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Interactive Effects of Video, Priming, and Music on Emotions and the Needs Underlying Intrinsic Motivation

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Highlights

- Impact of music, video, and priming on emotion/motivation-related variables was explored.
- A cross-cultural comparison was also conducted using English and Greek samples.
- The proposed positive effects of music on psychological states were supported.
- Positive effects of priming as a psychological intervention are expounded.
- A state-of-the-art application of video, priming, and music in sport is presented.

Abstract

Objectives: Emotions can enhance motivation towards a particular goal (Brehm, 1999), while activation of human motivation does not necessarily involve conscious processes (Bargh, 1990). The main purpose of the present study was to explore the impact of video, priming, and music on a range of emotion- and motivation-related variables, while the secondary purpose was to conduct a cross-cultural comparison. *Design:* A randomized controlled design was employed to address the interactive effects of video, priming, and music on emotions and motivation with reference to the circumplex theory of emotion. *Methods:* Participants comprised a convenience sample of 210 volunteers (English, n = 128; M = 20.0, SD = 4.7 years; Male, n = 65; Female, n = 63; Greek, n = 82, M = 23.3, SD = 2.4 years; Male, n = 59; Female, n = 23). A control condition and five experimental conditions were presented to participants in a counterbalanced order. The needs underlying intrinsic motivation were accessed using the Activity Feeling-state Scales (AFS; Reeve & Sickenius, 1994), while emotional states were assessed using adjectives from the Circumplex Model of Affect (Russell, 1980). *Results:* Findings showed that music had positive effects on emotional states and the psychological needs underlying intrinsic motivation. They also highlighted the positive effects of priming as a psychological intervention – particularly when presented through video and coupled with music. *Conclusions:* The study presents the state-of-the-art for the use of video, priming, and music in sport and includes recommendations for sport psychology practitioners and researchers.

Keywords: Circumplex Model, Affect, Self-determination Theory

Emotions can enhance motivation towards a particular goal (Brehm, 1999) while there is also a strong link between emotions and performance (Hanin, 2000; Jones, Mace, & Williams, 2000). Human motivation can be activated automatically without the involvement of conscious guidance or choice (Bargh, 1990), and an intervention that can impact upon motivation at a subconscious level is know as *priming*. Priming techniques are concerned with temporary activation states and how environmental information together with internal readiness interact to influence perceptions and evaluations as well as motivations and behaviours (Bargh, 1997). For example, by seeing an image of a Coca Cola can in a millisecond during a movie, one might feel the urge to purchase a can during the interval (Vicary, 1957 cited in Radford, 2007, pp. 18–21). Priming can therefore act as a process by which to unconsciously alter an individual's psychological state both prior to and during the execution of a task.

Use of video in sport

Video has been used in psychosocial interventions as a feedback tool for behaviour modification strategies as well as to develop specific communication skills and behaviours (Barwood, Weston, Thelwell & Page, 2009; Bishop & Forzoni, 2006; Halliwell, 1990; Ives, Straub, & Shelley, 2002; Williams & Grant, 1999). It can also be used to train decision-making skills and sport-specific anticipatory skills (Ives et al., 2002). Williams and Grant contended that video is one of the most efficacious perceptual motor training tools. Mental training videos can heighten motivation and be used for teaching purposes as well as to develop skills such as mental rehearsal (Ives et al., 2002). Halliwell noted that video coupled with visualization techniques led to "remarkable performance changes" (p. 371) and provided examples of how highlight videos might enhance both confidence and motivation. Ives et al. suggested that video can be used to enhance the communication and relationships between athletes and coaches, rather than eliminating the human element in sport psychology.

Baumgartner, Lutz, Schmidt, and Jänke (2006) designed a functional magnetic resonance imaging (fMRI) study to investigate how musical stimuli might enhance affective responses to pictures. They combined happy, sad, and fearful pictures from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 1995) either singularly or coupled with congruent classical music that was known to elicit the same emotional experience as the pictures (Peretz, Gagnon, & Bouchard, 1998). Ratings on the valence scale (pleasure/displeasure) showed that the emotional experiences (happy, sad, fear) during the interactive conditions (pictures with music) were significantly increased when compared to the pictures-only conditions. Further, despite the noisy scanner environment, it was reported that the participants were able to apprehend and recognise the emotional musical excerpts. It should be noted, however, that these researchers did not include a music-only condition. Accordingly, one cannot exclude the fact that the results observed in the interactive condition could also have been produced by a music-only condition; a potential confound that we sought to eliminate in the present study.

Music interventions in sport

In their review of psycho-musicological research in sport and exercise in the period 1997-2010), Terry and Karageorghis (2011) concluded that motor performance could be facilitated by music in a number of ways. For example, music has the capacity to act as a legal stimulant or sedative and can enhance both pre-task and in-task affect (feelings of pleasure/displeasure). Further, music stimulates the right hemisphere of the brain, which facilitates cognitive tasks such as imagery and mental rehearsal (Levitin & Menon, 2005). According to Karageorghis, Terry, and Lane (1999), factors that contribute to the motivational qualities of music include *rhythm response*, *musicality*, *cultural impact*, and *association*. Rhythm response relates to one's physical reaction to the speed (tempo) and accentuation (rhythm) of music. Musicality has to do with the pitch-related elements of music

such as harmony and melody, which, in combination with the speed of music, shape the listener's mood. Cultural impact refers to the pervasiveness of a piece of music within society; people tend to express a preference for familiar musical selections. Finally, association relates to extra-musical associations that are inspired by music (e.g., Vangelis's *Chariots of Fire* and Olympic glory).

