# THE EFFECT OF ACTIVE VERSUS PASSIVE HYPNOTIC INDUCTIONS ON IMPROVING REACTION TIME IN NCAA BASEBALL PLAYERS

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Title: The Effect of Active Versus Passive Hypnotic Inductions On Improving Reaction Time In NCAA Baseball Players

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Extensive anecdotal evidence and multiple case studies indicate that the use of hypnosis can help improve athletic performance. Several formal mental training programs using hypnotic techniques for performance enhancement have evolved. In sports, even a small gain in performance can mean the difference between a fantastic play and a costly error; therefore, techniques to improve reaction time could be of great benefit to athletes.

This study was designed to examine what effect manipulating athletes' arousal through hypnosis has on their reaction time, as well as investigating what impact, if any, the type of induction used (active vs. passive) has on reaction time.

Participants were recruited from an NCAA Division I baseball team. Sixteen players completed the hypnotic training. Each player was able to self-select his induction group. Players received a total of 7 hypnotic sessions. Reaction time was measured using the ImPACT, a computer-based measure used in athletics to examine functioning after a head injury.

Results indicated that hypnosis did not have a significant impact on reaction time. Participants reported enjoying the process and feeling like they were able to more vividly visualize the scenario. Participants, regardless of

induction group, showed significant improvement in visual memory ability. Further studies, with a larger sample size and a control group, are needed to explore the effect of hypnosis on visual memory.

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# CHAPTER 1

## REVIEW OF RELEVANT LITERATURE

Hypnosis, defined as “an alternative state of awareness and alertness characterized by heightened and focused concentration that is achieved in order to actualize a particular goal or latent potential” (Kohen & Olness, 1997, p. 359), is being used as a form of psychological intervention that is rapidly growing in popularity. Hypnosis, in various forms, has been in existence for thousands of years (Erickson, 1970). The earliest uses of hypnosis were primarily spiritual; including Chinese, Hindu, Greek, and Egyptian temples that employed types of suggestion to lessen pain and suffering (Erickson). Sigmund Freud then used it to treat “hysteria,” a psychological condition (as cited in Erickson). Today hypnosis continues to be used in ways akin to earlier applications but is also used to address physiological issues such as reducing pain or enhancing athletic performance.

The modern era of hypnosis began with Franz Anton Mesmer who believed that diseases could be cured by restoring the body’s magnetic balance, which he first accomplished with magnets, and later with the “animal magnetism” of the healer (Kirsch, Lynn, & Rhue, 1997, p. 5). However, Mesmer’s patients often displayed violent convulsions in response to his treatment; it was not until 1784 that one of Mesmer’s students, the Marquis de Puysequr, discovered the trance response that is associated with present-day hypnosis (Kirsch et al.). The trance response occurs when the hypnotist suggests that another person experience “changes in sensation, perception,

cognition, or control over motor behavior" that leads to an altered state often described as a "normal state of focused attention" (Kirsch et al., p. 4).

The word "hypnotism" was coined in the 19th century by Dr. James Braid, who believed that the trance state resulted from eye muscle fatigue, but hypnosis is associated by many people with Sigmund Freud's early work (Kirsch et al., 1997). Unfortunately, however, after Freud abandoned hypnosis in favor of free association, it took several decades for the clinical use of hypnosis to return to favor. In the 1930s, Clark Hull began an in-depth study investigating the use of hypnosis for examining psychological behavior; Hull was the first to show that the effectiveness of hypnosis could be studied by measuring physiological changes in the hypnotic subject (as cited in Erickson, 1970). One of Hull's students, Milton Erickson, is regarded as the "foremost hypnotherapist of the [20th] century" (Havens & Walters, 2002, xv), and it was Erickson who developed many of the theories and techniques used in modern hypnotherapy (Kirsch et al.).

Erickson's influence is widespread in modern-day hypnosis. According to one Neo-Ericksonian approach, there are six primary steps in the therapeutic process of hypnosis: 1) transition into trance, 2) trance induction, 3) direct statements or suggestions, 4) metaphorical or anecdotal guidance, 5) trance termination, and 6) follow-up evaluation (Havens & Walters, 2002). There are other hypnotic induction approaches that do not require both direct suggestion and metaphorical guidance; in fact, Erickson often relied solely on the use of metaphor in hypnosis (Gunnison, 1990).

Before a therapist initiates any of the steps in the hypnotic process, there are several common misconceptions about hypnosis that must be discussed with the subject. Many of these misconceptions are the result of the media's portrayal of hypnotism where clients are instantly hypnotized into a deep sleep, do silly things (e.g., cluck like a chicken), and come out of the trance with no recollection of their acts while in the trance. In fact, research has shown that people are still in control of their behavior while in a trance state (Lynn, Rhue, & Weekes, 1990), and they do not participate in any behavior they would not—or could not—do in a state of full wakefulness (Erickson, 1970); moreover, people in a trance state remain aware of their physical surroundings (Lynn, Weekes, & Milano, 1989). Additionally, amnesia following hypnosis is rare and preventable if the therapist informs the client that he/she will be able to remember anything he/she wants to about the session (Simon & Salzberg, 1985). The importance of clarifying misconceptions of hypnosis is emphasized by Capafons et al. (2008) which found that "accurate beliefs about hypnosis are correlated with positive attitudes and that misconceptions are correlated with negative attitudes toward hypnosis" (p. 147).

Once the misconceptions have been adequately discussed with the client, work can begin on the six steps. The first step, transition into trance, simply involves moving from regular conversation in therapy to trance work; this can be accomplished by a direct statement to the client or by a subtle suggestion (e.g., "why don't you move over to this chair? It is a recliner and

you probably will be more comfortable if you can just sit back, close your eyes, and relax," p. 43). The important part of this step is that the statement serves as both a transition and a beginning of a light trance state; additionally, the transition should follow the same basic format every time a client is to enter the trance state.

The transitional step is followed by the trance induction, a procedure that "promote[s] entry into the trance state of passively focused inner awareness" (Havens & Walters, 2002, p. 43). The trance state is a natural occurrence that happens spontaneously to people without any active effort on their part. For example, a person may become focused on a movie or activity such as driving on a highway to the degree that external stimuli go unnoticed. However, the trance state can also be attained deliberately. Induction can help people purposely reach the trance state, which can be desirable to promote change in people's thoughts and behaviors. Induction may involve relaxation (Edmonston, 1991), physical tension (Banyai & Hilgard, 1976), and/or verbal techniques such as confusion, puns, or wordplay (Havens & Walters). Depending on the client's level of hypnotizability (i.e., how readily someone is able to enter the trance state), it may be necessary to use additional techniques during the induction to deepen the trance state before any work related to the problem can be attempted (Beahrs, 1971).

There are two overarching types of trance induction: active and passive. Active induction involves techniques such as arm levitation or eye fixation that provide physical demonstrations of the transition into trance state;

these inductions are best suited for clients who have never experienced hypnosis before and are somewhat doubtful of the process, because it provides “proof” of hypnosis to the client (Havens & Walters). On the other hand, passive induction is a more indirect method of inducing the hypnotic state and often involves relaxation or conversation scripts that subtly induce the client into the trance state. This type of induction often works best with clients who either have never experienced purposeful trance before but seem open to the idea, or someone who is easily distractible (Havens & Walters). Regardless of the type of induction used, there are several physical signs to look for that indicate the person has sufficiently entered the trance state and is ready to segue to the next step in the model. These physical symptoms include “muscular relaxation, immobility, reduced breathing rate, slowed heart rate, reduced or eliminated swallow reflex, slowed eye-movements, quiet receptivity” (p. 59), spontaneous head movements, and facial feature immobility (Kroger, 1977).

