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The Hot Hand and Psychological Momentum as Adaptive Beliefs in Sport

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THE HOT HAND AND PSYCHOLOGICAL MOMENTUM AS ADAPTIVE BELIEFS IN SPORT

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To spirituality, positivity, genuineness, challenging life's norms, and last but not least, my mother: The things that have motivated me and brought me this far.

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ABSTRACT

This study aimed at examining the dispositional effects of the hot hand and psychological momentum beliefs on mental states such as self-efficacy, perception of control, and cohesion. One hundred and seventy-six male and female participants who have athletic experience in basketball, volleyball, or baseball (NCAA, club, or intramural) were surveyed. Revised versions of hot hand and psychological momentum questionnaires from past studies were used to measure a participant's level of belief in the hot hand and psychological momentum, respectively. The Physical Self-Efficacy Scale (PSE) was used to measure self-efficacy, a revised version of the Self-Control Scale was used to measure perceptions of control, and the Group Environment Questionnaire (GEQ) was used to measure team cohesion. The aim of this study was to examine whether athletes who have strong beliefs in the hot hand and psychological momentum have significantly different levels of self-efficacy, perceptions of control, and team cohesion. Also, it was examined whether skill level was related to any differences in beliefs. Results indicated that athletes with stronger beliefs in the hot hand exhibited significantly higher levels of self-efficacy. Belief in psychological momentum did not predict any of the dependent variables Also, high skilled athletes showed higher self-efficacy levels than low skilled athletes, and low skilled athletes showed higher levels of team cohesion than high skilled athletes. The results suggest that belief in the hot hand can be considered an adaptive belief that can potentially affect self-efficacy in a positive manner.

CHAPTER 1

INTRODUCTION

There is a widespread belief among players, coaches, and sports fans that an athlete or team can get "hot" or "on a roll." Formal terms for these beliefs include the *hot hand phenomenon* and *psychological momentum*. The hot hand phenomenon was defined by Gilovich Vallone, and Tversky (1985) as, "the belief that the performance of a player during a particular period is significantly better than expected considering the player's overall record" (p. 296). They also described it as the belief that someone is more likely to be successful on a task (e.g., free-throw) after a sequence of two or three successful attempts at the task. Psychological momentum has been defined in many different ways by researchers, but many choose to use the definition given by Iso-Ahola and Mobily (1980), which defines psychological momentum as "an added or gained psychological power that changes interpersonal perceptions and influences an individual's mental and physical performance" (p. 391).

A famous example of what people perceive as the hot hand occurred when Joe DiMaggio set the MLB record by recording a 56-game hit streak. What people perceive as psychological momentum is illustrated by the famous 32-point second half comeback by the Buffalo Bills against the Houston Oilers in the first round of the AFC playoffs in 1993. These phenomena are also believed to exist in realms outside of sports (e.g., picking stocks), and Wilke and Barrett (2009) even proposed that the hot hand phenomenon actually represents an evolved psychological assumption that has been used throughout evolution for foraging. Although hot hand and momentum are similar, they are examined separately by researchers. Richardson, Adler, and Hankes (1988) stated that, "The hot hand and psychological momentum are not

identical but akin, as the momentum does not deal with inevitable streaks but does with "turning points" (p. 69).

Although most athletes and sports fans believe that these concepts describe a statistical reality, scholars in the field of sport psychology have had varying opinions on these concepts. Ever since Gilovich et al. (1985) conducted the study in which they found that NBA (and college) basketball players were *not* more likely to make a shot after two or three previous makes, there have been numerous studies either supporting this finding or refuting the notion. As Crust and Nesti (2006) suggest in their review of psychological momentum in sports, constant debate over whether this phenomenon is real or illusory remains salient. The hot hand phenomenon is an issue of interest because regardless of the findings, players, coaches and fans continue to believe in its existence. This suggests that players are experiencing something that is causing them to feel that they can perform, or will continue to perform, better than usual for some period of time. As Raab, Gula, and Gigerenzer (2011) stated, "The logical question of whether a belief matches reality should not be confused with the ecological question of how useful the belief is to achieve some goal" (p. 82). This means that whether or not these concepts actually exist statistically, beliefs that they do are worth studying further.

Therefore, the more important issue at hand is the question of whether these beliefs can be beneficial to an athlete's self-efficacy and confidence levels, and ultimately their performance. Also, can these beliefs be beneficial to a team as a whole, improving things such as team cohesion and performance? In a study analyzing the same NBA shooting data as Gilovich et al. (1985), Burns (2004) showed that the hot hand belief can be an adaptive heuristic which teams use to decide who to give shots to. Also, Raab, Gula, and Gigerenzer (2011) found that volleyball players are sensitive to who they think is "hot" when deciding on whom to pass the

ball to, and that this can bring about more success than just passing to the player with the highest base rate. Psychological momentum has also been found to be related to improved mental performance in tennis players, increasing feelings such as self-efficacy and goal orientation (Shaw, Dzewaltowski, and McElroy, 1992).

Most (if not all) of the studies to date have dealt with the perceived effects of hot hand and psychological momentum "in the moment" or in particular moments of competition. However, beliefs in these concepts could potentially have extended or long-term mental benefits for an athlete. If an athlete has a strong belief in the hot hand, this could potentially increase their level of self-efficacy because they may believe that all they need to do is make two successful plays and now they are "hot" and performing at a higher level. This could also potentially relate to perceptions of control—if an athlete has a strong belief in the hot hand, they may feel more in control of a bad situation knowing that all they need is two or three successful attempts to get "back on track."

Do athletes with stronger beliefs in hot hand and psychological momentum have higher overall levels of self-efficacy and perception of control than athletes with weaker beliefs or no belief in the concepts at all? Also, can these stronger beliefs in these concepts lead to higher levels of team cohesion? These two questions are the core interests of this study. Supporting this line of reasoning, Eisler and Spink (1998) found that perceptions of psychological momentum were strongest when the team involved was perceived as being high in task cohesion (volleyball). This brings about the question of whether the shared belief in psychological momentum among teammates could potentially lead to higher levels of cohesion. If true, this indicates that hot hand and psychological momentum are concepts that can be mentally adaptive

on a long-term basis, and therefore should be seriously examined as a potential tool in the field of sport psychology.

CHAPTER 2

LITERATURE REVIEW

Psychological Momentum

One of the earliest studies on psychological momentum in sport was conducted by Iso-Ahola and Mobily (1980). They examined archival data from a coed competitive racquetball tournament relative to psychological momentum (defined by winning the first game) and its effect on winning subsequent games, and ultimately the match. They found that the player who won the first match was most likely to win, supporting their hypothesis that psychological momentum predicted winning. However, psychological momentum appeared to decrease as men's competitive experience increased, as well as when women's competitive experience decreased.

Due to the lack of strength in these findings, Iso-Ahola and Blanchard (1986) replicated this study with a group of competitive tennis players, and measured the effects of psychological momentum on self-perceptions and perceptions of the opponent. They predicted that the person who felt psychological momentum should elicit higher levels of self-confidence, better perceptions of their ability, and also greater perceived likelihood of winning when compared their opponent. The researchers found a significant psychological momentum effect with 74% of the second-game winners also having won the first game. Their hypothesis was also supported in that the winners of the first match showed significantly higher levels of self-confidence and perceived likelihood of winning the next game than the losers of the first game. It was noted that early success has a double effect of simultaneously giving psychological momentum to the winner while giving the loser "negative momentum" (Iso-Ahola & Blanchard 1986).

Richardson et al. (1988) also examined psychological momentum in tennis. Similar to Iso-Ahola and Blanchard (1986), they wished to determine if success in a match could be anticipated by observing the winner of previous games, and also if gender or ability level played a factor into psychological momentum. They failed to reveal significant gender effects, but delineated that winning any of the first eight games in either the first or second set was a significant indicator of success in the match for high- and mid-level players (Richadson et al, 1988). However, when the more competitive matches were analyzed, only particular games became predictors of winning the match. Their findings suggested that psychological momentum is likely a highly individual matter in tennis, and that the term should be used with caution.

After the early studies on psychological momentum, three conceptual models were proposed to explain the effect of psychological momentum on performance (Crust & Nesti, 2006). The first of these was the *Antecedents-Consequences Model* presented by Vallerand, Colavecchio, and Pelletier (1988). They used a conceptual model to describe psychological momentum as a "perception of 'moving towards a goal'", and proposed that it caused "changes in motivation, perceptions of control, optimism, energy, and synchronization" (Crust & Nesti, 2006, p. 2). Their model addressed previous problems relating to distinguishing between psychological momentum as a cause or effect of changes in performance, and whether momentum might be influenced by both personal and situational variables. The model also suggested that the crucial psychological variable that determines whether psychological momentum will be perceived is the degree of potential perceived control that exists within the situation and/or the individual's level of need for control (Vallerand et al., 1988). In their study on tennis players, they found that the presence of a psychological momentum pattern (which was manipulated by the score configuration) led to enhanced perceptions of momentum.

The second conceptual model explaining psychological momentum was the *Multidimensional Model of Momentum* (Taylor & Demick, 1994). This model proposed that series of events occur that "trigger altered cognitions, affect, and physiological changes," and these changes in turn influence the athlete's behavior and performance (Crust & Nesti, 2006, p. 2). Similar to Iso-Ahola and Blanchard (1986), they believed that outcome is not just determined by a player experiencing positive momentum, but also an opponent experiencing the reverse. In their study with university students performing a basketball-shooting task, Taylor and Demick (1994) found that participants with positive momentum had higher levels of self-efficacy and more positive thoughts. However, non-significant differences in arousal and persistence levels were observed, casting doubt on the validity of their theory.

The third theory of psychological momentum is the *Projected Performance Model* (Cornelius, Silva, Conroy, & Peterson, 1997). In this model, perceptions of positive and negative momentum states were posited as the result (rather than a cause) of performance change (p. 3). Two more constructs to further the understanding were included in this model of psychological momentum. The first is *positive inhibition*, which concerns situations in which athletes may have gained the momentum to catch up with an opponent, but once caught up, their performance decreases due to events such as "coasting." In contrast, *negative facilitation* is when an athlete is performing poorly and this poor performance motivates an increased effort (Crust & Nesti 2006, p. 2). In the study where Cornelius et al. (1997) proposed this model, a two-round free-throw shooting contest between pairs of participants was used in order to examine factors that influence the participants' perceptions of momentum and also subsequent changes in performance. They found that participants perceived experiencing psychological momentum and self-evaluations of performance had an important relationship to this perception. Performance

was not significantly changed by this perceived momentum, however, but the fact that self-evaluations were related to momentum brings about the question of whether self-efficacy is correlated with beliefs in this phenomenon.

Another study by Eisler and Spink (1998) examined the effects of scoring configuration and task cohesion on the perception of psychological momentum in high school volleyball players. In this study, participants completed a questionnaire which included two hypothetical volleyball game scenarios in which both games were tied; however, in one game the participant's team came from behind five points to tie it up (e.g., momentum condition), whereas in the other the score never exceeded a one point difference (e.g., non-momentum condition). Participants then completed the same psychological momentum scale which was used by Vallerand et al. (1988), and the Group Environment Questionnaire (GEQ) to measure cohesiveness. The results indicated that the teams that came from behind five points were perceived to have the greatest psychological momentum, and it was also found that perceptions of PM were strongest when the team involved was perceived as being high in task cohesion. This suggests that there is a relationship between perceived PM and team cohesion, and this could be a very important factor to improved performance.

