Can unconscious intentions be more effective than conscious intentions? Test of the role of metacognition in hypnotic response

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Abstract

While several theories assume that responses to hypnotic suggestions can be implemented without executive intentions, the metacognitive class of theories postulate that the behaviors produced by hypnotic suggestions are intended and the accompanying feeling of involuntariness is only a consequence of strategically not being aware of the intention. Cold control theory asserts that the only difference between a hypnotic and non-hypnotic response is this metacognitive one, that is, whether or not one is aware of one's intention to perform the relevant act.. To test the theory, we compared the performance of highly suggestible participants in reducing the Stroop interference effect in a post-hypnotic suggestion condition (word blindness: that words will appear as a meaningless foreign script) and in a volitional condition (asking the participants to imagine the words as a meaningless foreign script). We found that participants had equivalent expectations that the posthypnotic suggestion and the volitional request would help control the conflicting information. Further, participants felt they had more control over experiencing the words as meaningless with the request rather than the suggestion; and they experienced the request largely as imagination and the suggestion largely as perception. That is, we set up the interventions we required for the experiment to constitute a test of cold control theory. Both the suggestion and the request reduced Stroop interference. Crucially, there was Bayesian evidence that the reduction in Stroop interference was the same between the suggestion and the volitional request. That is, the results support the claim that responding hypnotically does not grant a person greater first order abilities than they have non-hypnotically, consistent with cold control theory.

Keywords: Hypnosis, Post-hypnotic suggestion, Higher order thoughts, Metacognition, Stroop effect

The cornerstone of hypnotic responding is the feeling of involuntariness that accompanies an otherwise goal-directed behaviour (Weitzenhoffer, 1974, 1980; Terhune, Cleeremans, Raz & Lynn, 2017). Responses to hypnotic suggestions vary widely in terms of their difficulty. Some motor actions can be done by almost everyone (e.g., feeling a magnetic power between the palms that is pulling them towards each other), whereas the imaginative exercise to produce vivid hallucinations of noises can only be performed by a minority of the population (usually highly suggestible people, henceforth highs). The question of how these alterations in cognition can be implemented with a disrupted sense of agency has been the focus of scientific endeavour for decades. Theories from the sociocognitive tradition of hypnosis stress the role of demand characteristics in forming the subjective experiences involved with hypnotic responding and often highlight the strategic nature of the action as appropriate to the specific context (Comey & Kirsch, 1999; Spanos, 1986). The cognitive approach also often underscores the active role of the participants in creating an altered sense of reality (e.g., Kihlstrom, 1998) and several theories of this tradition, the dissociation theories (Bowers, 1990; Hilgard, 1977, 1991; Kihlstrom, 1985), propose that the sense of involuntariness can emerge by dampening the monitoring of one's own control processes. Recently, a theoretical attempt has been made to synthesize these views by depicting a metacognitive account of hypnosis, namely the cold control theory (Barnier, Dienes & Mitchell, 2008; Dienes, 2012; Dienes & Perner, 2007), that draws from the higher-order thought theories (Lau & Rosenthal, 2011; Rosenthal, 2005) of consciousness.

The (higher-order thought) HOT theory of consciousness postulates that a representation or a state is only conscious if one becomes aware of its content by the existence of a "higher-order thought" or state (HOT) that refers to it (Rosenthal, 2005). A higher order mental state is a mental state not just about the world (which is first order) but about a mental state. For instance, imagine having a first-order state about the world (e.g., "there is a tree"). According to HOT theories, one has no conscious experience of the world unless one possesses in addition a second-order thought about that first-order state (e.g., "I see that there is a tree"). HOTs are not restricted to perception; thus, they can refer to any mental state, including those with control functions.

Cold control theory stresses that the mechanism by which hypnotic responding (intentional and strategic behavior accompanied by the feeling of involuntariness) emerges is a process that allows people to replace the HOTs about their intentions with inaccurate ones (Dienes, 2012). For instance, to create the experience of the hallucination of a noise (e.g., the buzz of a mosquito), one has to have an intention about imagining that particular noise (e.g., an intention with the content "imagine a buzzing mosquito"), while forming an inaccurate HOT about the intention (e.g. with the content, "I`m not intending to imagine a buzzing mosquito"). The theory also claims that the intention to produce the appropriate response is formed by the actor and it is implemented by regular cognitive control processes implying that the behaviour will be in accord with the goals of the actor and that a hypnotic response cannot be more efficient than a non-hypnotic one (if a simple first-order intention is logically sufficient to produce the response). In a nutshell, cold control theory posits that hypnosis is solely a metacognitive phenomenon, and, in the simplest version of cold control, the theory assumes

that hypnosis is targeting specifically the HOT of intending thereby leaves the first-order states untouched.[1] The latter assumption coincides with the idea that HOTs, or in other words, being conscious of mental states, have only limited or zero function in terms of influencing first-order states (Lau & Rosenthal, 2011; Rosenthal, 2008)[2]. In addition, this assumption also implies that the theory deems hypnotic responding as a form of unconscious control as it claims that responses to suggestions are intended (implemented by executive control processes) while the intention to act is unconscious by virtue of possessing an inaccurate HOT that the intention does not exist.