Once a person has entered the trance state, as evidenced by the physical symptoms listed above, they are better able to focus attention, and many people are more open to suggestion following an induction (Hilgard, 1965). Suggestions delivered by the hypnotherapist may take a direct form or a metaphorical form; either approach constitutes the active intervention stage. The direct approach involves either direct statements of fact or opinion designed to correct misconceptions or direct suggestions of alterations in awareness (Havens & Walters, 2002). Examples of this include telling

someone to stop smoking or telling someone his/her arm is too heavy to lift. Direct approaches can lead to quick results, but clients do not always respond well to the direct approach.

With persons who do not respond to the direct approach, it is often helpful to try a more metaphorical approach. Metaphorical approaches were pioneered by Milton Erickson, who used stories in a way that "captured the imagination, focused attention, turned awareness inward, encouraged receptive listening, and communicated messages that changed the way people thought and behaved" (Havens & Walters, 2002, p. 45). One example of Erickson's use of metaphor involved telling a client a story of how he taught his children to enjoy hoeing the garden by doing it in patterns; this metaphor suggested to the client that he could find ways to add more fun to his life (Havens & Walters). It has been theorized that metaphorical stories work in hypnosis because they are often safer for clients than direct suggestions and because people tend to believe stories and must actively work to not believe stories (Gerrig & Pillow, 1998). It should be noted that the Havens and Walters model makes direct suggestion and metaphorical interventions separate steps; however, other hypnotherapists, including Erickson, would say that hypnosis does not necessarily need to include both direct statements and metaphorical guidance; in fact, as previously stated, Erickson often used only metaphors when working with clients (Gunnison, 1990).

Following active intervention, whether direct or metaphorical, comes trance termination. Before the actual termination occurs, the therapist will

often use post-hypnotic suggestions; these can be used for relaxation, ego enhancement, and/or anchoring a physical gesture to the sense of mastery induced during hypnosis. Additionally, post-hypnotic suggestions can be used to help a client prepare for subsequent sessions by suggesting that the trance state will become easier and faster to reach each session (Kirsch, Lynn, & Rhue, 1997). Termination itself is accomplished through a change in voice tone and rate of speed and by redirecting the client's attention to external stimuli; most clients will easily return to wakefulness, however, some may take more time than others (Havens & Walters, 2002).

Finally, the last step in the therapeutic process of hypnosis proposed by Havens and Walters (2002) is the follow-up evaluation. Following a few moments of irrelevant conversation to separate the trance and the review of it, clients are often able to provide some feedback concerning what they enjoyed and did not enjoy about the process, as well as things that may have disrupted the trance. Feedback about insight or behavior change will not be immediately apparent, but clients may discuss these things at a later time. If the client does attribute changes to the hypnotic process, it is important to stress that he/she was actually the one responsible for his/her behavior during hypnosis and any subsequent changes, rather than being the passive recipient of change so that he/she feels in control of his/her future behavior and recognize that he/she possesses the necessary tools to facilitate change in him or herself (Havens & Walters). This is especially important so that

clients do not become dependent on the therapist or the setting to achieve the desired results.

The preceding paragraphs address how to conduct hypnosis, but how well does it work? At present, few outcome research studies examining the effectiveness of hypnosis have been conducted, but the research that does exist is favorable (Kirsch, Lynn, & Rhue, 1997). Smith, Glass, and Miller (1980) found, in a meta-analysis of outcome studies, that hypnotherapy produced significantly greater effects than all nonhypnotic therapies. Sapirstein, Montgomery, and Kirsch (as cited in Kirsch, 1997) performed a meta-analysis of 18 published studies comparing cognitive-behavioral treatment with and without hypnosis. Treating nonhypnotic treatment groups as control groups and hypnotic treatment groups as experimental groups, they found a mean effect size of 0.87; coupled with a significant *t* test, this indicated that the cognitive-behavioral therapies were more effective in a hypnotic context than in a nonhypnotic one. More recently, studies such as Halsband, Mueller, Hinterberger, and Strickner (2009) have used electroencephalography (EEG), positron emission topography (PET), and functional magnetic resonance imaging (fMRI) to examine plasticity changes in the brain as a result of hypnosis. In a series of experiments, they found increased occipital lobe activation and increased prefrontal activity during hypnosis. Additionally, their research found that the use of hypnosis led to changes in the fusiform gyrus, anterior cingulate cortex, and parietal areas. Taken together, these areas are responsible for processing, organizing, and

integrating sensory information. However, even with the existing encouraging research on the effectiveness of hypnosis, additional outcome research studies would be beneficial.

Even without definitive research on the effectiveness of hypnosis, psychologists have utilized hypnotic techniques to treat many different conditions and disorders with varying degrees of success; examples include phobias (Frankel & Orne, 1976), anorexia nervosa and bulimia (Nash & Baker, 1997), childhood sexual abuse (Rhue & Lynn, 1997), posttraumatic stress disorder (Spiegel, 1997), pain (Chaves, 1997), obesity (Barabasz & Spiegel, 1989), smoking (Javel, 1980), and even warts (Spanos, Williams, & Gwynn, 1990). One area where hypnosis has become very prevalent is in the field of sport psychology.

Sport psychology as a discipline is fairly new and still evolving. The first reported study involving athletic performance was reported by Norman Triplett in 1897; he examined the effects of social facilitation on cyclists' performances (as cited in Cox, 1999). Even though Triplett's investigation into cyclists' performance occurred over a century ago, it was not until the 1960s that sport psychology began to separate from the more general study of motor behavior; this switch was facilitated by the creation of sport psychology organizations and the publishing of journals dedicated to the topic of sport psychology (Cox). Sport psychology has also grown in part because of the popularity of cognitive-behavioral therapy, because, as Murphy (2005) points

out, cognitive-behavioral psychology is “the guiding force in sport psychology” (p. xii).

One of the most commonly researched and treated areas in sport psychology is performance enhancement, and one of the biggest factors influencing performance is arousal. By helping an athlete learn to find his or her appropriate level of arousal before and during a competition, sport psychologists can have a great impact on the athlete’s performance. One way to manipulate levels of arousal is through the use of hypnosis. The word “arousal” is often used interchangeably with the word “anxiety,” but the concepts are somewhat different. Anxiety is the apprehension one feels in response to a perceived threat, whereas arousal is the “physical level of activation of the person and the intensity of the behavior” (Balague, 2005, p. 76). The two terms are often confused because anxiety is often manifested as a change in arousal. The relationship between arousal and performance is well researched, and there are several often-cited theories that merit attention here. The first is drive theory, developed by Hull and Spence (as cited in Cox, 1999). According to drive theory, performance is the interaction of arousal and skill level so, in application to sports, higher levels of arousal should help skilled athletes while it hinders novices; additionally, difficult (i.e., fine motor) tasks (e.g., hitting a free throw in basketball) require comparatively lower levels of arousal than a simpler (i.e., gross motor) task (e.g., running a sprint). Drive theory was very popular until 1970, when it fell out of favor due to

conflicting results and the emergence of other theories, primarily the inverted-U theory (Cox).

Inverted-U theory, based on the 1908 work of Yerkes and Dodson (as cited in Cox, 1999), states that "as the complexity of a skill increases, the amount of arousal needed for optimal performance decreases" (Cox, p. 106). The primary difference between the inverted-U theory and drive theory is that drive theory predicts a linear relationship, whereas the inverted-U theory predicts a curvilinear relationship between performance and arousal. Despite widespread acceptance of the inverted-U, there are several problems with the theory. First, explanations can only be made in hindsight (i.e., if an athlete fails to perform, one can say he or she was not functioning at the optimal level of arousal). An additional problem is that the theory does not explain how arousal affects performance, only that it does. Moreover, the inverted-U is presented as symmetrical, which would imply that performance gradually decreases as arousal passes the optimal level, but in reality, it often decreases quickly and substantially (Balague, 2005). Finally, the theory does not account for cognitive interpretations; for example, one athlete may interpret a certain level of arousal as anxiety, whereas another interprets the same level as being psychologically ready for the game (Balague). This final concern is addressed by Hanin's Zone of Optimal Functioning (as cited in Cox, 1999).

