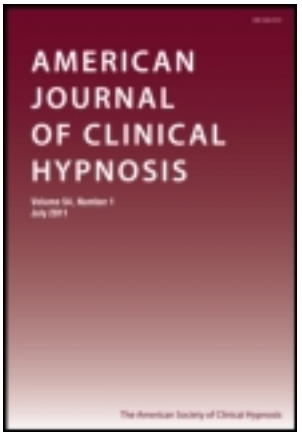

American Journal of Clinical Hypnosis
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/ujhy20

Deficits of Encoding in Hypnosis: A Result of Altered State of Awareness

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Version of record first published: 21 Mar 2013.

To cite this article: Nicholas C. Jacobson , Sam L. Kramer , Amanda G. Tharp , Kevin A. Harmon , Gregory P. Cejas & Salvatore C. Costa (2013): Deficits of Encoding in Hypnosis: A Result of Altered State of Awareness, American Journal of Clinical Hypnosis, 55:4, 360-369

To link to this article: http://dx.doi.org/10.1080/00029157.2012.696286

American Journal of Clinical Hypnosis, 55: 360–369, 2013

ISSN: 0002-9157 print / 2160-0562 online
DOI: 10.1080/00029157.2012.696286

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Deficits of Encoding in Hypnosis: A Result of Altered State of Awareness

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Because no studies have examined learning in hypnosis in an academic setting, the current study tested whether learning in hypnosis impacts test performance. Participants ($N = 43$) were randomly assigned into a hypnosis or a control group. Participants listened to an academic lecture, answered questions about their hypnotic depth, and completed a quiz based on the lecture. The data was analyzed using multilevel modeling predicting test performance from group placement. Learning in the hypnosis predicted significantly worse performance compared to the control group. This relationship was significantly mediated by attention, which had a positive relationship to test performance. However, the altered state of awareness produced by the hypnosis condition was associated with a more significant decrease in test performance.

Keywords: academic performance, cognitive, hypnosis, memory, test performance

The effects of hypnosis on one's memory have long been studied. However, most researchers have focused on the role of hypnosis in recalling previously learned material. This type of material would be of wide interest in attempting to help a witness recall forgotten details following a crime (Pinizzotto, 1989; Wagstaff, Brunas Wagstaff, Cole, & Wheatcroft, 2004). Moreover, most investigations regarding hypnosis and academic performance have tested the efficacy of hypnosis in increasing recall of previously learned material. These studies have found discrepancies in hypnosis' impact on previously learned material; some studies found that hypnosis enhances recall, while others found that hypnosis does not impact recall of previously learned material (Cole, 1976; Cooper, 1990; De Vos & Louw, 2006; Egan & Egan, 1968; Farady, 1992; Krippner, 1963; Pearce, 1999; Schreiber & McSweeney, 2004; Schreiber, 1997).

Although studies on the recall of previously learned material hold specific merit, these studies do not address if hypnosis affects the encoding of new material. Only four

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articles have investigated the efficacy of learning in hypnosis (Halsband, 2006; Jacobson, Kramer, Tharp, Costa, & Hawley, 2011; Sears, 1955; Wark, 1996). A dated study conducted by Sears (1955) suggested that individuals learned Morse code more effectively in a hypnosis condition when compared to a control condition, evidenced by the hypnosis group's fewer errors in a performance recall task. However, participants were able to practice according to their own schedules. Significant differences between treatment and control groups were only observed after 30 hours of instruction.

In a similar manner, Wark (1996) investigated learning in self-hypnosis by comparing a student's GPA's before, during, and after a 10-week learning skills course in which students used alert self-hypnosis while studying for various classes. Hypnotic depth was measured using a modified version of the Creative Imagination Scale. Wark found that the participants with the greatest depth experienced the most improvement. As Wark failed to utilize a control group, his findings may be a result of individual differences correlated with hypnotic depth rather than a product of hypnosis itself.

More recently, Halsband (2006) conducted two experiments regarding learning in hypnosis. His first study involved the use of positron emission tomography (PET) scanning to compare the brain images of participants encoding and retrieving word pair associations while in hypnosis or in a waking state. Halsband found that individuals encoded information with a high-degree of imagery differently in hypnosis than when learned in a normal condition. In an effort to further analyze these findings, Halsband's second study examined the efficacy of learning in hypnosis, differentiating between high and low-imagery words, and high and low hypnotizable persons. Participants were placed into a control and hypnosis condition, utilizing a repeated measures design. High and low hypnotizable participants heard 18 word-pairs of fluctuating difficulty and levels of imagery read aloud while in hypnosis or in a waking state. Results indicated that when using high-imagery word pairs, highly hypnotizable participants had the best recall in the hypnosis condition and were able to recall significantly more words than low hypnotizable participants in both the hypnosis and control conditions. Interestingly, the highly hypnotizable participants displayed the poorest learning performance in the hypnosis condition when trying to recall difficult abstract word-pairs.

