Effects of Attentional and Motivational Priming on Athletic Performance

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Abstract

The effect of motivational and attentional primes on athletic performance was assessed. Thirty-four male, recreational basketball players shot 10 free throws after completing a word scrambled sentence task that primed either autonomous motivation, fluency, or nothing (control). Results revealed that neither prime significantly increased free throw scores more than the control, but fluency primed participants scored significantly more free throws than autonomous motivation primed participants. Results provide support that athletes should try to relax during high pressure situations that require precision. Focusing on the task at hand will hinder performance, while naturally going through the motions will enhance performance. Results also provided support that there is an optimal level of arousal for performing one's best. Too low or too high of arousal actually hinders an athlete's performance.

Key words: autonomous motivation; attention; fluency

1. Introduction

Coaches, trainers, and athletes are always trying to find ways to improve a player's performance. It is widely known that having a good performance is not only based on an athlete's physical game but his/her mental game as well (Hall, Rodgers, & Bar, 1990). Many researchers are looking at the effects of priming on sports performance (Hall, Rodgers, & Bar, 1990; Wheeler & DeMarree, 2009). Priming is when anything in the environment stimulates a behavior by activating a mental construct (Wheeler & DeMarree, 2009). Primes usually take place below the conscious level, meaning individuals are unaware they received a prime or that a prime stimulus affected their behavior. Available research generally looks at two different types of priming on sports performance, motivational priming and attentional priming. Motivational priming focuses on increasing an individual's desire and belief that she/he can perform well (Hodgins, Yacko, & Gottlieb, 2006; Hodgins, Brown, & Carver, 2007), while the goal of attentional priming is to change what the individual is focusing on during her/his performance, (Ashford & Jackson, 2010; Adams, Ashford, & Jackson, 2014).

Research supports that primes positively affect an athlete's performance when she/he is autonomously motivated versus control motivated (Hodgins et al., 2006, 2007; Banting, Dimmock, & Grove, 2011; Radel, Sarrazin, & Pelletier, 2009), and when his/her attention is on fluency, rather than skill-focused (Ashford & Jackson, 2010; Adams et al, 2014; Beckmann, Gropel, & Ehrlenspiel, 2013). Autonomous motivation brings an individual's focus inward, meaning he/she looks for self-fulfillment and personal growth, while controlled motivation is based on external demands to reach a goal and individuals usually lack of self-

awareness (Hodgins et al., 2006). Fluency focus is when an individual is not consciously focusing on his/her actions; she/he is just doing it. Skill-focus is when an individual is consciously thinking about every action he/she is making (Ashford & Jackson, 2010).

Prior to this study, researchers focused on either motivational priming or attentional priming alone. The purpose of this study is to determine if one type of prime, autonomous motivation or fluency attention, would lead to a greater positive affect on athletic performance than the other. It was hypothesized that participants primed with fluency would perform significantly better ($p<.05$) than participants primed with autonomous motivation or participants in the control condition.

2. Review of Literature

Srull and Wyer (1979) were some of the first to study the effects of priming on human behavior. Participants were primed with thoughts of either hostility or kindness using a word scrambled sentence task. They were then asked to a rate a target person on different trait dimensions. As predicted, participants primed with hostility were more likely to rate the target as hostile, and participants primed with kindness were more likely to rate the target person as kind. To date, the specific effects of priming on athletic performance is limited to either motivational or attentional primes (Adams, Ashford, & Jackson, 2014; Ashford & Jackson, 2010; Banting, Dimmock, & Grove, 2011; Beckmann, Gropel, & Ehrlenspiel, 2013; Hodgins, Yacko, & Gottlieb, 2006; Radel, Sarrazin, Jehu, & Pelletier, 2013; Radel, Sarrazin, and Pelletier, 2009; Takarada & Nozaki, 2014).

2.1 Motivational Priming

Radel et al. (2013) studied the effects of high versus low motivational words and hand-grip dynamometer exertion. The researchers primed participants by having them listen for un-related target words, including "golf" and "vegetable," in one ear as they ignored the speech being played in the other ear. The ignored speech contained words that primed either high or low motivation. High motivational words included "desire, dynamic, effort, alive, energetic, active, joy, enthusiastic, persist, keen, energy, vigorous, performance, vitality, perseverance, improve, motivated, and striving." Low motivational words included "annoying, weak, obligation, tired, asleep, spineless, draining, bother, depleted, and resigned." Participants primed with high motivational words exerted more force and effort on the hand-grip dynamometer than participants primed with low motivational words.