Hanin's theory is an idiographic model that postulates that each athlete has his or her own zone of optimal functioning. Individual Zones of Optimal

Functioning (IZOF) can be identified, and then athletes can learn techniques to help them access their individual zones, thus maintaining their optimal levels of performance (Cox, 1999). The primary criticism of this theory is that it is not, in fact, a theory; it does not explain why different emotional states are optimal for different people (Balague, 2005).

Another theory, reversal theory, combines characteristics of the inverted-U and drive theory. Reversal theory, developed by Michael Apter (as cited in Balague, 2005), proposes that a person's level of arousal is affected by his or her perception of it; for example, the same person can perceive the same level of arousal as positive if the current state is interpreted to be excitement, or negative if the current state is interpreted to be anxiety. The four states on Apter's spectrum are relaxation, excitement, boredom, and anxiety; relaxation is pleasant low arousal, boredom is unpleasant low arousal, excitement is pleasant high arousal, and anxiety is unpleasant high arousal (Cox, 1999). An example of this would be an athlete who is able to perform well at practice, but is not able to do so in competitive situations; this athlete experiences the same physiological sensations in both cases, but interprets them as excitement during practice and anxiety during competition. Research on the reversal model applied to sports is rare, but studies have shown that "the direction of both cognitive and somatic anxiety is a better predictor of basketball performance than their intensity" (Balague, p. 84).

A final model applied to the effect of anxiety on athletic performance is catastrophe theory. Catastrophe theory addresses one of the problems with

inverted-U theory, that performance does not decrease in small, predictable increments, but often decreases dramatically and quickly (Cox, 1999). There are three variables in the model: physiological arousal, cognitive anxiety, and performance. When cognitive anxiety is low, the relationship between arousal and performance will follow the inverted-U; however, when cognitive anxiety is high, performance improves with increases in arousal to a point, and then performance drops dramatically (Balague, 2005). Additionally, when arousal is high, increased cognitive anxiety yields poorer performance, but when arousal is low, increased cognitive anxiety yields improved performance (Balague). The model is difficult to research, but it attempts to explain the complex relationship between arousal and performance.

Regardless of the model one chooses, it is unequivocal that arousal is hugely important to athletic performance. As such, it has become the realm of the sport psychologist to help athletes achieve an optimal level of arousal to facilitate optimal performance, and one way to accomplish this is through the use of imagery. Murphy (2005) describes the possible uses of imagery in sports including: learning new skills, retaining skills, creating precompetition rituals, developing competition-day strategies, reducing competitive anxiety, psyching up before the competition, managing stress, enhancing confidence, enhancing motivation, improving concentration, rehabilitating from injury, and building teamwork. There are two basic types of imagery used with athletes: mental and kinesthetic. Mental imagery involves the athlete envisioning himself or herself engaged in the task, almost as if he or she were watching a

movie; kinesthetic imagery occurs when the athlete is directed to, and able to feel the action in the muscles and experience the activity during the visualization (Liggett & Hamada, 1993). However, Liggett and Hamada point out that the two types of visualization are not mutually exclusive; instead, the level of the kinesthetic aspect varies along a continuum. “Because the connections between the brain and the muscles are stronger in a kinesthetic visualization, it is logical that a kinesthetic visualization will improve performance more than a strictly mental visualization” (Liggett & Hamada, p. 193).

Research on the efficacy of imagery has been equivocal. In an attempt to better understand the effect, Driskell, Copper, and Moran (1994) completed a meta-analysis of 35 studies involving imagery—what they called mental practice. They found that mental practice is effective for enhancing performance, but is less effective than physical practice. Their results also showed that mental practice works for both cognitive and physical tasks, but that the effects are stronger for cognitive tasks. However, experienced subjects benefited equally from mental practice for cognitive and physical tasks, whereas inexperienced subjects benefited more from mental practice of cognitive tasks. Concerning the benefits of the mental practice, they found that, without additional practice, the positive effects decline over time. Additionally, longer sessions decrease the positive effects, so the authors suggest that approximately 20 minutes is optimal for a mental practice session. Finally, they found that mental practice was helpful for tasks that are

dangerous to train for physically, for tasks with few opportunities to train physically, and for supplementing normal training. Feltz and Landers (1983) found that imagery was most effective for cognitive tasks, less effective for motor tasks, and least effective for strength tasks. Smith, Holmes, Whitemore, Collins, and Devonport (2001) worked with novice field hockey players to see if imagery would significantly enhance their performance; one group worked with a general stimulus script (i.e., watching self performing the task), and the other group worked with a personalized script that included the imagery from the general script, but also included the idiographic physiological responses of each player. At posttest, both imagery groups performed significantly better than the control group, and there was evidence that personalizing the script to the individual may have produced stronger results than a generalized script. The uniqueness of this study is in their sample as they employed imagery with completely novice players, whereas most studies focus on skilled or elite athletes.

However, each of the aforementioned studies examined the use of imagery with athletes who were not in a hypnotic trance state. Although imagery is a component of hypnosis, it can also be used separately. If imagery and visualization outside of the trance state are effective for enhancing performance, then what is the result of performing the visualization under hypnosis? Ward (1992) found that visualizations under hypnosis improved performance better than visualization alone. Liggett and Hamada (1993) describe their work with three power lifters; after a single hypnotic

session, they were each able to lift 15% more than they ever had before. They also describe working with gymnasts who were able, using hypnosis, to visualize a novel trick slowly enough to perfect the technique mentally and were then able to perform the trick physically for the first time. Liggett (2000) found that inducing a hypnotic state improved the quality of visualizations for athletes in various sports (i.e., distance running, gymnastics, soccer, golf, mountain biking, rugby, tennis, and water polo) in four different situations (i.e., practicing alone, practicing with others, watching a teammate, and competing); however, the results do not explore performance enhancement.

Other studies have shown a link between hypnotic imagery and performance enhancement. Johnson (1961a;b), frequently cited in the sport psychology hypnosis literature, used hypnosis to help athletes identify and correct technique errors. Johnson (1961a) employed hypnosis to treat a professional baseball player who, although he normally had a batting average over .300, had not hit successfully in 20 at-bats. His coaches could not detect any problems with his swing, his batting stance, or any other physical problem that would cause the batting slump, so the player sought Johnson for hypnosis. Johnson instructed the player that as he (Johnson) counted from 1 to 10, the player would become more and more aware why he was not hitting the ball, until, at the count of 10, the player would have complete knowledge of why he was in a batting slump. In Johnson's report, at the 10 count, the player began providing an extremely detailed analysis of his swing, including specific problems that he had not been aware of in a nonhypnotic state.

Johnson provided the player with the option to remember everything in the analysis of his swing during the hypnotic state or, if he would prefer, have the information return gradually over time. The player opted for the information to return gradually. The player's slump ended during the next game, and he went on to bat at an average of .400 for the season, an impressive average for a professional player.

Johnson also utilized psychodynamic methods of hypnosis when working with athletes (1961b). In this case, Johnson worked with a baseball pitcher who was able to perform well when he was able to be aggressive, but whose performance decreased as soon as he felt guilty and lost his aggressive affect. Johnson employed hypnotic age regression, a procedure where the hypnotherapist leads the client back through time to discover events the client may not remember in the nonhypnotic state, to discover that the client had lingering guilt over childhood aggression. Once this was discovered during hypnosis, therapy focused on working on the repressed guilt; when this was accomplished, the pitcher was able to perform more consistently.

Each of the methods employed by Johnson (1961a;b) were combined in a case study detailed in Morgan (2002). Morgan worked with a Division I college baseball player who was being scouted by professional teams. The player was a good hitter (.315 batting average), but he would bail out of the batter's box when he was in no danger of being hit by a pitch. The problem was compounded by his coach's repeated instruction to "hang in with the

pitch," which not only did not help the player, but also seemed to make the problem worse (Morgan, p. 172). Morgan age-regressed the player to the most recent game where the bailing out problem had occurred and asked him to describe what was happening. The player was unable to add any insight into the process that he did not possess in a nonhypnotic state. Morgan then used direct suggestion to try to help the player provide additional information; when this did not work, Morgan gave a suggestion that the player would feel relaxed and would look forward to the next session.

