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ABSTRACT

The present study examined whether motor skill learning could be enhanced through a hypnotic intervention. The task involved throwing a tennis ball overhand at a target. Participants were assigned to either a hypnosis or control group. Both groups first completed a pre-test of 20 throws. Prior to the second block of 20 throws (post-test), the hypnosis group received a 10-minute hypnotic intervention. The theme of the hypnosis session was to focus on the target while throwing. Participants were aroused from the hypnotic state prior to the throwing task. The control group was asked to relax in the same environment for the same length of time. Control group participants were told that focusing on the target had been shown to increase accuracy. On the post-test, as well as on a retention test (20 throws), conducted 5-8 days after the post-test, the hypnosis group showed an increase in throwing accuracy relative to the pre-test and more effective performance than the control group whose performance was similar to that on the pre-test. These findings show that hypnosis can have a positive impact on motor learning. Potential mechanisms for this effect are discussed.

Key words: Focus of Attention, Hypnosis, Motor Learning

INTRODUCTION

Studies have demonstrated that performance can be improved by direct suggestion during a state of physical relaxation and focused attention following hypnotic induction [1]. Research on hypnosis has a relatively long history. The majority of studies have been conducted in the fields of medicine, dentistry, and psychology [2]. Even though the mechanisms are not yet fully understood, hypnotic interventions have been used with some success in the treatment of various medical conditions, and before, during, or after surgery [3, 4]. Stewart's review [5] of medical hypnosis for the Mayo Clinic also reported that clinical trials using hypnosis have shown improvements in allergies [6], irritable bowel syndrome [7], peptic ulcer disease [8], hemophilia [9], hypertension [10], and asthma [11]. In clinical psychology, studies in

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hypnosis have been employed in the treatment of mild to severe personality disorders and non-organic behavioral and mood disorders [2].

Hypnosis has long been perceived as a mysterious, sleep-like trance. Yet, recent advances in imaging technology have helped to further our understanding of potential mechanisms underlying the effects of hypnosis. It appears these effects reflect the involvement of cognitive processes that mediate executive and attentional control systems [12, 13], which allow the individual to focus attention on currently relevant information [14]. In studies using electroencephalography and functional magnetic resonance imaging with hypnotized participants, activity was found in brain areas associated with attentional control, particularly the anterior cingulate cortex and prefrontal cortex [15, 16, 17], indicating hypnosis may be a top-down modulator of executive control [18]. Hypnosis appears to represent a heightened state of attention, suggestibility, and absorbability [19], and has been shown to be associated with enhanced attentional focusing [20]. This potentially makes it a useful tool for enhancing performance in a variety of areas, including motor performance. Nonetheless, hypnosis has been largely overlooked in the motor learning domain.

In the relatively few studies that examined effects of hypnosis in the context of sports performance, hypnosis was primarily used to alter emotional and psychological states in attempts to indirectly affect performance, rather than to provide specific suggestions to directly enhance motor skill performance. For instance, suggestions given to participants after a hypnotic induction were focused on “ego strengthening” [21], or recalling past peak performances [22]. In two case studies, one with a semiprofessional cricketer and one a professional soccer player, Barker and Jones [1, 23] found that hypnosis enhanced self-efficacy. In a more recent study using a soccer wall-volley task [21], both performance (i.e., accuracy of a soccer ball kick at a target) and self-efficacy was measured before and after hypnotic intervention. Although both scores improved in the group receiving hypnosis, further analyses in this study showed that heightened self-efficacy did not mediate the improved task performance. The authors suggested that the improvement might have been mediated by the relaxation release of anxiety and “ego-strengthening” suggestions given to the hypnotized participants.