The Circumplex Model of Affect

The Circumplex Model of Affect developed by Russell (1980) forms the basis of the circumplex theory of emotion. It illustrates how most emotions (emotional experiences) can be arranged in a circular fashion around the perimeter of two independent bipolar dimensions that intersect each other, namely pleasant/unpleasant and arousing/sleepy. These divide the circumplex into four quadrants that are numbered 1 to 4 moving clockwise. Loizou and Karageorghis (2007) provided initial support for the use of the Circumplex Model of Affect and its dimensions in sport, with both English and Greek samples. North and Hargreaves (1997) used a modified version of the Circumplex Model to investigate the relationship between liking and arousal potential in order to demonstrate that the emotions expressed by musical pieces may be predicted and explained using liking and arousal ratings. Despite evidence that music strategies could be used to alter mood regulation (Saarikallio & Erkkiläs, 2007), music has received limited attention as a pre-performance strategy in sports (e.g., Eliakim, Meckel, Nemet, & Eliakim, 2007; Pates, Karageorghis, Fryer, & Maynard, 2003).

The needs underlying intrinsic motivation

Motivation is a powerful inner force that directs, sparks, or maintains human behaviour (Virgilio, 1997). Deci and Ryan (1985) asserted that behaviour is influenced by three primary motivational factors: intrinsic motivation, extrinsic motivation, and amotivation. Intrinsic motivation is characterized by participation in an activity for the pleasure and satisfaction that one derives from it, while participation for the purpose of

gaining of external rewards characterizes extrinsically motivated behaviour. A lack of perceived competence coupled with low expectations of engaging in an activity, that is, the absence of either intrinsic or extrinsic motivation, is associated with the state of amotivation.

Motivation involves identification of personal and social factors that reflect some form of valued reward or encouragement. Therefore, the desire to successfully execute optimal skill challenges in sport settings determines intrinsic motives (Clews & Gross, 1995). The degree to which intrinsic motivation will be experienced, involves the extent to which, the needs for self-determination, competence, and relatedness are satisfied (Deci & Ryan, 1985, 1987; Ryan & Deci, 2000). Self-determination theory (SDT) was based on the assertion that human behaviour is affected by three psychological factors; namely competence, relatedness, and autonomy (Deci & Ryan, 1991; 1985; Georgiadis, Biddle, & Chatzisarantis, 2001; Ryan & Deci, 2000). Competence refers to how an individual perceives themselves as being efficacious in achieving a desired outcome. Relatedness involves the development of genuine interpersonal relationships, and autonomy refers to choiceful involvement in an activity without influence from external factors (Vallerard & Losier, 1994).

Considering the purported positive effects music can have in manipulating or regulating an athlete's pre-competitive emotions (Terry & Karageorghis, 2011), as well as those of priming and video techniques (Bargh, 1997; Ives et al., 2002; Williams & Grant, 1999) an additive effect is likely to transpire with reference to emotional manipulation and the satisfaction of the needs underlying intrinsic motivation. Investigation of the impact of such interventions on emotions and dimensions of motivation might shed considerable light upon how to integrate modern-day technologies such as the Blu-ray Disc (BD) and the android technology used in smartphones and tablet computers within applied practice.

The present study applies a revalidated version of the Circumplex Model of Affect (Loizou & Karageorghis, 2007) in a sporting context among two cultures – English and

Greek – using experimental conditions with various combinations of video, music, and priming. The main purpose was to explore the impact of the experimental conditions on the dependent variables (DVs; emotion and intrinsic motivation) while the secondary purpose was to conduct a cross-cultural comparison. To this end, an interaction approach was adopted to examine Culture x Condition differences in the DVs. Given that the study was primarily exploratory in nature, the sole a priori hypothesis was that the combination of video, music, and priming would be the most efficacious condition across cultures in facilitating positive change in the DVs. Specifically, more positive affect and less negative affect coupled with greater satisfaction of the psychological needs underlying intrinsic motivation was expected following exposure to this condition. A significant Culture x Condition interaction was not expected to emerge.

Method

Determination of sample size

In two meta-analyses of subliminal priming (Anatchkova & Rossi, 2002; DeCoster & Claypool, 2004) the mean effect size (Cohen's *d*) calculated was .5315. Using this effect size and a power of .80, the sample size needed to detect an effect using a one-tailed test was approximately 45–55 participants (Cohen, 1988). Due to the lack of experimental data to inform the expected effect size for the cultural differences and condition differences explored in this study, a minimum of 50 participants to be recruited from each culture under investigation was deemed appropriate.

Participants

Following procurement of institutional ethical approval, a convenience sample of 210 volunteers (English, $n = 128$; $M = 20.0$, $SD = 4.7$ years; Male, $n = 65$; Female, $n = 63$; Greek, $n = 82$, $M = 23.3$, $SD = 2.4$ years; Male, $n = 59$; Female, $n = 23$) who were heterogeneous in terms level of sports participation and involvement participated in the study. In the English

sample, 102 participants described their ethnicity as White UK/Irish while the remaining 26 participants were from a range of ethnic groups but all British nationals. Twenty-five of them were participating in sport at a recreational level, 56 at club level, 18 at county level, six at regional level, seven at national level, and 15 at international level. Forty-eight participants in the Greek sample described their ethnicity as Greek while 34 described theirs as Cypriot. Forty-six of them were participating in sports at recreational level, 15 at club level, six at county level, three at regional level, three at national level, and nine at international level.

Instrumentation

Affect. Participants were asked to state how they felt in response to listening to/watching the particular piece of music/video presented to them using an 11-point Likert-type scale anchored by 0 (*not at all*) and 10 (*very much so*). Ten words describing emotional states, two from each quadrant of the Circumplex Model (Quadrant 1: excited, delighted; Quadrant 2: contented, relaxed; Quadrant 3: depressed, bored; Quadrant 4: distressed, frustrated), and two representing the main axis of the Circumplex Model (arousal, pleasure) were presented to participants in their first language (English or Greek). Using the same rating scale, participants rated how much they liked the presented condition. At the end of sixth condition, participants were asked to place the different conditions in their preferred order from the most to the least liked.