When the player returned for a second session he was age-regressed and asked to go back in time and recall significant events in his baseball career (Morgan, 2002). The player recalled an incident during his first year at the university when he was batting, thought the ball was going to break away from him, but it did not; the result was that the player was hit with the ball and suffered a broken left scapula. Additionally, he recalled an event from high school when he was pitching and attempted to throw at the batter to distract him, but ended up hitting the batter in the head, causing him to leave the game. The player had not mentioned either of these events in the nonhypnotic state. During the third and final hypnotic session, the player was again asked to go back in time and recall significant events. Instead, during the hypnotic state, the athlete responded that he had been using a closed stance to crowd the plate and decrease the strike zone, but that he needed to change to an open stance with his foot dropped back, so that he would not bail out unnecessarily. This plan apparently worked, as the player stopped

bailing out on unnecessary pitches and had a batting average of .515 for the completion of the season (Morgan).

Other anecdotal evidence was provided by Kroger (1977), who utilized hypnosis to improve the athletic ability of baseball players, football players, boxers, and golfers; he reported that his results with athletes have “ranged from good to spectacular” (p. 339). Kroger recounts working with a professional golfer to help him improve both his driving and his putting, as well help him pay less attention to the crowd. While under hypnosis, various suggestions were given to improve the golfer’s performance. These included that the golfer would be able to completely block out the crowd when he wanted to, that he would be able to see a dotted line between his ball and the cup, that the cup would appear 2-3 times larger than it actually was, that he would have “unusual driving power,” that he would maintain his composure if he made a bad shot, and that he would visualize every shot successfully before it happened (p. 339). According to Kroger, the golfer missed winning a major tournament by one shot, won an additional challenge, and attributed his success to the hypnotic training.

More recently, Barker and Jones (2006) reported on the use of hypnosis to intervene with a cricket player concerned with a lack of self-efficacy. The intervention was provided in multiple stages: first, 4 sessions focused on general “ego-strengthening suggestions” (p. 99), next, 4 sessions focused on ego-strengthening suggestions specific to cricket, and finally, 2 sessions focused on training the cricket player to use self-hypnosis. Following

the intervention, Barker and Jones found a significant change in self-efficacy, which was also present at a 7-month follow-up. Moreover, the study found that self-efficacy was not only increased, it was more “stable and consistent” (p. 104). In a similar study, Barker and Jones (2008) examined the use of hypnosis with a professional soccer player who had sought help for self-efficacy issues. The player received 3 sessions of hypnosis using generalized suggestions followed by 5 sessions of soccer-specific suggestions. Unlike the cricket player in Barker and Jones (2006), the soccer player was unsuccessful at using self-hypnosis, so that part of the intervention was discontinued. The results indicated “significant improvements in self-efficacy, trait self-confidence, positive affect, and soccer performance, along with a significant decrease in negative affect following the hypnotic intervention” (Barker & Jones, 2008, p. 140).

Various researchers and clinicians have taken case study examples, such as those cited above, and developed mental training programs for athletes. Unestahl (as cited in Krenz, 1986) created Inner Mental Training to enhance athletic performance; the program combines posthypnotic suggestion, relaxation training, and other mental techniques. In a presentation to the American Society of Clinical Hypnosis, Krenz and Jencks detailed their use of hypnotic suggestion with mental imagery and rehearsal to help athletes prepare psychologically for competition; their program also utilizes sensory awareness and anxiety reduction (as cited in Krenz, 1986). Krenz (1984) developed a hypnotic technique called Modified Autogenic Training (MAT)

and reported on case studies showing performance enhancement (e.g., decreased anxiety, increased focus on practice, increased ability to perform more difficult tasks) for female gymnasts, male gymnasts, ballet dancers, and a tennis player. MAT is built upon Schultz's Standard Autogenic Training (SAT; as cited in Krenz), and adopts six exercises from SAT (i.e., heaviness of limbs, warmth of limbs, heartbeat, respiration, warmth of solar plexus, and coolness of forehead) combined with deep relaxation, breathing control, and hypnotic suggestion. The process is carried out over a 7-week period, where the number of repetitions necessary to obtain the effects decreases each time. The first two sessions are taught in a relatively stress-free environment (e.g., the hypnotherapist's office), and subsequent sessions are taught in the athlete's environment (e.g., on the baseball field). Krenz believes that the advantages of MAT over other methods are: a) it is shorter than other programs, including SAT, and b) after the initial sessions, MAT is self-practiced, so it does not depend on either a hypnotherapist or tapes.

Krenz (1984, 1986) was the first to propose the briefer MAT, but the original version, SAT, has been around much longer. Naruse (1965) used SAT with hypnosis and the teaching of self-hypnosis (i.e., the ability to control one's own ability to enter and exit the hypnotic state as desired) to improve athletes' concentration during stressful competition situations. Working with 125 Japanese Olympians, he identified those who were most bothered by what he termed stage fright, and then employed his hypnotic techniques. Several case studies were presented involving male and female gymnasts, a

female volleyball player, a male free pistol shooter, a male weightlifter, and a male baseball player. The baseball player, a professional, was having difficulty with anxiety and maintaining his self-confidence. While in a hypnotic state, Naruse trained the player to visualize in detail a game situation to a) desensitize him to the stimuli involved, and b) familiarize him to the environment. The suggestion was given that he should observe himself playing without fear or anxiety. Moreover, Naruse taught the player self-hypnosis, so that he was able to relax and rehearse the scene whenever it was necessary. Although no specific outcome data was provided, Naruse stated that the player improved and "returned successfully to his team" (p. 68).

Although there is no formal mental training program involved, Morton (2003) provided a detailed first-hand account of the use of hypnosis and self-hypnosis in alpine mountain climbing to visualize healing, enhance motivation, and to cope with anxiety, acute stress, and posttraumatic symptoms. Moreover, she used specific hypnotic techniques to create what she termed the hypnotic belay to secure herself on the mountain much like a belay rope secures climbers to their climbing partners (Morton). Howard and Reardon (1986) conducted research that compared hypnosis, cognitive restructuring, and a combination of the two. They found that the combination was able to decrease athletes' anxiety, improve their self-concept, improve neuromuscular performance, and even enhance muscle mass. Moreover,

these changes were sustained over time despite termination of treatment; self-concept and muscular growth were even enhanced over time.

Many of the studies cited above are case studies. Barker, Jones, and Greenlees (2010) examined the use of hypnosis to improve athletic performance using a group design. Using 28 collegiate soccer players, they created a repeated measures design with an experimental group and a control group. In small groups, the participants were shown a soccer task involving kicking a ball repeatedly at a target with scoring zones and given 3 practice trials before their pretest score was recorded. All participants were then involved in 3 training sessions (hypnosis for the experimental group and video watching for the control group). Following the training sessions, all participants again engaged in the soccer task. The participants returned 4 weeks later for a follow-up session where they again completed the soccer task. The results indicated that hypnosis had enhanced soccer task performance, both at posttest and follow-up. Additionally, the hypnosis group displayed higher self-efficacy scores than the control group at both posttest and follow-up.

The literature reviewed above indicates that hypnosis can improve athletic performance. This leads to another question: Why does hypnosis improve performance? Taylor, Horevitz, and Balague (1993) suggest that hypnotic imagery generates successful images, which increases self-confidence; this, in turn, improves body awareness and helps combat performance problems. Hypnosis can also help prepare athletes for the

potential stressors (e.g., crowd noise, surroundings, distractions) they may encounter during a competition (Krenz, 1984). Liggett and Hamada (1993) list five benefits of using hypnosis to enhance athletic performance: 1) it provides better concentration and focus, 2) mental rehearsal can be slow enough to guarantee perfect form, 3) more vivid imagery is possible in a hypnotic state, 4) hypnosis triggers and strengthens brain-to-muscle neural connections, and 5) better visualizations of actual performance provides better preparation for real stressors. Additionally, some of the biggest impediments to using imagery effectively such as anxiety, distractibility, and lack of imagery control (Murphy, 2005) can be controlled by combining imagery with hypnosis. Of course, hypnosis will not work for all athletes; there is a high failure rate for athletes with unrealistic expectations of the results (Cook, 1981).

