I am actually playing a shot"); putting skill (e.g., "I am usually good at reading greens"); seeking improvement (e.g., "During the past year I have made adjustments to my grip or swing"); and commitment (e.g., "Playing well in golf is important in my life right now"). Participants rate each item on a 5-point scale (1 = *strongly disagree* and 5 = *strongly agree*), and responses are averaged in calculating subscale scores. Internal consistency estimates for the nine subscales range from .67 to .90; test-retest reliability estimates are slightly higher. Scores on the GPS subscales were obtained at the outset and also at the conclusion of the study to enable any improvement in psychological skills to be measured.

Your Information Processing Preferences Scale (YIPPS). This scale was developed for the purpose of this study. It was based on the work of earlier researchers who had developed questionnaires to measure processing preferences (e.g., Ernest & Paivio, 1971; Richardson, 1977). The instrument employed here was modeled closely on the Verbalizer-Visualizer Questionnaire (VVQ) developed by Richardson (1977). Like the VVQ, the YIPPS contained 30 Likert-style items, 15 of which assessed the individual's tendency to use a visual form of encoding (e.g., "When preparing for a shot, I form a mental image of how it will be played"). The remaining 15 items assessed the tendency to use a verbal encoding form (e.g., "When preparing for a shot, I tell myself how I will play it"). Separate scores were obtained for visual and verbal processing preferences. The separate subscale approach was preferred to the ipsative format often employed in measures of processing preference because of evidence that these tendencies do not form a bipolar dimension (Fogarty & Burton, 1996). The YIPPS was administered for the first and only time in the introductory session.

Sport Imagery Questionnaire (SIQ). The format of earlier versions of this scale (Martens, 1982; Vealey & Walter, 1993) was retained, but the content was adapted to golf. The SIQ required participants to imagine themselves in four different practice and playing situations: (a) practicing alone, (b) practicing with others, (c) watching their partner play, and (d) playing in a contest. Using a scale from 1 to 5, they were asked to rate (a) how clearly they saw the images, (b) how clearly they heard the sounds associated with the images, (c) how well they were able to feel the bodily sensations associated with the images, (d) how aware they were of feelings and emotions, and (e) how well they were able to control the images. Ratings were summarized across the four situations to form five different SIQ imagery measures for each individual, with a minimum score of 0 and a maximum score of 20. An additional dichotomous question required participants to indicate whether they used an external (0) or an internal imagery perspective (1) in each of the four situations. The minimum score for this variable was 0, the maximum score was 4. The SIQ also was administered twice—at the beginning of the first session of imagery training and a week after the second imagery training session.

Evaluation Questionnaire. A 19-item evaluation questionnaire was developed to measure how much participants had learned and benefited from the imagery and self-talk training sessions and whether they preferred one technique

over the other. Responses to most items were scored on a 5-point rating scale (1 = *very little* and 5 = *a great deal*). For example, participants used this scale to rate how much they knew about imagery before (Question 1) and after (Question 2) the training workshops. Other items in this format tested the use of imagery, as well as the extent of knowledge and use of self-talk techniques before and after the workshops. The seven remaining items involved either categorical or open-ended responses. Participants expressed their preferences for technique in one of four categories (1 = *visual*, 2 = *self-talk*, 3 = *both equal*, 4 = *neither*) which formed a nominal scale. A similar format was used to measure whether participants felt they had benefited from the workshops (1 = *yes*, 2 = *no*, 3 = *uncertain*). The evaluation questionnaire was administered after the last training session.

Two performance measures also were used in the study:

Golf Skills Test (GST). The usual measure of a golfer's skill is his or her handicap. It is a crude measure, however, in that it is not affected by many of the weekly competitions held by golf clubs and changes more quickly in response to good performance than poor performance. Consequently, a test was developed to keep track of improvements in actual golf skill. It required participants to hit a total of 100 shots on a practice range between two targets that were moved closer together as the distance from the player to the targets decreased. Thus, in the first instance, the distance was set at 175 meters (191 yds) with the markers 17.5 meters (19.1 yds) apart. The next set of 10 shots was taken from 150 meters (164 yds) with the markers 15 meters (16.4 yds) apart. The final set of shots consisted of 10 breaking putts from a distance of 1 meter (1.09 yds). Participants worked in pairs with one player recording the number of shots that passed through the targets. The maximum possible score was 100. Participants completed the GST at the beginning, midpoint, and end of the study.