In a similar study, Takarada and Nozaki (2014) examined the effects of motivational priming on effort exerted on a hand-grip dynamometer but added positive, negative, or neutral words. Participants were primed using subliminal word images. They were primed with motivational words alone, motivational plus positive words, or with neutral words (control). Participants primed with motivational words plus positive words exerted the most force on the hand-grip dynamometer.

Other studies focused on different types of motivational primes. Radel et al. (2009) compared the effects of control motivation and autonomous motivation on participants' perseverance, effort, performance, persistence, interest, and satisfaction in completing a new motor task. Participants were asked to identify if two pictures were the same or different as quickly as possible. A subliminal word prime (autonomous or control motivation) or a string of letters (control) was inserted just before each picture was displayed. Words priming autonomous motivation included "desire, willing, freedom, and chose." Words priming control motivation included "constrained, obligation, duty, and obey." After being primed, participants were given 15 minutes to learn how to use a Powerball, a new motor task that none had any previous experience with. Participants who were primed with autonomous motivation rotated the Powerball the fastest and for the longest amount time. They were also more likely to use the Powerball during their free period, expressed more enjoyment and interest in the Powerball, and expressed the most satisfaction in using the Powerball.

Banting et al. (2011) also compared autonomous motivation to control motivation priming on participants' perceived rate of exertion (RPE), level of task enjoyment, heart rate, and exercise intentions during a cycling task. Participants began pedaling as fast as possible for 15 seconds, and then picked a self-selected pace. They completed a word scrambled sentence task containing either autonomous or control motivation primes or neutral words (control) and then they cycled for 20 minutes. At that time, they could either choose to stop cycling or continue for up to another 10 minutes. Participants primed with autonomous motivation reported lower RPEs, higher ratings of enjoyment, higher intentions of continuing to exercise, had higher heart rate maximums, and exerted more energy than the other conditions. Participants primed with control motivation were the fastest to stop cycling.

Hodgins et al. (2006) compared autonomous motivation to control motivation priming, as well as impersonal motivation priming on participants' likelihood to use self-handicaps as reasoning for their poor performance. Participants were primed using a word scrambled sentence and then filled out a self-handicapping questionnaire asking about claimed self-handicaps such as injury or illness and constructed self-handicaps such as poor diet or lack of sleep. Then they completed a rowing task for time. Participants primed with autonomous motivation marked the fewest self-handicapping items and had the fastest rowing times, while participants primed with impersonal motivation marked the highest number of self-handicapping excuses and had the slowest rowing times.

2.2 Attentional Priming

Another group of studies examined the effects of attentional priming on participants' athletic performance. Beckmann et al. (2013) examined the effect that squeezing a ball with either the right or left hand had on accuracy in soccer penalty kicks, taekwondo kicks, and badminton serves. Squeezing with the left hand promoted automaticity, while squeezing with the left hand promoted skill-focus. In all three categories, participants who squeezed the ball with their left hand performed more accurately than participants who squeezed the ball with their right hand.

In another study, participants completed a soccer dribbling task after being primed with fluency, skill-focus, a neutral prime, or were not primed at all using word scrambled sentence tasks (Adams, Ashford, & Jackson; 2014). They dribbled a soccer ball as quickly and accurately as possible through 6 cones with their dominant foot only. Participants primed with fluency completed the task the fastest, while participants primed with skill-focus completed the task the slowest. Lateral displacement (accuracy) had no significant effect across any of the conditions.

Finally, Ashford and Jackson (2010) compared fluency to skill-focus primes in high and low pressure situations. High pressure was induced by having participants recorded with a video camera. Participants completed a word scrambled sentence task and then completed a field hockey dribbling task for time. Participants completed the task faster under high pressure when they were primed with fluency compared to both the skill-focus prime and control group.

The aim of this study was to determine if one type of prime, autonomous motivational or attentional fluency, had a greater effect on athletic performance than the other. The results of previous research indicate both primes results successfully enhance athletic performance (Adam et al., 2014; Ashford & Jackson, 2010; Banting et al., 2011; Beckmann et al., 2013; Hodgins et al., 2006; Radel et al., 2013; Radel et al., 2009; Takarada & Nozaki, 2014), so the goal is to find out if one prime could enhance athletic performance to a greater degree than the other. To make the determination, the authors had participants shoot free throws under simulated pressure.

