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COGNITIVE STRATEGIES USED BY MARATHONERS IN EACH QUARTILE OF A TRAINING RUN

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ABSTRACT

The purpose of this study was to establish whether marathoners associate or dissociate more in particular quartiles of a training run. Sixty tape transcriptions of on-the-spot verbalised thoughts of 31 runners which had been collected during training runs were divided into quartiles and analysed according to thought categories. The 60 transcriptions were then further divided into four sub-groups based on the rating of perceived exertion (RPE) given by the runners after their training run recording sessions. Finally, the various cognitive strategies used by male runners were compared to those used by female runners. The results indicated significant differences in the cognitive strategies used in each quartile of all 60 transcriptions, and for groups with a RPE of 11-12, 13-14 and 15-18. Significant differences were also found in certain categories of thoughts for male and female runners.

Key Words: Cognitive strategy training programme; Association and dissociation; Perceived effort; Marathon runners; Quartiles of training run.

INTRODUCTION

Although many marathoners possess similar physiological and anatomical characteristics, only a select group actually attains success (Morgan & Costill, 1972). Since there seems to be little variability in the physical capabilities of superior runners, it is thought that the psychological response determines the real difference in achievement amongst the elite athletes (Ungerleider, 1985). An increased knowledge of the psychological processes of marathoners therefore holds important implications for the improvement of marathon runners' performances (Freischlag, 1981; Chen & Singer, 1992).

On the basis of early research the cognitive processes of marathoners have been divided into two main categories namely association and dissociation (Morgan & Pollock, 1977; Morgan, 1978). Association refers to the continual assessment and monitoring of one's internal state whereas dissociation refers to the externalisation of attentional focus and the shutting out of feedback from the body.

There has been much debate surrounding the use of these two cognitive strategies for promoting optimal performance and well-being of the athlete. Morgan and Pollock (1977) reported that non-elite runners used a predominantly dissociative strategy whereas superior runners, in contrast, implemented an associative strategy. They found that the elite runner kept a narrow-internal focus on body sensations, closely monitoring signals of discomfort and fatigue and adjusting pace accordingly.

Despite the fact that the work of Morgan and Pollock (1977) is widely cited to support the contention that an associative strategy enhances endurance performance, several researchers have concluded that dissociative strategies improve endurance performance (Pennebaker & Lightner, 1980; Gill & Strom, 1985; Fillingham & Fine, 1986; Rejeski & Kenney, 1987; Wrisberg & Pein, 1990). Unfortunately, the use of dissociation carries with it a variety of risks and dangers, since, by purposely cutting him or herself off from the sensory feedback he or she normally receives from the body, the runner may then be exposed to bone fractures, heat stroke, heat exhaustion and even mental disorientation (Morgan, 1978).

A problem which applies to much of the research aimed at gaining information on cognitive strategies during a run, is the fact that researchers have relied on data gathered from post-test questionnaires or interviews (Morgan & Pollock, 1977; Freischlag, 1981; McKelvie *et al*., 1985; Wrisberg & Pein, 1990; Goode & Roth, 1993).

The subjects of such studies would have had to cite, after the entire race was completed, what their general thought patterns were during the race. This type of retrospective introspection may be viewed as problematic when one considers athletes may not be able to accurately report on psychological states experienced during the sporting performance. Brewer *et al*. (1991) found that the outcome of the sport event biased the recall of psychological states experienced during that time. After achieving an outstanding outcome, athletes may simply report having experienced psychological states that they typically associate with a good performance, regardless of whether they actually experienced those states.

To counteract possible retrospective falsification or distortion of data, Schomer (1987) utilised light-weight micro-cassette recorders to document on-the-spot verbalisations of marathoners' thoughts during their training runs. To enable a complete and accurate encoding of all the obtained verbalised thoughts, Schomer devised a cognitive strategy sub-classification system consisting of 10 valid and reliable cognitive strategy sub-classifications: Feeling and affects (A); Body monitoring (B); Command and instruction (C); Pace monitoring (P); Environmental feedback (E); Reflective activity thoughts (R); Personal problem solving (S); Work, career and management (W); Course information (I); and Talk and conversational chatter (T). Thoughts in categories A,B,C and P were designated as associative, while thoughts in the remaining categories E,R,S,W,I and T were designated as dissociative.