Evidence against the Hot Hand

Whereas data on psychological momentum are still low in quantity and ambiguous, there is more extensive research on the hot hand belief. However, this data leaves people just as unsure, if not more, about the validity and status of the belief because of the inconsistent results. In a review of the past twenty years on hot hand research, Bar-Eli, Avugos, and Raab (2006) stated that the debate between hot hand and non-hot hand supporters is pretty even, with only about two more non-supportive studies than supportive studies regarding the hot hand in sports.

Most recently, Avugos, Koppen, Czienskowski, Raab, and Bar-Eli (2013) conducted a meta-analysis of 22 hot hand publications (56 effect sizes) that met inclusion criteria, and found a minor positive mean effect size suggesting that a general hot hand effect is not statistically present in sports; however, the results among individual studies continue to be inconsistent.

Many studies refuted the existence of the hot hand phenomenon, but none is better known than the original study by Gilovich and his colleagues (1985). They investigated whether the beliefs of basketball players and fans concerning a hot hand in shooting could be supported in archival basketball data (see Bar-Eli et al., 2006). They asked the question of whether a player has a better chance of making a shot after having just made his previous two or three shots than he would after having missed them. They found that 91% of fans agreed this is true, and players also expressed similar beliefs (Gilovich et al., 1985). They then analyzed statistical data of the shot sequences for nine members of the 1980-81 Philadelphia 76ers. The hypothesis that streaks would lead to more makes was not supported; the data failed to indicate that players were more likely to make a shot after a sequence of two or three previous makes. The authors concluded that the hot hand belief was a fallacy, and suggested that reliance upon the notion could even have negative consequences for a team.

More studies have also been conducted in the basketball arena that refuted the hot hand belief. Adams (1992) discussed the fact that Gilovich and colleagues failed to examine time factors and their impact on subsequent shooting success. Adams stated that if the hot hand was a valid phenomenon that diminishes with time, then "a successful shot should be more likely to follow a successful shot if it is taken soon" (p. 74). Because of this, he re-analyzed the same data as Gilovich et al. (1985), taking time into account; however, once he re-analyzed the data he found that the mean interval between a "Hit-Hit" was actually longer than a "Hit-Miss"

(although not significant), therefore rejecting the notion of time affecting hot hand data. Koehler and Conley (2003) also examined the hot hand in basketball, however controlling for potential in game confounds by looking at the NBA 3-point shootout contest. They analyzed the contests from 1994-97 and found that only two out of 23 players had significantly more clusters of makes than would be expected by chance. They also found that when an announcer stated something such as a shooter was "on fire" or "on a roll," the amount of subsequent made shots was not significantly different than expected overall base rates. In other words, the announcers' statements did not have much predictive value, further illustrating a fallacy in the hot hand belief.

These findings have also been replicated by other researchers in different sports. Albright (1993) looked at the sport of baseball in order to examine whether hot streaks occurred more frequently than would be predicted by chance. He analyzed 501 records of batting data from 1987-1990 and found that although some batters exhibited significant streakiness, logistic regression showed that there was not significantly more overall streakiness than what would be expected from a probabilistic model of randomness. Albert (2008) also analyzed professional baseball data for patterns of streakiness that are beyond the scope of chance. Using data from all "regular" (i.e., full-time starters, no pitchers) players in the 2005 season, he measured streakiness based on patterns of hits and outs, strikeouts, and home runs. In the study he presented an adjustment model (consistent-*p* model) based on a player's ability and number of opportunities, and compared a player's streakiness to this "hypothetical collection of players with the same ability and number of at-bats" (p. 5). It was found that this p-value model explained most of the variation of streakiness throughout a season; again suggesting that observed hot hand behavior in baseball is not different than what would be expected from probability.

Most recently, Neiman and Loewenstein (2011) illustrated that basketball players use the hot hand belief in determining whether they will take subsequent three point shots, although it doesn't appear to increase performance. They used a reinforcement learning model to show that past experiences of actions and rewards can affect future behavior. This study was different from previous studies in that it measured hot hand belief based on actual behavior rather than using a questionnaire. They analyzed data from two years of the NBA (2007-08, 2008-09) and WNBA (2008, 2009), and found that both NBA and WNBA players were significantly more likely to attempt a 3-point shot if their previous 3-point shot was a make compared to if it was a miss. However, 3-point percentage immediately after a made 3-pointer was significantly lower than after a missed 3-pointer, suggesting that this learned behavior of reinforcement actually negatively affected performance. While this suggests that the hot hand phenomenon doesn't exist statistically, it does suggest that the hot hand belief may increase overall self-efficacy and perceptions of control: after a made shot, basketball players seem to be more confident in their ability to make the next shot, and they feel more likely to make it compared to feeling less likely after a missed shot.

Evidence for the Hot Hand

Despite the findings against the hot hand, many studies have shown evidence that a player can get statistically "hot" compared to normal performance outside of basketball and baseball. Some studies suggest that the hot hand exists in golf (i.e., Gilden and Wilson, 1995; Clark, 2003). Gilden and Wilson (1995) conducted a study in which participants completed a putting (as well as dart throwing) task and found that significant streaks occurred, and they also found that outcomes were streakiest when there was a match between the ability of the performer and the difficulty of the task. The researchers also ran a trial which alternated between golf

putting and dart throwing, and found evidence of moderate streaks even while switching activities. This suggests that a potential reason that some basketball studies failed to find evidence of a streak was because they were only looking at shooting rather than other areas of performance as well. Results of this study indicated that maybe a streak would have been found if looking at an alternative skill along with shooting, such as rebounding. However, this study was criticized on methodological grounds by Smith (2003), making the claim that the results which showed streaks were artificial and resulted from varying levels of attention from the poorly motivated participants (i.e., they were paid only $5 for 300 repetitions).

Evidence of the hot hand has also been found in other sports, such as tennis. Klaassen and Magnus (2001) modeled the probability of winning a point in tennis in order to investigate whether points were independent and identically distributed. By analyzing data from 481 Wimbledon matches (86,298 points) from 1992-95, they found that points were not independent and that winning the previous point had a significant positive effect on winning the current point. They also found that at certain "important" points in the match, the server has a disadvantage (p. 507), which is very similar to the psychological momentum findings on tennis (Richardson et al., 1988). Another finding important to note was that as a player's skill level increased, there was a smaller deviation from the null hypothesis, which stated that points were independent. In other words, there was less of a hot hand effect as skill level increased.

A hot hand effect was also found in studies on bowling. Dorsey-Palmateer and Smith (2004) used a binomial model of probability to analyze data from the 2002-2003 PBA season. They examined whether the data was consistent with the model's assumptions of independence, and found that most bowlers rolled a higher number of strikes after a period of consecutive strikes than a period of consecutive non-strikes. The probability of rolling a strike also increased

as the number of consecutive strikes increased. Most recently, Yaari and David (2012) have further illustrated that a hot hand effect can be found in bowling. In the study, they sought to not only illustrate that the hot hand could be found in bowling, but also to explore whether this streakiness was due to previous psychological or physiological feedback mechanisms that could be considered causal. Using a permutation approach, they analyzed the top 100 PBA bowlers and found that the hot hand effect was shown to be significant at an individual level when aggregated across games. However, they also found that the reason for success was not a psychological/physiological feedback mechanism, but rather time fluctuations, or "better" and "worse" games. In other words they found that previous performance was not caused by the previous bowling attempt, but previous games were found to correlate with later success.

Although many of the earlier studies on the hot hand effect in basketball found significant data against the phenomenon, recent studies suggest otherwise. Arkes (2010) used free throw data from the 2005-06 NBA season in order to examine potential hot hand effects of an in game situation while also controlling for the external factors that could effect a regular field goal shot (e.g., defense, varying shot selection). Instead of using a univariate framework as most previous studies on basketball had, he pooled players into one model using a multivariate framework with individual fixed effects, and found that hitting the previous free throw increases the probability of making the next free throw by up to three percentage points for the full sample. This probability increased even more (5%) in players that shot free throws infrequently (i.e., 100 or less free throws in the season). These findings imply that the hot hand effect does exist in basketball, at least when it comes to free throw shooting.

Other recent studies supporting the hot hand have been conducted in volleyball. Volleyball is a team sport in which there are two opposing teams (i.e., offense and defense), but

due to the limitation of the net, there is no contact between players from opposing teams, and thus it is not as confounding as a sport such as basketball. Raab, Gula, and Gigerenzer (2011) provided the first study on the hot hand in volleyball, and examined whether volleyball players believed in the hot hand, and if they did how they use it for allocation decisions. They found that volleyball players (91%) and coaches (92%) do indeed believe in the hot hand, and found that 53% of the players studied showed significant streaks. They also found that playmakers are sensitive to these streaks and rely on them when deciding on whom to pass the ball to. Another key finding was that playmakers allocate the ball more often to players with streaks and that lead to better performance than when allocating the ball to the player with the higher average base rate. Koppen and Raab (2012) then expanded on this concept in volleyball by examining how allocation decisions are affected by the expertise of participants. They found that participants of different expertise levels were sensitive to all kinds of streaks, but the most experienced players exhibited the most allocations to the hot player, and the least allocations to the cold player. This brings us to a new question: can the hot hand belief affect a player's behavior positively and produce more success than usual?

Hot Hand and Psychological Momentum beliefs as Adaptive

Despite the uncertainty of whether the hot hand phenomenon exists statistically, the belief of it could still be beneficial to athletes. As Gula and Raab (2004) proposed, "the hot hand belief is mistakenly judged as being a fallacy due to a scientific norm of randomness, which is less important than the adaptive value of the belief in real decisions" (Bar-Eli et al. 2006, p. 536). Athletes believe in the hot hand, which likely indicates that they act on this belief, and in team sports such as volleyball, this belief is maintained because they believe that it is producing the most successful results. Whether it is the hot hand de-facto or some other factor that are

producing these results is irrelevant—the potential that this belief can lead to adaptive behaviors for a player or a team is of practical importance.

No one has illustrated the adaptation of the hot hand belief better than Burns (2001, 2004). In his study, he showed that Gilovich et al.'s (1985) implications that the hot hand belief could actually lead to negative consequences did not necessarily follow from their analysis. He also demonstrated through theory and statistical simulation (Markov Modeling) that the hot hand belief could actually be adaptive to a basketball team. Burns stated that players are unlikely to be able to calculate and determine the optimal distribution of the ball at game speeds, so fast and frugal heuristics for deciding whom the next shot should be allocated to are likely to be used if they can be efficient mechanisms for performance (i.e., increase scoring) (Burns, 2004). Because of this, players are more likely to give the ball to someone who recently hit a shot because it was recent and therefore easier to remember. He even used Gilovich et al.'s findings to illustrate why the players believe in the hot hand. He identified that, based on Gilovich et al.'s data, that if a player has a higher shooting percentage, he will complete more streaks. Therefore, allocating the ball to players that are "hot" is no different from allocating the ball to players with higher overall shooting percentages (Burns, 2001).