In another study with badminton players, Pates and Palmi [22] used regression (i.e., reliving of an earlier life experience) during hypnosis to recall past peak performance. During the hypnotic intervention, the participants were told that henceforth, holding the badminton racket would induce the same recalled experience, including all associated sensations and emotions. In this example, holding the racket was used as a trigger that would bring about the desired state. The intervention resulted in an enhanced flow-state experience when the trigger was utilized. A similar procedure was used in another study [24] with basketball players, with the result that performance was improved. This study additionally employed an ABA protocol. After the participants had been hypnotized and retested, the hypnotic trigger was removed. In the first part of the experiment, when the post-hypnotic trigger was used, performance was enhanced. When removed, performance returned to baseline levels.

It is noteworthy that many previous studies used several hypnotic sessions lasting an hour or more [1, 21, 23-25], and/or required self-hypnosis sessions to be exercised at regular intervals [1, 22-25]. For instance, in Barker and Jones’ study [1], the participant was asked to practice self-hypnosis the night prior to a competition, two hours before the game, and 10 minutes prior to game time. Also, participants in most of those studies were comprised of athletes who would benefit from a successful intervention – including elite cyclists [25], badminton players [22], or collegiate basketball players [24]. In some studies, the inclusion

of incentives, such as the possibility of winning a cash prize [21, 22], or the threat of public posting of performance scores [22] may have increased the efficacy of the hypnotic intervention. It is well documented that effects of hypnosis are increased when the participant has a high level of motivation to improve in the area addressed in the hypnotic procedure [26].

The present study builds on previous research in several ways. First, rather than using multiple long hypnosis sessions, we wanted to examine potential effects of a single, brief (10-minute) hypnotic intervention on the performance and learning of a motor task, as measured by a delayed retention test. Additionally, participants were regular college students and were not instructed to recall a pleasurable athletic performance, nor were they given a post-hypnotic trigger. Instead, the hypnotic intervention for the performance of a throwing task had only one central theme, which was the suggestion to adopt an external attentional focus on the target to increase throwing accuracy [27] (for reviews, see Wulf [28, 29]). After a pre-test on the throwing task, hypnosis and control group participants underwent hypnosis or relaxation treatments, respectively. These were followed by a post-test 10 minutes after the intervention and, approximately one week later, a retention test. Participants in a control group, who were asked to relax for the same time period (10 minutes), were also informed of the demonstrated benefits of adopting an external focus to improve throwing accuracy. We hypothesized that the hypnosis group would show increased throwing accuracy on the post-test and perhaps the retention test.

METHODS

PARTICIPANTS

Twenty-two undergraduate students (15 females, 7 males), with an average age of 23.0 years ($SD = 4.80$) participated in the study. Participants were not aware of the specific purpose of the study, and all gave their informed consent.

APPARATUS AND TASK

The task required participants to throw tennis balls overhand at a target that was 4.8 m away. The square target was a 90 x 90 cm black foam board (1 cm thick) that was hung in a net (Atec Catch Net; Sparks, Nevada, USA). The center area measured 6.35 x 6.35 cm and was surrounded by 4 additional zones all measuring 10.2 cm in width. (The zones served no specific purpose in the present study). The goal of the task was to hit the center area. All throws were recorded with a digital video camera (Canon ZR65MC). The recordings were used later to determine the exact distance (in cm) of each hit from the target center area.

PROCEDURE

Participants were assigned to either the hypnosis (7 females, 4 males) or control group (8 females, 3 males). All participants first completed the Tellegen Absorption Scale (TAS). The TAS is a subset of the Multidimensional Personality Questionnaire [30], which was designed to measure a person's level of absorbability (i.e., openness to hypnotic suggestibility). Absorption ability has been shown to be strongly correlated with hypnotizability [19]. The TAS consists of 34 statements, which are rated by participants on a scale from 0 (never) to 3 (almost always) (e.g., When I listen to music, I can get so caught up in it that I don't notice anything else; I find that different odors have different colors). After completing the TAS, all participants performed a pre-test on the throwing task, which consisted of 20 trials. TAS and pre-test throwing scores were used for stratification in the assignment of participants to the two groups. A certified hypnotist/hypnotherapist (first author) administered the TAS and also

conducted the pre-test to build rapport with each participant and answer any questions about hypnosis.

