Suggested visual hallucinations in and out of hypnosis

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Abstract

We administered suggestions to see a gray-scale pattern as colored and a colored pattern in shades of gray to 30 high suggestible and eight low suggestible students. The suggestions were administered twice, once following the induction of hypnosis and once without an induction. Besides rating the degree of color they saw in the stimuli differently, participants also rated their states of consciousness as normal, relaxed, hypnotized, or deeply hypnotized. Reports of being hypnotized were limited to highly suggestible participants and only after the hypnotic induction had been administered. Reports of altered color perception were also limited to high suggestibles, but were roughly comparable regardless of whether hypnosis had been induced. These data indicate that suggestible individuals do not slip into a hypnotic state when given imaginative suggestions without the induction of hypnosis, but nevertheless report experiencing difficult suggestions for profound perceptual alterations that are phenomenologically similar to what they report in hypnosis.

The domain of hypnosis consists of two central components (Hilgard, 1973; Kihlstrom, 2008; Kirsch & Lynn, 1995; Oakley, 2008). One component is the hypnotic induction, by means of which a hypothesized altered state of consciousness is induced. The second component involves the administration of suggestions for changes in perception, behavior, and cognition. In responsive individuals, these suggestions produce movements that are experienced as occurring automatically, temporary paralyses, and alterations in perception and cognition. Some of these responses (e.g., automatic movements) are displayed by large numbers of participants in hypnosis studies; others (e.g., hallucinations) are confined to a relatively small minority of participants. Because these suggestions request imaginative experiences, they have been termed imaginative suggestions (Braffman & Kirsch, 1999) to distinguish them from other forms of suggestion (e.g., placebo effects or misleading questions).

Although suggested experiences of this sort are most often obtained in the context of hypnosis, a large body of data has demonstrated that they can also be produced by suggestions administered in the normal waking state, without any prior hypnotic induction (reviewed in Kirsch, Mazzoni, & Montgomery, 2007). These studies also show that hypnotic and waking responses to the same suggestions are highly correlated, and the difference between them is relatively small. Furthermore, the ability to respond to suggestions in and out of hypnosis is not limited to self-reported experience, but instead represents an objective skill, as shown by data demonstrating that suggestion can enable suggestible individuals to at least partially overcome the automaticity associated with the Stroop effect (Raz, Kirsch, Pollard, & Nitkin-Kaner, 2006).

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The terms waking and hypnosis were coined because it was once believed that hypnotic inductions produced a sleep-like state. Although it is now known that hypnotized subjects remain fully awake, the terms have been retained as conventionally used.
Findings of this sort have led some authors to propose that the state of hypnosis is not a necessary precursor for the production of hypnotic responses, but instead enhances the production of suggested experiences to a relatively small degree (Hilgard, 1975), and has led others to reject the notion of a hypnotic state altogether (Lynn, Kirsch, & Hallquist, 2008). Another possibility that has been raised is that the induction of a hypnotic state may be necessary for the production of subjectively convincing hallucinations, but not for less difficult suggestions (Kallio & Revonsuo, 2003). Support for this latter hypothesis is provided in a PET study on the ability to alter color perception by hypnotic suggestion (Kosslyn, Thompson, Costantini-Ferrando, Alpert, & Spiegel, 2000). In that study, suggestions given in hypnosis produced bilateral changes in fusi-
form activation, but only right hemisphere changes when the suggestions were given out of hypnosis.

Two shortcomings in the Kosslyn et al. (2000) render it less than definitive in answering the question of whether highly suggestible individuals can experience suggested hallucinations outside of hypnosis. First, participants were not asked to report whether they had experienced changes in color perception when suggestions were given outside of hypnosis. As Kihlstrom (2008, p. 36) notes, the failure to find physiologic indicators of a subjective state without first establishing self-reported experiential alterations “puts the cart before the horse.” A more serious problem is that Kosslyn et al. changed the wording of the suggestion when it was administered outside of hypnosis. In the hypnosis condition, participants were asked “to alter their perception of the stimuli” (p. 1281), whereas in the subsequent waking condition they were asked to “remember and visualize” (p. 1281) what the stimulus was like in its other form. The main reason for this change in wording was to avoid the possibility of participants inadvertently slipping into a hypnotic state when the suggestions were given outside of hypnosis. However, this meant that the effect of inducing hypnosis was confounded with the wording of the suggestions. As shown by Rainville and colleagues, hypnotized participants are very sensitive to subtle differences in the wording of suggestions (Rainville, Carrier, Hobbauer, Bushnell, & Duncan, 1999). Hence, as noted by Oakley (2008, p. 377), “this study does not allow any clear conclusion as to the role of the hypnotic state. . . as the cognitive demands were different in the two cases. Specifically, the participants’ task was to hallucinate color changes in the hypnosis condition and to imagine color changes in the no-hypnosis condition.”