The notion that hypnotic responses are produced by a strategically relinquished metacognition of one's intentions has gained some support. For instance, individual differences in metacognition, particularly the tendency to generate inaccurate HOTs of intending, are moderately associated with hypnotisability (Dienes, 2012; Terhune & Hedman, 2017). Further, experimental evidence suggests that the temporary disruption of the dorsolateral prefrontal cortex (DLPFC), which has a vital role in the functioning of metacognition (Lau & Passingham, 2006; Rounis, Maniscalco, Rothwell, Passingham & Lau, 2010), with rTMS (Coltheart et al, 2018; Dienes & Hutton, 2013) or alcohol (Semmens-Wheeler, Dienes & Duka, 2013) facilitates hypnotic responding[3]. Another line of research also corroborates the idea that hypnotic responding is the product of a purely metacognitive process by revealing that behaviors created by hypnotic suggestions are not related to first-order abilities of cognitive functioning (apart from metacognition). For example, several studies have presented evidence that performance on tasks involving first-order abilities of executive functioning such as inhibition (Dienes et al., 2009) or sustained attention (Jamieson & Sheehan, 2002) do not predict hypnotisability. Moreover, evidence counts against the claim that responses to hypnotic suggestion can enhance first-order abilities compared to responses that are non-hypnotic. For instance, there is no evidence for the superiority of hypnotic suggestions in recollection (Erdelyi, 1994; Nogrady, McConkey, & Perry, 1985), (more controversially) analgesia (Milling, Kirsch, Meunier & Levine, 2002; Spanos, 1986; for a counter-argument: e.g. Derbyshire, Whalley & Oakley, 2009; Hilgard, 1977; Miller & Bowers, 1993) and endurance (Barber, 1966, Levitt & Brady, 1964). However, an experimental finding, the word blindness effect (Raz, Shapiro, Fan & Posner, 2002; the term was first used by Parris, Dienes & Hodgson, 2012), calls into question

[1] Cold control theory assumes that hypnotic response involves strategic changes in HOTs about solely intentions. This claim is independent of whether or not there is domain specificity in metacognitive abilities (e.g. Fleming, Ryu, Golfinos & Blackmon, 2014), or whether hypnotisability involves alterations in metacognition over other domains as well, such as perception.

[2] Of note, a special case of HOT theories, the cross-order integration theory (COI; Kriegel, 2007), stresses that first-order states and HOTs can causally influence each other by binding together to a unified conscious representation, which can, for instance, enhance cognitive functioning.

[3] It is to be noted that none of the experimental manipulations were exclusive in a sense that they might impair cognitive functions aside from metacognition (Dienes, 2012), allowing for theories focusing on the role of disrupted executive functioning (Woody & Sadler, 2008) to account for the data. Moreover, a recent replication failure of the Rounis et al. (2010) study suggests that the stimulation of the DLPFC with rTMS might not impair visual awareness (Bor, Schwartzman, Barrett & Seth, 2017); the meaning of these findings is a matter of ongoing debate (Ruby, Maniscalco & Peter, 2018; c.f., Bor, Barrett, Schwartzman & Seth, 2018).

the key statement of the theory, as it suggests that highs can acquire abilities through hypnosis that they do not possess when responding non-hypnotically.

The word blindness phenomenon can be induced by suggesting to highs that they will see words as meaningless characters, or as words of a foreign language, while they are engaged in a color naming Stroop task (Stroop, 1935). Generally, the suggestion is applied post-hypnotically, which means that it is provided during a hypnotic induction prior to the Stroop task and only later activated by a cue (e.g., a clap). It has been shown by various independent laboratories that when this suggestion is given to highs, they can lower the interference and the Stroop effects (as measured by the difference in response times (RTs) between the incongruent and neutral, and the incongruent and congruent trials, respectively) compared to their own performance in a non-hypnotic condition (Augustinova & Ferrand, 2012; Parris et al., 2012; Raz et al., 2002; Raz, Kirsch, Pollard & Nitkin-Kaner, 2006). Moreover, low suggestible people cannot reproduce this improvement in performance (Casiglia et al., 2010; Raz & Campbell, 2011; Raz et al., 2002, 2003) further underlining the notion that hypnosis and so the ability to respond hypnotically can have a causal influence on first-order states. It has been proposed that the word-blindness suggestion allows people to gain control over otherwise automatic processes (i.e., reading), specifically, by being able to dampen the processing of input words (Raz et al., 2002; Raz et al., 2006; Raz, Fan & Posner, 2005).

Overall, these findings cast doubt on the idea that a response by becoming hypnotic only impacts HOTs of intending and cannot alter first order abilities, but the findings do not refute the cold control theory *per se*. First, the cold control theory postulates that to produce the word blindness effect, one has to have a first-order intention to create the experience of the script as being meaningless by using a strategy at the disposal of the person without having an accurate HOT about intending to do so. Consequently, cold control theory asserts that the mere comparison of a suggestion and a no suggestion (Stroop task under normal circumstances) condition overlooks the fact that people have been (implicitly) instructed to create an experience of meaninglessness in the former case but they were told not do so in the latter one (Dienes, 2012). Therefore, this contrast cannot inform us whether the power of imagination (i.e., creating a counterfactual model of reality in which meaning cannot be extracted from the script) depends on the form of the accompanying HOT. Second, individual differences between highs and lows in the ability to create word blindness can account for the disparity in their performance, and indeed, it has been found that highs and not lows can produce the word blindness effect as a response to suggestions in the absence of a hypnotic induction (Parris & Dienes, 2013). This latter finding may seem to settle the matter in favour of cold control: subjects have no more first-order abilities responding hypnotically as non-hypnotically. However, this conclusion depends on hypnotic responding being entirely conditional on a previous hypnotic induction. If a subject can, without an induction, respond hypnotically, then the mere presence or absence of a hypnotic induction is irrelevant to theory testing. Indeed, it has been shown that highs can for example produce hallucinations in response to suggestion, or dramatically relieve pain, without a previous hypnotic induction (e.g., Kirsch et al., 2008; Milling et al., 2002). Moreover, it has been demonstrated that the induction procedure might be irrelevant to the production of the feeling of involuntariness, which is the core feature of a

