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maximal treadmill runs. The pre- and post-test sessions involved three incremental exercise levels and were utilised to confirm the exercise intensity for the sub-maximal run, and that no training-effect nor modification of individual music perceptions were present throughout the duration of the research. The three sub-maximal treadmill runs were of twelve minutes and the workload was selected to reflect typical exercise patterns for maintaining and developing cardiorespiratory fitness (ACSM, 2001: *Medicine and Science in Sports and Exercise*, 30, 975–991). The three environmental counter-balanced conditions were sub-maximal treadmill running in presence of no music (NM), preferred music (PM) or disliked music (DM). A repeated measures multiple Analysis of Variance (RM-MANOVA; the Greenhouse-Geisser test of within-subjects effects was considered) was conducted to evaluate the influence of the treatment condition (NM, PM, DM) on the dependent variables (RPE, HR, PANAS).

The RM-MANOVA identified a significant experimental effect for RPE ( $F_{2,34}=13.87$ ,  $P=.000$ ) and PANAS ( $F_{2,34}=27.76$ ,  $P=.000$ ), but no-significant effect for HR ( $F_{2,34}=1.32$ ,  $P=.280$ ). *Post hoc* t-test pairwise comparisons revealed significant differences for RPE between PM-DM ( $P=0.001$ ; PM  $11.62 \pm 0.41$ ; DM  $12.80 \pm 0.41$ ) and PM-NM ( $P=0.000$ ; PM  $11.62 \pm 0.41$ ; NM  $12.70 \pm 0.38$ ), but no significant difference was found between DM-NM ( $P=0.626$ ; DM  $12.80 \pm 0.41$ ; NM  $12.70 \pm 0.38$ ). Similarly, significant differences were found for PANAS between PM-DM ( $P=0.000$ ; 23.00  $\pm$  1.85; 7.94  $\pm$  2.10) and PM-NM ( $P=0.000$ ; 23.00  $\pm$  1.85; 9.00  $\pm$  1.70), but no significant difference was found between DM-NM ( $P=0.533$ ; 7.94  $\pm$  2.10; 9.00  $\pm$  1.70).

These findings illustrated that music influenced the subjective-emotional indicators considered. Participants perceived their effort to be lower when exercising sub-maximally listening to their preferred musical choice compared to their effort perception under the disliked musical choice and no music conditions. Similarly, participants reported better emotional states during the sub-maximal run when listening to their preferred musical choice as opposed to the disliked music and no music conditions. In contrast to subjective indicators, music failed to influence the objective indicator considered in the study in all three testing conditions; this strongly indicates that the differences found were due to psychological interpretation.

It can be concluded that background music had an effect on the emotional sensations (PANAS) and physiological effort perceptions (RPE) of the participants exercising at sub-maximal intensity, but had no impact on the actual physiological indicator (HR). Furthermore, the results suggest that to provide a

positive effect by reducing perceived exertion and enhancing emotional state the music must be 'liked' by the participant. This finding has implications for exercise prescription using RPE, exercise adherence, and the effect of music on emotional states.

#### 4. Examining the effects of practice and external feedback on netball shooting performance

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Different forms of information can be used to reinforce the correct execution of a motor skill. Past research on the use of augmented feedback has been inconclusive as to which is optimal, although a combination of both knowledge of performance and knowledge of results may elicit the greatest improvement in performance (Hebert and Landin, 1994: *Research Quarterly for Exercise and Sport*, 65, 250–257). The aim of the present study was to examine the effects practice and external feedback had on netball shooting performance in novice players.

Thirty healthy active participants (12 male and 18 female,  $21.8 \pm 2.4$  yrs) were randomly assigned to one of the three experimental groups (control  $n=10$ , practice  $n=10$ , or external feedback  $n=10$ ). The participants had no previous experience in similar shooting activities (i.e., netball, basketball). The experiment took place over a 5-day period. All participants attended pre- and post-training sessions (on the first and last day of the 5-day period respectively) in which they completed 20 netball shots from a standardised position 2 m away from the post. Participants received zero points if they missed completely, two points if they hit the ring and five points if the ball passed through the ring; therefore the most points that one participant could achieve was 100. Each day during the 3-days' training, both the practice and external feedback groups participated in a practice session lasting 20 minutes. Additionally, the external feedback group received specific shooting instructions (i.e. augmented feedback) from a netball coach.