Psychological needs underlying intrinsic motivation

The Activity Feeling-State Scales questionnaire (AFS; Reeve & Sickenius, 1994) was used to assess the degree to which the needs underlying intrinsic motivation were satisfied. The AFS is a psychological state measure of the three psychological needs underlying intrinsic motivation and tension. Tension is considered to be an emotional marker of internal motivations that are antagonistic to intrinsic motivation (Ryan, Koestner, & Deci, 1991). Participants were asked to state how they felt in response to listening to/watching the

particular piece of music/video presented to them using a 5-point Likert-type scale anchored by 1 (*strongly disagree*) and 5 (*strongly agree*). Reeve and Sickenius provided initial satisfactory alpha coefficients for all subscales, self-determination = .61, competence =.90, relatedness = .75, and tension =.87.

Preparation of experimental conditions

The experimental conditions comprised of video footage from past Olympic Games, which was 148 s in duration, and coupled with either music and/or primes. Video footage that could be directly related to either English or Greek culture was excluded. A combination of clips from objectively and subjectively assessed sports was included (e.g., track and field vs. diving). Further, Vangelis's *Chariots of Fire* was chosen to accompany the video clips owing to its relevance to the Olympic Games (see Karageorghis & Terry, 1997). The particular piece of music was chosen as it is well known in both cultures given that it was written by a famous Greek composer about the British Olympic team. Primes consisted of the Olympic motto, *Faster, Higher, Stronger*, which was presented in the participants' first language. Again this motto is widely known by both English and Greeks. Conditions comprised of: (a) video only; (b) music only; (c) video and music; (d) video with motivational priming; (e) video with motivational priming and music; and f) a no-music/no-video/no-primes control.

Experimental procedure

After providing written consent and demographic details, each participant was instructed to sit comfortably and attend to each condition. They were administered two questionnaires immediately after each presented condition. Sound intensity was adjusted to 75 dBA using a decibel meter (CR:303 Sound Level Meter; Cirrus Research Plc, E.U.) which is within safe limits from an audiological perspective. The conditions were presented in counterbalanced order to minimize any externally induced effects pertaining to the order of presentation. Primes were presented on the screen randomly at different time intervals and

lasted for 40 ms. In between each condition, a simple mental arithmetic task was used as a filler (Bargh, 1997) to mitigate the potential influence of carry-over effects. Once all experimental conditions were completed, participants were debriefed as to the precise purpose of the study.

Data analysis

Following data screening using standardized scores ($-3.29 \leq z \geq 3.29$) for univariate outliers and Mahalanobis distance tests for multivariate outliers ($p < .001$; Tabachnick & Fidell, 2007, p. 77) and checks for the relevant parametric assumptions, a mixed-model 2 x 6 (Culture x Conditions) multivariate analysis of variance (MANOVA) was conducted to examine possible differences between the two cultures under investigation as well as among the different conditions. A 2 x 5 (Culture x Conditions) analysis of variance (ANOVA) was conducted to examine possible differences in the scores of the two cultures in the liking scale. Significant *F* tests were followed-up with Bonferroni-adjusted pairwise comparisons to identify where differences lay.

Results

Following outlier tests, four cases identified as univariate outliers (English, $n = 3$; Greek, $n = 1$) were excluded prior to further analyses. Given the large number of comparisons in the present study, in the interests of parsimony, only significant findings will be highlighted. Accordingly, on each occasion that the descriptors "higher" or "lower" are used they can be taken to mean "significantly higher" and "significantly lower".

Analysis of the liking scores

A mixed-model 2 x 5 (Culture x Conditions) analysis of variance (ANOVA) was conducted to examine possible differences between the two cultures under investigation as well as among experimental conditions. Mauchly's test indicated that the liking score violated the assumption of sphericity, Mauchly's $W = .683$, $\chi^2_9 = 77.122$, $\varepsilon = .843$, $p < .001$,

therefore, a Greenhouse-Geisser adjustment was applied to the *F* test. Also, results of Box's *M* test ($p < .001$) indicated that the more conservative Pillai's Trace omnibus statistic should be used in preference to Wilks' λ (Tabachnick & Fidell, 2007, p. 252).

The Culture x Condition interaction effect was significant, Pillai's Trace = .285, $F(4,201) = 20.03$, $p < .001$, $\eta_p^2 = .29$. Further, a main effect for culture was observed, Pillai's Trace = .287, $F(5,200) = 16.10$, $p < .001$, $\eta_p^2 = .29$, with the large effect size indicating that 29% of the variance was accounted for by culture. There was a difference between the English and Greek samples in video (English: $M = 3.39$, $SD = 2.14$; Greek: $M = 5.88$, $SD = 2.28$; $p < .001$), video-music (English: $M = 5.52$, $SD = 2.14$; Greek: $M = 6.56$, $SD = 2.33$; $p = .001$), and video-primes conditions (English: $M = 4.06$, $SD = 1.87$; Greek: $M = 4.99$, $SD = 2.09$; $p < .001$; see Fig. 1).

In general, the video-music-primes condition ($M = 7.80$, $SD = 1.42$) was the most liked, followed by music ($M = 6.75$, $SD = 1.75$) and video-music conditions ($M = 5.93$, $SD = 2.27$). The video ($M = 4.37$, SD = 2.50) and video-primes ($M = 4.43$, $SD = 2.01$) conditions were the least liked. Follow-up pairwise comparisons across conditions indicated that video was lower than video-music-primes (95% confidence interval [CI] –3.60 to –2.64, $p < .001$), music (95% CI –2.579 to –1.598, $p < .001$) and video-music conditions (95% CI –1.87 to –.94, $p < .001$). Further, video-primes scored lower than video-music-primes (95% CI –3.67 to –2.79, $p < .001$), music (95% CI –2.65 to –1.74, $p < .001$), and video-music conditions (95% CI –1.95 to –1.07, $p < .001$).

Both samples ranked the video-music-primes condition as their most preferred (English = 82.0%, Greek = 59.8%). The English sample indicated music as their second most preferred (54.7%), while the Greek sample chose the video-music condition as their second most preferred (40.3%). The least preferred conditions among both samples were the video-only (English = 58.6%, Greek = 35.4%), video-primes (English = 39.8%, Greek = 45.1%),

and control conditions (English = 32.8%, Greek = 56.1%). Visualization of the results of the two samples combined indicated a distinct preference for the video-music-primes condition (73.3%) followed by the music-only condition (41.4%).