Schomer's (1987) findings did not support the popular notion that elite runners engage in associative thinking while novice and average runners implement dissociative strategies. What the analysis revealed instead was a highly significant relationship between the use of associative cognitive strategies and perceived training intensity, regardless of the running status of the marathoner. Thus the higher a runner's perceived effort, the more he or she implemented associative strategies during a run. This finding was independently confirmed by Tammen (1996).

The current researchers were interested in analysing Schomer's (1987) obtained data to establish whether there are significant differences in the levels of association and dissociation in different segments of the run. The rationale behind taking Schomer's collected tape transcriptions and dividing each one into quarters was based on previous research by Carmack and Martens (1979), who first speculated about whether certain types of thoughts prevailed in

different sections of the race. These researchers developed a scale to measure Commitment to Running (CR) which, among other phenomena, attempted to measure changes in mental states which occur during different segments of a run. They generated three relative state of mind factors, namely psychological well-being, psychological uneasiness, and a state of naturally "spinning free". Questionnaires were completed by 250 male and 65 female marathoners of varying levels of fitness and experience. Their finding showed that during the first half and last quartile of the run, the under-40-minute runners experienced dominant feelings of psychological uneasiness, such as depression, irritability and boredom, whereas the over-40-minute runners reported psychological perceptions of well-being, such as happiness and optimism. This trend was reversed for both groups in the third quartile. Carmack and Martens (1979) went on to suggest that the mind-set a runner engages in when setting out on a run may be the determining factor in differentiating between the groups' distinctly different state of mind experiences. It should be noted that the research conducted by Carmack and Martens (1979) did not take into account the cognitive strategies of association and dissociation when attempting to measure differing states of mind in each quartile of the run.

Okwumabua (1985) investigated the physical and psychological contributions to marathon performance and reported that throughout the marathon there was a pattern of slightly increasing dissociative strategy until the final quartile of the race. The data was, unfortunately, based only on runners' estimation of percent of time spent using each strategy.

The current researchers thus aimed to establish whether the dominant strategy implemented at the beginning of a run remained at more or less the same level throughout the rest of the training session, except for the third quartile, as proposed by Carmack and Martens (1979), or if, in actual fact, there were significant differences in the use of associative or dissociative strategies in each quartile of the run and these differences were linked to perceived effort rating of the runner.

The researchers were also interested in establishing whether there were significant differences in the predominant thought processes of male runners compared to female runners. A recent research finding by Ogles, Masters and Richardson (1995) indicated that females endorsed psychological coping as a more important motive for running than males. In their research, psychological coping meant concentrating on personal thoughts and problem solving. Female runners were also found to endorse affiliation (socialising with runners) more than male runners.

METHOD

Subjects

Thirty-one subjects were taken from Schomer's (1987) original study on the relationship between cognitive strategies and perceived effort of marathon runners. They were randomly selected from the following three distinct marathoner groups:

Novice Runners

This group consisted of six male (mean age: 37.8 years) and six female (mean age: 30.8 years) novice runners who had never participated in a marathon before. They were chosen from a large group of volunteers who had responded to an advertisement placed in a local newspaper

asking for healthy, but physically unfit individuals willing to take part in an interdisciplinary research project involving a seven month training programme leading to their first marathon attempt.

Average marathoners

This group was made up of six male (mean age: 27 years) and four female (mean age: 29.8 years) marathon runners who had taken part in at least two marathons prior to the study and had race times between 3 and 4 hours for males and 3.5 and 4.5 hours for females. They volunteered after being contacted by telephone and consented to have their thoughts recorded on their regular training runs.

Elite marathoners

This group consisted of six male (mean age: 29.3 years) and three female (mean age: 25 years) highly competitive marathon runners with race times below 3 hours for males and below 3.5 hours for females. These subjects were approached in the same manner as the average runners.

Apparatus

Schomer (1987) utilised light-weight Pearlcorder S901 micro-cassette recorders by Olympus Optical Co-operation, and Pearlcorder ME4 electret condenser microphones to record the on-the-spot verbalisations of the runners. A padded, adjustable belt was designed to enable the runners to carry the micro-cassette recorder on the small of their back.