One problem surrounding the use of hypnosis with athletes is the possibility of developing a reliance on the person, place, or thing (e.g., the hypnotherapist, the office, or a cassette tape) in order to achieve desired results; for example, an athlete may be able to perform successfully when the hypnotherapist is present, but not when he or she is absent. One way to combat this problem is to teach the athlete self-hypnosis so that he or she is able to achieve the desired results regardless of the surroundings in which the hypnosis occurs (Krenz, 1986). Krenz (1984, 1986) proposed that MAT (detailed previously), a form of autogenic training (i.e., learning to self-regulate bodily functions such as the autonomic nervous system response or circulation), for use with athletes because “self-hypnotic techniques and

autogenic training are essentially the same and should produce the same results" (1986, p. 212).

Beyond the problem of dependence on a hypnotherapist, there also exists the problem of paradoxical effects. Mittleman, Doubt, and Gravitz (as cited in Morgan, 2002) worked with Navy divers to teach self-hypnosis to relax during cold water swims. Those divers who were able to successfully utilize self-hypnosis were able to relax and feel warmer; unfortunately, because they subconsciously felt warmer, they also stopped shivering. Because shivering is the body's normal response to extreme cold and produces heat, the divers who were best at self-hypnosis were also at the highest risk for hypothermia. It is important that sport psychologists wishing to use hypnosis or self-hypnosis with clients attend to the possible paradoxical effects of the procedure.

One of the problems surrounding research concerning the use of hypnosis is sport psychology is that there have been conflicting results. For example, some researchers have found that hypnosis has no effect on strength or endurance, whereas others have found that hypnosis can be used to increase or decrease muscular performance; similar results have been found in research involving psychomotor tasks such as reaction time (see Morgan, 1997, for a summary of the research involved). Research concerning physiological changes and the perception of effort has been unequivocal; hypnosis can be used to approximate the physiological conditions of competition and to alter the perception of the level of effort necessary to

perform a task (Morgan). In regard to performance enhancement, the research has been overwhelmingly positive, but there remains some question as to its effectiveness. First, it is impossible to know how many studies with null results were never published (Morgan). Additionally, the vast majority of studies on the topic are case studies or anecdotal reports. Finally, it is important to note that “direct hypnotic suggestions of enhanced performance are not likely to be successful” (Morgan, p. 668), but it is possible to enhance performance by using hypnosis to enhance imagery. Even a small gain in performance can be important for athletes when the outcome of a competition can be determined by one swing of a bat or a few hundredths of a second.

With such a small amount of time making the difference between a win and a loss, reaction time becomes an important factor in athletics. Differences in reaction time can cause one baseball player to make a fantastic diving catch and another to miss the ball and give up extra bases to a hitter. In the past, measures of reaction time involved complicated mechanisms involving iron bars, wristbands, and electromagnets (Slater-Hammel, 1955). More recently, researchers have developed computer programs to help measure reaction time; one such program is the Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT) test (Iverson, Lovell, & Collins, 2003). The ImPACT is a computer-administered test battery that consists of six test modules that tap different cognitive functions including attention span, working memory, sustained and selective attention time, response variability, nonverbal problem solving, and reaction time. The modules of the test are:

word discrimination, design memory, x's and o's, symbol matching, color match, and three letters (see Appendix A for a more detailed description of each task). The ImPACT has often been used with professional, Olympic, collegiate, and high school athletes and teams sport teams to evaluate athletes who have suffered head injury (ImPACT test, 2006). Athletes take the battery before beginning their sport training to obtain a baseline measure of their abilities; this information can then be compared to scores following a head injury to see if athletes have returned to their baseline functioning (Schatz et al., 2006). The ImPACT is a good measure of reaction time because of its short administration time, automated analyses, and relative inexpensiveness.

The present study attempts to examine what effect manipulating athletes' arousal through hypnosis has on their reaction time. There are several benefits that this study will add to the present literature. First, it will explore the effects of hypnosis using groups of subjects rather than case studies or anecdotal reports, which would improve the ability to generalize the results. Moreover, even though the subjects will self-select their preferred induction type rather than being randomly assigned, this study seeks to explore what effect, if any, different induction techniques have on the performance-enhancing effect of hypnosis, even though the results could indicate a factor of the person (due to self-selection of hypnotic method in our procedure) rather than the type of induction. Additionally, this study seeks to replicate findings that hypnosis can, in fact, manipulate an athlete's arousal

so that it reaches an optimal level, which, in turn, will measurably improve athletic performance. In this instance, athletic performance will be measured by changes in reaction time. It is the author's belief that direct suggestion, whether following active or passive induction, will lead to positive changes in arousal which will lead to improved reaction time as evidenced by improved scores on the ImPACT, which is detailed in the method section.

# CHAPTER II

# METHOD

## Participants

Sixteen adult males, who were members of their university baseball team, were recruited to participate in this study. Participants were between the ages of 18 and 22 and were assigned to one of the two groups outlined in the Procedures section based on their personal preference of active or passive induction. Participants received no tangible compensation for their participation in this study.

## Measure

The ImPACT is a computer-administered test battery that consists of six test modules that tap different cognitive functions including attention span, working memory, sustained and selective attention time, response variability, nonverbal problem solving, and reaction time. The modules of the test are: word discrimination, design memory, x's and o's, symbol matching, color match, and three letters (see Appendix A for a more detailed description of each task). The ImPACT has often been used with professional, Olympic, collegiate, and high school athletes and sport teams to evaluate athletes who have suffered head injury (ImPACT test, 2006). Athletes take the battery before beginning their sport training to obtain a baseline measure of their abilities; this information can then be compared to scores following a head injury to see if athletes have returned to their baseline functioning (Schatz et

al., 2006). The ImPACT is a good measure of reaction time because of its short administration time, automated analyses, and relative inexpensiveness.

These subtests combine to form five composite scores: Verbal Memory, Visual Memory, Reaction Time, Visual Memory Processing Speed, and Impulse Control. The Verbal Memory Composite consists of the average of the following: the total memory percent correct, the Symbol Match total correct hidden symbols, and the Three Letters total percent of total letter correct. Higher scores indicate better performance.

The Visual Memory Composite consists of the average of the following: Design Memory total percent correct and X's and O's total correct memory score. As in the Verbal Memory Composite, a higher score indicates better performance.

The Processing Speed Composite consists of the average of X's and O's total correct divided by four and the Three Letters average counted correctly multiplied by three. Higher scores indicate better performance.

The Reaction Time Composite consists of the average of X's and O's correct reaction time, Symbol Match average correct reaction time divided by three, and Color Match average correct reaction time. On this composite, lower scores indicate better performance.

Finally, the Impulse Control Composite consists of X's and O's total correct interference and Color Match total commissions. Lower scores indicate better performance. Scores greater than twenty typically indicate an

incorrect approach to the test such as misread directions or careless responses (ImPACT Test, 2006).

In terms of accuracy, the ImPACT sensitivity has been calculated at 81.9% and its specificity at 89.4% (Schatz et al., 2006). The test has not shown the practice effects of similar paper tests (Lovell et al., 2003). The normative data for university students found no difference in scores due to year in school; there was a gender effect for the Verbal Memory Composite (Iverson, Lovell, & Collins, 2003), but as only males were sampled for this study, this difference is irrelevant to the current research.