Analysis of affect and needs underlying intrinsic motivation

Mauchly's test showed that all DVs violated the sphericity assumption at $p < .001$, therefore a Greenhouse–Geisser adjustment was applied to each *F* test. In the mixed-model MANOVA, Box's *M* test of equality of covariance matrices could not be computed as there were fewer than two non-singular cell covariance matrices. Thus, the more conservative Pillai's Trace omnibus statistic was used in preference to Wilks's λ.

The results revealed a significant main effect indicating differences between the English and Greek samples, Pillai's trace = .37, $F(50,5075) = 8.13$, $p < .001$, $\eta_p^2 = .07$. The small-to-medium effect size indicated that 7% of the variance was accounted for by the culture independent variable. Follow-up pairwise comparisons between cultures revealed that the Greek sample exhibited higher scores than the English sample in emotions of Quadrant 1 ($p < .001$), Quadrant 2 ($p < .001$), and Quadrant 4 ($p < .001$) as well as in the pleasure score ($p < .001$). Further, the Greek sample scored significantly higher than the English sample in self-determination ($p < .001$), competence ($p < .001$), and relatedness ($p < .001$) scores. Despite the differences observed between the two samples in the DVs, the pattern of change across conditions was very similar.

The results for affective changes across conditions for the English sample revealed a significant main effect for condition emerged, Pillai's Trace = 1.22, $F(50, 3075) = 19.85$, $p < .001$, $\eta_p^2 = .24$, and the large effect size indicated that 24% of the variance was accounted for by condition. More specifically, there was a difference across conditions in the emotions of Quadrant 1, $F(3.410, 422.841) = 121.91$, $p < .001$, $\eta_p^2 = .50$, Quadrant 2, $F(3.773, 467.816) = 73.69$, $p < .001$, $\eta_p^2 = .37$, Quadrant 3, $F(3.266, 405) = 66.03$, $p < .001$, $\eta_p^2 = .35$, and

Quadrant 4, $F(3.207, 397.702) = 76.83$, $p < .001$, $\eta_p^2 = .38$. The video-music-primes, music, and video-music conditions were shown to have the most positive impact on emotions, scoring higher in Quadrant 1 ($p < .001$) and Quadrant 2 when compared with the video ($p < .001$), video-primes ($p < .001$), and control conditions (video-music-primes condition, $p < .001$ and video-music condition, $p = .015$). Moreover, the aforementioned conditions scored significantly lower in Quadrant 3 ($p < .001$) and Quadrant 4 ($p < .001$) when compared with video, video-primes, and control conditions.

Results for the main axes of the Circumplex Model of Affect, namely pleasure and arousal across conditions, mirrored those of the circumplex quadrants with the music, video-music, and video-music-primes conditions being the most effective in increasing pleasure and arousal. Pairwise comparisons indicated that participants felt more aroused in the video-music-primes condition ($M = 5.33$, $SD = 2.91$) when compared with the remaining conditions (music condition; $M = 3.74$, $SD = 2.69$; 95% CI 3.01 – 4.55, $p < .001$, video condition; $M = 1.79$, $SD = 1.89$; 95% CI 2.79 – 4.28, $p < .001$, video-music condition; $M = 3.72$, $SD = 2.55$; 95% CI 1.04 – 2.18, $p < .001$, video-primes condition; $M = 2.11$, $SD = 1.96$; 95% CI 2.55 – 3.88, $p < .001$, control; $M= 1.54$, $SD = 1.94$; 95% CI 3.01 – 4.55, $p < .001$). Similar comparisons were observed in the pleasure axis with the video-music-primes condition ($M = 6.04$, $SD = 2.30$) scoring higher than other conditions ($p < .001$).

Changes in the needs underlying intrinsic motivation across conditions in the English sample showed that the music condition ($M = 3.27$, $SD = .67$) elicited higher score than the control ($M = 2.96$, $SD = .66$; 95% CI .142 – .470, $p < .001$) for self-determination. A similar change was observed in the competence subscale ($M = 3.55$, $SD = .65$; 95% CI .136 – .536, $p < .001$). However, there was no difference in the relatedness subscale ($p = 1.000$). Further, there was a decrease in tension ($M = 1.72$, $SD = .69$) relative to control ($M = 2.27$, $SD = .79$; 95% CI –.741 to –.336, $p < .001$). When comparing the music with the remaining

experimental conditions, higher scores were recorded in both the self-determination subscale (video condition; M = 2.43, SD = .82; 95% CI .573 – 1.10, p < .001, video-music condition; M = 2.85, SD = .77; 95% CI .25 – .59, p < .001, video-primes condition; M = 2.72, SD = .73; 95% CI .36 – .73, p < .001), and the competence subscale (video condition; M = 2.64, SD = .84; 95% CI .66 – 1.17, p < .001, video-music condition; M = 3.09, SD = .72; 95% CI .29 – .65, p < .001, video-primes condition; M = 2.87, SD = .75, 95% CI .47 – .90, p < .001).

The video-music-primes condition exhibited a trend similar to the music condition when compared to the control with higher scores in the self-determination subscale (M = 3.44, SD = .66; 95% CI .31 – .65, p < .001) and competence subscale (M = 3.72, SD = .63; 95% CI .31– .70, p < .001). Tension exhibited a decrease in the video-music-primes condition (M = 1.60, SD = .65) when compared with the control (95% CI –.86 to –.47, p < .001). When video-music-primes was compared with the remaining experimental conditions, higher scores were recorded in both the self-determination subscale (music; 95% CI .07 – .27, p < .001, video; 95% CI .75 – 1.26, p < .001, video-music; 95% CI .42 – .76, p = .000, video-primes; 95% CI .55 – .89, p < .001) and the competence subscale (music; 95% CI .03 – .31, p = .008, video; 95% CI .81 – 1.34, p < .001, video-music; 95% CI .46 – .80, p < .001, video-primes; 95% CI .65 – 1.05, p < .001).