Handicap. A golfer's handicap is the traditional measure of skill in this sport, with low handicaps indicating a high level of competence. As mentioned above, however, it was not particularly well-suited to the time frame for this study. Many of the weekly club competitions do not require individual players to keep track of the number of strokes taken during the round (e.g., stableford competitions, fourball events), and it is mostly single-stroke events that affect the handicap. Nevertheless, the time frame for the present study was approximately 8 weeks and it was felt this might still allow for changes in skill to be reflected in changes to player handicaps, especially since both clubs use a computerized handicap assessment system that automatically adjusts a player's handicap (if appropriate) after the completion of each competition round. Consequently, handicaps as measured by the Australian Golf Union were recorded at the commencement, midpoint, and also at the completion of the study.

Procedure

Separate notices were posted in each clubhouse stating a member of the College of Sport Psychologists would be running workshops on psychological skills training and calling for volunteers. Five separate sessions lasting between 1.5 and 2.5 hours each were held on alternate Monday nights in each clubhouse. The initial session was used to explain the nature of psychological skills training, and also to collect baseline measures for the GPS subscales and assess processing preferences (YIPPS). The remaining four sessions formed two blocks; one dedicated to self-talk, the other to visualization training. The two groups went through these sessions in reverse

order to counterbalance stage of practice effects. Thus, the Toowoomba group did their visualization training and assessment while the Brisbane group worked on their self-talk skills. Researchers exchanged materials at the end of the first block and completed the training and assessment program. Each of the sessions was highly structured with the researchers working through scripted training notes that had been prepared jointly and using the same supporting materials. The materials are described in the Appendix.

Results

Participants completed all sessions, although some variables suffered from missing data and this problem was considered first. The GST took longer to complete than anticipated and a number of participants ($N = 9$) did not manage to complete the third session within the time frame allowed for the study. Because golfers entered their current handicaps on the GST forms, this meant final handicaps also were not recorded for these people—although one person submitted the final GST form with just the handicap recorded, leaving eight persons for whom there were no data on final handicaps. Regression equations were used to estimate these missing values, but the conclusions were the same as those obtained when using the listwise-deletion option, so the latter method of handling missing data was used throughout the analyses that follow.

Before proceeding to tests of the main hypotheses, preliminary analyses were conducted on the tests used in the present study. The main aim of these preliminary analyses was to look for evidence of reliability and validity for new scales and, in the case of the SIQ, to establish the dimensionality of an instrument before obtaining scores to be used in tests of hypotheses. A brief summary of the preliminary analyses for each scale follows.

Validating and Examining Relations Among the Self-Report Measures

Golf Performance Survey. This survey has been validated elsewhere (Thomas & Over, 1994), but it was important to check that the relations among the subscales in the present study were in line with expectations. The GPS was administered twice, once at the commencement of the study and again at the end. The correlations among the subscales for the first administration are shown in Table 1. Note that following the practice adopted in the presentation of multitrait-multimethod matrices (e.g., Campbell & Fiske, 1959), the correlations with the second administration of the GPS have been entered in the main diagonal as approximations to test-retest reliability coefficients. Despite the fact that training sessions have taken place between the administrations of the GPS and perhaps affected the rankings of individuals, these reliability coefficients are generally quite high. The pattern of correlations among the subscales is also very similar to that reported by Thomas and Over (1994) in their validation study of the GPS.

Thomas and Over (1994) also reported there were differences between elite and nonelite golfers on the Golf Performance Survey. The initial handicaps of the golfers in the present study ranged from 4 to 43 with a mean of 20.11. When handicaps were correlated with the GPS scores, significant correlations ($p < .05$) were obtained with negative emotions and cognitions (.44), concentration (–.36),