As a consequence, Burns (2004) implied that the hot hand belief was actually the incorrect rationalization for their behavior, and that athletes actually allocate the ball to the players with the highest chance of making the shot. He stated that "it could be argued that what sustains belief in the hot hand is simply that players have learned that giving the ball to the player experiencing streaks has a positive outcome" (Burns, 2001, p. 6). In his study, he found that the more skilled the players were, the more likely they were to believe in the hot hand and behave based on this belief during play. Also, most of them held the erroneous belief (according

to Burns) that shots are conditionally dependent, instead of believing that they allocate the ball to certain players because they shoot better. However, although this "hot hand behavior" may be falsely attributed to the hot hand belief, that does not change the fact that this belief is adaptive. As mentioned earlier, Raab et al. (2011) and Koppen and Raab (2012) found that the hot hand belief led to allocating the ball to the most appropriate players also, which further indicates this belief is adaptive.

Research on psychological momentum also suggests that this belief can be adaptive, causing increases in many perceptions of confidence and ability. After Iso-Ahola and Blanchard's (1986) report of significant effects of psychological momentum on subsequent performance, they suggested that, "psychological momentum, as reflected by an athlete's self-confidence about winning because their ability was perceived as superior, improved the winners' mental performance, and also increased the probability of winning the match" (p. 767). Shaw, Dzewaltowski, and McElroy (1992) also indicated that changes in performance attributed to psychological momentum can be caused by changes in goal orientations, self-efficacy, and causal attributions. Cornelius et al. (1997) further illustrated that this belief can positively benefit athletes, stating that it is how the competitor reacts phenomenologically to the circumstances around them that influences performance. These findings suggest that the belief of psychological momentum can be adaptive, causing athletes to feel better about themselves, therefore eliciting better performance. Bar-Eli et al. (2006) illustrated it best when they stated, "When a player feels 'hot,' his confidence in his ability increases. He becomes relaxed and focused on performing the shots accurately" (p. 339). Although they were referring to the hot hand, this can definitely be applied also to the concept of psychological momentum.

An athlete's skill level has also been shown to be related to these phenomena, especially when it comes to ball allocation and perception of control. Burns (2004) found that athletes who had played basketball longer, and attained higher skill levels, were more likely to utilize the hot hand behavior of allocation because they held a stronger believe in the hot hand. Raab et al. (2011) also found similar results when examining volleyball players' allocation tendencies. However, psychological momentum may not carry the same potential benefit in highly skilled athletes. Richardson et al. (1988) found that as skill and competition level increased in tennis matches, only certain games in a set could predict who would win the match—compared to any game in lower skilled athletes being able to predict match wins—suggesting less of an effect of psychological momentum on performance. This is likely due to the concept of control; athletes of a similar (high) skill level are not able to take control of a game or match as easily. However, this may not apply to the actual *perception* of control that an athlete may possess. As stated by Shaw et al. (1992), "Although past archival investigations suggest that psychological momentum does not exist when skill is controlled, these findings may be suspect because the researchers failed to separate the psychological construct from its behavioral consequence" (p. 135).

Skill level has also been shown to be related to self-efficacy and confidence in athletes. In a study examining self-regulation differences between expert, non-expert, and novice basketball players, Cleary and Zimmerman (2001) found that experts displayed higher levels of self-efficacy compared to non-experts and novices. Jones, Hanton, & Swain (1994) also found higher levels of self-confidence in elite swimmers compared to non-elite swimmers when interpreting anxiety symptoms between both groups. These findings imply that skill level can play a significant role in determining an athlete's level of self-efficacy in their sport.

Purpose of the Study and Hypotheses

Regardless if the hot hand or psychological momentum exist statistically, the intention in this study is to examine whether belief in these phenomena can be adaptive in terms of perceived control, self-efficacy, and team cohesiveness, which can ultimately improve the performance of an athlete or a team. Raab, Gula, and Gigerenzer (2011) stated, "There is a huge body of literature on the hot hand phenomenon, virtually all of which has addressed the first question concerning its existence but not the second concerning its behavioral use." Just as in the antecedents-consequences model proposed (Vallerand et al., 1988), the belief may cause changes in perceptions, which overall can change performance. Some research thus far has indicated that these beliefs can potentially be adaptive (e.g., Burns, 1994; Raab et al., 2011; Shaw et al., 1992), but they have mainly looked at short-term or in-game consequences of these beliefs. However, there could be potential long-term benefits (or risks) from believing in these phenomena. Belief in the hot hand could perhaps relate to higher levels of overall self-efficacy and perceptions of control in a sport because an athlete can use this belief as a mental tool for getting out of "slumps" or periods of bad play (i.e., a basketball player knowing all he needs is two made shots to get "back on track"). Also, although most athletes indicate they believe in these phenomena, the extent to which they believe in them (i.e., someone who thinks they can get hot at any time vs. someone who thinks this is rare) could have differing effects on self-efficacy and perceptions of control. If athletes hold strong beliefs in the hot hand phenomenon, this may also affect ball allocation, which may lead to more team success and ultimately, better perceptions of team cohesion. Therefore, the purpose of the present study was to examine the long-term effects of the hot hand and psychological momentum beliefs on mental skills such as self-efficacy, perception of control, and team cohesion. Do athletes with stronger beliefs in the hot hand and

psychological momentum have higher overall levels of self-efficacy and perceptions of control? Also, do teams with stronger beliefs in these phenomena perceive higher levels of team cohesion? Do the beliefs in these concepts vary based on the skill level and experience of the athlete? These were the main aims of the current study. Using multiple regression, the five potentially related constructs (i.e., hot hand belief, psychological momentum belief, self-efficacy, self control, and team cohesion) were examined in the study.

The hypotheses of this study were as follows:

1. Belief in the Hot Hand and belief in Psychological Momentum will be positively correlated
2. Belief in the Hot Hand will predict self-efficacy, self-control, and team cohesion.
3. Belief in psychological momentum will predict self-efficacy, self-control, and team cohesion.
4. Self-Efficacy, Self-Control, and Team Cohesion will all be positively correlated with one another.
5. Athletes with a higher skill level will hold stronger beliefs in the hot hand, psychological momentum, self-efficacy, self-control, and team cohesion.

CHAPTER 3

METHOD

Participants

Based on a power analysis (Power = 0.80, Appendix A), moderate effect size f = .25, 3 groups), a total of 201 male and female athletes who participate in the sports of basketball, volleyball, and baseball were recruited to participate in this study. These sports were chosen because they are the three most popular sports that were used to test the hot hand and psychological momentum phenomena in previous research. In order to obtain the varying skill levels desired for this study, a stratified sample of Division I, II and III NCAA athletes, club athletes, intramural athletes, and students of the general college population will be chosen for this study. To take part in the study the participants had to have participated in the sport for at least two years (competitively or recreationally) to ensure that they can understand the concepts and relate to the experience in the sport. Due to incomplete data or not meeting the criteria of 2 years of experience, 25 participants' data were deleted and the final number of participants was 176 (82 male, 94 female). Participants ranged from age 18-50, with 150 of the 176 participants ranging from age 18-23. The remaining participants over the age of 23 indicated that they were current college students that played intramural basketball, baseball, or volleyball at their university. Seventy-six of the participants indicated that their main sport was basketball, and both baseball and volleyball consisted of 50 participants per group.

Design

The independent variables in the study were the extent of the belief in the hot hand and psychological momentum, and skill level (low, middle, high). Low skill level was classified as intramural athletes who have no experience with a varsity college sport; middle skill was

classified as division III athletes, club athletes, or students who have indicated that they previously played a varsity college sport; and high skill was classified as Division I and Division II varsity college athletes. The low skill group consisted of 86 participants (23 baseball, 25 volleyball, 38 basketball), the middle skill group consisted of 25 participants (10 baseball, 11 volleyball, 4 basketball), and the high skill group consisted of 65 participants (17 baseball, 14 volleyball, 34 basketball). The dependent variables were self-efficacy, perception of control, and cohesion.

Measures

Informed Consent Form (Appendix B). An informed consent form, which has been approved by The Florida State IRB Committee, explained the purpose of the study, procedures, any possible risks, confidentiality of information, and that participants could withdraw at any time without any consequences.

Demographic Questionnaire (Appendix D). This questionnaire obtained information about general demographics of each participant such as age and gender. Also, this questionnaire obtained information on the sport played, highest level of the sport played (recreational, high school, intramural, club, or varsity), years of experience in the sport (and sports in general), and current involvement in the sport.

Hot Hand Questionnaire (HH; Appendix E). This questionnaire consisted of several questionnaires used by Gilovich et al. (1985) and Raab et al. (2011). The aim of this questionnaire is to examine whether participants believe in the hot hand phenomenon, and if so, to what extent. This questionnaire starts off by briefly explaining what the definition of the hot hand in sport is. It then continues with general questions regarding the hot hand, all of which are

answered in a Likert-type scale format, ranging from 1(*not at all*) to 7 (*very much so*). In the Gilovich et al. (1985) and Raab et al. (2011) study, the questions were answered in yes/no format, but in this study the researcher seeks to also determine the magnitude of the belief in the hot hand—in other words, whether some people believe in this phenomenon more than others—which is why the questions will be answered in Likert-scale format.

The first question asks, "Do you believe the hot hand exists in sport?" and is followed up by, "Do you believe the hot hand exists in your sport?" From here, a list of all sports that were included in a review of the hot hand (Bar-Eli et al., 2006) are given, and participants are asked to rank these sports in order of which they believe the hot hand is most present (Raab et al., 2011). This was given in order to ensure that participants in the study believed that the sports being analyzed were believed to consist of the hot hand phenomenon. Raab et al. (2011) found that 86 of the 94 (around 91%) athletes believed in the hot hand in volleyball. They also found that the average rank order of the 14 sports that the hot hand was believed to occur consisted of basketball and volleyball as the top 2 sports, with baseball being ranked 6th. The belief in which sports hot hand was most prevalent was found to be independent of the sport in which an athlete had expertise. In the present study, it was found that out of the 14 sports listed, participants believed that the hot hand behavior occurred most in basketball, 2nd most in baseball, and 3rd most in volleyball.

The questionnaire then contains the question asked by Gilovich et al. (1985) in their study, "Does a player have a better chance of making a shot after having made two or three previous shots than he/she does after having missed the previous ones?" In their study, they found that 91% of fans believed that a player did have a better chance of making a shot after

having made two or three previous shots. The question is answered on a Likert-type scale format rather than simple yes/no format used by Gilovich et al (1985).

Following are questions in reference to the hot hand and ball allocation by a team. Participants are asked, "Do you believe that playmakers play or pass to a player that is hot?" The last question asked is, "Do you believe that playmakers **should** play/pass to a player that is hot?" These questions were taken from Gilovich et al. (1985) and Raab et al. (2011); 84% of fans in the Gilovich et al. (1985) study believed that players should pass to a player that is hot. The questions are answered on a Likert-type format ranging from 1 (*not at all*) to 7 (*very much so*).