hypnotic response; for example, highs reported comparable levels of involuntariness after a suggestion to experience a sex change with and without a prior induction (McConkey, Szeps & Barnier, 2001). Thus, the use of an induction or not is not relevant to testing the prediction of cold control theory. What is relevant is requesting subjects to have the same first-order intentions while having an accurate or inaccurate HOT about the intention. That is, a clear test of the key prediction of cold control theory necessitates the contrast of the control of highs experienced as voluntary with the control of highs experienced as involuntary (henceforth voluntary and involuntary control) in the capacity of reducing the Stroop interference effect while asked to achieve this by having the same first-order intention. By this, we could investigate whether hypnosis is purely a metacognitive phenomenon. Cold control theory defines hypnotic responding as nothing more nor less than acting intentionally while having the inaccurate HOT that one is not intending to perform that action. This is perhaps one of the simplest theories of hypnosis one could have: the essence of a response being hypnotic lies only in a type of metacognitive monitoring. Thus, critically testing the theory is important: Is a more complex theory needed or not?

One might argue that former research has already tested the core claim of cold control theory in studies investigating the efficiency of imagination compared to hypnotic responding to suggestions and that the theory has been disconfirmed. For instance, there is evidence that the fusiform activation of highs is bilateral when they are responding to a hypnotic suggestion to hallucinate colours whereas only the right fusiform shows activation when they are requested to imagine a grey-scale pattern in color, indicating that voluntary imagination might not produce the same visual experience as hypnotic responding (Kosslyn, Thompson, Costantini-Ferrando, Alpert & Spiegel, 2000). In addition, it has been shown that highs produce stronger pain experience of heat when responding to a hypnotic suggestion contrasted with a request to imagine the same type of pain (Derbyshire, Whalley, Stenger & Oakley, 2004). However, in both of these studies other factors than a mere change in monitoring of the HOT of intending might have been in play to produce varying experiential and neuropsychological responses. For example, if the wording is not carefully phrased in the non-hypnotic and hypnotic conditions it can create demand characteristics resulting in a "hold back" effect (Spanos, 1986; Zamansky, Scharf & Brightbill, 1964) or stronger expectations in the hypnotic condition (Braffman & Kirsch, 1999), as the participants aim to please the experimenter or they do not believe that their non-hypnotic response can be as effective as the hypnotic one. We argue that none of these studies provide an unequivocal test of the prediction of cold control theory as the expectations of the subjects were not measured in any of them. The wording of the conditions in Kosslyn et al.`s (2000) experiment were not designed to convince the participants that they can and should try to create comparable responses in the different conditions. Further, and crucially, it was not demonstrated in these examples that the imagination condition involved greater feelings of voluntariness than the hypnotic condition; thus, cold control may have been the mechanism in both conditions. Therefore, a genuine test of the prediction of cold control theory need to possess a volitional request that can create equal level of expectations about the efficiency of non-hypnotic and hypnotic responses ensuring that the participants expect to perform the same with and without the HOT of intending.

To address this issue, we constructed a fully within-subjects design experiment in which the performance of involuntary and voluntary control can be directly compared. We employed three experimental conditions using highly suggestible subjects. In the posthypnotic suggestion condition (henceforth simply "suggestion" condition), we used the word-blindness posthypnotic suggestion to see the words as meaningless characters during the Stroop task. In the volition condition, we told the participants to reproduce the effect of the word blindness suggestion by responding to our volitional request to imagine the words as meaningless characters while doing the Stroop task. In the no suggestion condition, we asked the participants to undertake the Stroop task with the instruction of not imagining the words as meaningless so that we can measure their baseline performance. In this scenario, the cold control theory predicts that people can overcome the Stroop interference to the same extent in the suggestion and volition conditions when compared to the no suggestion condition. Therefore, if the results show a stronger reduction of the interference effect in the suggestion compared to the volition condition then one has to conclude that there is more to hypnosis than the strategic relinquishment of metacognitive monitoring in the form of accurate HOTs of intending. The experiment is testing a core prediction of the simplest version of cold control theory and so if it is disconfirmed, we need to revise the theory to fit the data. The key assumption of cold control theory is that the difference between hypnotic versus non-hypnotic responding is just the difference between having and not having a HOT; if this assumption is retained, the finding of a greater Stroop reduction in the suggestion rather than volition condition would imply that the HOT of an intention can have a causal influence on first order states by hindering cognitive control processes (a rare finding of conscious executive processing being less effective than unconscious, contrast Cleeremans, 2006).