## Procedure

All participants were asked to attend an initial orientation session with the therapist. During this session, they were asked to give informed consent to participate; they were also be asked to complete a brief demographics questionnaire (see Appendix B) with information about their age, ethnicity, years on the team, and years of experience with baseball. They also completed the ImPACT during the initial session to obtain baseline measures of reaction time. Additionally during this initial session, the therapist discussed with the participant issues surrounding hypnosis including the nature of the process, misconceptions, and expectations.

Following the discussion of hypnosis, two hypnotic inductions (one active, one passive) were performed with each participant in order to choose the more effective method for each individual for subsequent sessions. These inductions were counterbalanced so that half of the participants received the

active induction first and half of the participants received the passive induction first. For the active induction, an arm levitation induction technique (see Appendix C) was used, whereas for the passive induction, a conversational induction technique (see Appendix D) was used; each induction was modeled after Havens and Walters (2002). After each of the inductions, before the candidate was brought out of the trance state, a posthypnotic suggestion was given to facilitate later reinductions; the participant was then brought out of the trance state. Subsequently, the participant was questioned about the experience and, based on the subjective report of the participant as to which induction he preferred, the participant was assigned to either the active group or the passive group.

Each participant returned for an additional six sessions. Sessions were individual and occurred approximately twice per week for 3 weeks. During each subsequent hypnotic session for each participant, the participants received either the active or passive induction depending on their group, followed by a kinesthetic deepening technique to help ensure the participant reached the trance state; the script for the deepening technique was taken from Liggett & Hamada (1993; see Appendix E). Once the participant sufficiently entered the trance state, the therapist read from a prepared hypnotic script (see Appendix F) in which the participant was asked to visualize a batting play in which the opposing team's pitcher threw the ball to the participant. Wording in the script was purposely kept vague so that each participant could envision himself regardless of whether he was a left- or

right-handed batter. During each visualization, a suggestion was given to increase the player's speed in responding to the ball thrown by the pitcher. Following the visualization, participants were brought out of the hypnotic state.

The ImPACT measure was administered following the third and sixth sessions. Additionally, all participants were asked to return for a posttest administration of the ImPACT; this occurred approximately 1 week after the final hypnotic session.

# CHAPTER III

## RESULTS

Sixteen participants completed the study through the 1-week follow-up. All participants were male and members of their university's intercollegiate baseball team. Those individuals included in analyses reported a mean age of 20 years (SD = 1.46) with an average of 14.68 years (SD = 1.08) of experience playing baseball. Their year of eligibility (i.e., college-level playing experience) ranged from 1-5 years with a median of 2. Thirteen of them reported having worked with a sport psychologist in the past. None of them reported prior hypnosis experience, and nine of them reported prior exposure to visualization exercises. Eight participants selected passive induction, and eight selected active induction; however, two of the active induction participants did not complete their 1-week follow-up due to circumstances unrelated to the study.

To examine the hypothesis that hypnosis would improve reaction time, the results from the ImPACT reaction time composite at baseline, following the third hypnotic session (Time 1), following the sixth hypnotic session (Time 2), and the one-week follow-up were analyzed using repeated measures ANOVA. No significant results were found for the effects of hypnosis over time, $F(3,30)=0.54$, $p>.05$, indicating that participants, as a group, did not experience significantly improved reaction time immediately following hypnosis or at follow-up. Additionally, there were no significant differences found between the groups, $F(1,30)=0.34$, $p>.05$, indicating that the type of

hypnotic induction did not have a significant effect on reaction time. Means and standard deviations for reaction time scores for each group at each data point are reported in Table 2.

Table 1

*ImPACT Composites*

| *Composite* | *Contributing Modules* |
|---|---|
| Verbal Memory | Word Memory, Symbol Match, Three Letters |
| Visual Memory | Design Memory, X's and O's |
| Reaction Time | X's and O's, Symbol Match, Color Match |
| Visual Motor Speed | X's and O's, Symbol Match, Three Letters |
| Impulse Control | X's and O's, Color Match |

Change in the other four ImPACT composites over time and between groups were also examined using repeated measures MANOVA. Although not formally a part of the hypotheses associated with this study, this was relevant because the composites represent areas that Liggett and Hamada (1993) suggest benefit from hypnosis including concentration and focus (Impulse Control composite), strengthened neural connections (Visual Motor Speed and Verbal Memory), and more vivid imagery (Visual Memory). No significant overall effects were found for group, or the interaction of group and time. There was a significant effect found for time $F(3,30)=1.85$, $p<.05$.

Because the multivariate test was significant, the univariate tests could be interpreted. Significant results were found for visual memory $F(3,30)=2.89$, $p<.05$, in that participants, as a group, experienced significantly increased ability to retain and recall visual information immediately following participation in the study and at follow-up. The effect size for this analysis was .14. Means and standard deviations for visual memory scores at baseline, following the third session (Time 1), following the sixth session (Time 2) and

Table 2

*Reaction Time Composite Descriptive Statistics*

| | *Mean* | *SD* |
|---|---|---|
| Passive Induction Group | | |
| Baseline | 0.521 | 0.04 |
| Time 1 | 0.515 | 0.06 |
| Time 2 | 0.513 | 0.06 |
| Follow-Up | 0.504 | 0.08 |
| Active Induction Group | | |
| Baseline | 0.498 | 0.04 |
| Time 1 | 0.507 | 0.04 |
| Time 2 | 0.485 | 0.03 |
| Follow-Up | 0.508 | 0.05 |

one-week follow-up are reported in Table 3. See Appendix G for descriptive statistics of all non-significant tests.

Table 3

*Visual Memory Composite Descriptive Statistics*

| Measure Time | *Mean* | *SD* |
|---|---|---|
| Visual Memory, Baseline | 84.81 | 10.70 |
| Visual Memory, Time 1 | 87.50 | 10.02 |
| Visual Memory, Time 2 | 86.81 | 9.32 |
| Visual Memory, 1-Week Follow-Up | 94.43 | 6.58 |

# CHAPTER IV

# DISCUSSION

Results of this study indicated no significant change in reaction time following participation in hypnosis. The results did indicate a significant change in visual memory ability following participation, but little change in verbal memory, visual motor speed, or impulse control. As a group, participants in this study increased their visual memory capacity; however, significant results were not found based on participation in the active versus passive induction groups.

Although significant results were not obtained relative to reaction time, the majority of the participants reported that they enjoyed the process, felt they had achieved a trance state, and felt they had received some benefit (e.g., relaxation, enhanced visualization). This self-report information is consistent with the players' pre-study reports that mental preparation is fairly to very important, as summarized in Table 4.

There were several limitations to the current study. First, it is hypothesized that the measure chosen for this study may be less than ideal for the purpose of measuring improved reaction time. Although the ImPACT test has been used extensively to measure return to baseline following a head injury, little-to-no research exists on its use as a measure of progress past baseline. It is also possible that reaction time is a more fluid construct, so that the ImPACT measure of reaction time, which is based on subtests involving visual information on a computer screen does not adequately measure the

Table 4

*Importance of Mental Preparation*

| | *N* |
|---|---|
| Not At All | 0 |
| A Little | 0 |
| Fairly | 4 |
| Very | 11 |

reaction time involved in responding to a thrown object (a baseball) in an outdoor setting.

Another limitation to the current study is the small number of participants. Although the original goals of this study included recruiting 40 participants, and although 2 NCAA intercollegiate baseball teams were contacted, only 16 individuals responded to the study. It is hypothesized that the lower number of athletes interested in participating may be due to one of several factors. The study was time-intensive on the part of participants and, as college athletes have many demands on their time already, student-athletes may have lacked the time or motivation to participate in the study. Additionally, when presented with the idea of the study, several players expressed mistrust of hypnosis and a lack of interest in “losing control” of their functioning. This is consistent with Capafons et al.’s study (2008), which found a correlation between misconceptions about the purpose and

mechanisms of hypnosis and negative attitudes toward hypnosis. Although the purpose and process of hypnosis was explained to each athlete, it is likely that some were still hesitant to engage in the study, given their initial feelings about hypnosis.