The study reported here is part of an ongoing research endeavor aimed at establishing whether people high in hypnotic suggestibility are able to generate subjectively convincing hallucinatory experiences without the induction of hypnosis. The first step in this endeavor was to establish whether participants high in hypnotic suggestibility inadvertently slip into hypnosis when given suggestions for perceptual alterations. In a pilot study limited to highly suggestible individuals (Kirsch et al., 2008), participants were asked to rate the degree to which they felt hypnotized when responding to the color alteration suggestions used in the Kosslyn et al. (2000) study with and without a hypnotic induction. They reported being in hypnosis only when given a formal hypnotic induction; when not given a hypnotic induction, none of the participants reported being in hypnosis, despite having been given the identically worded color alteration suggestion. This indicates that it is possible to disentangle the effects of suggestions for perceptual alterations from the effects of inducing hypnosis, without undue worry that participants might slip into a trance state during the no-hypnosis part of the study.

In the present study, we administered suggestions for alteration in color perception to participants who had been selected for high and low levels of hypnotic suggestibility. The color alteration suggestions were administered twice, once in the normal waking state and once following the induction of hypnosis. As in the pilot study, we also elicited altered state reports to verify that participants had not inadvertently slipped into hypnosis during the no-induction part of the study. Slipping into hypnosis would be indicated if high suggestible participants were to report being hypnotized during the no-hypnosis part of the testing session. The main aim of the study was to assess whether highly suggestible individuals can hallucinate perceptual experiences both in and out of hypnosis when the wording of the suggestion given in the two conditions is exactly the same. We included a sample of low suggestible participants to verify that the ability to respond to the suggestions we used was specific to individuals with high levels of suggestibility.

2. Method

2.1. Participants

Participants were 30 highly suggestible undergraduate students at the University of Florence (12), University of Hull (9), Higher Institute of Applied Psychology in Lisbon (8), and University of Sussex (1). In addition, eight low suggestible participants at the University of Florence were assessed. British participants were paid for their participation. Participants in Florence and Lisbon participated without compensation. Sessions were conducted by authors of the study, all of whom were on the staff of their respective institutions.

The participants were among several hundred students who had been screened for hypnotic suggestibility. Screening was on the Waterloo-Stanford Group C scale of hypnotic susceptibility (WSGC) (Bowers, 1993) or a modified version of the Carleton University Responsiveness to Suggestion Scale (CURSS) (Comey & Kirsch, 1993; Spanos et al., 1983a). To qualify as highly suggestible, students had to score 9–12 on the WSGC or 5–7 on the CURSS. Low suggestible participants scored between 0 and 1 on the CURSS.

The WSGC is a group adaptation of the Stanford Hypnotic Susceptibility Scale: Form C (SHSS:C) (Weitzenhofer & Hilgard, 1962), which is widely considered the gold standard in measuring responsiveness to hypnotic suggestion. Bowers (1993) has reported high level of internal consistency and a correlation of .85 between the WSGC and the individually administered
SHSS:C. The CURSS also shows adequate internal consistency and is highly correlated with the SHSS:C \((r = .65)\) (Spanos et al., 1983b). The CURSS and the SHSS:C have been found to yield “good levels of agreement” in identifying highly responsive individuals (Perry, Nadon, & Button, 1992, p. 482). Specifically, 75% of participants who score in the high range on the CURSS also score in the high range on the SHSS:C. We used the Comey and Kirsch (1999) version of the CURSS, which has an extended hypnotic induction and introductory instructions that are similar to those of the Stanford scales.