Psychological Momentum Questionnaire (PM; Appendix F). The aim of this questionnaire is to examine whether participants believe in psychological momentum, and if so, to what extent. This questionnaire consists of general questions regarding belief in psychological momentum, which were created by the researcher, but are similar to and based upon previous definitions of psychological momentum (i.e., Iso-Ahola and Mobily, 1980). The questionnaire consists of a perceived psychological momentum scenario (PMS), which is a revised version of the scenario used by Vallerand et al. (1988).

The Psychological Momentum Questionnaire begins by introducing a brief description of what the concept of psychological momentum is, and then asks two simple questions: "Do you believe in psychological momentum during an athletic competition?" and "Does a team or individual have an added or gained advantage over their opponent that makes them more likely to win a game/match if they score a sequence of unanswered points in a row?"

At this stage the perceived psychological momentum scenario was given to participants to read. The scenario describe a match (based on their sport), in which the score is tied in the

final minute, point, or inning of a match; however, one team was up significantly, and the other has just scored a number of points in a row to tie the match. After the scenario is explained, participants are asked the question, "Who is more likely to win the match?" (a. The team who came from behind, b. The team who started off ahead, or c. Neither team is more likely to win). In the Vallerand et al. (1988) study, it was found that this scenario had a significant effect on Psychological Momentum perceptions, yielding a main effect for score configuration, $F(1, 40) = 32.54$, $p < .0001$), such that subjects perceived more psychological momentum when the momentum pattern was present than when it was omitted. In order to make this variable a continuous, Likert-style variable like the rest of the variables in the study, response "b" was scored as "1" or "no momentum belief," response "c" was scored as "2" or "neutral belief," and response "a" was scored as "3" or "psychological momentum belief."

Physical Self-Efficacy Scale (SE; Ryckman et al., 1982; Appendix G). In order to measure self-efficacy, a modified version of the Perceived Physical Activity (PPA) subscale of the Physical Self-Efficacy Scale (PSE) will be used in this study. The PSE is a scale consisting of 22-items that measures the extent to which participants believe each item reflects their own capabilities on a scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). It is composed of two subscales, the Perceived Physical Ability (PPA) subscale and the Physical Self-Presentation Confidence (PSPC) subscale. The PPA subscale consists of a scoring range from 10 to 60, whereas the PSPC subscale scoring range from 12 to 72. Ryckman et al., 1982 found that the PPA predicted subjects' reported degree of involvement in sports, expectancies for a physical task performance, and actual performance on physical skills, whereas the PSPC did not predict any of these. For this reason, only the PPA subscale of the Physical Self-Efficacy Scale will be used in this study.

Six different studies were conducted by Ryckman et al. (1982) to construct the Physical Self-Efficacy Scale and to ensure significant reliability and validity. The first study consisted of 90 questions with 6-point Likert-type response format administered to 363 students enrolled in introductory courses at the University of Maine. After eliminating items based on high-social desirability contamination (r >.20) and low factor loadings (<.35), they created a 10-item Perceived Physical Ability (PPA) subscale with a possible range of 10 to 60; higher scores on this subscale indicate higher perceived physical ability (Ryckman et al., 1982). Cronbach's alpha was .84 for the PPA and .81 for the full scale (PSE), therefore indicating satisfactory internal consistency.

The remaining 5 studies indicated that the PPA had significant test-retest reliability (r = .85, $p < .001$), construct validity ($r < .001$ correlations with The Tennessee Self Concept Scale (TSCS), which measures physical self-concept), and predictive reliability—which was measured by actual performance, reaction task, $F(1, 94) = 27.45$, $p < .001$, sports involvement (hours per week, $F(1, 94) = 9.39$, $p < .01$, and level of sports experience, $F(1, 94) = 12.56$, $p < .001$). The results of the studies also indicate significant differences between the two subscales—while the PPA was significantly related to level of sports experience, sports involvement, and performance, the PSCP did not correlate significantly with any of these. This indicates that the two scales do measure different constructs and should continue to be categorized separately.

Although the PSE was created to measure general physical self-efficacy, McAuley and Gill (1983) found the PSE to be a reliable and valid instrument for measuring an individual's general physical self-efficacy in sport (i.e., gymnastics). In their study, they found that the PSE correlated positively with the gymnastic-specific self-efficacy scales they created four all four Olympic gymnastics events that were analyzed: Vaulting self-efficacy (r = .26), beam self-

efficacy (r = .30), uneven bars self-efficacy (r = .40), and floor exercises self-efficacy (r = .36, p < .01). The PPA subscale correlated significantly with bars (r = .33) and floor (r = .36) self-efficacy as well. The PSE was also significantly (although weak) correlated with actual performance of two of the events, bar score (r = .26) and floor score (r = .29).

Self-Control Scale (SC; Tangney, Baumeister, & Boone, 2004; Appendix H). To measure perception of control, a modified version of the Brief Self-Control Scale created by Tangney et al. (2004) will be used in the study. The scale consists of various statements that indicate how well or poorly someone can control themselves under certain conditions. For this study, the scale has been modified so that the questions are specific of the original question, "I have a hard time breaking bad habits" will be rephrased by, "I have a hard time breaking bad habits on the court/field."

The Self-Control Scale was administered to a group of 351 (Study 1) and 255 undergraduate students (Study 2) at a large east coast state university. The studies consisted of two self-control scales: the total self-control scale, which consists of 36 items, and the brief self-control scale, which consists of 13 items The brief self-control scale correlated .93 and .92 with total self-control scale in studies 1 and 2, respectively. Internal consistency was high in both studies (alpha = .83 and .85). Test-retest reliability was .89 for the total self-control scale and .87 for the brief total self-control scale (Study 2). The authors found that task performance (measured by GPA) was significantly related to both the total and brief self-control scales (r = .32, p < .001 for both scales); participants with higher self-reported self-control had better grades than those with lower self-reported self-control, suggesting that perceived self-control could support academic performance. They also found that higher self-control scores were related to less impulse control problems, such as binge eating (r = -.30 & -.28 for Full & Brief scales,

respectively; p < .001) and alcohol abuse (r = .26, p < .001 for both scales). Higher self-control scores were also strongly and significantly related to better psychological adjustment (i.e., depression, r = -.34 & -.32 for Full & Brief scales, respectively; p < .001), better interpersonal relationships (i.e., family cohesion, r = .27 & .24 for Full & Brief scales, respectively; p < .001), and experiencing more guilt (r = .26, p < .01) and less shame (r = -.30 & -.32 for Full & Brief scales, respectively, p < .001).

Group Environment Questionnaire (GEQ; Carron, Widmeyer, & Brawley, 1985; Appendix I). The GEQ is a scale that measures group cohesion in sport by assessing an individual's perspective of their team (group) on task and social dimensions from both an individual and group orientation (Eisler and Spink, 1998). The questionnaire is used widely throughout the sport and exercise fields. The GEQ consists of 18 items which all fit into one of four scales: Individual Attraction to Group-Task (4); Individual Attraction to Group-Social (5); Group Integration-Task (5); and Group Integration-Social (4). For this study, only the task-related questions of the GEQ will be used (both individual and group), because the researcher is mainly concerned with perceptions of team cohesion based on task goals.

Two studies were conducted by Carron, Widmeyer, and Brawley (1985) to measure the reliability of the GEQ. In the first study, 212 adult Canadian athletes (male and female) from a number of teams (n = 20) were administered version one of the GEQ, which consisted of 53 questions. Factor analysis and item-total correlations reduced the number of questions to 24 while still retaining good internal consistency. The new scale was divided as follows between the four groups: individual attraction to group—task, 7 items; individual attraction to group—5 items; group integration—task, 7 items; group integration—social, 5 items. Cronbach's alpha for the individual attraction to group—task scale and the group integration—task scale were .74

and .78, respectively, and the inter-scale correlations did not exceed .80, indicating that there should be no concern for multicollinearity.

The second study was conducted to determine the reliability of the new, shortened scaled (Version 2), and to also determine if internal consistency from the first study could be replicated with a different athlete sample. The researchers administered the questionnaire to 247 athletes playing on 26 different teams (male and female). Cronbach's alpha values for the two task-related scales (individual and group) were $r = .65$ and $r = .71$, which were similar to those obtained in in study 1.

Due to validity issues in the previous studies, another analysis was performed which also assessed each item for a second criterion or internal consistency, which was its relation to its own scale and other scale total scores. This analysis resulted in Version 3 of the GEQ, which is the 18-item questionnaire currently used today. Cronbach's alpha values for individual attractions to group-task and group integration-task were .75 and .70, respectively. This Version 3 of the GEQ eliminated the problem items in the 24-item version, while keeping the same internal consistency of the previous studies, thus making it the scale of choice to measure cohesion currently.

Procedure

After IRB approval was received, e-mails were sent out to coaches of NCAA Division I and II basketball, volleyball, and baseball teams throughout the southeast to ask to let their athletes participate in this study (along with a link of the study), and if so, to send the researcher the athletes' e-mail addresses. Regarding club athletes, e-mails were sent to the captains of the club teams asking their willingness to participate. If the captain approved, then the link was sent to them to complete and forward to their teammates. A list of the e-mail addresses of all of the

players that completed the survey on the team was also requested. To obtain intramural athletes and other athletes in the general student population, e-mails were sent out through the College of Education wide subject pool of Florida State University. The e-mail message indicates that a participant will need to have some type of experience and knowledge in basketball, volleyball, or tennis to participate in the study. More specific exclusion criteria (i.e., at least 2 years of experience in the sport) were considered during the demographics portion of the study.

Once a participant clicked on the link to complete the survey, they were directed to the informed consent form, where they were informed of the risks of the study, and were reminded that they can withdraw at any time and will remain anonymous. By clicking on the button "agree," the participants indicated that they consent to participating in the study, and were directed to the first questionnaire, which is the demographics questionnaire.

Once participants completed the demographics questionnaire, the participants clicked "next" and were then directed to the Hot Hand Questionnaire. After the Hot Hand Questionnaire, the survey then directed them to the Psychological Momentum Questionnaire. Once these were completed, participants were directed to the Perceived Physical Ability Scale and the Brief Self-Control Scale. Once they finished up the BSCS, they were directed to the Group Environment Questionnaire (GEQ). Once finished with this, participants clicked "submit" and were thanked again for their participation in the study.

Data Analysis

The analyses in this study consisted of multiple regression (MR), MANOVA, ANOVA, post-hoc tests, and descriptive statistics, which were all performed through SPSS. The first four hypotheses were tested through multiple regressions and correlations. Three separate multiple

regression analyses were conducted in order to predict the three dependent variables, self-efficacy, self-control, and team cohesion. The predictor variables were the same for all three analyses: hot hand belief and psychological momentum belief. Due to the differences in scale between the psychological momentum questionnaire and the game scenario illustrating momentum, these variables were separated into two distinct predictor variables. In order to examine any potential mediation effects among variables, the four steps to establishing mediation, presented by Baron and Kenny (1986), were used. Pearson's correlation was also run in order to test the linear correlation between all of the variables involved in the study. Alpha level for all statistical analyses was set at .05.