Table 1 Correlations Among Subscales of the Golf Performance Survey

	Negative emotions and cognitions	Mental preparation	Conservative approach	Concentration	Maximum distance	Automaticity	Putting skill	Seeking improvement	Commitment
Negative emotions and cognitions	(.88***)								
Mental preparation	–.44**	(.80***)							
Conservative approach	.15	.13	(.42*)						
Concentration	–.70***	.32		–.06	(.72***)				
Maximum distance	.08	.02	–.36*	.02	(.60***)				
Automaticity	–.53**	.32	.00	.35*	–.26	(.77***)			
Putting skill	–.47**	.20	.13	.24	.10	.41*	(.89***)		
Seeking improvement	–.01	.30	.17	–.21	.18	.04	.10	(.82***)	
Commitment	–.40*	.54**	–.24	.21	.13	.44**	.17	.24	(.58***)

Note. *$p < .05$. **$p < .01$. ***$p < .001$.

automaticity (–.68), and commitment (–.49). In other words, the better golfers in our group were less nervous, better able to concentrate, more automatic, and more committed. This result, again, is in line with previous findings.

Information Processing Preferences. This trait was measured by the Your Information Processing Preferences Scale (YIPPS). This 30-item instrument consisted of two subscales—one measuring a preference for using visual imagery in golf, the other measuring a preference for self-talk. Because the YIPPS was developed for this study, item analyses were conducted in the preliminary stages of data analysis. The RELIABILITY procedure in SPSS was used for this purpose. The 15-item visual processing preference subscale (Vispref) had an internal consistency estimate (Cronbach's alpha) of .83 after one item was dropped because of negative item-total correlation. The 15-item verbal processing preference subscale (Verbpref) had an internal consistency estimate of .67. Both of these were judged to be satisfactory, although the coefficient for the Verbpref subscale fell into what DeVellis (1991) calls the "minimally acceptable" category. The correlation between the two subscales was .65 ($p < .001$), indicating that people who used visual imagery at the start of this study also tended to use self-talk strategies.

Sport Imagery Questionnaire. The Sport Imagery Questionnaire (SIQ) was administered during the first imagery training session and again a week after the second imagery training session. The SIQ contained a basic set of six questions requiring participants to rate how well they were able to use imagery in each of six dimensions: visual, auditory, kinaesthetic, mood, controllability, and internal perspective. In each administration of the SIQ, the six questions were repeated four times, each time with a different situation in mind. Scores for each dimension then were obtained by summing the ratings across the four situations. Thus, six measures of imagery ability were collected on two separate occasions with 3 weeks of extended practice in between.

Correlational analysis of these six variables showed evidence of multicollinearity among the first five, with correlations ranging from .59 to .84 in the first administration and from .59 to .89 in the second administration. The sixth imagery dimension (internal perspective) was not correlated with the first five dimensions in the first administration, but was related to these variables in the second administration. Multicollinearity can present a problem in multivariate analyses, so data-reduction techniques were employed to see whether there were sufficient grounds for combining scores on the first five dimensions. Principal components analysis suggested there were only two uncorrelated dimensions underlying the SIQ on the first administration, and that these two dimensions accounted for 81% of score variance. The first five variables had loadings above .80 on the first factor and the internal perspective variable defined a second factor. On the second administration, root one criterion again returned a two-factor solution accounting for 87% of score variance. This time the two factors were correlated (.51). The internal perspective variable had much more in common with the first five variables in this second administration, perhaps because participants were now using this technique along with the other imagery techniques.

Tabachnick and Fidell (1989, p. 87) warn against using variables in multivariate analysis that have correlations in excess of .70. Most of the correlations among the first five SIQ questions in the second session exceeded that value. To avoid these problems of multicollinearity, scores on the first five questions of the SIQ were aggregated to form one measure of imagery ability (SIQ1-5a). The internal

perspective variable formed another (SIQ6a). The same data reduction procedures were applied to the variables from the second administration of the SIQ. That is, the six imagery measures were reduced to two by combining scores on the first five questions and treating the internal perspective question as a separate variable. Thus, the two administrations yielded four measures: SIQ1-5a, SIQ6a, SIQ1-5b, SIQ6b. Again, as a form of preliminary validation, the correlations of SIQ1-5a and SIQ6a with the initial administration of other measures used in the study were investigated. Both SIQ1-5a (.45, $p < .05$) and SIQ6a (.50, $p < .01$) were related to the mental preparation subscale of the GPS, but not to any of the other subscales of the GPS. Both SIQ1-5a (.48, $p < .01$) and SIQ6a (.52, $p < .01$) also were correlated with the Vispref (imagery) subscale from the YIPPS, but not with the Verbpref (self-talk) subscale. A measure of imagery ability would be expected to correlate with a measure of imagery preference, but not necessarily with a measure of self-talk, so these findings are once again in line with expectations.