A key relevant outcome neutral test is that subjects experienced the word blindness effect as more volitional in the volition condition than in the suggestion condition. This would be the evidence that there was a difference in the presence of relevant HOTs of intending. To the best of our knowledge, this study is the first that measured the subjects' conscious experience of control over 'word meaninglessness' to unravel whether such an experience feels like something that has been intentionally imagined or merely perceived. Investigating the phenomenological level of the participants' cognition can inform us whether their behaviour felt involuntary when the suggestion was active compared to the volitional control. Moreover, controlling the potentially confounding role of expectations is imperative (Braffman & Kirsch, 1999), so we implemented a self-report measure to gauge the participants` expectations about seeing the words as meaningless characters. If subjects reported different levels of expectation for producing a word blindness effect in the suggestion than in the volition condition, expectations alone may explain differences in Stroop reduction in the two conditions (Magalhães De Saldanha da Gama et al, 2013). In addition, we took the participants` subjective experiences of `word meaningfulness` to explore the extent to which voluntary and involuntary control can alter the conscious experiences of the world. The measures reflect the extent to which subjects subjectively responded to the suggestions and to the volitional request; they could therefore constitute the crucial test of whether suggestions and volitional requests are equally effective. However, as the apparent problem for cold control lies with the objective measure of Stroop reduction, it is the RT measures that form the crucial test. Finally, we

measured the `depth` of hypnosis to shed more light on the nature of the experienced state that accompanies the implementation of both types of control. This is an exploration, a sideline from the main point of the experiment, testing the assumption that the experience as of being in a hypnotic state, as interpreted by the participants, does not accompany post-hypnotic suggestion.

First, we report a pilot experiment using this procedure. While the results yielded moderate evidence against cold control theory, the procedure and analyses were not pre-registered. Further, there was not a strict stopping rule (albeit Bayesian analyses were used). Thus, the pilot study will serve as a basis for a proper pre-registered test of cold control theory.

Pilot Experiment

Methods

Participants. Thirty-three highly suggestible students of the University of Sussex, all proficient readers of English, attended the experiment in exchange for course credits or payment. Eleven participants were recruited in 2013 and twenty-two students were recruited in 2014. The students had been screened in group sessions for being highly suggestible prior to the study. Students scoring 9 or higher on the Waterloo-Stanford Group Scale of Hypnotic Susceptibility, Form C (WSGC; Bowers, 1993) were recruited to the study. Recruitment was terminated when highs stopped responding to the invitation emails. The participants granted their informed consent before participation and the Ethical Committee of the University of Sussex has approved the study.

Stimuli and apparatus. The stimuli of the experiment closely followed those used by Raz et al. (2002). The stimuli consisted of 4 types of color words (RED, BLUE, GREEN, and YELLOW) and 4 types of neutral words (LOT, SHIP, KNIFE, and FLOWER). The stimuli set of the congruent condition included the color words presented in colours matching the meaning of the words (e.g., RED in the color red). The incongruent items were color words displayed in colours mismatching the meaning of the word (e.g., RED in the color blue). The neutral words were length-matched to the color words and so all items had their corresponding presentation color (e.g., LOT presented always in red). All words were written in upper-case font and presented against a white background. The vertical visual angle of the stimuli was 0.5º, while the horizontal visual angle of the stimuli lied between 1.3º and 1.9º depending on the length of the word. The distance between the participants` eyes and the computer screen was approximately 65cm. The response keys used in the experiment were “V”, “B”, “N”, “M” for the colours red, blue, green and yellow, respectively. The keyboard buttons were not colour-labelled. The experiment was produced in and run by the software Experiment Builder (SR Research Ltd, Ottawa, ON, Canada).

Design and procedure. The study had a 3x3 within subjects design with the independent variables of the congruency type of the trial (congruent vs. neutral vs. incongruent) and the experimental condition (no suggestion, suggestion, volition). The proportion of congruent, neutral and incongruent trials was equal (33%) in each condition and the presentation of color and neutral words was frequency and length matched. The conditions

were counterbalanced across participants and the Stroop trials (144 per condition) were displayed in a random order within each condition.

The experiment took place in a small room with the experimenter present and only one participant at a time. After providing their informed consent to the study, the participants engaged in a practice Stroop task for 5 minutes. The participants were asked to lay their left middle finger on "V", left index finger on "B", right index finger on "N" and right middle finger on "M" while undertaking the Stroop task. The participants were told to focus on the middle of the screen during the Stroop task, where a black fixation cross appeared for 1500ms at the beginning of each trial. The fixation cross was replaced by one of the Stroop stimuli and remained on the screen until response. Finally, a feedback ("CORRECT" or "INCORRECT") flashed in black on the screen and then a new trial started with the fixation cross. The response to stimulus interval was 2000ms. This sequence remained constant among the experimental conditions.

Next, a hypnotic induction[4] with the post-hypnotic suggestion to see the words as meaningless characters (Raz et al., 2002) was delivered by the experimenter and the participants were told that a clap would activate, and a double clap would deactivate this suggestion. To test the effectiveness of the suggestion, the experimenter activated it by the clap and asked the participant to rate the meaningfulness of a presented coloured word on the following scale: 1 - completely clear, 2 - little unclear, 3 - unclear, 4 - completely unclear. Those who reported to see the word completely clear or little unclear received an additional instruction: "Notice how as you look at the word on the screen, you can look at it with the meaning fading to the background of your mind. We have found even when people consciously experience some meaning after this suggestion, they still process the words differently at a deeper level. You know you are capable of not reading meaning fully, remember how you have zoned out while reading a book.". Finally, the suggestion has been deactivated, and the participants have been brought back to wakefulness by a deinduction. For the exact wording of the protocol, see Appendix A.