The second experimental session took place from 6-9 days (mean: 7 days) after the first one. It began in a separate laboratory, where the participant was asked to sit in a comfortable chair. The hypnosis group was given a 10-minute hypnosis intervention. It consisted of a physical relaxation (hold-release method), an induction and deepening phase (counting from 10 to 1), the hypnotic suggestion phase (focusing on the target improves accuracy), and the arousal phase (counting from 1 to 10). This method is standard procedure for hypnotic intervention. Following the hypnosis intervention and prior to the throwing task, a research assistant provided a written form for participants to evaluate their perceived depth of hypnosis on a scale from 1 (not at all hypnotized) to 10 (deeply hypnotized). Control group participants sat in the same chair for the same amount of time (10 minutes) and were asked to quietly relax. A book of nature photos was provided. At 8 minutes into the 10-minute period, the hypnotist informed each control group participant that research had shown that a focus on the target can improve throwing accuracy. Subsequent to the hypnosis intervention or relaxation period, respectively, participants were taken to the original laboratory in which they completed the post-test (20 throws). The third and last experimental session consisted of a retention test (20 throws). It was performed 5-8 days later (mean: 7 days). The research assistant administered both the post-test and retention test to avoid any potential influence of the hypnotist's presence.

DATA ANALYSIS

The throwing accuracy data (deviation from target in cm) were averaged across all 20 trials on the pre-test, post-test, and retention test. They were analyzed in a 2 (group: hypnosis versus control) x 2 (time: post-test versus retention test) analysis of covariance (ANCOVA) with repeated measures on the last factor. The pre-test score was used as the covariate. This type of analysis was used to determine possible changes in group differences, if any, as a function of time.

RESULTS

ABSORBABILITY

TAS scores were very similar for the two groups. The hypnosis group had an average score of 46.7 ($SD = 17.7$) and the control has a score of 47.3 ($SD = 16.5$). The group difference was not significant, $F(1, 20) < 1$.

THROWING ACCURACY

Hypnosis group participants rated their hypnotic depth as 6.73 ($SD = 1.35$, range: 5) on a scale from 1-10. Throwing accuracy, or deviations from the target, for both groups on each of the 3 tests can be seen in Figure 1. Only the hypnosis group reduced their errors, relative to the pre-test, on the post- and retention tests. On the post-test, about 10 minutes after the hypnosis intervention, the hypnosis group showed smaller deviations from the target (20.9 cm) than did the control group after the relaxation phase (26.6 cm). After the one-week retention interval, throwing errors were still smaller in the hypnosis group (23.4 cm) compared with the control group (26.4 cm). The main effect of group, $F(1, 19) = 4.87$, $p < .05$, $\eta_p^2 = .20$, was significant. The main effect of time was also significant, with $F(1, 19) = 4.61$, $p < .05$, $\eta_p^2 = .20$, indicating a general increase in errors. The interaction of group and time was not significant, $F(1, 19) = 2.31$, $p > .05$.