There was a condition main effect for Affect in the Greek sample, Pillai's Trace = .76, F(50, 1975) = 7.06, p < .001, η_p^2 = .15. The large effect size indicated that 15% of the variance could be accounted for by the within-subjects factor. With reference to the affective changes in Quadrant 1, there was a decrease in the video-primes condition (M = 9.53, SD = 4.73) compared with the control (M = 11.51, SD = 4.18; 95% CI –3.67 to –.28, p = .011). Further, an increase was observed in video-music-primes (M = 13.65, SD = 4.20) when compared with control (95% CI .64 – 3.66, p = .001).

Affective change in Quadrant 2 indicated a positive effect derived from the music condition (M = 13.12, SD = 4.69) when compared with control (M = 11.30, SD = 4.12; 95% CI .14 – 3.52, p = .023). A positive effect was also observed when the video-music-primes (M = 12.58, SD = 4.16) was compared with video (M = 10.95, SD = 4.37; 95% CI .23 – 3.03, p = .011), and video-primes conditions (M = 10.69, SD = 4.63; 95% CI .46 – 3.31, p = .002).

The video-music-primes condition (M = 3.54, SD = 3.66) exhibited a negative effect on Quadrant 3 emotions when compared with video-music (M = 5.60, SD = 5.27; 95% CI –3.37 to –78, p < .001) and video-primes conditions (M = 7.37, SD = 4.53; 95% CI –5.23 to –2.45, p < .001). Music (M = 3.91, SD = 3.84) scored lower in Quadrant 3 when compared with the video-primes condition (95% CI –4.90 to –2.01, p < .001). In addition, the video-music condition (M = 5.60, SD = 5.27) scored significantly lower in Quadrant 3 when compared with the video-primes condition (95% CI –3.39 to –.14, p = .023). However, video-music was higher in Quadrant 3 when compared with video (M = 3.49, SD = 3.38; 95% CI .23 – 3.99, p = .016), and video-music-primes conditions (95% CI .78 – 3.73, p < .001) as well as with control (M = 3.49, SD = 3.38). Finally, the video-primes condition was found to be higher in Quadrant 3 when compared with the other conditions (p < .001).

Emotions related to Quadrant 4 of the Circumplex Model were lower in the music condition (M = 2.10, SD = 2.29) when compared with video-music (M = 3.69, SD = 3.38; 95% CI –2.75 to –.43, p = .001) and video-primes conditions (M = 3.74, SD = 3.36; 95% CI –2.86 to –.42, p = .002). Further, a lower score was observed for video-music-primes (M = 2.23, SD = 2.43) when compared with video-music (95% CI –2.41 to –.51, p < .001) and video-primes conditions (95% CI –2.49 to –.53, p < .001).

Turning to changes in the main axes of the Circumplex Model of affect among the Greek sample, pairwise comparisons indicated an increase in arousal in all conditions when compared with control. More specifically, the music condition (M = 3.80, SD = 3.12) was

significantly higher than control (M = 2.50, SD = 2.65; 95% CI .59 – 2.91, p < .001). In addition, video-music (M = 4.66, SD = 3.45) was higher than video (M = 3.14, SD = 2.83; 95% CI .53 – 2.53, p < .001), video-primes (M = 3.19, SD = 2.63; 95% CI .61 – 2.35, p < .001), and control conditions (95% CI .53 – 3.83, p < .001). Moreover, the video-music-primes condition (M = 4.28, SD = 3.48) was higher than the video (95% CI .12 – 2.18, p = .017) and control conditions (95% CI .98 – 3.49, p < .001).

With regard to the pleasure axis scores, video-music-primes (M = 7.08, SD = 2.30) was higher when compared against all conditions (control condition, p < .001, music condition, p = .009, video condition, p < .001, video-music condition, p = .001, video-primes condition, p < .001). Also, music (M = 6.17, SD = 2.57) was more efficacious than video-primes (M = 4.75, SD = 2.62; 95% CI .48 – 2.37, p < .001). Additionally, video-music (M = 6.23, SD = 2.59) score was higher than the video-primes condition (95% CI .59 – 2.37, p < .001).

In terms of the needs underlying intrinsic motivation across conditions for the Greek sample, self-determination in video-music-primes (M = 3.89, SD = .77) was higher than in the music condition (M = 3.68, SD = .83; 95% CI .03 – .40, p = .011). Similar effects were observed for video (M = 3.58, SD = .90; 95% CI .08 – .54, p = .002) and the video-primes conditions (M = 3.59, SD = .78; 95% CI .11 – .50, p < .001).

For competence, video-music (M = 3.66, SD = .93) elicited higher scores than video-primes (M = 3.35, SD = .85; 95% CI .06 – .55, p = .004) and control conditions (M = 3.42, SD = .91; 95% CI .04 – .73, p = .019). Further, video-music-primes (M = 3.80, SD = .83) elicited higher scores for competence when compared with music (M = 3.42, SD = .914; 95% CI .10 – .67, p = .002), video (M = 3.41, SD = 1.00; 95% CI .11 – .67, p = .001), video-primes (95% CI .20 – .69, p < .001), and control (95% CI .22 – .82, p < .001) conditions.

For relatedness, video-music-primes (M = 3.61, SD = .93) elicited higher scores when compared with music (M = 3.35, SD = .94; 95% CI .02 – .50, p = .020), video (M = 3.37, SD = .99; 95% CI .01 – .48, p = .037), and video-primes conditions (M = 3.30, SD = .96; 95% CI .11 – .52, p < .001). The only difference observed in the tension subscale was between the music (M = 1.77, SD = .76) and video conditions (M = 2.15, SD = .99; 95% CI –.71 to –.50, p = .012). The two samples in combination show clearly that the video-music-primes condition was the most effective, in terms of affective change. The video-music-primes condition scored higher than any other condition in Quadrant 1 (M = 12.51, SD = 4.48, p < .001), higher than all conditions other than music condition in Quadrant 2 (M = 12.57 SD = 3.56, p < .001), lower than all conditions in Quadrant 3 (M = 2.69, SD = 3.18, (control condition, p < .001, music condition, p < .001, video-condition, p = .006, video-music condition, p < .001, video-primes condition, p < .001), and lower than all conditions other than music in Quadrant 4 (M = 1.91, SD = 2.48, p < .001).