Subsequently, the participants undertook the three experimental conditions in a random order. In the no suggestion condition, the participants were told to respond as fast and as accurately as they could, and they were asked not to make any attempt to see the words as gibberish or words of a foreign language. The suggestion condition started with a clap accompanied by a sentence highlighting that the suggestion had been activated. At the end of the condition, the suggestion was deactivated by the double clap. In the volition condition, the participants were requested to voluntarily reduce the Stroop interference:

"Highly hypnotisable individuals such as you have been shown to be able to eliminate the interference from the irrelevant word when under the influence of the post-hypnotic suggestion and even when the suggestion is given without hypnosis. We would like you to voluntarily strongly and clearly imagine the irrelevant words as gibberish, words of a foreign language so

[4] Although, according to the cold control theory, the usage of the induction procedure is not necessary to produce a hypnotic response to a suggestion, we included the induction in the protocol to make sure that the responses of the subjects can unambiguously be considered as hypnotic.

that no meaning can be taken from them. This is not a hypnotic suggestion and we have not hypnotised you for this part of the task. You'll notice we have not initiated a suggestion by clapping or giving any other cue. You have the ability to do that anytime you please, under your control, as effectively as you just did. Please now voluntarily remove meaning from the words. You can do this so that it is under your control, just by exercising your imagination. You can be aware it is your imagination at the same time as it produces powerful effects."

Throughout the experiment, we administered several self-report measures, and in each case, the experimenter read out loud the question and provided the answer options on a sheet for the participants. Before the start of the Stroop task in each condition, the participants reported their expectations on how certain they are that the words will be meaningless. When they finished the Stroop task, the following measures were taken: four items assessing the subjective experience of the meaningfulness of the words; a task to recall the words they have seen[5]; depth of hypnosis scale (Hilgard & Tart, 1966); an item gauging the experienced control over the meaningfulness of the words; a dichotomous question whether they perceived or imagined the words as meaningless[6]. For the exact questions and answer options see Appendix B. After finishing the last condition, the participants were thanked and debriefed.

Data analysis

Statistical analyses. We conducted all of our analyses with the statistical software R 3.3.1 (R Core Team, 2016). Since we had a fully within subjects design, we calculated difference scores so that we were able to test directly all of our hypotheses with Bayesian paired t-tests (we only conducted direct contrasts; i.e. not an omnibus *F* or *B* comparing the three conditions as the omnibus statistic would not be informative in terms of our hypotheses). Along with frequentist statistics, we calculated the corresponding Bayes factor (B) which was used as the basis of decision making in respect of the compared hypotheses.

Bayes factor. The Dienes and McLatchie (2018) calculator in the R environment was used to calculate the Bayes factors, which has a t-distribution as a likelihood function for the data, and we set the degrees of freedom of the theory to 10,000 in each analysis to have a likelihood function for the theory close to normal. The computation of the B requires the specification of the prediction of the two models that we intend to compare. We applied a half normal distribution with a mode of zero to model the predictions of the alternative hypotheses, as the tested hypotheses have directional predictions and assume that smaller effects are more probable than larger effects (Dienes, 2014). We report Bs in the following format: $B_{H(0, X)}$, in which H indicates that the model is half-normal, the first parameter (0) stands for the mode of the distribution and the second parameter (X) is the SD of the distribution. To specify the standard deviation of the alternative models, we applied the following strategies. Based on the meta-analysis of Parris, Dienes & Hodgson (2013) who have found that the word blindness suggestion roughly halves the interference effect of the baseline (no suggestion) condition, we employed half of the interference effect observed in the no suggestion condition as the SD of all models testing the difference between the suggestion and volition and the no suggestion

[5] The data regarding this question have not been utilised for this project.

[6] This question was omitted from the no suggestion condition

conditions. In order to test the traditional Stroop and interference effects, we used the average of the Stroop and interference effects found among studies containing the word blindness suggestion (See Table 1 of Parris et al., 2013). Concerning the self-report measures, we applied the rule of thumb of Dienes (2014) that suggests, in the absence of prior information, to halve the scale of measurement and use it as the SD of the one-sided model (if that matches scientific intuitions closely enough: In this case a population mean difference anywhere on the scales is not completely unreasonable).

Although, B is a continuous measure of evidence by definition, we used the convention of 3 and 1/3 to distinguish between no evidence and good enough evidence for the alternative and null hypotheses, respectively (Jeffreys, 1961). Moreover, we use the label of moderate evidence for the values between 3-10 or 1/3-1/10, and the label of strong evidence for Bs greater than 10 or smaller than 1/10, in order to highlight the strength of the evidence (Lee & Wagenmakers, 2013).

A Bayes factor is the strength of evidence for one model over another and thus depends on what the models are (Rouder, Morey, Verhage, Province & Wagenmakers, 2016; Rouder, Morey & Wagenmakers, 2016). We have endeavoured to keep the models simple and otherwise scientifically informed; nonetheless, the chosen parameters (e.g., the SD of a half-normal distribution) could be motivated in different ways. Therefore, to ascertain the robustness of our Bayesian conclusions to the SDs of the H1 models, we report a robustness region for each B, providing the range of SDs of the half-normal models that qualitatively support the same conclusion (using the threshold of 3 for moderate evidence for H1 and ⅓ for moderate evidence for H0) as the chosen SD[7]. The robustness regions are notated as: RR [x1, x2] where x1 is the smallest and x2 is the largest SD that gives the same conclusion.