To facilitate the runners' rating of perceived exertion (RPE) the Borg Scale (Borg, 1978) was printed on cardboard and shown to runners after each completed cognitive strategy recording.

PROCEDURE

In Schomer's (1987) original study the tape transcriptions were completely content-analysed with the 10 sub-category abbreviations i.e. Feelings and affects (A); Body monitoring (B); Command and instruction (C); Pace monitoring (P); Environmental feedback (E); Reflective activity thoughts (R); Personal problem solving (S); Work, career and management (W); Course information (I); and Talk and conversational chatter (T).

Although verbalisation style was unique to each runner, the flow rate of verbalisation within each different training run was upheld for each separate recording (Schomer, 1987). Consequently, for the present study, the total number of sub-category abbreviations were counted and divided into four numerically equal segments. If the obtained total sub-category abbreviations was, for example 100, then the transcription was divided into quartiles each containing 25 thoughts - the first 25 constituting the first quarter of the race, the second 25 constituting the second part of the race, and so on. If the total obtained number of thoughts did not give whole numbers when divided by four, for example, 101, the transcript was divided as follows: 25, 25, 25, 26. If the obtained figure was, for example, 102, the transcript was divided in the following way: 25, 26, 25, 26. If the total obtained number of cognitions was, for example, 103, the transcript's quartiles contained 25, 26, 26 and 26 thoughts respectively.

It should be noted that in Schomer's (1987) original study there were 62 transcribed recordings. Unfortunately two of the transcriptions could not be traced. The present research is therefore based on 60 transcripts, not 62 (i.e. two recordings per subject).

A recording sheet was completed for each of the 60 transcripts which showed the frequencies of each type of thought in each quarter of the race. The number of the A, B, D and P sub-categories in each quartile of each transcription were added together to give a total frequency of associative strategies implemented in each quarter. The same was done with the E, R, S, W, I and T sub-categories to obtain the total number of dissociative strategies used in each quartile of each transcription.

Statistical tests were done on all 60 transcriptions together to see if there was an overall difference between the four quartiles of the race. The transcriptions were then divided into four groups based on rating of perceived exertion (RPE: 7-10, n=6; RPE: 11-12, n=23; RPE: 13-14, n=20; RPE: 15-18, n=11). The same statistical tests used for the overall data were run on each of the four smaller groups. Up to three statistical tests were used. All the sets of obtained data in this study were analysed using chi-square. If the Chi-square was significant then the coefficient Cramér's Phi was also run to establish how much of the variance was accounted for, as well as a two-tailed test of the standardised residuals, using Bonferroni's probability procedure, to try and locate which cells were especially influencing the overall significant picture.

The final statistical tests were conducted on the obtained data from all the males and all the females, to see if there were any significant differences between the two groups. The total frequency of each sub-category for the 37 transcriptions from male subjects and 23 transcriptions from female subjects was calculated. The data was then analysed by conducting the same statistical tests mentioned above.

RESULTS

A total of 14 537 verbalised thoughts were recorded in the 60 tape transcriptions obtained from Schomer's (1987) original study. Figure 1 shows how both the associative and dissociative cognitive strategies were distributed across the four quarters of the training run. Observed frequencies were transformed into percentages in order to show more clearly the differences between association and dissociation for each quarter. From Figure 1 it appears that there is an increase in the use of associative strategies in the fourth quartile. A chi-square test performed on the obtained data confirmed that there are significant differences between the four quarters of the run (obt. chi-sq=72.36; df=3; $p<.05$). Cramér's Phi indicated that the observed differences accounted for the approximately 8% of the variance (Cramér's Phi=0.08). A test of the standardised residuals confirmed that there were significantly more associative strategies used in the final quartile ($z=5.35$; $p<.0003$) and, accordingly, significantly less dissociative strategies in the last segment of the run ($z=-3.72$; $p<.0003$).