Evidence of Improvement in Psychological Skills from Self-Report Measures

Golf Performance Survey. A number of the measures used in this study were administered on more than one occasion. The intention was to check for self-rated improvement on the skills addressed in the training program. The broadest of the measures, covering nine different areas, was the GPS. Two participants failed to complete the second administration. A repeated measures MANOVA was conducted on the two administrations of the GPS to test for overall differences in means across the two administrations. The multivariate F test indicated there was an overall effect for time, $F(9, 21) = 4.28$, $p < .01$, with scores on the second administration higher than the first. Means, standard deviations, univariate F tests, and standardized discriminant coefficients are shown in Table 2.

Univariate tests indicated the improvement occurred on negative emotions and cognitions $F(1, 29) = 15.27$, $p < .001$, mental preparation $F(1, 29) = 6.21$, $p <$

Table 2 Comparison of Golf Performance Survey Pretest Posttest Scores

Subscale	Pretest		Posttest		Univariate F tests	Standardized discriminant coefficient
	M	*SD*	*M*	*SD*		
Negative emotions and cognitions	3.37	.78	3.11	.70	15.27***	.747
Mental preparation	3.43	.72	3.63	.64	6.21*	–.281
Conservative approach	3.46	.80	3.43	.66	.05	–.035
Concentration	2.87	.99	3.10	.92	3.00	.768
Maximum distance	3.17	.76	3.15	.79	.02	.112
Automaticity	3.03	.64	3.21	.61	5.10*	–.535
Putting skill	3.13	1.17	3.56	1.03	17.05***	–.566
Seeking improvement	3.02	.80	3.23	.74	6.03*	–.590
Commitment	4.11	.51	4.11	.51	.01	–.048

Note. *$p < .05$. **$p < .01$. ***$p < .001$.

.05), automaticity $F(1, 29) = 5.10$, $p < .05$, putting skill $F(1, 29) = 17.05$, $p < .001$, and seeking improvement $F(1, 29) = 6.03$, $p < .05$. Scores on concentration also showed signs of improvement but this difference was not significant at the conventional .05 level, $F(1, 29) = 3.00$, $p = .09$. The means for the other three subscales—conservative approach, striving for maximum distance, and commitment—were virtually identical across the two testing sessions.

To correct for overall Type I error rate, Roy-Bargmann stepdown tests were employed to estimate the relative contribution of the variables to the difference between pre- and post-test scores. Stepdown tests are particularly effective in controlling for Type I error, especially when dealing with correlated repeated measures (Stevens, 1992). Negative emotions and cognitions was correlated with five of the other variables (see Table 1) so it was entered first in the stepdown analysis. When this was done, the univariate F values for some of these other subscales were considerably reduced. Mental preparation, for example, no longer made a significant contribution to the pre-post difference, $F(1, 29) = 2.24$, $p > .05$. Automaticity also just failed to reach conventional levels of significance, $F(1, 29) = 4.18$, $p = .05$. Seeking improvement, $F(1, 29) = 5.25$, $p < .05$, and putting skill, $F(1, 29) = 4.79$, $p < .05$, continued to contribute to the difference between sessions. Various entry orders were tried, but they all resulted in the same outcome: the three variables that contributed most to the difference in pre-post scores were negative emotions and cognitions, seeking improvement, and putting skill.

Improvement in Imagery and Self-Talk Techniques. Improvement in imagery technique was assessed by the two administrations of the SIQ. Only one participant failed to complete both tests. Means and standard deviations for both testing sessions are shown in Table 3. It can be seen from this table that all means increased. As mentioned earlier, scores on the first five questions were correlated to the point of being multicollinear. Comparisons of self-rated imagery performance across the two testing sessions were made by using the composite scores from SIQ Questions 1 through 5 and the separate SIQ Question 6 scores. A multivariate repeated measures F test indicated there was an overall effect for time $F(2, 29) = 15.71$, $p < .001$, with performance better after the imagery training. Univariate tests showed that improvement occurred on the composite variable which included the visual, auditory, kinaesthetic, mood, and controllability aspects of imagery.