A One-way Analysis of Variance (ANO VA) with factor 'group' for the variable 'total score' showed that the groups did not significantly differ before the training ( $F_{2,29}=0.714$ ,  $P=0.499$ ), but did so at the post-training ( $F_{2,29}=3.732$ ,  $P=0.037$ ). Scheffe's *post-hoc* analysis indicated that the only significant difference at the post-training ( $P=0.045$ ) was between the control group ( $56.30 \pm 11.12$  points) and the external feedback group ( $69.30 \pm 12.70$  points).

When studying the training effect, a correlated ANOVA for repeated measures showed a significant difference for the variable total score ( $F_{1,27}=22.784$ ,  $P=0.000$ ) for the whole sample (pre-training:  $50.90 \pm 11.90$  points; post-training:  $61.83 \pm 11.97$  points). Pairwise comparisons showed no significant difference for the control group ( $P=0.356$ ,  $t=-0.974$ ; pre:  $52.3 \pm 13.0$ , post:  $56.3 \pm 11.11$ ), but revealed significant differences for both the practice group ( $P=0.022$ ,  $t=-2.773$ ; pre:  $47.2 \pm 12.74$ , post:  $59.9 \pm 8.77$ ) and the external feedback group ( $P=0.001$ ,  $t=-5.212$ ; pre:  $53.1 \pm 9.94$ , post:  $69.3 \pm 12.7$ ). Although both practice and external feedback groups were found to have significant improvement post-training, the external feedback group showed a greater improvement (16.2%) compared to the practice group (5.8%).

The results showed that overall, both practice and external feedback groups improved their netball shooting performance. More specifically, the group receiving external feedback showed a higher improvement in scoring performance compared to practice alone as shown by the actual scores. These specific findings on netball shooting in beginners are in agreement with previous research in other sports (Boyce, 1991: *Journal of Teaching in Physical Education*, **11**, 47–58). The importance of the coaching role and appropriate external feedback becomes apparent when one considers the impact that such brief interventions have on sport performances.

### 5. The impact of psychological skills training on football performance

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Recently, there has been an increase in the number of experimental studies examining the efficacy of psychological skills on sporting performance (Thelwell and Greenlees, 2003, *The Sport Psychologist*, **17**, 318–337). Despite this trend, there remains a limited knowledge base as to the efficacy of such skills within team sports and in particular football (Reilly and Gilbourne, 2003, *Journal of Sports Sciences*, **21**, 693–705). As a result, the purpose of the present study was to develop a role-specific intervention for football midfielders taking into account the different requirements of this position. When analyzing the requirements of a midfield footballer, one can see that they require the physical

capability to cover great distances within a 90-minute match, ability to carry out complex motor skills (e.g., tackling whilst in motion), perceptual skills (e.g., knowing movements of teammates) and decision-making skills (e.g., knowing the correct pass to make). Having developed a position specific intervention, the study employed a multiple-baseline across individuals, single-subject design to examine its efficacy on two role specific performance subcomponents, tackling and passing.

A total of 4 male footballers ( $M$  age=20.2), each reporting themselves as midfield players from a British University Sports Association 1<sup>st</sup> team squad gave their consent to participate in the study. Data for pass completion percentage (P%) and tackle success percentage (T%), were collected over a nine-match league period by a Football Association (FA) Level 3 coach. An 'a priori' decision was made to deliver the intervention at staggered time points over the nine-match period where participant 1 received the intervention after match 3, participant 2 after match 4, participant 3 after match 5 and participant 4 after match 6. The interventions were delivered across a 3-day period by a British Association of Sport and Exercise Sciences Accredited Sport Psychologist and comprised of relaxation, imagery and self-talk strategies. The intervention content was based on Taylor's (1995, *The Sport Psychologist*, **9**, 339–357) conceptual framework for identifying psychological priorities for a sport, and previous applied-based literature. At the completion of the study, social validation data were collected to assess the intervention process as recommended in applied-based literature (Thelwell and Greenlees, 2003).

The data for the four players were analysed following the recommendations forwarded by Hrycaiko and Martin (1996, *Journal of Applied Sport Psychology*, **8**, 183–199). Resultant visual inspection of the P% data revealed that all four individuals experienced an immediate improvement, and a higher mean 'pass completion rate' following the intervention period (increases ranged from 6% to 20%). In addition to the improvement in P%, there was greater consistency around the mean performance following the intervention and very few overlapping data points across the four performers between pre- and post-intervention. Results for T% indicated both an immediate and sustained higher level of performance post-intervention (increases ranged from 10% to 23%). Again, a greater consistency of performance was witnessed following the intervention, with a total of three overlapping data points between pre- and post-intervention across the individuals being evident.

The purpose of the present study was to develop a role specific psychological skills intervention for