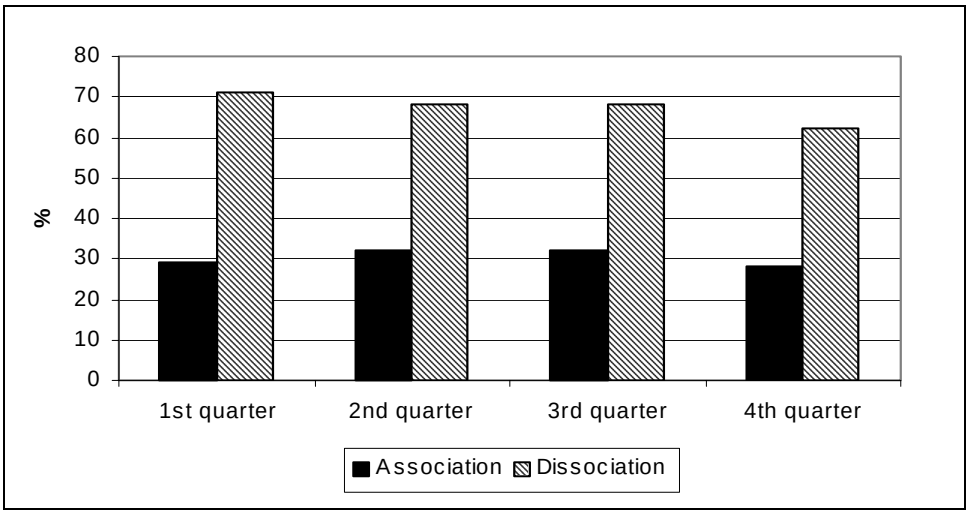

FIGURE 1. **PERCENTAGE OF ASSOCIATIVE AND DISSOCIATIVE THOUGHTS FOR ALL RUNNERS**

A total of 1 129 verbalised thoughts were recorded in the six tape transcriptions in which subjects perceived their effort level to be 7, 8, 9 or 10. Figure 2 shows how the associative and dissociative cognitions of these runners were distributed over the four quarters of the training run. A chi-square test performed on the obtained data failed to reach a significant level (obt. chi-sq=6.9; df=3; $p<.05$).

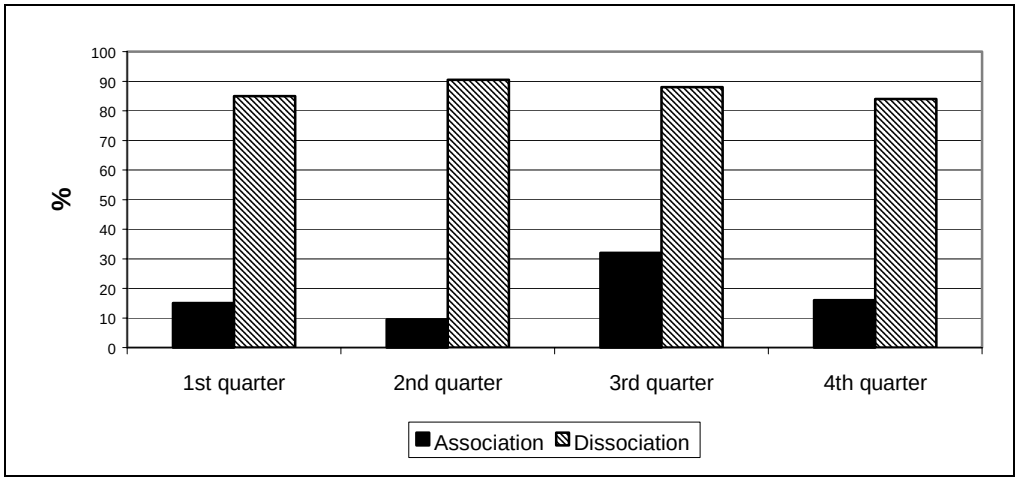

FIGURE 2. **PERCENTAGE OF ASSOCIATIVE AND DISSOCIATIVE THOUGHTS FOR RPE 7-10**

The third set of data was obtained from 23 transcriptions in which runners perceived their effort level to be 11 or 12. A total of 6 707 on-the-spot verbalisations were recorded during these subjects training runs. The way in which the associative and dissociative strategies used are distributed across the four quarters of the training run can be seen in Figure 3. Chi-square analysis demonstrated that there were significant differences between the four quarters of the run (obt. chi-sq=73.75; df=3; p<.05). Cramér's Phi was calculated as 0.1, indicating that approximately 10% of the variance was accounted for. A two-tailed test of the standardised residuals confirmed that significantly more associative strategies were implemented in the last quarter for this group of runners (z=6.18; p<.003), and significantly less dissociative strategies were used in the last quarter of the run (z= -3.32; p<.003).