Pairwise comparisons across conditions, for changes in the main axes of the Circumplex Model of Affect, for both samples in combination, indicated that music (M = 3.77, SD = 2.87) was higher than video (M = 2.32, SD = 2.39; 95% CI .74 – 1.89, p < .001), video-primes (M = 2.53, SD = 2.30; 95% CI .54 – 1.71, p < .001), and control conditions (M = 1.74, SD = 2.26; 95% CI 1.36 – 2.59, p < .001). In addition, video-music (M = 4.90, SD = 2.96) was higher than video (95% CI 1.21 – 2.25, p < .001), video-primes (95% CI 1.07 – 2.02, p < .001), and control conditions (95% CI 1.75 – 3.04, p < .001). Moreover, the video-music-primes condition (M = 4.92, SD = 3.18) was significantly higher than any other condition (control condition, p < .001, music condition, p < .001, video-condition, p < .001, video-music condition, p = .005, video-primes condition, p < .001).

With reference to the pleasure axis, music (M = 5.31, SD = 2.46) was higher than video (M = 3.35, SD = 2.79; 95% CI 1.20 – 2.29, p < .001), video-primes (M = 3.47, SD =

2.43; 95% CI 1.25 – 2.29, $p < .001$), and control conditions ($M = 3.68$, $SD = 2.65$; 95% CI .92 – 2.05, $p < .001$). Further, video-music ($M = 4.70$, $SD = 2.68$) was higher than video (95% CI .77 – 1.75, $p < .001$), video-primes (95% CI .80 – 1.76, $p < .001$), and control conditions (95% CI .42 – 1.57, $p < .001$). Additionally, the video-music-primes condition ($M = 6.45$, $SD = 2.35$) was higher than all other conditions ($p < .001$).

Changes in the needs underlying intrinsic motivation across conditions for both samples in combination showed that the music ($M = 3.43$, $SD = .76$) elicited higher scores than video ($M = 2.89$, $SD = 1.02$; 95% CI .28 – .65, $p < .001$), video-music ($M = 3.22$, $SD = .86$; 95% CI .03 – .28, $p = .006$), and video-primes conditions ($M = 3.06$, $SD = .86$; 95% CI .17 – .46, $p < .001$) for self-determination. Additionally, video-music was higher than video (95% CI .14 – .48, $p < .001$) and video-primes conditions (95% CI .04 – .29, $p = .001$). Moreover, the video-music-primes condition ($M = 3.62$, $SD = .74$) was higher than any other condition ($p < .001$).

For the competence subscale, the music condition ($M = 3.50$, $SD = .77$) was higher than video ($M = 2.95$, $SD = .98$; 95% CI .26 – .66, $p < .001$), video-primes conditions ($M = 3.06$, $SD = .82$; 95% CI .20 – .55, $p < .001$), and control ($M = 3.24$, $SD = .62$; 95% CI .06 – .42, $p = .001$). Video-music ($M = 3.31$, $SD = .85$) was higher than video (95% CI .17 – .53, $p < .001$) and video-primes conditions (95% CI .12 – .40, $p < .001$). Moreover, video-music-primes ($M = 3.75$, $SD = .72$) was significantly higher than other conditions ($p < .001$).

For the relatedness subscale, the music condition ($M = 2.91$, $SD = .95$) elicited higher scores than video ($M = 2.53$, $SD = 1.09$; 95% CI .12 – .49, $p < .001$) and video-primes conditions ($M = 2.61$, $SD = .99$; 95% CI .11 – .41, $p < .001$). Video-music ($M = 2.78$, $SD = 1.06$) was higher than video (95% CI .04 – .39, $p = .006$) and video-primes conditions (95% CI .04 – .30, $p = .002$). It should be noted that video-music-primes condition ($M = 3.13$, $SD = .96$) and control ($M = 3.07$, $SD = .94$) elicited similar effects in terms of relatedness; both

scoring higher than the other conditions (for the video-music primes condition, $p < .001$, for the control condition, $p < .001$ against all conditions except the music condition where $p = .005$).

For the tension subscale, control ($M = 2.15$, $SD = .81$) elicited significantly lower scores than video condition ($M = 2.43$, $SD = 1.01$; 95% CI –.48 to –.03, $p = .013$). Music ($M = 1.74$, $SD = .71$) was lower than video (95% CI –.84 to –.42, $p < .001$), video-music ($M = 2.18$, $SD = .94$; 95% CI –.59 to –.21, $p < .001$), video-primes conditions ($M = 2.16$, $SD = .80$; 95% CI –.57 to –.22, $p < .001$), and control (95% CI –.56 to –.19, $p < .001$). Further, video-music was lower than the video condition (95% CI –.43 to –.04, $p = .005$). In addition, video-primes was lower than the video condition (95% CI –.44 to –.04, $p = .006$). Finally, video-music-primes ($M = 1.69$, $SD = .73$) yielded lower scores than video (95% CI –.88 to –.44, $p < .001$), video-music (95% CI –.61 to –.24, $p < .001$), video-primes (95% CI –.60 to –.24, $p < .001$), and control conditions (95% CI –.59 to –.22, $p < .001$).

Collectively, the present results indicate that the video-music-primes condition was the most efficacious in terms of eliciting positive affective changes and greater satisfaction of the needs underlying intrinsic motivation in both cultures, with video-music and music conditions following. The English sample reported a secondary preference for the music condition as an alternative to the video-music-condition. The Greeks' secondary preference was the video-music condition. The video and video-primes conditions were shown to be the least efficacious conditions across both samples.