2.2. Procedure

For the main part of the study, participants were assessed individually. After being greeted by the experimenter, they were told: “Previous research has shown that some people with very high levels of imaginative ability are able to see a color stimulus as gray and a gray stimulus as colored. Research has also shown that people can respond to suggestions for perceptual alterations whether or not they have been hypnotized. The purpose of this study is to assess your ability – both in and out of hypnosis – to experience colored stimuli as if they were gray and gray stimuli as if they were colored.” They were then shown the two stimuli displayed in Fig. 1, so that they would understand the nature of the color changing task.

On each of four trials, two of which were preceded by a hypnotic induction consisting of suggestions for relaxation, pleasant visual imagery, and entry into a hypnotic state (Kirsch, Lynn, & Rhue, 1993), participants were asked to first see the stimulus as it actually was (in color or in shades of gray). Following a pause of 10 s, they were asked to alter their perception of the stimulus. When shown the gray-scale pattern, the suggestion was to alter their perception by adding color, so that they actually saw it in full color. When shown the colored pattern, the suggestion was to drain color so that they only saw shades of gray. Hypnotic and non-hypnotic trials were counterbalanced.

2.3. Measures

Following each trial, participants were asked to indicate how much color they saw in the stimulus (from 0 to 100%) after the suggestion to alter their perception of it. These scores were then transformed into indications of responsiveness to suggestions for color alteration. This was done by dividing each score by 100 and, for the color draining suggestion, subtracting the result from 1. Then the mean of these two scores was calculated for each participant. Thus, 0 represented no success at adding or draining color, and 1 represented complete success on both tasks. Reliability of this measure is indicated by correlations of .63 and .44 between success in adding color and success in draining color, in hypnotic and waking conditions, respectively. The difference between these correlations is not significant.

At the conclusion of the session, participants were asked to indicate their state of consciousness during the hypnosis trials and during the no-hypnosis trials. This was done on the four-point state scale used by Hilgard & Tart (1966) for this purpose. The four choices on this scale indicate that the participant reports being in a normal wide awake state (0), relaxed (1), hypnotized (2), or deeply hypnotized (3).

3. Results

We first conducted two preliminary analysis to check for possible effects of the scale that was used to select high suggestible participants (WSGC versus CURSS) and of order of administration (hypnosis first versus waking first) on response to suggestions for perceptual changes. These analyses did not reveal any significant main effects or interactions.

3.1. Suggestibility

Next, we assessed the effect of hypnotic suggestibility on state reports and responses to color changing suggestions. As low suggestible participants were assessed only in Italy, this analysis is confined to the Italian sample of participants. A 2 × 2 (suggestibility by hypnosis) mixed model analysis of variance (ANOVA) on hypnotic state reports revealed significant main
effects for suggestibility, $F(1,18) = 12.80, p = .002, \eta^2 = .42$, and hypnosis, $F(1,18) = 16.36, p < .001, \eta^2 = .48$, as well as a significant suggestibility by hypnosis interaction, $F(1,18) = 16.36, p < .001, \eta^2 = .48$. As shown in Fig. 2, reports of being in hypnosis were confined to high suggestible participants and only during the hypnosis part of the session. An ANOVA on responses to the color changing suggestions revealed a significant effect only for suggestibility, $F(1,18) = 23.07, p < .001, \eta^2 = .56$. As shown in Fig. 3, only highly suggestible participants reported being able to change their perception of the stimuli.

3.2. Induction of hypnosis

Finally, we assessed the effect of inducing hypnosis on state reports and responses to the color changing suggestions in high suggestible participants across the three countries. Means and standard deviations are displayed in Table 1. Mixed model ANOVAs revealed a significant effect of the induction of hypnosis on state reports, $F(1,27) = 115.15, p < .001, \eta^2 = .81$, but not on response to suggestion, $F(1,27) = 3.15, p = .087, \eta^2 = .10$. Among the high suggestible participants, only one reported not being able to either add or drain color, one reported only negligible color changes (i.e., <5%), and one reported being able to alter color perception only in the no-hypnosis condition. For the remaining high suggestible individuals, the success in altering color perception ranged from 15% to 90% in the waking condition and from 20% to 100% in the hypnosis condition.