Bayesian parameter estimation with 95% Credibility intervals. To explore the extent to which highs experience being in a hypnotic state when they respond to the post-hypnotic suggestion or the voluntary request, we applied parameter estimation rather than hypothesis testing. To conduct the estimation, we report the condition means of the depth of hypnosis with the 95% Credibility Intervals (CI). Note that the 95% CIs are numerically identical to the 95% Confidence Intervals as we employed uniform prior distributions.

Results

Data transformation. The data of three participants were partially missing (one participant had only response time data whereas two participants had only self-reported data), and therefore they were excluded from the analyses. Trials with errors were omitted from the analysis of the response times (RTs) data (4.7% in total from which 1.4% from the no suggestion, 1.9% from the suggestion and 1.5% from the volition conditions)[8]. Moreover, using the outlier exclusion criterion of Raz et al. (2002), we deleted RTs that were 3 standard deviations either above or below the mean (1% of the correct trials from which 0.2% from the

[7] Thanks to Balazs Aczel for this suggestion

[8] Note that we do not possess the raw data collected in 2013 anymore (only the RTs averaged across trials and within conditions and participants), therefore, these percentages have been based on the data collected from 22 participants in 2014.

no suggestion, 0.3% from the suggestion and 0.4% from the volition conditions). In order to test the congruency related effects, we computed new variables. We calculated the extent of interference effect (RT incongruent – RT neutral) in the different suggestion conditions for each participant. The interference effect was specifically identified by Parris et al. (2013) as the Stroop component most reliably affected by the word blindness suggestion.

Outcome neutral tests 1: Was there a Stroop effect and did the suggestion work? As expected, the RTs were the longest in the incongruent (M = 811, SD = 182) followed by the neutral trials (M = 766, SD = 177) and the fastest in the congruent trials (M = 729, SD = 173). Comparing the conditions revealed support for the Stroop interference ($t(29) = 6.34$, $p < .001$, M_{diff} = 45 ms, d_z = 1.16 , $B_{H(0, 62)} = 8.1*10^3$, RR[3, $1.47*10^5$]) and the Stroop effects ($t(29) = 8.09$, $p < .001$, M_{diff} = 82 ms, d_z = 1.48, $B_{H(0, 90)} = 7.4*10^5$, RR [5, $2.79*10^5$]). Also importantly, we found moderately strong evidence for the classical word blindness effect ($t(29) = 1.99$, p = .056, M_{diff} = 34 ms, d_z = 0.36, $B_{H(0, 30)}$ = 3.99, RR [15, 63]), as the extent of the Stroop interference was reduced from the baseline of 60 ms to 26 ms in the suggestion condition.

Outcome neutral tests 2: Did suggestion and volition conditions differ in experienced degree of control? The analysis of the experienced level of control over the meaningfulness of the words indicated that the instruction to imagine the word as meaningless characters triggered a process experienced as more controlled than the suggestion ($t(29) = 5.34$, $p < .001$, M_{diff} = 0.9, d_z = 0.98, $B_{H(0, 1.5)} = 5.4*10^3$, RR [0.07, $2.75*10^2$]). Although, the participants tended to report that they *perceived* the script as meaningless in the suggestion condition (64% of the participants reported that they perceived rather than imagined the meaninglessness) and they rather *imagined* it in the volition condition (57% of the participants reported that they imagined and not perceived the meaninglessness), the results remained insensitive concerning whether the two procedures are different in nature ($t(25) = 2.00$, p = .056, M_{diff} = 0.23, d_z = 0.39, $B_{H(0, 0.5)}$ = 2.78, RR [0.45, 4.8]).[9]

Crucial test: Is the suggestion equally effective for suggestion and volition conditions? Next, we tested the key prediction of the cold control theory by comparing the suggestion and volition conditions in terms of the RTs of interference effects, and the analysis yielded supporting evidence of a smaller interference effect in the suggestion condition ($t(29) = 2.03$, p = .052, M_{diff} = 25 ms, d_z = 0.37, $B_{H(0, 30)}$ = 4.00, RR[11, 50]). The participants managed to decrease the interference by 34 ms in the suggestion condition and only by 9 ms in the volition one compared to the no suggestion condition. However, the evidence regarding the difference between the volition and no suggestion conditions remained insensitive ($t(29) = 0.51$, p = .611, M_{diff} = 9 ms, d_z = 0.09, $B_{H(0, 30)}$ = .74, RR[0, 81]). Table 1 displays the descriptive

[9] Note that the corresponding item of the questionnaire had only two levels (either imagination or perception), but we analysed the data as a continuous variable to make it comparable with the measure we will use in the pre-registered experiment. The Supplementary Materials include an analysis of these data that considers this item as a dichotomous variable and aims to estimate the effect size. The results are in accordance with those in the main text, namely, the estimation revealed that the effect size lies within a broad range covering values larger as well as smaller than 1(OR = 4, 95% CI[0.64-25.02]).

statistics of the RTs in the congruency conditions broken down by the experimental conditions. Figure 1 depicts the distribution of the Interference scores in the three experimental conditions.