3. Method

3.1 Subjects

Thirty-four college-aged males (18-29 years old) attending a division II university who regularly played recreational basketball participated in this study. To be considered a regular recreational basketball player, they played an average of at least one day a week, or they played varsity basketball in high school and currently played at least once a month (Herman, Weinhold, Guskiewicz, Garrett, Yu, & Padua; 2008). We recruited recreational basketball players at the gym during recreational play and from emails sent to students in physical education classes. Subjects received a free baked good and a letter of thanks for their participation in the study.

We randomly assigned subjects to one of three conditions: control (10 participants), fluency prime (12 participants), or autonomous motivation prime (12 participants). All participants signed an informed consent form and were informed they could withdraw at any point during the study. At the conclusion of the entire study, we debriefed the subjects via email and answered any of their questions. The Institutional Review Board of the university approved this study.

3.2 Instrumentation

3.2.1Word scrambled sentence task

In the priming conditions, participants took a word scrambled sentence task to prime thoughts of autonomous motivation or fluency. In the control condition, participants took a word scrambled sentence task containing sentences completely unrelated to the study. In all conditions, the task consisted of 20 five-word items subjects used to make into a sentence using four of the five words as established by Srull and Wyer (1979).

3.2.2 DELL OptiPlex 9010

All statistical tests were run on a DELL OptiPlex 9010 using SPSS 23.

3.2.3 Panasonic PV-GS500 4MP 3CCD MiniDV Camcorder with 12x Optical Image Stabilized Zoom

Free-throws were recorded using a Panasonic Camcorder.

3.3 Procedure

3.3.1 Task

All participants started by shooting ten regulation free throws using a men's regulation basketball. The number they made out of ten was recorded. Participants then went to a room adjacent to the gym to complete their word scrambled sentence task. After completion of their treatment conditions, participants shot another ten free throws under the same conditions as the first ten free throws. At the end of the entire study, participants received an email on the purpose of the study and had the opportunity to ask any questions they had.

In order to induce a higher amount of pressure in the participants, researchers video recorded subjects shooting (Ashford & Jackson, 2010) and told them their free throw routine and shooting form were being analyzed.

3.3.2 Conditions

Participants in the priming condition completed a word scrambled sentence task (Srull & Wyer, 1979) in a room adjacent to the recreational gym. The word scrambled sentence task primed participants with thoughts of either autonomous motivation (Hodgins et al., 2007) or fluency, depending on which condition they were in. They were told that this was a time-filler task to complete before shooting their next set of free throws. They were given 20 five-word items and told to use 4 of the 5 words to make a complete sentence. Five of the five-word items were fillers, so that the participants did not realize the true purpose of the word scrambled sentence tasks. In each group of 5 words, only one grammatically correct sentence could be made. Examples of words associated with autonomous motivation included "self-determined," "unrestricted," and "freedom." Examples of words associated with fluency included "fluent," "smooth," and "relaxed." After completing this task, participants returned to the gym to shoot their second set of ten free-throws.

Participants serving as controls followed the same procedure as participants in the priming condition, but

their word scrambled sentence task consisted of 20 five-word items that were completely unrelated to the study.

3.4 Data Analysis

An analysis of covariance (ANCOVA) was administered with the pre-test scores as the covariate to determine if there was a significant difference ($p<.05$) between conditions in post-test free throw scores. After determining if there was a significant difference in scores between conditions, ($p<.05$), a Bonferroni Pairwise Comparisons was run to determine where the significant differences were.

4. Results

Levene's Test of Equality of Error Variances was run ($p=.276$), so the assumption of homogeneity of variance was met, meaning there were no significant differences between conditions. The Homogeneity of Regression ($p= .176$) was not significant, so the assumption that there was not a significant interaction between conditions and the covariate was met. The assumption of linearity was met between the covariate and dependent variables.

Pre-test scores served as the covariate for the ANCOVA, and had a significant ($p= .001$) effect on the outcome. This allowed for adjustment for different skill levels among the shooters. The adjusted mean of the covariate for all conditions was $M = 4.41$.

Table 1 displays the post-test mean scores and adjusted post-test mean scores for the conditions. An ANCOVA was run to determine if there were any significant differences between post-test scores using the adjusted means. The results of the ANCOVA yielded a significant difference ($p= .048$) among the groups (see Table 2). A Bonferroni post hoc test was then applied to determine where the differences were. There was no significant difference ($p= .925$) between the control and fluency prime or the control and autonomous motivation prime ($p= .490$). There was a significant difference ($p= .048$) between the fluency prime and autonomous motivation prime post-test scores (see Table 3).