We obtained a significant main effect of country on state reports, $F(1,27) = 6.17, p = .006, \eta^2 = .31$, and a marginally significant main effect of country on response to color changing suggestions, $F(1,27) = 3.31, p = .052, \eta^2 = .20$. LSD comparison ($\alpha = .05$) indicated that Italian participants reported lower state reports than British or Portuguese participants, and British participants reported greater alterations in color perception than Portuguese or Italian participants. However, the interaction between country and condition did not approach significance in either state reports or color change. Therefore the differences across countries do not affect the crucial results of this study.

4. Discussion

Our data indicate that highly suggestible individuals report suggested changes in perception not only in hypnosis, but also without a hypnotic induction. The intensity of the color hallucination reported in hypnosis was not significantly different from what it was out of hypnosis. However, the probability level for this effect was .09, and although our within-subject comparisons were well-powered to detect medium effect sizes (power = .90), they were not sufficiently powerful to detect small effects (power = .26). Thus, it is not possible to rule out the possibility of a small effect, consistent with previous studies indicating that hypnotic inductions have small facilitatory effects on suggested behavior.

Participants reported suggested changes in perception without slipping into a trance state. This is confirmed by the substantial and significant differences in state reports produced by the hypnotic induction, which accounted for more than 80% of the variance in state reports. None of the participants reported feeling hypnotized when suggestions were given in the

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**Fig. 2.** State reports in high and low suggestible individuals, with and without the induction of hypnosis.
waking condition. In contrast, 73% of the highly suggestible participants reported being in a hypnotic state during the hypnosis part of the experiment. Low suggestible participants reported that they were in a normal state of consciousness and that the suggestions had no effect at all, regardless of whether or not they had been hypnotized. Given that perceptual experiences were comparable across conditions (hypnosis versus no-hypnosis), differences in state reports are likely to reflect experiential changes due to various components of the induction (e.g., relaxation and the suggestion to enter a hypnotic state), and attributions about these altered experiences based on participants’ conception of the situation and their self-evaluations as high or low hypnotizable individuals. This could profitably be disentangled in future research including moderately suggestible participants and using more sophisticated measures of the experience of a hypnotic state (Pekala & Wenger, 1983).

Our present data are consistent with those reported by Raz and colleagues (2006) in which a suggestion to alter the perception of words modulated Stroop performance regardless of whether the participants had or had not been hypnotized. They are inconsistent, however, with the neurophysiologic results reported by Kosslyn et al. (2000), in which left hemisphere visual areas devoted to color perception were activated only when suggestions for visual changes were given in hypnosis. Thus, there seems to be a disjunction between the self-report and behavioral data obtained in this study, on one hand and the physiologic data on the other.

There are several possible explanations for this disjunction, and several implications. One explanation is that the results reported by Kosslyn et al. were due to the use of differently worded suggestions in and out of hypnosis. Outside of hypnosis, their participants imagined, but did not actually see, color differences because the suggestion was to imagine rather than to see. This explanation leaves open the possibility that visual perceptual changes in and outside of hypnosis, which we found to be behaviorally similar, are produced by the same brain processes. If this turns out to be correct, it would confirm that the induction of a special hypnotic state is not required for subjectively convincing hallucinations to occur.

### Table 1

<table>
<thead>
<tr>
<th>State Report</th>
<th>Response to Suggestion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Waking mean (SD)</td>
</tr>
<tr>
<td>Florence</td>
<td>1.17 (0.39)</td>
</tr>
<tr>
<td>Portugal</td>
<td>1.88 (0.35)</td>
</tr>
<tr>
<td>England</td>
<td>1.40 (0.52)</td>
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</tbody>
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### Fig. 3.

Responses to color changing suggestions in high and low suggestible individuals, with and without the induction of hypnosis.
A second possibility is that the neural mechanisms by which suggestion elicits altered perceptual experiences may be different when suggestions are administered in a hypnotic state than when they occur in the waking state, even if the subjective and behavioral consequences of the two conditions are not much different, and cannot be distinguished from each other. This would be consistent with the idea that a special hypnotic state is a necessary prerequisite for having hallucinatory experiences in highly suggestible individuals (Kallio & Revonsuo, 2003).

These two contrasting hypotheses can be tested by assessing brain changes obtained when the same suggestion is given in and out of hypnosis. We are currently comparing these possibilities in an extension of the present study.

References