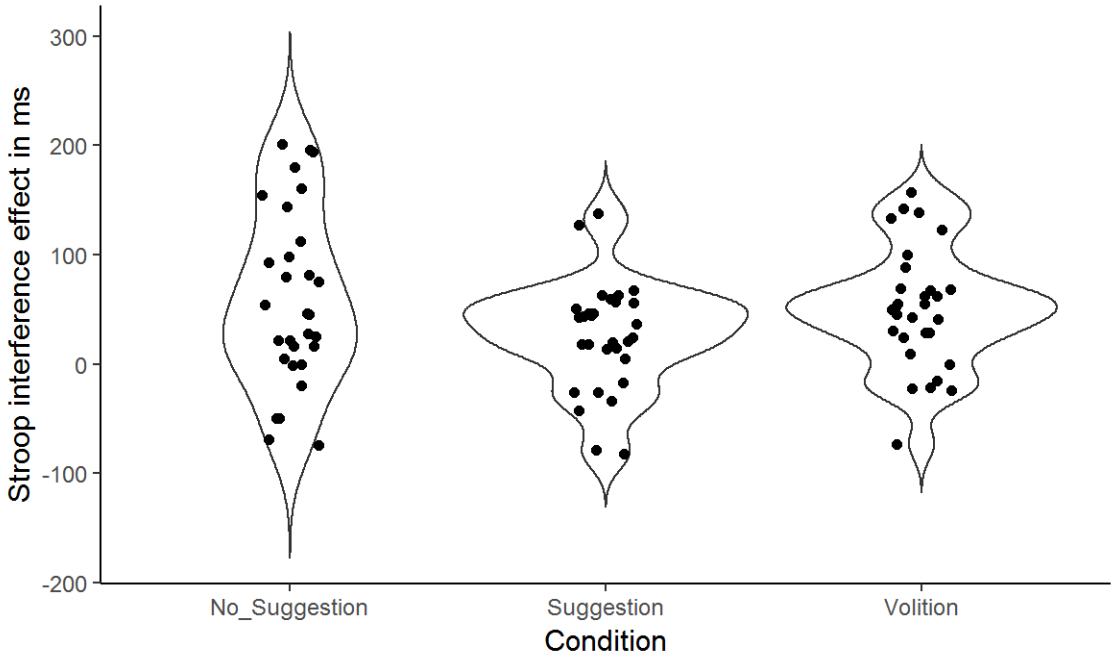

Figure 1. Violin plot portraying the distribution of interference scores in the three experimental conditions. The black dots indicate individual data points; one dot represents the interference score of a single participant.

The expectations to see the words as meaningless characters were raised in both of the suggestion ($t(29) = 5.99$, $p < .001$, $M_{diff} = 1.7$, $d_z = 1.09$,$B_{H(0,\ 2.5)} = 3.19*10^4$, RR[0.11, $5.42*10^2$]) and the volition conditions ($t(29) = 5.65$, $p < .001$, $M_{diff} = 1.58$, $d_z = 1.03$, $B_{H(0,\ 2.5)} = 1.27*10^4$, RR[0.11, $4.93*10^2$]) compared to the no suggestion condition. Yet, these increments were comparable (See Table 1) and there is evidence for no difference between the suggestion and volition conditions ($t(29) = 0.38$, $p = .710$, $M_{diff} = 0.12$, $d_z = 0.07$, $B_{H(0,\ 2.5)} = 0.18$, RR[1.33, Inf]) implying that the difference between the suggestion and the volition condition in terms of the magnitude of the word blindness effect is not simply the product of varying expectations (we have not regarded this as an outcome neutral test, in that if there had been an difference in expectancies we still could have conducted a version of the crucial test by partialling out expectancy effects).

Supporting test of interest: Do suggestions and volitional requests produce the same subjective response? We investigated whether the manipulation of the meaninglessness of the words was successful on the subjective level of the participants, and whether the posthypnotic suggestion and volitional request produced similar subjective responses. The descriptive statistics about the subjective experience of meaninglessness are shown in Table 2 for each question and condition separately. Note that the first question was phrased reversed compared to the other three questions, thus, smaller values indicate stronger experience of meaninglessness in that case. The results of the phenomenological data on how the meaninglessness was sensed were only partly in line with the findings of the RTs. Statistically

speaking, we found strong evidence favoring suggestion and volition over no-suggestion in creating vivid experiences of meaninglessness. Although, the participants reported that they sensed more meaningless words in the suggestion than in the volition condition (in case of three measures from the four) the evidence regarding the advantage of the posthypnotic suggestion over volition remained insensitive in each case.

Q1. We found strong evidence for a difference between no-suggestion and each of the suggestion ($t(29) = 5.78$, $p < .001$, $M_{diff} = 45.0\%$, $d_z = 1.05$, $B_{H(0, 50)} = 2.04*10^4$, RR[3, $1.42*10^4$]) and volition conditions ($t(29) = 4.29$, $p < .001$, $M_{diff} = 36.8\%$, $d_z = 0.78$, $B_{H(0, 50)} = 4.15*10^2$, RR[4, $9.45*10^3$]). However, the evidence is insensitive in respect of the difference between these latter two conditions($t(29) = 1.56$, $p = .13$, $M_{diff} = 8.2\%$, $d_z = 0.29$, $B_{H(0, 50)} = 0.65$, RR[0, 99]).