Hypothesis five, which assumes skill-level differences, was tested by using a MANOVA procedure followed by an ANOVA test if the MANOVA is significant ($p < .05$ for each variable). These tests were followed by Tukey's and Scheffe's post-hoc procedure. Means, standard deviations, and Cohen's d-values will also be employed in the analysis.

CHAPTER 4

RESULTS

Skewness and Kurthosis for all six variables employed in the study indicated that they were normally distributed. All of the variables returned skewness values within the standard ±2 range, and kurtosis values within the standard ±7 range (Muthen & Kaplan, 1985). Five variables that were tested for internal consistency reliability (ICR) proved to be reliable. Cronbach's alpha values were: .82, .60, .81, .76, and .79 for the hot hand questionnaire (HH), the psychological momentum questionnaire (PM), the physical self-efficacy scale (SE), the self-control scale (SC), and the group environment questionnaire (TC), respectively. The only variable that couldn't be tested for reliability was the psychological momentum scenario because the measure consisted of one question. All the mean scores were above the center point of each scale (see Table 1). The hot hand and psychological momentum questionnaires were each rated on a Likert-type scale ranging from 1-7, the psychological momentum game scenario ranged from 1-3, the self-efficacy scale ranged from 1-6, the self-control scale ranged from 1-4, and the group environment questionnaire ranged from 1-9.

Table 1
Descriptive statistics for the study's variables

Variable	M	SD	SK (SE)	K (SE)
Hot Hand Questionnaire (HH)	6.01	0.92	-1.19 (.18)	1.47(.36)
Psychological Momentum (PM) Questionnaire	5.91	1.08	-1.34(.18)	2.58(.36)
PM Game Scenario (PMS)	2.51	0.68	-1.05(.18)	-.16(.36)
Self-Efficacy Scale (SE)	4.61	0.72	-.56(.18)	.27(.36)
Self-Control Scale (SC)	3.06	0.41	-.07(.18)	-.46(.36)
Group Environment Questionnaire (TC)	6.07	1.38	-.03(.18)	-.59(.36)

Note. SK = Skewness; SE = Standard Error; K = Kurthosis

The correlations among all the variables are shown in Table 2. As hypothesized, belief in the hot hand was significantly positively correlated with belief in psychological momentum (r = .50, $p < .01$ for the questionnaire, r = .17, $p < .05$ for the game scenario). Belief in the hot hand was also shown to be significantly positively correlated to self-efficacy (r = .35, $p < .01$); however, it was not significantly correlated to self-control and team cohesion. The Psychological Momentum questionnaire and the game scenario were both significantly correlated with each other (r = .28, $p < .01$) and self-efficacy (r = .23, $p < .01$ for the PM questionnaire, r = .17, $p < .05$ for the game scenario), but neither were significantly correlated to the dependent variables of self-control and team cohesion. Also, the three dependent variables were significantly positively correlated with each other as hypothesized ($p < .05$).

Table 2
Correlations among the variables in the study

Variable	HH	PM	PMS	SE	SC
HH	-				
PM	.50**	-			
PMS	.17*	.28**	-		
SE	.35**	.23**	.17*	-	
SC	.15	.10	.12	.35**	-
TC	.09	.04	.00	.17*	.33**

** $p < .01$ (2-tailed).
* $p < .05$ (2-tailed).

Note. HH = Hot Hand Belief; PM = Psychological Momentum Belief; PMS = Psychological Momentum Scenario; SE = Self Efficacy; SC = Self Control; TC = Team Cohesion

Multiple Regression

To test the hypotheses that belief in the hot hand and psychological momentum significantly predict self-efficacy, self-control, and team cohesion, three separate multiple

regression analyses were performed. All of the variables in the analyses met the normality assumptions for multiple regressions (see Appendix H). Tests for multicollinearity revealed that a very low level of multicollinearity was present in the predictor variables (*VIF* = 1.33 for hot hand belief, 1.40 for psychological momentum belief, and 1.08 for the momentum scenario).

The first multiple regression analysis was conducted to examine whether belief in the hot hand (HH) or psychological momentum (PM, PMS) predict self-efficacy levels (SE). The regression findings are shown in Table 3. Results of the analysis partially confirmed hypothesis two, which stated that the hot hand perception would be a predictor of SE. The ANOVA was significant, F (3, 172) = 9.27, $p < .001$, $R^2 = .14$, adjusted $R^2 = .12$. The regression coefficients showed that hot hand belief was a significant predictor of self-efficacy ($b = .31$, $t = 3.79$, $p < .001$); however, neither of the psychological momentum variables were significant predictors of self-efficacy (PM, $b = .05$, $t = .62$, $p = .54$; PMS, $b = .10$, $t = 1.42$, $p = .16$). Thus, the third hypothesis stating that PM would be a predictor of SE, was not confirmed.

Table 3
Summary of multiple regression analyses. Predictor variables, hot hand belief (HH), psychological momentum belief (PM), and psychological momentum scenario (PMS) regressed on self-efficacy (SE), self-control (SC), and team cohesion TC (N = 176)

	SE			SC			TC		
Variable	*b*	*t*	*p*	*b*	*t*	*p*	*b*	*t*	*p*
HH	.31**	3.79	.00	.13	1.48	.14	.10	1.14	.26
PM	.05	.62	.54	.01	.05	.96	-.01	-.12	.91
PMS	.10	1.42	.16	.10	1.26	.21	-.01	-.13	.89
R		.37			.18			.09	
R^2		.14			.03			.01	
adjusted R^2		.12			.02			.01	
F		9.27	.00**		1.86	.14		.51	.68

*$p < .05$. **$p < .01$.

The next multiple regression analysis was conducted to examine whether HH, PM, or PMS predict perceptions of self-control (SC). Results of the analysis failed to confirm any of the predictions. The overall ANOVA was non-significant, F (3, 172) = 1.86, p = .14, R^2 = .03, adjusted R^2 = .02,. As shown in Table 3, none of the predictor variables, HH, PM, or PMS, significantly accounted for the variance of SC.

The next multiple regression analysis was run in order to test whether HH, PM, or PMS predict team cohesion (TC). Similar to the second regression, the results of this analysis did not confirm this hypothesis (see Table 3). The overall ANOVA was non-significant, F (3, 172) = .51, p = .68, R^2 = .01, adjusted R^2 = .01. As shown in Table 3, none of the predictor variables accounted significantly for the TC variance.

To examine whether any of the other variables mediate the significant relationship between hot hand belief (HH) and self-efficacy (SE), the four steps to establishing mediation (Baron & Kenny, 1986) were used with self-control and team cohesion as potential mediators. Step one is to show that the independent variable significantly predicts the dependent variable. However, note that the significant relationship between the independent and the dependent variable is not a necessary condition to establish that a third variable acts as a mediator variable between the independent and dependent variable. Step two is to show that the independent variable is correlated with the potential mediator. Step three is to show that the potential mediator is a significant predictor of the dependent variable while controlling for the independent variable. Ideally speaking, in this multiple regression, the effect of the potential mediator is large and significant while the effect of the independent variable is weak (or zero) and not significant. Finally, step four is to establish whether the mediator variable completely or partially mediates the relationship between the independent and dependent variable.

Step one, which is to show that HH significantly predicts the SE, had already been done. However, step two, which is to show that HH was correlated with the mediator, was unsuccessful for both SC and TC, i.e., no significant relations between HH and SC and between HH and TC were found. Belief in the hot hand was not significantly related to either of these variables. Although it was found that SC predicted the dependent variable (SE) while controlling for HH (Step 3; $b = .31$, $t = 4.50$, $p < .001$), the fact that step two was not satisfied (i.e., no relationship between hot hand belief and self-control) implies that self-control is not a mediator of the relationship between hot hand belief and self-efficacy levels.

Skill Level Differences

To test the hypothesis that athletes with a higher skill level will hold stronger beliefs in the hot hand, psychological momentum, self-efficacy, perceptions of self-control, and team cohesion, a multivariate analysis of variance (MANOVA) procedure was conducted with three different levels for skill group (low, middle, high). Results from the MANOVA revealed significant differences among skill levels, *Wilk's* $\lambda = .84$, F (2, 175) = 2.52, $p < .001$, $\eta_p^2 = .08$. Upon further examination, follow-up univariate ANOVAs revealed significant differences among skill levels on self-efficacy, F (2, 175) = 5.80, $p < .001$, $\eta_p^2 = .06$, and team cohesion, F (2, 175) = 4.91, $p = .01$, $\eta_p^2 = .05$, but not for hot hand belief, F (2, 175) = .47, $p = .63$, $\eta_p^2 = .01$, psychological momentum belief, F (2, 175) = .22, $p = .81$, $\eta_p^2 = .00$ and F (2, 175) = .14, $p = .87$, $\eta_p^2 = .00$ (for momentum scenario), or perceptions of self-control, F (2, 175) = .30, $p = .74$, $\eta_p^2 = .00$.

Tukey's post-hoc tests were performed to further test significant group-wise differences among skill levels for self-efficacy and team cohesion. These tests revealed significant

differences in self-efficacy scores between the low (M = 4.47, SD = .74) and high (M = 4.84, SD = .62, d = -.55) skill level groups. The high skilled athletes reported significantly ($p < .001$) higher self-efficacy than their low skill counterparts. There were non-significant differences in self-efficacy scores between the middle skill level group and either of the other groups, however. The post-hoc tests also revealed significant differences in team cohesion scores between the low (M = 6.36, SD = .1.29) and high (M = 5.67, SD = .1.45, d = .51) skill level groups. Low skilled participants reported significantly ($p < .01$) higher perception of team cohesion than their higher skill-level counterparts. Once again, the middle skill level athletes did not differ significantly from the others in team cohesion, in contrast to the proposed hypothesis.

Summary

The results of this study confirmed two hypotheses (1 and 4), partially confirmed two hypotheses (2 and 5), and failed to confirm one hypothesis (3). Belief in the hot hand and belief in psychological momentum were significantly positively correlated, and the three dependent variables, self-efficacy, perceptions of self-control, and team cohesion were significantly positively correlated, confirming hypotheses 1 and 4. Belief in the hot hand predicted self-efficacy levels, but did not predict self-control or team cohesion; thus partially confirming hypothesis 2. Belief in psychological momentum did not predict any of the dependent variables, therefore no evidence supporting hypothesis 3. Finally, differences in beliefs among skill level were noted for self-efficacy levels; higher skill athletes reported stronger beliefs than those with lower skill levels, thus partially confirming hypothesis five. There were also differences among skill levels for team cohesion; however, these differences were in the opposite direction of what was hypothesized; lower skilled athletes reported higher levels of team cohesion. None of the

other variables showed significant differences among skill levels, therefore not confirming the study's hypothesis.