Table 3 Comparison of Sport Imagery Questionnaire Pretest Posttest Scores

SIQ Question	Pretest		Posttest	
	M	*SD*	*M*	*SD*
Visual	13.78	3.67	14.77	4.67
Auditory	10.19	4.01	12.90	5.15
Kinaesthetic	12.41	3.58	14.32	3.87
Mood	12.34	3.62	14.06	4.34
Controllability	10.97	3.91	12.97	4.69
Internal perspective	2.81	1.55	3.13	1.43

Note. The maximum possible score for Questions 1 through 5 was 20. For Question 6, the maximum possible score was 4.

The improvement on Question 6, which assessed whether people used an internal imagery perspective, was not significant.

Imagery and self-talk improvement also were assessed by eight questions in the evaluation questionnaire. The first two contrasted initial and final *knowledge* of imagery techniques, two further questions contrasted initial and final *use* of imagery techniques. Another four questions explored similar issues in the area of self-talk. Comparisons between ratings for these questions do not fit into the classic pre-post experimental paradigm because they were not collected at different time periods, but they did follow a standard evaluation procedure employed in situations where participants cannot be expected to give informed answers at the outset of a program. Thus, the four questions assessing initial knowledge and usage were treated as a set of pre-test measures and the four questions assessing final knowledge and usage were treated as post-test measures. A repeated measures multivariate F test showed there was a difference between initial and final ratings $F(4, 28) = 22.90$, $p < .001$, with univariate analyses (corrected for Type I error by Bonferroni adjustments) showing there was a significant improvement in both knowledge and application of imagery and self-talk techniques ($p < .01$).

Other Indicators of Benefit Derived from Training Sessions

There were two main indicators of actual improvement in performance: changes in handicap and improvement in the Golf Skills Test. Three measures were taken of each variable: at the commencement, midpoint, and end of the workshops. Means and standard deviations are shown for both variables in Table 4. The correlations among the three handicap measures were very high, as were those among the GST scores. Sphericity assumptions also were violated in the multivariate analysis of handicap differences. In this situation, it is usually recommended the most suitable tests are the polynomial contrasts following the multivariate F test (e.g., Tabachnick & Fidell, 1989, p. 471). These are based on orthogonal linear transformations of the original variables and are unaffected by violations of assumptions. With three repeated measures, there were two such contrasts: the first testing for a linear trend in the data, the second testing for a quadratic trend. In the case of both the handicap and the GST measures, a linear trend was predicted. The linear trend for handicap was significant $F(1, 23) = 4.47$, $p < .05$, indicating a decrease in handicaps over time. The Golf Skills Test was designed as a more sensitive measure of performance, with players trying to increase the proportion of shots hit within designated target areas. The maximum score on each test was 100, the minimum score 0. The linear trend also was significant here, $F(1, 22) = 11.36$, $p < .01$, indicating an increase in GST scores over time. The quadratic trends were not significant in either of these analyses.

Table 4 Handicaps and Golf Skills Test Scores at Beginning, Midpoint, and End of Training

Variable	Beginning		Midpoint		End	
	M	*SD*	*M*	*SD*	*M*	*SD*
Handicap	19.46	11.53	19.08	11.42	19.00	11.66
Golf Skills Test	33.48	16.41	34.87	13.56	40.30	14.90

It could be argued these improvements were a consequence of the additional practice gained during the workshop. There was no control group in this study, but it was still possible to check for practice effects. An item in the final questionnaire asked participants whether they felt they had benefited from the workshop. In response to this question, 20 said they had, 3 were uncertain, and 8 indicated they had not benefited. All participants had completed the same training sessions, so if improvement was related to other factors such as practice, all three groups should have shared in it equally. In fact, this was not the case. When the "uncertain" and "no benefit" respondents were combined, this group showed no improvement on any of the GPS subscales, nor did their handicaps or Golf Skills Test scores improve between the beginning and the end of the study. The "benefit" group, on the other hand, improved on all GPS subscales except conservative approach, striving for maximum distance, and commitment. This group also lowered its average handicap score and showed a significant increase in scores on the Golf Skills Test.