A final limitation to the current study is the use of standardized scripts for each of the inductions, as well as the visualization. Research has shown that hypnosis is most effective when personalized to the individual (Smith et al., 2001). This is a problem inherent in any study on the effects of hypnosis with a standardized group design, but may have been at least partially dealt with by allowing participants to self-select their induction group.

To expand and improve upon the current study, future studies in this area should consider working with student-athletes in the off-season of their sport, providing more detailed education about hypnosis prior to the start of the study, and using a different measure of reaction time. Future studies may also benefit from increased kinesthetic visualizations in the script, as suggested by Liggett & Hamada (1993). Additionally, future studies on the benefits of hypnosis may want to follow the example of Halsband et al. (2009) and include brain imaging measures such as fMRI to examine physical changes to the brain during and after hypnosis.

Previous research in sport psychology has indicated that hypnosis can provide five main benefits than visualization alone: 1) better concentration and focus, 2) better form as a result of slowed mental rehearsal, 3) more vivid imagery, 4) strengthened brain-to-muscle neural connections, and 5) better

preparation for actual stressors as a result of better visualization (Liggett & Hamada, 1993). Future research could expand on the preliminary findings of this study that participants significantly improved their visual memory scores following hypnosis. This finding seems to be in line with the findings of Liggett (2000) that hypnosis can increase the quality of visualizations. It would be interesting to replicate the current study using a visualization only group and a control group to further investigate whether the improvement in visual memory: 1) would be replicated, and 2) would be a result of the hypnosis rather than any structured mental preparation.

Pending additional study, it is not reasonable to conclude that the use of hypnosis is able to improve reaction time in collegiate baseball players. Although the participants' self-report with regard to the experience was overwhelmingly positive, the data did not support a significant change in reaction time. However, despite the limitations of the current study, significant changes in visual memory were found. This, coupled with the participants' self-report about the process, suggests that hypnosis had an effect. In hindsight, reaction time may not have been an ideal dependent variable to attempt to manipulate. Hitting in baseball is a complex action involving multiple tasks including picking up on small cues from the pitcher, timing the physical motion of the swing, and having the control to only swing at appropriate pitches. Additionally, some elite athletes report that when they are in their zone of optimal functioning, things appear to occur in slow motion, so trying to increase reaction may be both paradoxical and an over-simplification

of the process. Moreover, when one considers the models of arousal in performance enhancement, the balance between arousal and relaxation is central, and the current study did not incorporate any measure of anxiety to explore this balance. One future direction for the current research would be to replicate the study with alternative dependent variables, perhaps performance on a baseball-specific task such as hitting a pre-identified baseball from a hitting machine coupled with a measure of anxiety or fMRI data. With the addition of an aforementioned control group, these changes may more accurately reflect the effects of hypnotic intervention.

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Appendix A

ImPACT Modules*

1. *Word Discrimination*: Twelve target words are presented for 750 milliseconds each on the screen; the list is presented twice. Following the second presentation, a 24-word list is presented (12 target words and 12 non-target words taken from the same semantic category). The test taker must click “yes” or “no” on screen.

Delay: After the presentation of all other modules, the test taker is again tested for recall using the same list of words.

2. *Design Memory*: Twelve designs are presented for 750 milliseconds each; each design is presented twice. Following the second presentation, 24 designs are presented (12 target designs and 12 non-target designs comprised of target designs that have been rotated). The test taker must click “yes” or “no” on screen.

Delay: After the presentation of all other modules, the test taker is again tested for recall using the same group of designs.

3. *X’s and O’s*: This test consists of two parts: a visual memory task and a distractor test. The distractor is a choice reaction time test where the test taker is asked to click the left mouse button if a blue square appears and the right mouse button if a red circle appears. The test taker practices the distractor test once before being presented with the memory task. For each memory trial, a screen is displayed for 1.5 seconds with a computer-generated assortment of X’s and O’s; in each trial, three of the letters are

yellow, and the rest are not. The test taker is asked to remember the location of the three yellow letters. Immediately following the presentation of the X's and O's, the distractor test returns to the screen. After completing the distractor task, the memory screen appears, and the test taker is asked to identify the letters that were yellow. There are four total trials.

4. *Symbol Matching*: The test taker is presented with a screen with nine common symbols; underneath each symbol is a number from 1-9. Beneath this grid, a symbol is presented; test takers must click the matching number as quickly as possible. After 27 trials, the symbols in the top grid disappear. The test taker is again asked to recall the correct number/symbol pairing by clicking the correct number.

5. *Color Match*: The test taker first must click a red, blue, or green button on the screen (this is to be sure the test will not be affected by colorblindness). Then a word is displayed that is the same color as the word or in a different color. The test taker must click the box as quickly as possible, but only if the word matches the ink.

6. *Three Letters*: This module consists of a working memory task and a distractor task. The test taker is presented with the distractor task first, which consists of a 5x5 numbered grid; he/she must click the numbers as quickly as possible in reverse order beginning with "25." After this, the test taker is presented with three consonants. Immediately after, the distractor task is presented again (for a maximum of 18 seconds). The test taker must then recall the three letters. There are 5 total trials.

*Composite scores*:

Verbal Memory: Word Memory, Symbol Match, Three Letters

Visual Memory: Design Memory, X's and O's

Reaction Time: X's and O's, Symbol Match, Color Match

Visual Motor Processing Speed: X's and O's, Symbol Match, Three Letters

Impulse Control: X's and O's, Color Match

*Taken from ImPACT test (2006)

Appendix B

Demographic Questionnaire

Name:_____

Age: _____

Ethnicity: _____

Year of Eligibility (circle one): **1st** **2nd** **3rd** **4th** **5th**

How many years have you been playing baseball? (include tee ball, Little League, high school, etc.): _____

Primary position played: _____

Other positions played: _____

Have you ever worked with a sport psychologist? **Y** **N**

Have you ever done hypnosis or self-hypnosis? **Y** **N**

Have you ever done visualization exercises to improve your baseball performance? **Y** **N**

How important do you think mental preparation is to your baseball performance? **Not at all** **A little** **Fairly** **Very**

## Appendix C

### Arm Levitation Technique

The first thing I would like you to do, before you continue to relax and enter into a trance, is to place the very tips of your fingers very lightly on your thighs, with your arms in the air, elbows away from your sides, as if your arms and hands were just floating there, fingers just barely touching the cloth, so you can just feel the texture.

That's right! Fingers just barely touching, and focus your full attention on those sensations in the very tips of those fingers, where they just barely touch, where that floating continues.

Because, as I talk to you and you continue to relax, and to pay close attention to those sensations, an interesting thing is beginning to happen. Because everyone knows how easy it is to learn something when you're comfortable. And sooner or later everyone has the experience of learning something new when they're relaxed.

So go ahead and allow that comfortable feeling to continue with the recognition that after awhile you can notice that your unconscious mind has begun to gently lift up one hand or the other, or both. It may be difficult to hold it there, just barely touching your leg, as it keeps trying to move upwards a bit as it feels lighter, and lighter, and lifts upwards, drifts upwards, almost by itself at times and the other may seem to get heavier, difficult to tell the difference at first, but as you pay close attention, it becomes easier, and easier, to notice which seems heavier, and which seems lighter.

And when you begin to notice which hand seems heavier, you may let it relax and come to rest in a comfortable place while you pay more and more attention to that other hand, to that light lifting upwards hand, that moves up a bit at times, and then back down perhaps, and then back upwards again.

And after awhile you may begin to notice that you can allow that drifting upwards to continue…more and more upwards, lighter, floating upwards as you allow that movement to continue on and on, an automatic movement upwards as your unconscious mind lifts that hand, that arm, upwards, one step at a time, upwards and then more and more.

It may be difficult to tell exactly how much that arm and hand have drifted up, to tell exactly what position they are in, and it may be difficult to tell when that slow effortless movement occurs more and more rapidly, as it drifts up, lighter and lighter, higher and higher. That's right [pause for upward movement]. That's right.