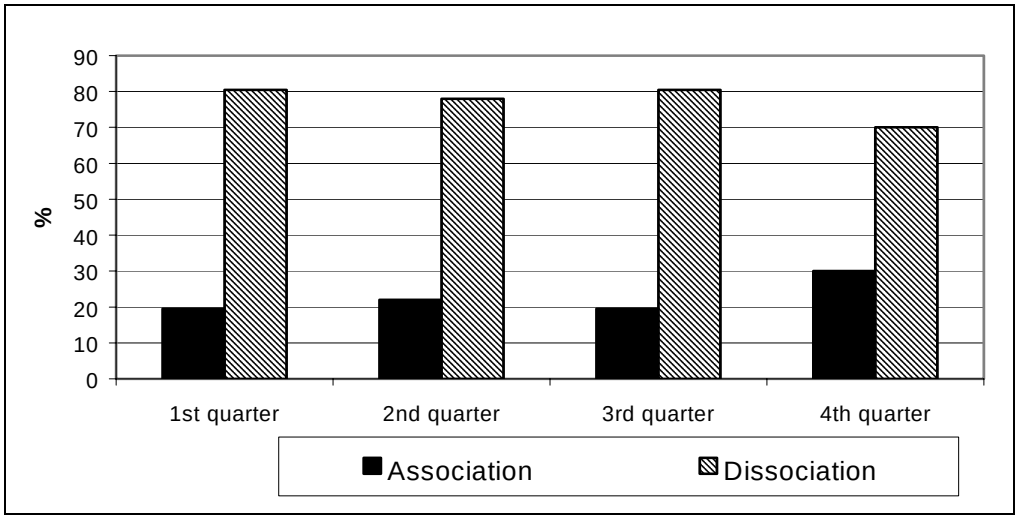

FIGURE 3. **PERCENTAGE OF ASSOCIATIVE AND DISSOCIATIVE THOUGHTS FOR RPE 11-12**

3 933 cognitions were counted in the 20 transcriptions in which subjects had a perceived effort rating of 13 or 14. Figure 4 shows the distribution of the recorded associative and dissociative strategies across the quartiles of the training run. Chi-square analysis indicated that there was a significant difference in the strategies used in different sections of the run (obt. chi-sq=17.47; df=3; p<.05). Cramer's Phi was calculated to be 0.07, thus indicating that ± 7% of the variance was accounted for. A two-tailed test of the standardised residuals indicated that significantly less associative strategies were used in the first quartile, compared to the other three quartiles of the training run (z=-2.79; p<.003).

The fifth set of data was obtained from 11 transcriptions in which runners perceived their effort level to be 15, 16, 17 or 18. A total of 2 768 verbalised thoughts were recorded during these subjects' training runs. Figure 5 shows the percentages of associative and dissociative strategies used in each quarter of the race. Chi-square analysis confirmed that there were significant differences between the quartiles (obt. chi-sq=23.24; df=3; p<.05). Cramer's Phi was calculated to be 0.09. Two-tailed tests were run for four of the standardised residuals: associative strategies in the first quarter (z= -2.2; p>.003); dissociative strategies in the first

quarter (z=2.61; p>.003); associative strategies in the third quarter (z=1.55; p>.003); and dissociative strategies in the third quarter (z = -1.83; p>.003). The standardised residuals thus failed to reach a significant level.