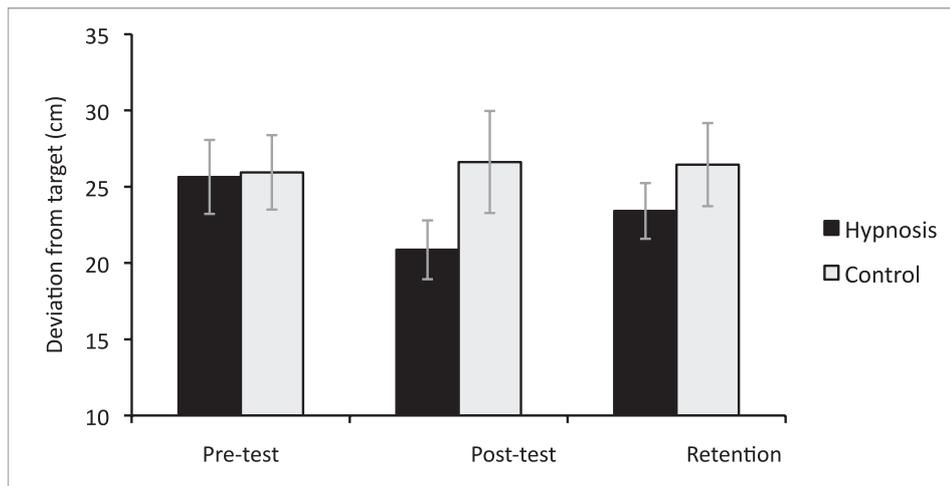


Figure 1. Throwing Performance (Deviation from Target) of the Hypnosis and Control Groups on the Pre-Test, Post-Test (After the Intervention), and Retention Test (About 1 Week Later)

DISCUSSION

The present results demonstrate that a brief hypnotic intervention can improve motor learning. Throwing accuracy was significantly increased in the hypnosis group on the post-test (i.e., about 10 minutes later), whereas it remained unchanged in the control group. More importantly, the effect was still seen after a 1-week interval (even though it appeared to be somewhat reduced). Thus, hypnosis enhanced the learning of the task. The present findings seem to be the first to show improved motor performance and learning after a relatively short, 10-minute hypnotic intervention.

A central theme of the hypnosis session was the suggestion that a focus on the target would increase throwing accuracy. This suggestion was based on numerous findings showing that an external focus on the intended movement effect (e.g., hitting a target) enhances motor performance and learning [28, 29]. Relative to an internal focus on body movements or no particular focus (control conditions), an external focus has been found to promote automaticity, fluidity, and efficiency in movement production – and, as a result, movement accuracy. Even though control group participants in the present study were also informed that an external focus on the target would benefit throwing accuracy, this information did not seem to have an effect on their performance. Simply mentioning research findings may not have been sufficient to cause participants to use that external focus. (In studies on attentional focus, participants are typically instructed to adopt a specific external focus.) The participants in the hypnosis group were given the external focus suggestion in combination with deepened relaxation and absorption during hypnosis. This may have heightened the attentional focus, with the result that motor behavior was improved.

The effectiveness of the hypnotic intervention may have multiple causes. Neuroscientific investigations have demonstrated that brain activity in the state of hypnosis is unique [17, 18, 31]. For example, increases in mental absorption during hypnosis have been found to be associated with regional cerebral blood flow increases in a distributed network of cortical

and subcortical structures previously described as the brain's attentional system [17]. Hypnotic suggestion has also been shown to reliably elicit physiologic responses [32].

Hypnosis can also increase outcome expectations and self-efficacy [21] – which, in turn, may have led to the performance enhancements seen in the present study. A number of recent studies have demonstrated that enhanced performance expectancies and self-efficacy have beneficial effects on motor skill learning. For example, the belief that one's performance or improvement on a motor task is above average has been found to result in enhanced performance or learning [33-36]. Even the mere mention that one's peers typically do well on a given task can lead to improved learning outcomes [36]. Finally, the simple suggestion that one is likely to do well under pressure has been shown increase throwing accuracy [37]. Thus, even though self-efficacy was not assessed in the present study, it appears likely that the hypnotic intervention led to changes in self-efficacy that contributed to the enhanced movement outcomes. Future studies may shed more light on this issue.

CONCLUSION

Whatever the exact underlying causes of the effects of hypnosis, the present findings demonstrate that a simple (external focus) suggestion given in the state of hypnosis can positively impact motor learning. Thus, hypnosis may provide an additional resource for coaches, athletic trainers, physical and occupational therapists, and their clients and patients. Future studies will likely provide more insights into the underlying psychological and neurophysiological mechanisms of hypnotic suggestions.

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