CHAPTER 5

DISCUSSION

The purpose of this study was to explore the concepts of hot hand and psychological momentum beyond their statistical realities, and examine their relation to self-efficacy, perceptions of self-control, and team cohesion. More specifically, I examined whether athletes with stronger beliefs in the hot hand and psychological momentum had higher overall levels of self-efficacy, perceptions of control, and team cohesion. Also, it was examined whether any of these beliefs varied by the level of skill and experience athlete posses in the sport. Moreover, I aimed to determine whether (a) belief in the hot hand and psychological momentum were positively correlated, (b) belief in the hot hand predicted self-efficacy, self-control, and team cohesion, (c) belief in psychological momentum predicted self-efficacy, self-control, and team cohesion, (d) self-efficacy, self-control, and team cohesion were all positively correlated with one another, and (e) athletes with a higher skill level held stronger beliefs in the hot hand, psychological momentum, self-efficacy, self-control, and team cohesion.

Hot Hand

It was hypothesized that belief in the hot hand would predict self-efficacy. As expected, the results of this study indicate that athletes with a stronger belief in the hot hand also perceive higher self-efficacy and vice versa. These results are aligned with prior research (Bar-Eli et al., 2006) indicating that when a player feels hot, his/her confidence in their ability increases. These findings are also similar to Iso-Ahola and Blanchard's (1986) study on competitive tennis players, where winners of the first match showed significantly higher levels of self-confidence than their opponents. Although their study examined the concept of psychological momentum, a win can still be considered a "successful" attempt, thus aligning with the hot hand as well. These

studies, however, tested momentary self-efficacy while the current study pertains to a more general relation between belief in the hot hand and self-efficacy.

The current findings indicate that none of the other variables in the study mediated the relationship between belief in the hot hand and self-efficacy. However, it was found that perceptions of self-control significantly predicted self-efficacy levels. While this was not one of the proposed hypotheses in the study, this is similar to prior research on the two concepts. Haney and Long (1995) examined the relationship between self-efficacy and self-control and their effects on performance. They found that self-efficacy significantly mediated the relationship between perceptions of control and performance. The finding that self-control can predict sport-related self-efficacy implies that athletes who perceive high levels of control are more likely to believe in their ability in their sport. This can potentially lead to higher levels of performance, and future research should further examine the relationship between these two concepts and their affect on performance.

It was also hypothesized that belief in the hot hand would predict perceptions of self-control and team cohesion. No prior research on the hot hand related this phenomenon to perceptions of self-control and team cohesion, despite their relation to psychological momentum (Vallerand et al., 1988, Eisler and Spink, 1998). Despite the lack of prior research, it was hypothesized that belief in the hot hand would predict perceptions of control and team cohesion because of the close relationship between the hot hand and psychological momentum, and also momentum's relationship to self-control and team cohesion. In addition to its close relationship to psychological momentum, the hot hand was believed to be related to perceptions of self-control because belief in the hot hand could potentially be a resourceful tool for things such as getting out of slumps. Contrary to expectations, belief in the hot hand failed to significantly

predict either of these. Higher levels of self-control have been found to positively affect performance in sport (Haney & Long, 1995) as well as other domains, such as academic performance (Tangney et al., 2004). Since belief in the hot hand refers to increased performance, it was thought that belief in the hot hand would predict self-control perceptions, but this was not the case. This finding may be attributed to the measures used to analyze hot hand belief; the questionnaire asked general questions and not specific, in-game moments. Belief in the hot hand may only predict perceptions of self-control in the moment an athlete feels "hot," and it is important for future research to examine this possibility.

Although no previous research had examined the relationship between hot hand belief and team cohesion, Burns (2004) and Raab et al. (2011) found that athletes allocated the ball to players that they perceive as "hot," and this was a successful strategy. These successful allocation behaviors could lead to an increased sense of team cohesion, since it indicates that the team is performing better. However, the results of this study show no relationship between belief in the hot hand and psychological momentum. A potential reason that hot hand belief did not predict team cohesion is that the hot hand is an individualistic concept, whereas team cohesion is a team concept. Since belief in the hot hand refers to one athlete's performance rather than full team behavior, the reason for the lack of an observed relationship between hot hand belief and team cohesion beliefs could be attributed this phenomenon.

Psychological Momentum

The results indicate that belief in psychological momentum is not significantly related to general self-efficacy, perceptions of self-control, and team cohesion. It has previously been found that perceived psychological momentum was significantly related to increased levels of self-efficacy (Iso-Ahola & Blanchard, 1986; Taylor & Demick, 1994), perceptions of control

(Vallerand et al. 1988), and team cohesion (Eisler & Spink, 1998). These findings led me to hypothesize that belief in psychological momentum would be an adaptive belief which leads to higher overall of self-efficacy, perceptions of self-control, and team cohesion beliefs among athletes. Contrary to expectations, belief in psychological momentum failed to predict any of these psychological constructs. This was evidenced both for the psychological momentum questionnaire, and the game scenario that presented a momentum-like situation. Although psychological momentum was significantly correlated to self-efficacy, it did not significantly predict it or the two remaining dependent variables of self-control or team cohesion when the multiple regression analysis was performed. These results are not aligned with prior studies on psychological momentum reporting significant relationships among perceived momentum and self-efficacy, perceptions of control, and team cohesion. This could be due to the fact that this study examined dispositional effects of the belief in psychological momentum and its relation to the other variables, compared to previous studies which studied perceived psychological momentum in real time.

The current results indicate that although belief in psychological momentum is related to self-efficacy, perceptions of self-control, and team cohesion when the momentum occurs in real life, this is not the case when the relationships are measured generically. Psychological momentum is defined as "an added or gained psychological power that changes interpersonal perceptions and influences an individual's mental and physical performance," (Iso-Ahola & Mobily, 1980, pg. 391). Also, the Multidimensional Model of Momentum (Taylor & Demick, 1994) states that psychological momentum is caused by a series of events that trigger altered cognitions, affect, and physiological changes, and these changes influences the athlete's behavior

and beliefs. These definitions indicate that psychological momentum may be a concept that is hard to measure outside of the actual events that trigger these changes in mental state.

Relationship between Self-Efficacy, Self-Control, and Team Cohesion

Although previous research (to the researcher's knowledge) has not measured the concepts of self-efficacy, self-control, and team cohesion in a unified form, they have all been found to be related to performance (Ryckman et al., 1982; Tangney et al., 2004; Carron, Brey, & Eys, 2010), and thus considered integratively in this study. It was hypothesized that self-efficacy, perceptions of self-control, and team cohesion would be positively correlated with one another. As expected, the results of this study indicated that indeed this was the case; all three variables had significant relationships with one another. Self-efficacy and self-control were strongly related to one another as well as self-control and team cohesion. The relationship between self-efficacy and team cohesion was not as strong as the other two relationships, but it was still significant. Self-efficacy, perceptions of self-control, and team cohesion have all previously been found to be related to performance on skill related tasks, but have never been examined together in a study that analyzed whether beliefs in certain phenomena (i.e., hot hand, psychological momentum) could affect their levels. Although the majority of the hypothesized relationships between their relationship with hot hand and psychological momentum were insignificant, this study sheds insight that all three concepts are related and should be analyzed together in future research. Self-efficacy and perceptions of self-control have previously been found to be related to one another (Haney & Long, 1995), which isn't surprising because both of them measure personal, individual characteristics. However, the fact that they are also related to team cohesion is a novel finding and implies that these beliefs can also potentially be beneficial to a group or team setting, and not just an individual alone.

Skill Level Differences

Skill level has been shown to be related to beliefs in the hot hand (Burns, 2004; Raab et al., 2011), as well as self-efficacy levels (Cleary & Zimmerman, 2001; Jones, Hanton, & Swain, 1994), with higher skilled athletes seeming to have higher levels of both. Burns (2004) and Raab et al. (2011) found that the most experienced players exhibited the most ball allocations to the player that was "hot" at the time, indicating a stronger belief in the hot hand. Cleary and Zimmerman (2001) found that high skilled athletes displayed higher levels of self-efficacy than non-experts and novices, and Jones, Hanton, and Swain (1994) also found that elite swimmers displayed higher levels of self-confidence than non-elite swimmers. Thus, it was hypothesized that higher skill level athletes will posses stronger beliefs in the hot hand and psychological momentum, as well as higher levels of self-efficacy, perceptions of self-control, and team cohesion. Contrary to expectations, high skill level athletes didn't indicate stronger beliefs for the majority of the variables. Self-efficacy was the only variable in which highly skilled athletes reported significantly higher values than lower skilled athletes. These findings on self-efficacy are in line with prior research indicating self-efficacy was higher among experts than in non-experts and novices in basketball (Cleary & Zimmerman, 2001) and swimming (Jones, Hanton, & Swain, 1994).

The finding that skill level had no significant effect on belief in the hot hand is rather surprising. Prior research (Burns, 2004; Raab et al., 2011) indicated that athletes who were more skilled and experienced held stronger beliefs in the hot hand, and that they also were more likely to allocate the ball to certain teammates because of this belief. The fact that higher skilled players are more likely to have streaks—and more often than not attribute these streaks to being "hot" (Burns, 2004)—makes it a surprising finding that skill level was not significantly related to

hot hand belief. I assume that the hot hand questionnaire which asked questions about a participant's general beliefs about the hot hand, rather than their personal beliefs on whether they could be "hot" themselves might have been the reason for the current findings. If the questions were more focused on individual hot hand experience instead of general questions about the hot hand, there potentially may have been differences in beliefs among skill levels. Also, previous studies (Burns, 2004; Raab et al., 2011) measured hot hand belief differently; they looked at behavior to determine hot hand belief, not a questionnaire. If athletes' behavior was analyzed in this study (e.g., game performance), then there could have potentially been observed skill level differences.

Although it was hypothesized that belief in psychological momentum would be strongest in higher skill athletes, the finding that there was no significant difference is not surprising. Richardson et al. (1988), for example, found that the effect of psychological momentum on performance decreased as skill level increased. However, it was hypothesized that psychological momentum would be strongest in higher skilled athletes because it was thought that the perception of psychological momentum may be different from its actual effect on performance. Because athletes with a higher skill level have been shown to have stronger self-efficacy (Cleary & Zimmerman, 2001), and since self-efficacy is related to self-control (Haney & Long, 1995), it was assumed that higher skill level athletes would perceive higher perceptions of control, which could potentially lead to a feeling of psychological momentum because perceived control is a key variable in determining whether momentum is perceived as present (Vallerand, et al. 1988). However, both perceptions of self-control and psychological momentum belief had no relationship to skill level, indicating that this was not the case. Hanton and Connaughton (2002) examined perceptions of control in regards to anxiety in swimmers and found that although

athletes of different skill levels perceive anxiety symptoms in a similar fashion, the manner in which they interpreted and worked to control the symptoms differed among skill levels. This indicates that the level of self-control perceived may not differ with regards to skill level, but rather the *type* of self-control methods used to perform successfully may potentially differ. Future research should examine in greater detail the methods of self-control used by athletes and if these differ among skill levels.