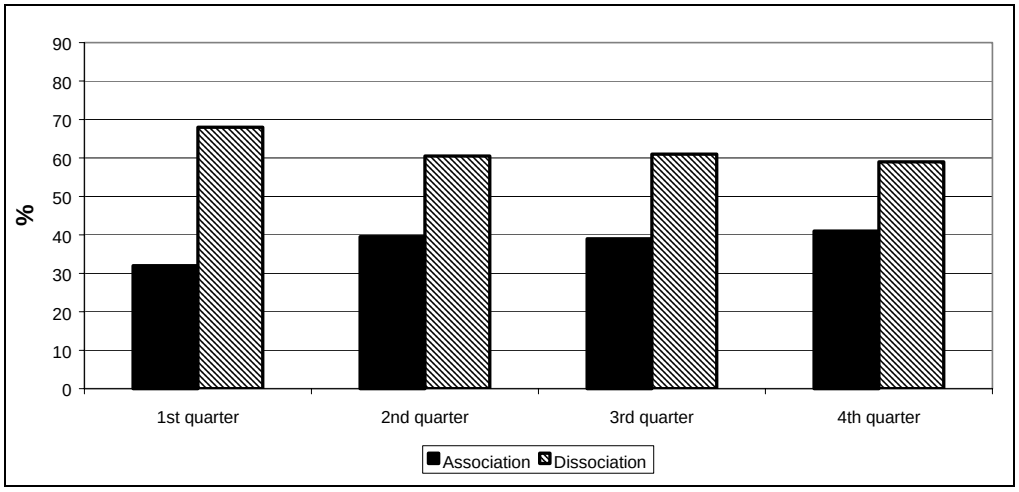

FIGURE 4. **PERCENTAGE OF ASSOCIATIVE AND DISSOCIATIVE THOUGHTS FOR RPE 13-14**

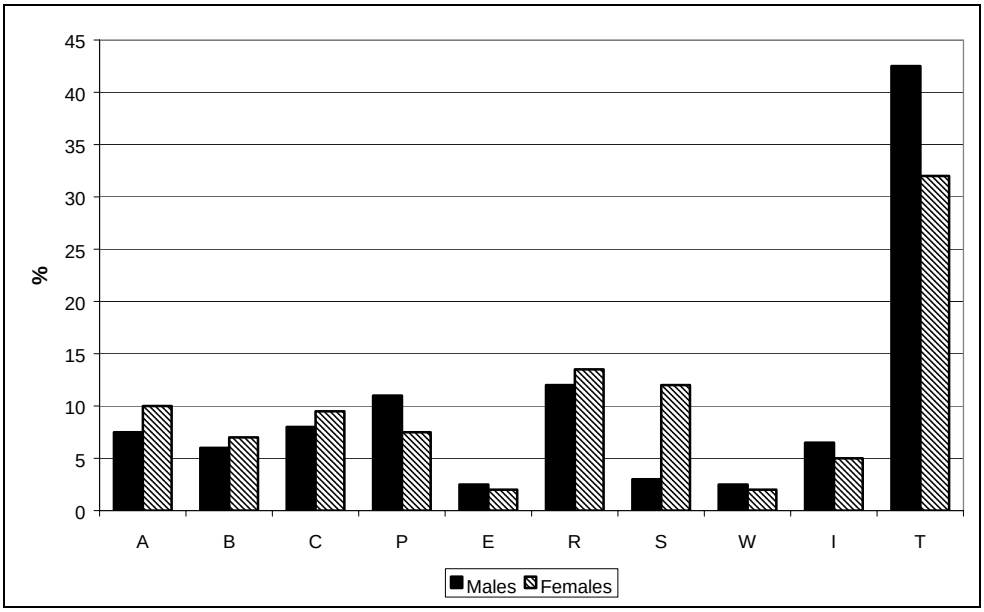

FIGURE 5. **PERCENTAGE OF ASSOCIATIVE AND DISSOCIATIVE THOUGHTS FOR RPE 15-18**

The final set of obtained data to be analysed was the comparison between the various cognitive strategies used by males and females respectively. The transformed percentages obtained from the frequency data for each sub-category, for both males and females, are graphically represented in Figure 6. Chi-square analysis indicated that there were significant differences between the predominant strategies used by males and females (obt. chi-sq=655.28; df=9; p<0.5). Cramer's Phi was calculated to be 0.211, indicating that approximately 21% of the variance was accounted for. Two-tailed tests were run on four of the standardised residuals: Male personal problem solving (S) (z= -13.22; p<.00125); Female personal problem solving (S) (z=17.02; p<.00125); Male talk and conversational chatter (T) (z=5.85; p<.00125); and Female talk and conversational chatter (T) (z= -7.52; p<.00125).