In a study done by Jacobson et al. (2011) the effects of hypnosis and post-hypnotic suggestion on academic performance were investigated by comparing the quiz scores of participants who learned new material in hypnosis to a control group. After being inducted into hypnosis, participants in the hypnosis group were given a post-hypnotic suggestion to reduce anxiety and improve memory and were read a short literature passage by one of the researchers. Immediately afterward, participants were taken out of hypnosis and given a 10-item multiple choice test over the aforementioned passage. Participants in the control group heard the same literature passage and watched a brief unrelated film to account for the time the hypnosis group spent being inducted and taken out of hypnosis. The control group was then given the same multiple choice test. Analysis of the test scores using an ANCOVA indicated that the hypnosis condition

performed significantly worse than the control condition on the multiple choice test. However, Jacobson et al. did not measure a participant's altered state of awareness during hypnosis, and therefore it was unknown whether participants were actually hypnotized to the degree intended by the researchers. Due to the fact that hypnosis and academic performance are of primary concern, another possible limitation was that the testing conditions did not adequately resemble the pressures and motivations of a realistic testing experience since participants were still rewarded for participating in the study regardless of how well they performed on the test.

The purpose of the current study was to extend and improve upon the methodology of Jacobson et al. (2011). In an effort to measure a participant's hypnotic depth, the current study used a Phenomenology of Consciousness Inventory. We also tried to create a realistic testing environment by awarding participants for performing well on tests administered to assess performance. A mixed design was used thus allowing us to further control for individual differences and make better comparisons between individual and group performance.

Method

Participants

Participants ($N = 67$, 43% Male, 79% Caucasian, 4% African American, 6% Mixed or Multiple Ethnicities, 6% Asian, 1% Hispanic, 3% Other ethnicity, $M = 19.99$ years old, age range 18–24 years old) were pooled from four sections of general psychology courses across two semesters (two classes per semester). All participants were given a health questionnaire and an informed consent form to fill out prior to participating in the study. Participants were not allowed to take part in the study if they had a medical history that included diabetes or epilepsy due to previous research indicating that seizures or low blood sugar can be induced by hypnosis (Khan et al., 2009; Olson, Howard, & Shaw, 2008; Schwarz, Bickford, & Rasmussen, 1955; Vandenbergh, Sussman, & Titus, 1966). However hypnosis' effect on blood sugar levels has been recently disputed by other research (Riazi & Bradley, 2007).

Materials

Pre-recorded audio tapes were used to create the experiment's hypnotic induction, lectures, short stories, and to take participants out of hypnosis. The recordings were performed by the same experimenter and played to each condition group to systematically control for any possible differences that could arise from one session to the next. All participants in the hypnosis condition were given the same hypnotic induction each time.

Both the hypnosis group and the control group were given the Phenomenology of Consciousness Inventory, which enabled the researchers to measure the altered state

of awareness that the participants had experienced during hypnosis. This attempted to address the concern by Jacobson et al. (2011) who listed hypnotic depth as potentially confounding the previous findings. This 53-item questionnaire contains 12 primary scales on a 0–6 Likert scale: altered experience, positive affect, negative affect, attention, imagery, self-awareness, altered state of awareness, arousal, rationality, volitional control, memory and internal dialogue. The altered state of awareness was measured by differences between the hypnosis condition and control condition in measures on the altered experience scale and altered state of awareness. By measuring the altered state of awareness during hypnosis, the experimenters were able to make sure that each participant was affected enough to actually qualify them as being hypnotized.

The session lectures took place the night before the participants' general psychology class. During the following days' class, 15-item quizzes based on the material covered in the previous nights' lecture were given. Students were awarded extra credit directly based on their score on the multiple-choice test. Extra credit was provided in this way to intrinsically motivate them to perform well on the quizzes. Participants also reported their ACT scores; the ACT is a standardized test that measures academic aptitude and is commonly utilized for college admissions (ACT, 2008).