Another interesting finding was that skill level was significantly related to team cohesion—but in the opposite direction of what was hypothesized. Athletes of lower skill levels reported higher levels of team cohesion than that of highly skilled athletes. This is a surprising finding as it has been found in many studies (e.g., Carron et al., 2002) that team cohesion is positively related to performance, and higher skilled athletes perform better than lower skilled athletes. The type of teams for the low skilled athletes in this study could have contributed to this finding. Low skilled athletes in this study were selected from college intramural teams. Intramural sports, for the most part, are not taken very seriously and are meant to be played solely for fun. The highly skilled athletes in the study were Division I and II athletes who compete at a much higher level and deal with many other factors when playing the sport (e.g., maintaining a scholarship, gaining/keeping a starting position). The more serious nature of the teams of the high skill level group could be the reason for the lower feelings of team cohesion compared to the low skilled group. When athletes are playing on a varsity college team, they are constantly competing for a starting spot, expected to play well both individually and as part of the team, and winning is taken much more seriously. This constant competition and expectation could potentially lead to turmoil between players, which therefore could lower perceived team cohesion. Future research should look at low skilled athletes who are still part of an organized,

more serious team, such as a recreational team or competitive high school level athletes, and compare their levels of team cohesion to highly skilled athletic teams.

Conclusions, Limitations, and Future Research

This study contributes to the literature in that it is one of the first in the field to examine the relation between the belief in the hot hand and psychological momentum outside of an "in vivo" experience and on a dispositional scale. It is the first study, to the researcher's knowledge, that examined their relation to self-efficacy and perceptions of self-control in general, and not at times an athlete feels "hot" or in a momentum. It is also one of the few studies that explored the concepts of hot hand and psychological momentum beyond their statistical nature, and focused on how the beliefs in these phenomena—whether statistically present or not—can affect athletes mentally.

Similar to the studies conducted by Burns (2004) and Raab et al. (2011), this study sought to examine whether beliefs in the hot hand and psychological momentum could be adaptive beliefs for a player or a team. It was found that belief in the hot hand can, in fact, be adaptive when it comes to self-efficacy. This conceptual linkage between the belief in the hot hand and self-efficacy is even greater when an athlete exhibits a high level of self-control. However, psychological momentum was not found to be a significant adaptive belief in this study when it comes to perception of self-efficacy, self-control, or team cohesion.

There are some limitations in this study that may have contributed to the insignificant relationships found in the regressions and the MANOVA procedures. One limitation was that there were only three questions used to measure beliefs in the concept of psychological momentum. Two questions were used for the psychological momentum questionnaire, and one

question was used for the momentum game scenario. Although the scales exhibited good reliability and consistency (Cronbach's alpha), the small number of questions may have been a reason for the lack of a relationship between momentum and the dependent variables. Future research should add more items to assess psychological momentum, and perhaps focus on the scenario aspect more because game scenarios are what truly create the feel of psychological momentum.

An additional limitation of the study was that team cohesion was analyzed based on the full population of participants and not a subset of grouped teams. Participants were not grouped based upon the specific team they played on; they were only grouped based on skill level. This could have led to the reason why psychological momentum did not significantly predict team cohesion. If participants that were a part of the same team were grouped and compared to other teammates in the study, there could have potentially been a difference in team cohesion scores, thus may change the results of the study. However, perceived team cohesion was only analyzed on the individual level, and athletes on the same team were not compared. Future research that considers the effect of psychological momentum on team cohesion should group members of the same team together and compare them to other teams.

Also, the number of participants who fit into the middle skill group could have affected the results pertained to this group. There were only 25 participants in the middle skilled group compared to 86 in the low and 65 in high level, making it much more difficult for significant results to occur. This was largely due to incomplete data from participants in the middle skill group. Future research should ensure a better sample size balance for each skill level group.

The type of sports used in the study is also a potential limitation of the study. All three sports (baseball, basketball, volleyball) that were included in the study are team sports. This was done intentionally in order to measure team cohesion and analyze similar populations; however, individual sports (e.g., tennis, bowling) could have elicited different results than the team sports in this study due to the nature of the sports. Future research should analyze how hot hand and psychological momentum can effect self-efficacy levels and perceptions of self-control in individual-sport athletes, and also compare the results with team-sport athletes.

Another shortcoming of this study is that the directionality of the relationships between the variables was only studied one-way. There has not yet been a set direction established in the research of whether belief in the hot hand and psychological momentum predict self-efficacy, self-control, and team cohesion, or if it is actually self-efficacy, self-control, and team cohesion that predict belief in the hot hand and psychological momentum. It is plausible that the variables may have a cyclic influence on each other, especially since the majority of variables in the study were correlated. The Projected Performance Model (Cornelius et al., 1997) proposes that psychological momentum is the result, rather than the cause, of performance change; this could be the case regarding high levels of self-efficacy, self-control, and team cohesion as well. Future research should longitudinally study the relationship between belief in the hot hand, psychological momentum, self-efficacy, self-control, and team cohesion to better understand their mutual relationships.

Future research should work to distinguish the effects of internal vs. external hot hand beliefs. An athlete may be affected differently by hot hand belief when they personally believe they are "hot" compared to when teammates or coaches think they are "hot." If a player thinks they are playing better than normal, but their teammates do not agree, then this may not be

beneficial to self-efficacy; this may also be the case if their teammates think they are "hot," but they do not feel this way personally. It is important for future research to distinguish individual hot hand beliefs from external, environmental hot hand beliefs in order to see if they affect self-efficacy levels differently.

This study indicates that the hot hand belief can indeed be adaptive beyond allocation techniques, and it can potentially be a tool used for increasing self-efficacy. It is not just something that can increase self-efficacy in the moment while someone feels "hot," but also on a dispositional level as seen by this study. This is important because self-efficacy has continually been found to be positively related to performance, and this study suggests that hot hand belief can potentially increase self-efficacy levels. Future studies should use the findings of this study and work to apply them in a real-life situations or experimental settings. It should be tested whether athletes can be experimentally led to believe they are playing better than normal, and if so, can this increase overall levels of confidence and efficacy. If stronger beliefs in the hot hand can lead to higher levels of self-efficacy (e.g., an athlete making two consecutive shots and believe that they are now "hot"), this can be an extremely beneficial mental benefit, which could lead to better subsequent performance.

The effects of psychological momentum should also continue to be studied in a live or scenario-type setting, so that participants can truly get the mental experience of psychological momentum. This study illustrated that the belief in the hot hand can predict levels of self-efficacy in an athlete—even if a player is not experiencing the operationally defined hot hand phenomenon (i.e., two or more subsequent successful attempts). This is a fact that can be beneficial to performance and further examined in the future.

APPENDIX A

POWER ANALYSIS

F tests - ANOVA: Fixed effects, omnibus, one-way

Analysis:	A priori: Compute required sample size	
Input:	Effect size f	= 0.25
	α err prob	= 0.05
	Power (1-β err prob)	= 0.80
	Number of groups	= 3
Output:	Noncentrality parameter λ	= 9.9375000
	Critical F	= 3.0540042
	Numerator df	= 2
	Denominator df	= 156
	Total sample size	= 159
	Actual power	= 0.8048873

APPENDIX B

INFORMED CONSENT FORM

You have been invited to participate in a research study regarding hot hand/psychological momentum and confidence. You were selected as a potential participant because of your interest and/or current participation in sports. This study is being conducted by BaRack Little (Master's student), as a requirement by the Department of Educational Psychology and Learning Systems Sport Psychology program at Florida State University. Please read the following form, and if anything is unclear or you have any questions, please ask for clarification before you agree to participate.

Study Information

The purpose of this study is to examine the belief of "hot hand" and psychological momentum in sport, and also to examine confidence in athletes and former athletes. If you agree to participate in this survey by moving on to the next page, you will be asked to complete a brief demographic information questionnaire and then complete four to five short questionnaires regarding the topics of this study. The entire questionnaire should take less than 20 minutes to complete.

Benefits and Risks of Participating in the Study

There are no tangible benefits from participating in this study, but once we figure out the relationship between hot hand, psychological momentum, and confidence we will be able to advise coaches, mentors, trainers, and even other teammates on how to keep athletes' confidence at a high level which can help them perform at their best.

There is minimal risk involved in this study. Also, you may freely discontinue participation in the study, for any reason, without penalty.

Confidentiality

The results of this study will be kept completely private and confidential to the extent permitted by law. In order to ensure anonymity, no information will be requested that will make it possible to identify a participant. Coaches, trainers, professors, etc. will not know who does or does not decide to participate in the study, and they will not have any access to the survey responses.

Voluntary Nature of the Study

Participation in this study is completely voluntary. If at any point in the study you want to withdraw or not answer a question, you may do so without any penalty or punishment.

Contacts and Questions

The researcher conducting this study is BaRack Little. If you have any questions regarding this study, contact BaRack by phone at (***) ***-**** or by e-mail at ******@**.***.***. You may also contact Dr. Gershon Tenenbaum by phone at (***) ***-**** or by e-mail at **********@**.***.***. If you have any questions or concerns regarding this study and would rather talk to someone other than the researcher, you can contact the FSU IRB at **** **********, **********, ********** or ***-***-****, or by email at ***********@**.***.***.

Statement of Consent

I have read all of the above information. I have clarified any questions about the study that I may have. I consent to participate in this study.

Signature of Participant _____ Date _____

APPENDIX C

INSTITUTIONAL REVIEW BOARD APPROVAL LETTERS

Office of the Vice President for Research Human Subjects Committee Tallahassee, Florida *****

*** *** **** · FAX *** *** ****

APPROVAL MEMORANDUM

Date: 12/02/2013

To: BaRack Little <******@**.***.***>

Address: **** ******* ***** **

Dept.: EDUCATIONAL PSYCHOLOGY AND LEARNING SYSTEMS

From: Thomas L. Jacobson, Chair

Re: Use of Human Subjects in Research

The Hot Hand and Psychological Momentum as Adaptive Beliefs in Sport

The application that you submitted to this office in regard to the use of human subjects in the proposal referenced above have been reviewed by the Secretary, the Chair, and two members of the Human Subjects Committee. Your project is determined to be Expedited per 45 CFR § 46.110(7) and has been approved by an expedited review process.

The Human Subjects Committee has not evaluated your proposal for scientific merit, except to weigh the risk to the human participants and the aspects of the proposal related to potential risk and benefit. This approval does not replace any departmental or other approvals, which may be required.

If you submitted a proposed consent form with your application, the approved stamped consent form is attached to this approval notice. Only the stamped version of the consent form may be used in recruiting research subjects.

If the project has not been completed by 12/01/2014 you must request a renewal of approval for continuation of the project. As a courtesy, a renewal notice will be sent to you prior to your expiration date; however, it is your responsibility as the Principal Investigator to timely request renewal of your approval from the Committee.

You are advised that any change in protocol for this project must be reviewed and approved by the Committee prior to implementation of the proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition, federal regulations require that the Principal Investigator promptly report, in writing any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the chairman of your department and/or your major professor is reminded that he/she is responsible for being informed concerning research projects involving human subjects in the department, and should review protocols as often as needed to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

This institution has an Assurance on file with the Office for Human Research Protection. The Assurance Number is IRB00000446.