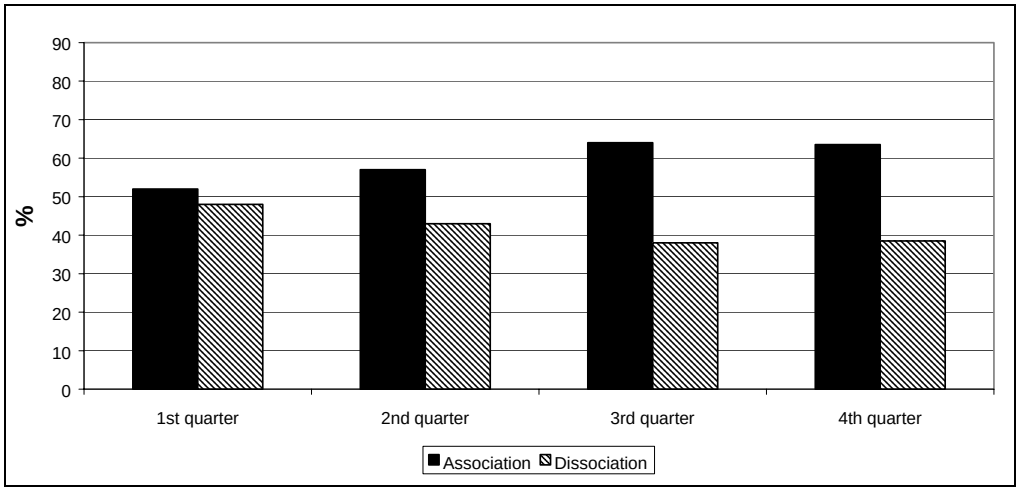

FIGURE 6. **COMPARISON OF COGNITIVE STRATEGIES USED BY MALE AND FEMALE RUNNERS**

DISCUSSION

The first set of data to be analysed consisted of the calculated frequencies of the sub-categories of thoughts for all 60 tape transcriptions. This data reached significant levels, indicating that there are differences in the levels of association and dissociation over the four quarters of the run. Further analysis revealed that it was the last quartile in which the level of associative thinking increased significantly compared to the earlier quartiles. These results do not support Carmack and Martens' (1979) contention that it is in the third quartile where changes in state of mind occur, before returning to the state of mind prevalent in the first half of the race. Despite the fact that the current data was found to be significant, there did not appear to be a noticeable difference in the amount of association or dissociation for the first three-quarters of the race. It was thus felt that analysing more specific groups of runners, by taking into account their perceived effort rating, might reveal a clearer pattern of association and dissociation over the duration of the training run.

Analysis of the data taken from those runners with a RPE of 11 or 12 was statistically significant, closely resembling the pattern observed in the first set of data with all 60 transcriptions. Thus, there was little variance in the amount of association or dissociation for the first three quartiles, with a significant increase in the use of associative strategies in the last quarter. The current researchers felt that the observed lack of variance between the first three quarters of the run for this particular group was indicative of the fact that these runners, who were still running at a relatively low intensity, could afford to maintain high levels of dissociation, rather than focus on internal sensations, throughout the run, until the last quarter when they would have begun to feel more fatigued, which in turn would have steered their attention slightly more towards what was happening to their physiological state.

Analysis of the data obtained from those runners with a RPE of 13 or 14 indicated that there were significant differences between the number of associative and dissociative strategies implemented over the four quarters of the training run. It was interesting to note that the overall picture for this group resembled the reverse pattern obtained for all 60 transcriptions, and runners with a RPE of 11 or 12: while for the two latter groups associative strategies remained at approximately the same level for the first three quarters of the run, with an increase in the last quartile; for the subjects who ran at a RPE of 13 or 14, a significantly lower level of association was observed in the first quarter, followed by a significant increase in associative strategies which remained at approximately the same level for the last three quarters of the training run.