Aptitude Treatment Interactions

A major point of interest in this study was the response of people who expressed a preference for either verbal or visual processing on the YIPPS to different mental-training techniques. It was expected that those who were predominantly visualizers would respond better to the imagery training techniques, and those who were predominantly verbalizers would respond better to the self-talk training sessions. As it turned out, however, these two subscales (Vispref & Verbpref) were highly correlated (.65, $p < .001$), indicating there were few people in this study who had a strong preference for one mode over the other. An examination of the scatterplot for these two variables confirmed this pattern with the points indicating a strong linear relationship with no outliers. This research question was explored further by comparing Vispref and Verbpref scores from the YIPPS with a question from the evaluation questionnaire that asked whether they preferred the (a) visualization techniques, (b) self-talk techniques, (c) both equal, or (d) neither. In response to this question, 5 participants said they preferred the visualization, 10 preferred the self-talk, and 13 rated both equal. Four participants either did not respond to the question or failed to complete the YIPPS. A between-subjects multivariate F test (Pillais) indicated there were no overall differences between these groups on Vispref or Verbpref scores $F(4, 50) = 1.27$, $p > .05$. In other words, although many people found they did prefer one training technique over the other, this preference was not related to their scores on the YIPPS.

Discussion

One of the main aims of the present study was to link reported changes in psychological skills with changes in performance. Thomas (1993) showed that simply providing feedback to golfers about their skills profile did not lead to improved performance and argued that training in psychological and psychomotor skills is needed for this to occur. Here, we have introduced a psychological skills training program for imagery and self-talk in the sport of golf; a program that involved some 8 to 10 hours of face-to-face instruction over a period of two months, and probably double that time in self-directed study. No attempt was made to alter

psychomotor skills while the study was being conducted; participants continued to play in the normal competition rounds and engaged in their normal practice sessions. It is apparent that the use of these imagery and self-talk materials developed specifically for the sport of golf has led to improvements in the players' mental approach and actual performance. The evidence for this claim comes from a number of converging sources.

Looking first at the self-report measures, participants rated their psychological skills on the Golf Performance Survey (GPS) higher at the end of the study. Had the increase occurred across all subscales, it could be argued this was a consequence of an expectancy effect on the part of the participants. The fact that the increase occurred on only those subscales that might be expected to respond to this particular intervention, however, is a clear indication the increase was not due to any such general tendency. There also are the data from the Sport Imagery Questionnaire (SIQ) to consider, where there was improvement on all aspects of the SIQ except the use of internal imagery. These differential effects suggest the participants were responding reliably to these self-report measures. Finally, the evaluation questionnaire indicated there was a significant improvement in both knowledge and application of imagery and self-talk techniques.

Turning to the performance measures, trend analysis indicated participants were lowering their handicaps and improving on the Golf Skills Test. By itself, this could simply mean participants played or practiced golf more often during the study than in the period before it commenced. When considered along with the improved scores on the self-report measures, however, the data suggest there has been a real change in the psychological skills and it is reasonable to suppose this change is at least partly responsible for the improved performance. Perhaps the strongest evidence for this argument comes from the results of analyzing responses to the item in the evaluation questionnaire that asked whether the sessions had helped the participants to play better golf. Most indicated that they had, but some indicated that they had not. When the participants were divided into two groups—one that reported benefit and the other reporting no benefit—we found the "no benefit" group did not improve on any of the self-report or the actual performance measures. The "benefit" group improved on all. We take this result as very persuasive evidence that the interventions practiced in this study were effective.

The other aim of the study was to look for an aptitude-treatment interaction that was expected to take the form of "visualizers" preferring and benefiting more from imagery training, and "verbalizers" preferring and benefiting more from self-talk training. There was no evidence of this interaction. It is possible the YIPPS scale developed specifically for this study was not a valid measure of the verbalizer-visualizer tendency. At this stage of theory development in this field, however, we believe the YIPPS was probably as good as any other measure we could have used. A more likely reason for the lack of interaction is the construct of processing preferences is not yet clearly defined in the psychological literature. Fogarty and Burton (1996) compared a number of measures of processing preferences and concluded that they show little commonality. They also suggested the notion of processing preferences may be somewhat exaggerated, with very few individuals actually showing a strong preference for one or the other. This pattern is certainly what emerged in the present study, with both subscales of the YIPPS strongly correlated. The interaction hypothesis, then, is not supported by the findings of the present study, but it should not be discarded at this stage. It is still uncertain whether

some people do form strong preferences, what proportion of the population they represent, and what might be the best method for assessing these preferences. This is one area that requires a lot more research, both by sport psychologists and those working in the more general field of cognitive styles.