Discussion

The purpose of the present study was to investigate the interactive effects of video, priming, and music on emotions and intrinsic motivation with reference to the Circumplex Model of Affect (Loizou & Karageorghis, 2009; Russell, 1980) and self-determination theory (Deci & Ryan, 1985, 1987; Ryan & Deci, 2000) in the English and Greek cultures. Based on

previous work in the area of psycho-musicology and sport psychology (Barwood et al., 2009; Bishop & Forzoni, 2006; Ives et al., 2002; Karageorghis & Terry, 1997; Hargreaves & North, 1999; North, Hargreaves, & Hargreaves, 2004; Saarkillio & Erkilläs, 2007; Williams & Grant, 1999) it was hypothesised that the video-music-primes condition would facilitate positive psychological changes among both English and Greek cultures. The results of the study provided strong evidence in support of this hypothesis.

Preference and liking Scores

Results of both the preference ranking and liking scores indicated that the video-music-primes condition was the most influential for both cultures. This lends support to the use of primes as a technique by which to change individuals' psychological states, given that priming is concerned with temporary activation states and how environmental information together with internal readiness, interact at an unconscious level to produce perceptions and evaluations (Bargh, 1997). Although, participants were conscious of their psychological state, their thinking and actions were probably underpinned by brain processes that were not open to examination. Accordingly, they were unconscious of the processes underlying their end response (Blackmore, 2003; Nisbett & Wilson, 1977; Nørretranders, 1991). Further, the video and the video-primes conditions were shown to be the least liked, scoring significantly ($p <$ .001) lower than the other experimental conditions.

It has been proposed that music has the capacity to act as a legal stimulant or sedative and can enhance both pre- and in-task affect (Terry & Karageorghis, 2011; Karageorghis & Terry, 1997). In the present results, it was evident that the absence of music caused a decrease in liking scores within the respective experimental conditions. A decrease was also observed in the scores of the Circumplex Model as well as in intrinsic motivation. This indicated the additive effect that music can engender; it appears to facilitate the application of priming techniques. Examining the two cultures separately, it is evident that the English

participants ranked the music condition as their second preference, while the Greek participants chose the video-music condition. With respect to the liking scores, no significant differences were observed between the two cultures in the video-music-primes and music conditions, despite this, the Greeks scored significantly ($p < .001$) higher than the English in all other conditions.

Ives et al. (2002) indicated that video could be used in psychological interventions as a tool to enable to training of communication skills and changes in behaviour. Imagery, on the other hand, can incorporate as many senses as possible in order to create or recreate an experience in the mind. With regard to the Greek sample, it seems that the visual information presented in the video further enhanced their liking scores relative to the music-only condition, indicating that the presence of video might have had an additive effect in terms of their liking scores.

Affective responses

The results of the preference and liking scores in both cultures were mirrored by the changes in affective responses as well as by the satisfaction of the needs underlying intrinsic motivation. The results supported the proposition that the emotional responses to a piece of music can be predicted by the degree of preference which the listener holds (North & Hargreaves, 1997). Further, they support the previous findings indicating that music can elicit positive effects on psychological states (Bishop, Karageorghis, & Loizou, 2007; Karageorghis et al., 2013; Pates et al., 2003). Also, Baumgartner, Lutz, Schmidt, and Jäncke (2006) indicated that combined visual and musical stimuli automatically produce a strong emotional response.

In the video-music condition, the English sample scored higher in positive emotions compared to negative emotions. However, emotions related to Quadrant 2 elicited higher scores when compared to those of Quadrant 1, indicating that the English felt significantly (*p*

< .001) less excited and more content compared to the video-music-primes condition and music condition. Findings of the video-music condition could be partially explained by the findings of Loizou and Karageorghis (2007) wherein emotions such as glad, happy, and pleased were placed in Quadrant 1 in the case of a category-sort task related with arousal, while in the case of a group-sort task, they were placed in Quadrant 2 which related with sleepiness, reflecting the more conservative nature of the English in terms of expressing feelings when compared with the Greeks.

The video and the video-primes conditions were the least effective in terms of affective changes. However, in the video-primes condition, the positive emotions of Quadrant 2 received higher scores than emotions in the other quadrants suggesting that priming might have had a positive effect on affective change. Lang (1995) contended that responses to unconditional stimuli are regulated according to the classification of the reflex as well as the affective valence of the individual's ongoing emotional state. Therefore, it can be suggested that the presence of primes in conjunction with video enhanced the affective state of the participants, through facilitation of the appetitive motivation system (Lang, 1995). Video and video-primes conditions were found to have no significant positive impact on affect compared to the remaining conditions indicating reduced efficacy for priming in the absence of music. When combined with music, the effects of priming were considerably greater. Specifically, the music, video, and priming condition exerted a positive impact on liking, and also the arousal and pleasure dimensions of the Circumplex Model of Affect. Such results lend support to the proposition that priming facilitates the effects of psychological interventions (Bargh, 1990).

Changes in the needs underlying intrinsic motivation

Similar to the affective changes observed in the English sample, the video-music-primes and music conditions had the most beneficial effect on the psychological needs

underlying intrinsic motivation, while the video and video-primes conditions were the least effective. This underscores the argument that motives and goals can be activated automatically by unconscious processes without the involvement of conscious guidance or choice (Bargh, 1990). However, there were no significant ($p > .05$) changes observed in the relatedness subscale. The design of the present study, however, did not allow for any close or genuine interpersonal relationships to be developed which may go some way towards explaining this finding.

Similar results were observed for the Greek sample. Further, the Greeks exhibited a significant positive effect on competence in the video-music condition when compared with the control ($p = .019$) and video-primes conditions ($p = .004$). This might explain the Greeks' preference towards the video-music condition rather than the music condition, since competence refers to how an individual perceives themselves as being efficacious in achieving a desired outcome (Vallerard & Losier, 1994). In general, it was evident that there was an enhancement of the satisfaction of the needs underlying intrinsic motivation in both the English and Greek samples during the video-music-primes condition, since when individuals feel competent and self-determined in dealing with their environment, intrinsic motivation increases (Ryan & Deci, 2000)

Main axes of the Circumplex Model

Arousal and pleasure scores followed a similar trend to that of the affective changes and liking in both samples. This supports the notion that most emotions (emotional experiences) could be arranged in a circular fashion around the perimeter of two independent bipolar dimension intercepting each other; namely, pleasure and arousal (Russell, 1980). Also, the ability of the Circumplex Model to predict the affective quality of several stimuli (Russell, Lewicka, & Niit, 1989) including priming, video, and music was supported by the present findings.