There was no significant difference observed between the number of associative or dissociative strategies implemented in the second quarter compared to the third quarter, nor between the third quarter and the fourth quarter.

The data obtained from the group of runners with a RPE of 13-14 did not reflect the findings of Okwumabua (1985) either: there was not a gradual increase in the use of dissociative strategies for the first three quarters of the race; in fact almost the opposite was observed, with a decline in the number of dissociative strategies used in the last three quarters of the race compared to the first quarter. It would thus seem that when runners are training at a moderate intensity level they maintain a higher level of association during the last three quartiles compared to the first quarter.

The analysis of the data from the runners with a RPE of 15-18 showed up a particularly smooth increase in the use of associative strategies from the first to the third quartile, while remaining at almost the same level in the fourth quarter as observed in the third. Chi-square analysis confirmed that the observed differences were significant. Unfortunately significant statistical levels were not reached when Bonferrini's probability test was conducted on the standardised residuals. A possible reason for this could be the relatively small sample size, compared to the groups with a RPE of 11-12 or 13-14. Despite the fact that the standardised residuals did not reach significant statistical levels, when compared to one another they did indicate an increase in associative strategies from the first to the second quartile, and from the second to the third. This information, coupled with the fact that the larger statistical test, the chi-square analysis, was significant, leads the authors to suggest that the obtained data does demonstrate a trend of increasing association as the training run progresses when an individual is running at maximum effort.

The findings of the current research hold important implications for the development of future mental strategy training programmes. Sport psychologists currently utilise numerous interventions and techniques intended to enhance the performance of athletes in competition (Greenspan & Feltz, 1989). Three areas in particular which have been focused on are relaxation, behavioural techniques and cognitive restructuring. The implementation of this last factor may be significantly improved with the added knowledge of runners' patterns of cognitive strategies gained from the present study.

During Schomer's (1990) cognitive strategy training programme the thoughts of marathoners were monitored and shaped whilst running by utilising two-way radios, enabling hands-free communication between the trainers and the runners. At the beginning of the five week thought intervention period the trainers positively reinforced associative thoughts while not commenting on dissociative verbalisations. In the second week the trainers began to politely interrupt runners from dwelling on dissociative thoughts and requested them to revert to an internal attentional focus. By the third week only short dissociative episodes were tolerated and, by the time of the fourth week, associative thinking was strengthened and dissociative thinking was discouraged.

The final set of data analysed in the current study was the comparison between the cognitive strategies used by male and female runners. It was found that female runners engaged in personal problem solving significantly more than their male counterparts. This finding adds weight to the research conducted by Ogles *et al*. (1995), who asserted that females endorse psychological coping as a more important motive for running than males. In contrast to the study by Ogles *et al*. (1995) male runners engaged in significantly more talk and conversational chatter than female runners. It would thus appear that the male subjects in this study placed more importance on the social aspect of running than the female subjects did.

Despite the fact that both the categories Personal problem solving (S) and Talk and conversational chatter (T) are considered to be dissociative in nature, it is not the intention of the authors to automatically discourage these thoughts in runners, since they may help to reduce general stress and lead to an improved lifestyle of the individual. What is important, however, is to take into account the level of training intensity: Once runners begin to increase their effort output, the use of associative rather than dissociative strategies should be encouraged to ensure a more efficient and safer run.

Having established that runners training at maximum effort do not maintain the same level of associative thinking throughout the run, it is suggested that Schomer's (1990) cognitive strategy programme might be further improved upon by taking this latest finding into consideration. In the first quartile of the training run, those subjects training at a high intensity level displayed an almost fifty-fifty balance between the use of associative and dissociative cognitive strategies. Thereafter there was a progressive increase in association with a corresponding decrease in dissociation, underlining Tenenbaum's (2001) contention that under heavy and continuous load, associative cognitive strategies are perhaps even unavoidable. Therefore, if it is accepted that what sport psychologists should be doing is modelling training according to what runners are already doing at high effort, future training programmes may be more effective if they allow runners more leeway in the amount of dissociative strategies used in the first quartile, beginning to push for an increase in associative thinking from the second quartile onwards.

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NOTES