Procedure

Five experimenters that were trained in hypnosis conducted group sessions with the members of the general psychology sections. There were three, hour-long sessions conducted for three different lecture topics that would be not be covered in students' general psychology course: (a) the life and research of Lev Vygotsky; (b) attraction theory; and (c) posttraumatic stress disorder. Participants signed up for a session time, and they were asked to come to the same time each week. Each week the time blocks alternated between hypnosis and control conditions. Participants could take part in all three lecture topics as long as they signed up for the same time slot as their first session. This allowed us to statistically control for within subject and between-subject differences.

Once the health questionnaire and informed consent were completed, participants were asked to release their ACT score results to serve as an indicator of academic aptitude, although the release of this information was entirely voluntary. Using pre-recorded audio, the hypnosis group was induced into hypnosis by employing a progressive relaxation technique to help each participant to relax their muscles one at a time. The tape went on to use a "staircase method," in which participants visualized walking down stairs until they reached a soft bed, while the induction tape counted down from 21 to 1 in odd increments.

Participants were then played a lecture that lasted approximately 10 minutes and discussed one of the three areas of advanced psychology that were previously mentioned. Once the lecture concluded, another pre-recorded audio tape was used to bring the participants out of hypnosis. Subsequently, the participants were asked to complete the

Phenomenology of Consciousness Inventory. The participants were then given their 15-item quizzes in class the following day.

Rather than be inducted into hypnosis, participants in the control condition were played a pre-recorded reading of a short story, roughly equivalent in time to the hypnotic induction and enhancement. They were then played the same lecture that the participants in the hypnosis condition heard. Subsequently, the participants in the control condition were also given the Phenomenology of Consciousness Inventory to serve as a baseline for the hypnosis condition. The participants in the control condition were then given the same 15-item quiz that those in the hypnosis condition received in class the following day.

Results

Internal Consistency of Measures

The internal consistency is presented in Table 1 for each of the subscales on the Phenomenology of Consciousness Inventory. Each subscale demonstrated adequate internal consistency (range: α: .68–.92, Median α: .78).

Manipulation Check

To ensure that individuals in hypnosis were actually being hypnotized, the 13-item altered experience subscale of the Phenomenology of Consciousness Inventory was used. A hierarchical linear model with repeated measures was used to test if the hypnosis condition's altered experience was significantly different from the control condition's

TABLE 1
Internal Consistency of the Phenomenology of Consciousness Inventory

Variable	*Number of Items*	*Alpha*
Altered experience	13	0.92
Positive affect	6	0.76
Negative affect	6	0.86
Attention	5	0.68
Imagery	4	0.84
Self-awareness	3	0.78
Altered state of awareness	3	0.89
Arousal	2	0.77
Rationality	3	0.73
Volitional control	3	0.64
Memory	3	0.81
Internal dialogue	2	0.77

Note. This table shows the number of items and internal consistency for each subscale used on the Phenomenology of Consciousness Inventory.

altered experiences during each lecture. Additionally, the model statistically controlled for the following: participants (via repeated measures) nested within class learning session time; class learning session was nested within class time; class time was nested within the semester. The model also controlled for the ACT and the multiple-choice test number through fixed effects in the model. Similarly, eleven separate models were used with the same structure to test the eleven other subscales: positive affect, negative affect, attention, self-awareness, arousal, rationality, memory, and internal dialogue subscales. See Table 2 for the effects in each model. The manipulation check indicated that the hypnosis condition significantly impacted the altered state of experience, positive affect, attention, imagery, self-awareness, arousal, rationality, volitional control, memory, and internal dialogue. Accordingly, due to the significant impact on the altered experiences and the altered state of awareness scale, we found that the hypnosis group experienced an actual hypnosis condition.

Primary Analyses

The results were tested with hierarchical linear models with repeated measures. The multiple-choice test score was predicted by the condition, while statistically controlling for academic aptitude via the ACT. Additionally, the model statistically controlled for the following: participants (via repeated measures) nested within class learning session time; class learning session was nested within class time; class time was nested within the semester. These models were analyzed using SAS version 9.2's Proc Mixed, treating