And that arm and hand could continue to drift higher, and get lighter and lighter, but as you pay close attention to it, you may begin to notice how it feels now, how tired and heavy it is, as your unconscious mind reminds your mind, to pay more and more attention to that heaviness pulling down. And that arm can begin to move down now, as that heaviness increases, and it would be so comfortable, just to allow that heavy arm to drift down now.

That's right, drifting down moving it down now, letting it return to a comfortable resting position where it can relax completely, and you can relax completely, drifting down with it, down into a deep, deep trance, as your arm

relaxes and the mind relaxes as well, and you drift deeper and deeper as I continue to talk, and your arms and hands feel so comfortable, comfortable and relaxed. That’s right.

## Appendix D

## Conversational Induction

I know that sometimes it is difficult to relax or to learn how to relax more than you have before. And so, as you sit there with your eyes closed, and begin to become aware of your own thoughts, of your own sensations, I begin to wonder if you have ever had the pleasure of sitting on the bank of a river, on the shore of a lake or ocean.

Because there is something very comforting about just sitting there, listening to the peaceful sound of the waves, as they move in, and out, in a continuous flow, that just seems to go on and on. Relaxing in the sun, feeling the soothing warmth, and just letting the mind drift, effortlessly, with that quiet, almost silent, sound, in the background of awareness.

I'm not even sure you've ever done that before, relaxed in that way, listening to the peaceful quietness, of water washing the shore. Perhaps it was a waterfall, or just a silent place in the center of the woods, a happy memory of contentment, of just a dream…of a place so comfortable and safe, that it was easy to allow the body to relax, everything, to relax.

I don't know, but I do know that everyone has a place they can go, a relaxing space deep down inside where they can really let go of all their cares and concerns, and wonder at the wonder of those waves of relaxation, at the smooth heaviness, of arms and legs as relaxation continues.

Maybe it was the warm smoothness of the soft white sand, you could hold it in your hand and watch it flow effortlessly through your fingers, the

same sand that flows in an hourglass, hour after hour, with nothing to do for a time, except let go and flow, warm, heavy, sand, listening to the waves of relaxation, secure inside and out, while you were sitting there, by the shore, forgetting to make the effort it takes even to try to be aware of when, or where, that relaxation began, and the soothing sounds or sensations were.

## Appendix E

## Deepening Technique

…And as I count up, the muscles in your arm, shoulder, and chest begin to tighten gradually, so that when I reach 15, they feel as rigid as a board. 10…the muscles in your arm begin to tighten and your hand may make a fist…11…your shoulder starts tensing…12…your chest lifts and tightens… 13…your upper body feels tight and tense…14…the tension and tightness increases…15…your upper body tightens completely. Now, as I begin to count down, your muscles begin to relax again. 14…the tension starts to drain out of your upper body…13…your chest relaxes…12…your shoulder relaxes…11… your arm relaxes…10…completely relaxed.

## Appendix F

## Visualization Script

Picture yourself standing in the batter's box at the plate. Take a moment and sense the distance between you and the pitcher. Notice the sound of the crowd behind you and to your sides, hearing the sounds of your fans, your teammates, and your coach. You can smell the grass and the dust. Feel the weight of the bat in your hands, notice how the grip feels as you hold it. Perhaps you take a practice swing, perhaps you go through a personal ritual. Feel yourself settle into your usual batting stance. Your body and mind continue to feel relaxed and you continue to breathe deeply and evenly. Notice that your mind becomes more aware of the task at hand and your body remembers what it feels like to connect solidly with the ball at just the right time. You can picture yourself following through with your swing as you know that you've connected soundly with the ball. Remember what it sounds like to successfully hit that ball to the appropriate place in the field, and what that connection feels like. Now that you are getting into the mindset, picture the pitcher standing on the mound. Watch as he moves his body into his rotation, bringing his front leg off the ground as he raises his hands. The pitcher stands with his side facing you, watching the glove of the catcher behind you. Your focus increases as the pitcher begins his delivery, dropping his front foot to the ground and raising his back leg off the ground as he follows through. As the ball leaves the pitcher's hand and loses contact with his fingers, visualize time slowing, and watch the ball come toward you slowly. You can see the

seams of the ball and watch as it slowly rotates through the air. Even as the ball is moving you can imagine where it will stop its journey, where it will connect with your bat. You find that time can slow or speed up so that you can see what you need to in order to make that solid connection. At the appropriate and correct moment you begin to shift your stance backward, pulling back on the bat. Notice your grip, how the bat feels in your hands, and at the correct time you will swing forward in the proper arc. At that moment you can feel your body lining up correctly, each muscle and nerve knowing what needs to be done to be successful. Hear the distinctive sound of a solid connection, and watch as the ball sails over the field to the appropriate end point. Hear the sound of your bat dropping to the ground as you shift your stance to run. Pay attention to the frame of mind that accompanies a solid hit. Hold that feeling, and that mental video of a successful hit in your mind. Realize that you can recall that feeling any time you need, and that remembering the feeling and process of solidly connecting with the ball can help you to successfully bat each time you step up to the plate. In that moment before the pitch you can settle into that state of relaxed awareness, ready to hit the ball.

(Pause for a few moments)

In a few moments I'll ask you to return to the room and to help you do that, I'll count for you from 1-5. As I count, notice that even though you become more and more alert, you continue to feel relaxed and comfortable. When I say the number 1, notice how you just begin to think about becoming more alert and

active. At 2, a bit more and at 3 you're actually half way back. You may notice that the sounds around you are more noticeable and at 4, you may want to stretch or wiggle a toe or finger and when I say the number 5 and your eyes open, notice how energized and alert you feel but the relaxation continues. 1…2…3…4…5.

Appendix G

Table G1

*Descriptive Statistics for Non-significant Measures*

| ImPACT composite | *Mean* | *SD* |
|---|---|---|
| Reaction Time | | |
| Passive Induction Group | | |
| Baseline | 0.521 | 0.04 |
| Time 1 | 0.515 | 0.06 |
| Time 2 | 0.513 | 0.06 |
| Follow-up | 0.504 | 0.08 |
| Active Induction Group | | |
| Baseline | 0.498 | 0.04 |
| Time 1 | 0.507 | 0.04 |
| Time 2 | 0.485 | 0.03 |
| Follow-up | 0.508 | 0.05 |
| Verbal Memory | | |
| Passive Induction Group | | |
| Baseline | 90.38 | 8.11 |
| Time 1 | 93.13 | 7.88 |
| Time 2 | 92.88 | 6.49 |
| Follow-up | 93.88 | 5.51 |

| | | | |
|---|---|---|---|
| Active Induction Group | | | |
| | Baseline | 87.38 | 10.38 |
| | Time 1 | 95.00 | 5.81 |
| | Time 2 | 96.25 | 5.50 |
| | Follow-up | 94.83 | 5.34 |
| Visual Motor Speed | | | |
| Passive | | | |
| | Baseline | 42.49 | 4.69 |
| | Time 1 | 44.03 | 13.55 |
| | Time 2 | 43.92 | 13.56 |
| | Follow-up | 44.32 | 11.83 |
| Active Induction Group | | | |
| | Baseline | 41.54 | 6.06 |
| | Time 1 | 45.18 | 5.25 |
| | Time 2 | 49.87 | 3.41 |
| | Follow-up | 51.04 | 4.11 |
| Impulse Control | | | |
| Passive Induction Group | | | |
| | Baseline | 7.75 | 4.20 |
| | Time 1 | 4.88 | 5.00 |
| | Time 2 | 7.88 | 7.04 |
| | Follow-up | 8.63 | 5.37 |

| | | |
|---|---|---|
| Active Induction Group | | |
| Baseline | 7.88 | 3.91 |
| Time 1 | 4.75 | 2.43 |
| Time 2 | 5.13 | 3.36 |
| Follow-up | 6.83 | 4.17 |