Table 1. Post-Test Mean and Adjusted Mean Scores

Condition	Means	Adjusted Means
Control	5.70	5.81
Automaticity/Fluency	6.50	6.54
Autonomous Motivation	4.92	4.79

Table 1. Comparison of the original post-test means and adjusted post-test means between the conditions

Table 2. ANCOVA Table

	Sum of Squares	*df*	*Mean Square*	*F*	*p*
Contrast	18.408	2	9.204	3.368	.048*
Error	81.983	30	2.733		
Note. *Significant difference among the groups using the estimated marginal means.					

Table 3. Pairwise Comparisons

Treatments	Mean Difference	Standard Error	Sig. b	95% Confidence Interval for Difference b	
				Lower Bound	Upper Bound
1.00 2.00 3.00	-.734 1.016	.708 .711	.925 .490	-2.529 -.786	1.062 2.818
2.00 1.00 3.00	.734 1.750*	.708 .676	.925 .044*	-1.062 .034	2.529 3.465
3.00 1.00 2.00	-1.016 -1.750*	.711 .676	.490 .044*	-2.818 -3.465	.786 -.034
Note. *The mean difference is significant at the .05 level. 1.00 = Control, 2.00 = Automaticity, 3.00 = Autonomous Motivation b. Adjustment for multiple comparisons: Bonferroni.					

5. Discussion

There were no significant differences in the post-test number of free throws made between the control condition and either priming condition. Though participants primed with automaticity had the greatest improvement in post-test scores (M= 6.50; SD= 1.62), this was not significantly greater than the control (M= 5.70; SD= 2.63). One possible explanation is that the video camera was not successful in inducing an adequate amount of pressure on the participants. Based on the observations of the researchers, participants seemed unfazed by the camera or did not seem to notice it at all. The purpose of the video camera was to make the participants feel like they were under pressure while shooting free throws to mimic a situation that would be more realistic to how they would feel during an actual game. If participants were not affected by the video camera, then they would have all been relaxed, and the fluency prime would not have been enough to cause participants to relax even more than they already were. Had participants actually felt like they were under pressure, the fluency prime may have been enough to relax the participants more than

those in the control condition, potentially leading to a significant improvement in post-test free throw scores.

What was interesting is that there was a significant difference in post-test free throw scores between the fluency prime condition (*M*= 6.50; *SD*= 1.62) and the autonomous motivation prime condition (*M*= 4.92; *SD*= 2.01). Participants primed with fluency had significantly higher post-test free throw scores than their autonomous motivation prime counterparts. These results partially support the hypothesis that participants primed with fluency would make more free-throws than participants in either of the other conditions. It is possible that the autonomous motivation prime actually hindered the performance of shooting free throws by causing participants to become tenser than they were before being over aroused. Previous research using autonomous motivation primes have had participants complete tasks that required them to "go all out" on a task, such as squeezing as hard as they possibly could on a hand dynamometer (Radel et al., 2013), biking as long and hard as they wanted (Banting et al., 2011), and rowing as fast as they could (Hodgins et al., 2006). In all of these studies, participants primed with autonomous motivation performed significantly better. The difference in these tasks and the free throw task in the current study is that they did not require the participants to focus on skill so much as they required them to give maximum effort. The idea behind the relationship of arousal and athletic performance is based off Yerkes-Dobson Law (Yerkes & Dodson, 1908). The law states that the arousal stage can only increase performance to a certain point, then arousal will be too much before the performance will suffer. Research on the relationship between arousal and athletic performance supports that tasks requiring a single feat of power and force requires higher levels of arousal for an optimal performance than those performing more complex tasks, such as shooting free throws (Yerkes & Dodson, 1908). Because shooting free throws is a task that requires more precision and control, the autonomous motivation prime may have hindered participants' performance by causing them to become over aroused and tense up in an effort to give their maximal effort. Previous research also states that skill level of the athlete plays a role on the optimal level of arousal to enhance performance (Yerkes & Dodson, 1908). Higher level athletes perform better under higher arousal situations than do low skill athletes, because they are most accustomed to higher levels of competition. Because recreationally skilled basketball players were used in this study, the autonomous motivation prime may have aroused them more than what was optimal for their skill level, causing a decline in their scores.

Overall, priming can be a useful way to improve athletic performance. Using the right prime for the right task is important. Fluency primes are good in situations where players must focus on complex tasks, while autonomous motivation primes are useful tools for tasks that require participants to exert maximal effort.

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