TABLE 2
Phenomenological Effects of Hypnosis vs. Control

			Hypnosis Group Placement		
Scale	*Hypnosis M (SD)*	*Control M (SD)*	*F (1, 22)*	*p*	d_p
Altered experience	27.87 (15.53)	12.11 (11.00)	22.68	<.001	0.43
Positive affect	9.72 (6.56)	5.98 (6.18)	8.80	.007	0.27
Negative affect	4.46 (6.36)	3.30 (4.83)	2.38	.138	0.14
Attention	18.70 (4.57)	15.43 (5.19)	6.50	.018	0.23
Imagery	11.80 (3.71)	10.28 (5.56)	6.57	.018	0.23
Self-awareness	10.36 (3.98)	14.00 (3.63)	14.18	.001	−0.34
Altered state of awareness	9.67 (4.90)	3.30 (4.01)	38.74	<.001	0.57
Arousal	2.46 (2.18)	3.85 (3.39)	3.07	.094	−0.16
Rationality	11.80 (3.71)	12.30 (3.73)	5.50	.028	−0.21
Volitional control	10.44 (4.11)	12.65 (3.73)	16.55	<.001	−0.37
Memory	11.89 (4.27)	13.39 (4.17)	7.58	.012	−0.25
Internal dialogue	5.92 (3.51)	4.70 (3.90)	1.12	.302	0.10

Note. This table shows the results of 12 separate models where hypnosis group placement predicted the 12 scales on the Phenomenology of Consciousness Inventory. Higher Cohen's *d*'s indicate a positive relationship between hypnosis and the dependent variable. Note that the Cohen's *d*'s were calculated based on the least square means, rather than the sample means and standard deviation.

each hierarchy as a nested random effect. In an attempt to gain the greatest control from each of the random effects, the covariance structure was treated as unstructured. Please note that all Cohen's *d*s were computed based on the least squares means and the standard errors. Likewise, all of the r's represent the partial standardized betas rather than the correlation coefficient. As such, these represent the independent effect sizes controlling for the other variables in the model. Accordingly, the Cohen's *d*s and partial standardized betas were denoted as d_p and r_p, respectively.

The models indicated that individuals in the hypnosis condition ($M = 7.44$, $SD = 2.01$) performed significantly, $F(1, 62) = 4.32$, $p = .042$, $d_p = -0.20$, worse than those in the control condition ($M = 8.11$, $SD = 3.28$). The multiple-choice test condition control variable significantly, $F(2, 5) = 8.91$, $p = .022$, predicted the test score. However, ACT, $F(1, 5) = 1.07$, $p > .05$; time, $F(2, 2) = 0.64$, $p > .05$; and class time, $F(1, 62) = 1.25$, $p > .05$, did not significantly predict the test score.

Mechanism of Deficit Analyses

The primary analyses showed that the hypnosis placement accounted for a significant depreciation in test scores, but these analyses did not reveal the mechanism behind the deficit. Accordingly, a single hierarchical equation was used to see if one of these manipulations predicted test score change. The multiple-choice test score was predicted by the condition, while statistically controlling academic aptitude via the ACT. Additionally, the model statistically controlled for the following: participants (via repeated measures) nested within class learning session time; class learning session was nested within class time; class time was nested within the semester. Accordingly, altered experience, positive affect, attention, imagery, self-awareness, altered state of awareness, rationality, volitional control, memory, and the type of session were used to predict the multiple-choice test score. See Table 3 for the results. Only one of the variables significantly affected the test score, that being attention. However, the relationship between attention was positively associated with hypnosis group placement, and attention was also positively associated with test scores. Accordingly, it seems that while attention was providing unique positive variance to the model, other factors were providing non-unique negative associations with the model. Although the altered state of awareness appeared to be contributing to a practically meaningful extent ($r_p = -.32$), issues of multicollinearity, which inflated the standard errors of the predictors, may have prevented this effect from reaching statistical significance.

A follow-up analysis was conducted by dropping all of the variables from the model except for the two strongest predictors: attention and altered state of awareness. To determine whether the hypnotic placement was still contributing unique variance, test placement was left in the model. As in the past model, attention significantly, $F(1, 27) = 8.73$, $p = .006$, $r_p = .28$, predicted an increase in test performance. However, the altered state of awareness uniquely predicted, $F(1, 27) = 15.35$, $p < .001$, $r_p = -.43$, a

TABLE 3
Relation of Phenomenological Indices to Exam Performance

Scale	*F (1, 20)*	*p*	r_p
Altered experience	0.96	.34	−.19
Positive affect	0.48	.499	−.08
Attention	7.19	.014	.29
Imagery	0.83	.372	.11
Self-awareness	0.27	.608	.09
Altered state of awareness	2.41	.136	−.32
Rationality	0.09	.763	.04
Volitional control	0.64	.434	−.13
Memory	0.00	.985	.00
Type of session	0.02	.901	−.10