In conclusion, the findings of the present study suggest cognitive interventions that are tailored to particular sports can be effective in improving psychological skills and actual performance measures. The benefits can be observed over a period as short as two months. These findings were obtained with club golfers whose handicaps ranged from the maximum possible to low "single figures." Although there were no elite golfers in the study, there was no indication within the sample that handicap had any bearing on benefits derived from the intervention. Low handicappers were just as likely as high handicappers to claim that the sessions helped them to play better golf. Finally, the club golfers sampled in this study showed considerable cognitive flexibility. Many did not have a strong preference for one mode over the other and those with a distinct preference still found it easy to adapt to a training approach that favored the alternative mode. Until more research is conducted on the notion of processing preferences and associated measurement operations, practitioners should not assume there is much to be gained by tailoring interventions to suit particular processing preferences.

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Appendix

Description of Training Materials and Training Program

Imagery Training—Session 1. The major components of the first session were as follows:

- introduction to the topic;
- handout "Who Uses Visualization?"—a compilation of quotes from prominent golfers describing their imagery techniques;
- videotape on visualization—"Visualization: What You See is What You Get" (Botterill, 1988);
- first administration of SIQ;
- basic imagery training—aspects of the training program described by Vealey and Walter (1993) were adapted for golf to develop vividness (Exercises 3 & 4) and controllability (Exercise 3) in the players' images, to develop their self-awareness (Exercise 1), and to build imagery techniques into their preshot routines;

- completion of an imagery training log—a sheet where notes were made on the quality of images achieved in four different sensory modalities during an exercise adapted from Terry (1989);
- handouts dealing with the benefits of imagery and guidelines for its use based on the videotape (Botterill, 1988; Winter & Martin, 1991);
- a take-home training audiotape produced by the researchers that contained two imagery training exercises—participants were asked to use this tape daily and to complete an imagery training log each time.

Imagery Training—Session 2. The major components of the second session were as follows:

- review of material from the first session;
- basic imagery training—a further aspect of Vealey and Walter's (1993) self-perception training program was adapted for golf to provide players with techniques for controlling anxiety (Exercise 2);
- second videotape on imagery—from the Sybervision golf videotape on Al Geiberger, a 20-minute excerpt was selected dealing with long-iron and short-iron shots;
- advanced imagery training—after viewing the appropriate segment of the Sybervision tape, participants visualized playing short-iron shots varying the speed (normal/slow motion), angle of viewing (side/front), and imagery perspective (external/internal);
- handout on imagery training techniques—based on Vealey (1990);
- further take-home practice sessions using the audiotapes and imagery training logs;
- for the group that completed the imagery training first, the SIQ was administered for the second time at the start of the following session; for the group that completed the imagery training last, the SIQ was mailed to them one week later.

Self-Talk—Session 1. The major components of the first session were as follows:

- a handout describing how self-talk influences feelings and behavior in situations;
- an exercise contrasting self-talk before best and worst rounds adapted from Orlick (1986);
- an exercise developing a verbal performance cue adapted from Crace & Hardy (1989) and Nideffer (1992);
- handout on readings relevant to self-talk in golf, including quotes from prominent players describing their self-talk techniques;
- distribution of "Self-Talk Record," a log of thoughts in performance situations adapted from Bunker, Williams, and Zinsser (1993), which participants completed before the next session.

Self-Talk—Session 2. The major components of the second session were as follows:

- discussion of participants' log entries and reactions to readings distributed in the previous session;
- exercises on thought stoppage, changing negative thoughts to positive thoughts, using countering and reframing, and constructing affirmation statements (adapted from Bunker et al., 1993);
- handout on inappropriate and correct thinking (Owens & Bunker, 1992);
- handout on "Using Self-Talk to Facilitate Learning and Performance" (from Bunker et al., 1993);
- training on the five self-talk techniques introduced in the workshop handout.

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