Cc: HSC No. 2013.11503

Gershon Tenenbaum <*********@***.*** >, Advisor

Office of the Vice President For Research Human Subjects Committee P O Box 3062742 Tallahassee, Florida 32306-2742

(850) 644-8673 · FAX (850) 644-4392

APPROVAL MEMORANDUM (for change in research protocol)

Date: 01/14/2014

To: BaRack Little <******@**.***.***

Address: **** ******* ***** ****

Dept: EDUCATIONAL PSYCHOLOGY AND LEARNING SYSTEMS

From: Thomas L. Jacobson, Chair

Re: Use of Human subjects in Research

Project entitled: The Hot Hand and Psychological Momentum as Adaptive Beliefs in Sport

The application that you submitted to this office in regard to the requested change/amendment to your research protocol for the above-referenced project has been reviewed and approved.

Please be reminded that if the project has not been completed by 12/01/2014 , you must request renewed approval for continuation of the project.

By copy of this memorandum, the chairman of your department and/or your major professor is reminded that he/she is responsible for being informed concerning research projects involving human subjects in the department, and should review protocols as often as needed to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

This institution has an Assurance on file with the Office for Human Research Protection. The Assurance Number is IRB00000446.

Cc:

HSC NO. 2014.12059

The Hot Hand and Psychological Momentum as Adaptive Beliefs in Sport

APPENDIX D

DEMOGRAPHIC INFORMATION

1. Gender

   Male Female

2. Age: _____

3. Sport Played (Primary Sport/pick one)

   Basketball Volleyball Baseball

4. Are you currently an athlete on a team? Yes No

5. If you are currently an athlete, are you on a club or varsity level team?

   Club Varsity Intramural Other (please specify:_____) n/a

6. What is the highest level of the sport you have played?

   Recreational High School Intramural Club

   D-3(Varsity) D-2(Varsity) D-1(Varsity)

   Other (Please Specify:_____)

7. How many years of experience do you have in the sport? _____

8. Have you played any other sports? Yes No,

   If so what sport?

   How many years have/did you play(ed) that sport? _____

APPENDIX E

HOT HAND QUESTIONNAIRE

The concept of an athlete "getting hot" in a sport is a topic that is very prevalent in the sports world. It has been discussed so much that it has been formally defined by researchers (Gilovich, et al, 1985). The **hot hand phenomenon** was defined as the belief that during a particular period a player's performance is significantly better than expected based on that player's overall record. It was also described as the belief that someone is more likely to be successful on a task (e.g., free-throw) after a sequence of two or three successful attempts at the task.

Do you believe the hot hand exists in sport?

1 (Not at all) 2 3 4 5 6 7 (Very Much So)

Do you believe the hot hand exists in *your* sport?

1 (Not at all) 2 3 4 5 6 7 (Very Much So)

Rank the following sports in order of which you believe hot hand is present (most to least):

-archery
-basketball
-baseball
-billiards
-bowling
-darts
-golf
-hockey
-horseshoe pitching
-soccer
-table tennis
-team handball
-tennis
-volleyball

Does a player have a better chance of making a shot after having made two or three previous shots than he does after having missed the previous ones?

1 (Not at all) 2 3 4 5 6 7 (Very Much So)

Do you believe that playmakers play or pass to a player that is hot?

1	2	3	4	5	6	7
Not at all						Very Much So

Do you believe that playmakers ***should* play/pass to a player that is hot?**

1	2	3	4	5	6	7
Not at all						Very Much So

APPENDIX F

PSYCHOLOGICAL MOMENTUM QUESTIONNAIRE

Psychological Momentum (PM) is another concept that is widely known and discussed in sport. Although it is very similar to the hot hand, researchers have separated the concept to be more psychological than statistical, as compared to hot hand research. Psychological momentum has been defined in many different ways by researchers, but many choose to use the definition given by Iso-Ahola and Mobily (1980) which defines psychological momentum as "an added or gained psychological power that changes interpersonal perceptions and influences an individual's mental and physical performance."

Do you believe in psychological momentum during an athletic competition?

1 (Not at all) 2 3 4 5 6 7 (Very Much So)

Does a team or individual have an added or gained advantage over their opponent that makes them more likely to win a game/match if they score a sequence of unanswered points in a row?

1 (Not at all) 2 3 4 5 6 7 (Very Much So)

What is the main sport you play? Basketball Volleyball Baseball

(Volleyball Scenario)

"An important volley match is underway between two teams. Team 1 and Team 2 are playing a match where the winner wins the national championship. It is a best-of-three match, and the match is currently tied as both teams have won 1 game a piece. It is currently game 3, and the match is tied 13-13. However, Team 2 was winning 13-8, and Team 1 proceeded to win five games in a row and tie it up at 13."

Who is more likely to win the match?

a. The team who came from behind (Team 1) b. The player who started off ahead (Team 2) c. Neither Team is more likely to win

(Basketball Scenario)

"An important basketball game is underway between two teams. Team 1 and Team 2 are playing game 7 of a championship series, and the winner of this game wins the national championship. The series is currently tied 3-3, and the game is currently tied 95-95 with 2 minutes remaining in the 4th quarter. However, Team 2 was winning 95-85, and Team 1 proceeded to score 10 points in a row and tie it up at 95."

Who is more likely to win the game?

a. The team who came from behind (Team 1) b. The player who started off ahead (Team 2) c. Neither Team is more likely to win

(Baseball Scenario)

"An important baseball game is underway between two teams. Team 1 and Team 2 are playing game 7 of a championship series, and the winner of this game wins the national championship. The series is currently tied 3-3, and the game is currently tied 8-8 with 1 inning remaining in the game. However, Team 2 was winning 8-3, and Team 1 proceeded to score 5 runs in a row and tie it up at 8."

Who is more likely to win the game?

a. The team who came from behind (Team 1) b. The player who started off ahead (Team 2) c. Neither Team is more likely to win

APPENDIX G

PHYSICAL SELF-EFFICACY SCALE (PSE)

1. I have excellent reflexes *during play*

1	2	3	4	5	6
Strongly Disagree					Strongly Agree

2. I am not agile and graceful *on the court/field* (R)

1	2	3	4	5	6
Strongly Disagree					Strongly Agree

3. My physique is rather strong

1	2	3	4	5	6
Strongly Disagree					Strongly Agree

4. I can't run fast (R)

1	2	3	4	5	6
Strongly Disagree					Strongly Agree

5. I don't feel in control when I take tests involving physical dexterity (R)

1	2	3	4	5	6
Strongly Disagree					Strongly Agree

6. I have poor muscle tone (R)

1	2	3	4	5	6
Strongly Disagree					Strongly Agree

7. I take little pride in my ability in my sport (R)

1	2	3	4	5	6
Strongly Disagree					Strongly Agree

8. My speed has helped me out of some tight spots *during a game*/*match*

1	2	3	4	5	6
Strongly Disagree					Strongly Agree

9. I have a strong grip

1	2	3	4	5	6
Strongly Disagree					Strongly Agree

10. Because of my agility, I have been able to do things which many others could not do *on the court/field*

1	2	3	4	5	6
Strongly Disagree					Strongly Agree

APPENDIX H

SELF-CONTROL SCALE

Using the scale provided, please indicate how much each of the following statements reflects how you typically are during a game or match.

	Not at all	Very Much
1. I am good at resisting temptation *during play*	1----------2----------3----------4	
2. I have a hard time breaking bad habits *on the court*	1----------2----------3----------4	
3. I am lazy *on the court/field*	1----------2----------3----------4	
4. I say inappropriate things *during play*	1----------2----------3----------4	
5. I do certain things that are bad for me *during play,* if they are fun	1----------2----------3----------4	
6. I refuse things that are bad for me *during play*	1----------2----------3----------4	
7. I wish I had more self-discipline *on the court/field*	1----------2----------3----------4	
8. People would say that I have iron self-discipline *when I play*	1----------2----------3----------4	
9. Pleasure and fun sometimes keep me from performing my best	1----------2----------3----------4	
10. I have trouble concentrating *during play*	1----------2----------3----------4	
11. I am able to work effectively toward long-term goals *during play*	1----------2----------3----------4	
12. Sometimes I can't stop myself from doing something *during a game*, even if I know it is wrong	1----------2----------3----------4	
13. I often act *on the court/field* without thinking through all the alternatives	1----------2----------3----------4	

APPENDIX I

GROUP ENVIRONMENT QUESTIONNAIRE (GEQ)

This questionnaire is designed to access your perceptions of your team. There are no wrong or right answers, so please give your immediate response. Some of the questions may seem repetitive, but please answer ALL questions. Your personal responses will be left in strictest confidence.

The following statements are designed to access your feelings about YOUR PERSONAL INVOLVEMENT with this team. Please CIRCLE a number from 1 to 9 to indicate your level of agreement with each of these statements.

1. I'm not happy with the amount of playing time I get.

   1 2 3 4 5 6 7 8 9

   Strongly Disagree Strongly Agree

2. I'm unhappy with my team's level of desire to win.

   1 2 3 4 5 6 7 8 9
   Strongly Disagree Strongly Agree

3. The team does not give me enough opportunities to improve my personal performance.

   1 2 3 4 5 6 7 8 9
   Strongly Disagree Strongly Agree

4. I do not like the style of play on this team.

   1 2 3 4 5 6 7 8 9

   Strongly Disagree Strongly Agree

The following statements are designed to assess your perceptions of YOUR TEAM AS A WHOLE. Please CIRCLE a number from 1 to 9 to indicate your level of agreement with each of these statements.

5. Our team is united in trying to reach its goals for performance.

1	2	3	4	5	6	7	8	9
Strongly Disagree								Strongly Agree

6. We all take responsibility for any loss or poor performance by our team

1	2	3	4	5	6	7	8	9
Strongly Disagree								Strongly Agree

7. Our team members have conflicting aspirations for the team's performance.

1	2	3	4	5	6	7	8	9
Strongly Disagree								Strongly Agree

8. If members of our team have problems in practice, everyone wants to help them so we can get back together again.

1	2	3	4	5	6	7	8	9
Strongly Disagree								Strongly Agree

9. Our team members do not communicate freely about each athlete's responsibilities during competition or practice.

1	2	3	4	5	6	7	8	9
Strongly Disagree								Strongly Agree

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BIOGRAPHICAL SKETCH

I am BaRack Little, just a young man living out his dreams and trying to make it big in life one way or another! I am originally from College Park, Georgia, a city just south of Atlanta. When I was 8, my family moved to the next town over, Fayetteville, Georgia, and this is where I spent the majority of my adolescent years. I played varsity football, basketball, and baseball in high school and was fortunate enough to receive a full scholarship to attend and play football at Colgate University in Hamilton, New York in 2008. My senior season unfortunately ended prematurely due to a severe ankle injury, but this was a blessing in disguise; my rehabilitation process helped me to realize how important the mind was when it comes to recovery, and ultimately, optimal performance. I proceeded to complete my Master's degree in Sport Psychology at Florida State University in the summer of 2014. I also became an NSCA-certified personal trainer while at FSU in the summer of 2013 and have been training clients ever since. My passion is working with athletes of all ages in fitness as well as mentoring and enhancing mental skills. I also am very passionate about music, and write, compose, and produce music in my spare time. I plan to further pursue both my sport and music interests, but will never stop furthering my knowledge through empirical research.