Note. This table shows one model wherein each scale predicted the multiple choice test score. In this table, r_p represents the partial standardized beta, rather than a correlation coefficient.

significant decrease in test performance. The type of session did not significantly, $F(1, 27) = 0.20$, $p = .659$, uniquely predict test performance in the model. The type of session predicting test performance in this model is the residual direct effect. The finding that the type of session did not predict test performance indicates that the reasons for the poor test performance are entirely accounted for through the scales of the Phenomenology of Consciousness Inventory.

Discussion

These results confirm Halsband (2006) and Jacobson et al.'s (2011) findings, suggesting that learning in hypnosis is significantly worse than learning in a control condition. Moreover, this study extends these findings confirming that these effects hold true among group settings, using standardized audio-recordings, and in actual testing environments. Additionally, because participants were given extra-credit based on their multiple-choice test scores, this study extends previous research regarding a realistic testing environment. This extension suggests that previous findings did not result from a lack of motivation (both previous studies relied solely on intrinsic motivation). Moreover, through our measurements we can confirm that individuals were significantly more hypnotized than the control group as evidenced by the large increase in the altered state of awareness.

Perhaps most interestingly, the results indicated that two variables mediated the relationship between hypnosis and test performance. The hypnosis condition increased the level of attention. Moreover, the level of attention coincided with an increase ($r_p = .29$) with the level of the test scores. This variable alone does not explain the performance deficits seen between the hypnosis condition and test performance. When the state of altered experience was included in the model, the effects became clear. The altered state of awareness was more profoundly impacted in the hypnosis condition ($d_p = 0.57$ for

the altered state of awareness compared to $d_p = 0.23$ for attention). Additionally, the altered state of awareness produced a deficit in test scores ($r_p = -.32$) so profound that it counteracted the positive effects of hypnosis and attention.

The relationship among the mediating variables with hypnosis and test performance may shed light on the discrepancy between relaxation and hypnosis. For example, Cassady, Bloomfield, and Hayward (2002) found that relaxed environments coincided with increases in short-term memory, even when the participants recalled the material in a non-relaxed environment. As such, this would indicate that state dependency did not affect the results in memory based on the self-reported measure of memory in the Phenomenology of Consciousness Inventory (e.g., "I cannot remember what I experienced," "I can recall nothing that happened to me," and "my memory of the events I experienced is extremely clear and vivid"). Our results suggested that memory did not contribute ($r_p = .00$) to the relationship between the multiple-choice test performance and hypnosis. As such, this confirms that state-dependent memory does not cause the deficits found in the hypnosis group.

Previous research on relaxation suggests that relaxation also increases attention (Yesavage & Jacob, 1984). Accordingly, it may be that attention causes the increases in recall in the relaxation conditions. Similarly, individuals in hypnosis may also benefit from the relaxation condition. However, the discrepancy likely lies in what could be unique to hypnosis: the altered state of awareness (Holroyd, 2003). As those in relaxation do not experience altered states of awareness, this may explain the unique performance deficits produced by hypnosis and learning.

Please note that the generalizability of these findings may be limited due to the constraints placed on internal validity in the age range and hypnosis materials. Specifically, the age range of the participants was limited. Additionally, it may be that previously audiotaped induction sessions may be different from newly generated induction scripts. Also, the extra credit may not constitute the same type of motivation that an actual test may elicit. Another limitation of this research is the use of the self-report scales. These scales may not coincide with behaviorally or neurologically oriented measures of hypnosis, attention, and altered states of awareness. As such, future research should examine these effects in broader age groups and use newly generated induction scripts, actual test scores, and behavioral or neurologically-based measures. Thus, further research needs to be conducted to investigate the relationship between hypnosis and learning. Moreover, this study did not examine the long-term impact of hypnosis on learning. It seems plausible that the negative effects of the altered state of awareness may fade with sufficient training and experience with hypnosis. As such future research should examine the impact of hypnosis on learning in longer time periods.

These results provide some tentative answers toward the relationship between deficits of hypnosis and learning in single-trial study periods. Due to the performance deficits in the hypnosis group, it is not advisable to learn new material in hypnosis. As such, this suggests that hypnosis is not an effective study tool and should not be used to improve study habits.

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