Combining the two samples together and examining the "big picture", it can be concluded that the video-music-primes condition was the most beneficial condition followed by the music and the video-music conditions respectively. All three conditions exhibited positive significant effects on affect and the needs underlying intrinsic motivation, resulting in an increase in positive emotions, intrinsic motivation, and a corresponding decrease in tension.

Limitations of the present study

The musical excerpt used in the current study as well as the video were somewhat repetitive in nature. This approach was chosen as it was thought that it would moderate the subjective complexity of the music and video, which, as North and Hargreaves (1995) demonstrated, might show an inverted-U relationship with liking. The excerpt and video were played for a total of three and four occasions respectively, in the various experimental conditions. This may have influenced responses to later conditions, due to the repetitive nature of the protocol and the fact that all testing took place on the same day. However, this potential limitation was addressed, to some extent, by presenting the different conditions in a counterbalanced order and the use of an arithmetic task between conditions as a filler (Bargh, 1997). Alternative experimental procedures might involve a similar repeated measured design with each condition presented on a separate day; this would represent a possible extension of the present study.

A further possible limitation could be the use of the AFS questionnaire (Reeve & Sickenius, 1994) and in particular its relatedness subscale. The design of the study did not permit for close interpersonal relations to be established which, might have led to their being no significant changes evident in this particular psychological need. The AFS was completed immediately after exposure to the different conditions; however the absence of a practical activity from the procedure might have impacted upon participants' responses.

Conclusions and recommendations

The findings of the present study illustrate the potential benefits that could be acquired by the use of video and music in sport psychology interventions. It is evident that music can be a source of motivation and inspiration in sporting settings (cf. Terry & Karageorghis, 2011). Video on the other hand, could act as a behaviour modification and motivational tool (Barwood et al., 2009, Ives et al., 2002). Combining the two, along with priming techniques could be particularly effectual in motivation- and emotion-related interventions. The present results supported the proposed positive effects of music on emotional states and the needs that underlie intrinsic motivation (Terry & Karageorghis, 2011). Further, they supported the potentially positive effects of priming in psychological interventions and exhibited the considerably higher impact of priming through video when this is coupled with music.

The present findings are particularly noteworthy for public health given the extensive use of music and video in everyday life. Musical excerpts and video clips coupled with primes could be used in public places to promote physical activity and exercise. Such techniques could be further used in rehabilitation programmes to help facilitate motivation and increase the enjoyment levels of patients. As a result, the number of unsuccessful or uncompleted sessions might be reduced, enhancing public health and reducing the costs associated with such programmes.

Future studies might address gender differences and the application of priming techniques in both individual and team sports using a variety of musical works and videos. They might also examine the effects of priming, video, and music on physiological indices of performance (e.g., heart rate and heart rate variability). Previous studies investigating cardiovascular and respiratory responses during music induction have lead to somewhat contradictory results (e.g., Etzel, Johnsen, Dickerson, Tranel, & Adolphs, 2006; Sokhaze,

2007). Psychophysiological research involving emotional and motivational responses to video, priming, and music is relatively sparse. A fruitful next step in sport psychology research would be the acquisition of psychophysiological data in order to better understand the impact of video, priming, and music interventions. In conclusion, it appears that the use of video, priming, and music might be a valuable tool for sport psychology practitioners in their quest to optimize athletes' affective states and enhance their intrinsic motivation.

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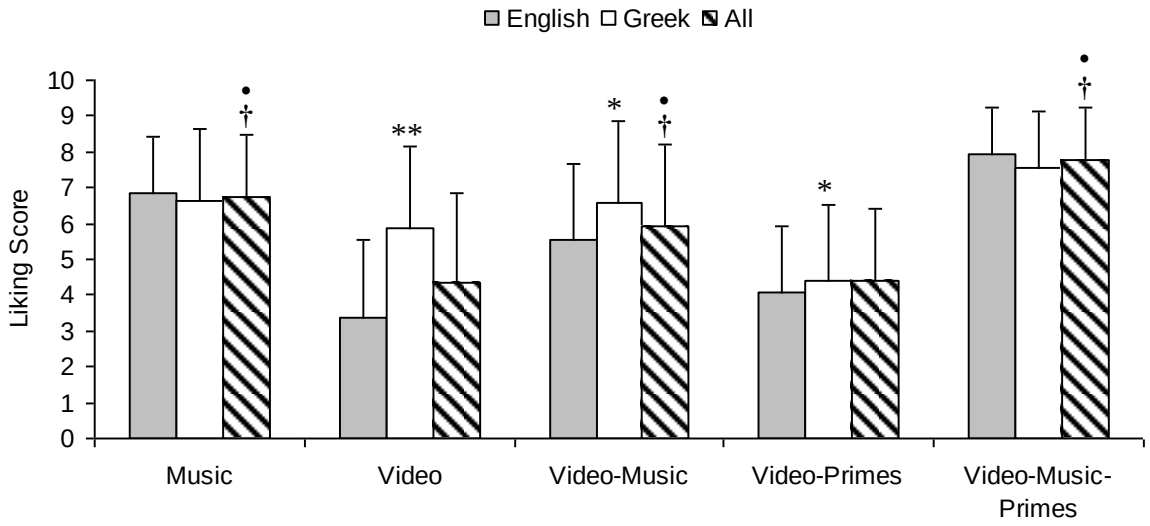

Fig. 1. Changes of liking scores across experimental conditions. *Note.* * Significantly different from the English sample, $p < .01$; ** Significantly different from the English sample $p < .001$; † Significantly different from the video condition, $p < .01$; • Significantly different from the video-primes condition, $p < .01$.