Q2. The results revealed strong evidence in favour of the difference between no suggestion and suggestion conditions ($t(29) = 4.69$, $p < .001$, $M_{diff} = 34.1\%$, $d_z = 0.86$, $B_{H(0, 50)} = 1.10*10^3$, RR[3, $9.65*10^3$]) and moderate evidence favouring a difference between no suggestion and volition conditions: ($t(29) = 2.64$, $p = .013$, $M_{diff} = 19.6\%$, $d_z = 0.48$, $B_{H(0, 50)} = 6.90$, RR[5, $1.23*10^2$]). The data show insensitivity whether the suggestion and volition conditions differ ($t(29) = 2.04$, $p = .0502$, $M_{diff} = 14.5\%$, $d_z = 0.37$, $B_{H(0, 50)} = 1.99$, RR[31, $3.14*10^2$]).

Q3. The results indicate strong evidence favouring a difference between no suggestion and suggestion conditions ($t(29) = 3.66$, $p < .001$, $M_{diff} = 24.5\%$, $d_z = 0.67$, $B_{H(0, 50)} = 71.47$, RR[3, $1.35*10^3$]) and between no suggestion and volition conditions ($t(29) = 3.32$, $p = .002$, $M_{diff} = 28.7\%$, $d_z = 0.61$, $B_{H(0, 50)} = 36.9$, RR[4, $7.33*10^2$]). Moreover, we have strong evidence that the suggestion and volition do not differ ($t(29) = -.59$, $p = .557$, $M_{diff} = -4.3\%$, $d_z = -0.11$, $B_{H(0, 50)} = 0.09$, RR[14, Inf]).

Q4. Similarly to Q2, we found strong evidence for a difference between the no suggestion and suggestion conditions ($t(29) = 5.31$, $p < .001$, $M_{diff} = 34.4\%$, $d_z = 0.97$, $B_{H(0, 50)} = 5.51*10^3$, RR[3, $1.05*10^4$]), moderate evidence for a difference between no suggestion and the volition condition ($t(28) = 2.60$, $p = .015$, $M_{diff} = 17.0\%$, $d_z = 0.48$, $B_{H(0, 50)} = 5.71$, RR[4, 100]) and insensitive evidence for the difference between suggestion and volition conditions ($t(28) = 2.05$, $p = .049$, $M_{diff} = 15.2\%$, $d_z = 0.38$, $B_{H(0, 50)} = 2.11$, RR[33, $3.35*10^2$]).

Exploration: Do highs experience being in a hypnotic state when they respond to the post-hypnotic suggestion? The suggestion might not be truly *post*-hypnotic as the participants reported being relaxed or even hypnotised ($M = 1.37$, 95% CI[1.06 – 1.67]) when the post hypnotic suggestion was triggered, indicating that a hypnotic state might have been experienced. Seemingly, voluntary control does not involve experiencing this hypnotic state, as the upper bound of the 95% CI ($M = 0.8$, 95% CI [0.52, 1.08]) barely exceeded the level of being relaxed.

Table 1

Summary Table about the Means of the RTs and Self-report Measures in the three Experimental Conditions

Category	Item (scale)	Experimental condition		
		No Suggestion	Suggestion	Volition
Response times (RTs)	Incongruent (ms)	853 (187)	775 (207)	805 (213)
	Neutral (ms)	793 (183)	749 (205)	755 (198)
	Congruent (ms)	748 (141)	712 (212)	726 (214)
Expectations	Expecting the words to be meaningless (0-5)	0.59 (1.03)	2.29 (1.40)	2.17 (1.28)
Experienced Control	Control over meaningfulness (0-3)	2.33 (0.84)	1.1 (0.69)	2 (0.71)
	Perception vs. Imagination (% of perception)	-	64% (49)	43% (50)
Depth of hypnosis	Depth of hypnosis during the task (0-3)	0.43 (0.5)	1.37 (0.81)	0.8 (0.76)

Note. The Standard Deviations (SD) of the means are shown within the brackets.

Table 2

Summary Table of the four Items Measuring the Subjective Experience of Meaninglessness

Item	Experimental condition		
	No suggestion	Suggestion	Volition
Q1: „Was the meaning of the words on the screen completely clear to you"	81.8% (25.9)	36.8% (28.5)	45% (35)
Q2: „Were you aware of only an unclear meaning of the words on the screen"	13.7% (25.7)	47.8% (34.3)	33.3% (30.6)
Q3: „Were you just aware of the color and had no idea of what script of the words were written in"	20.9% (29.3)	45.3% (31.8)	49.6% (33.7)
Q4: „Were the words on the screen written in a clear yet meaningless script"	12.6% (23.1)	47% (30.5)	30% (31)

Note. The Standard Deviations (SD) of the means are shown within the brackets.

Discussion

In this experiment we aimed to discover whether highly suggestible people can produce the word-blindness effect outside of hypnotic context by voluntarily imagining the words as meaningless. The results provided moderate to strong evidence supporting the successfulness of the experimental manipulations in outcome neutral tests. Most importantly, the classical word-blindness effect was replicated, and the volitionally induced meaninglessness was experienced as voluntary compared to its post-hypnotic counterpart. Although, the second measure assessing the nature of control was not sensitive, the amount of evidence was close to the convention of 3 (B = 2.78), suggesting that the process of meaninglessness was experienced as imagined in the volitional condition and as perceived in the suggestion condition. This difference between the two measures of control might be due to the fact that the latter item was

only dichotomous and so not sensitive enough to capture the mild difference in how people sensed the meaninglessness. Therefore, a continuous item assessing the nature of control would be more appropriate. In sum the outcome neutral tests were satisfied, and we can proceed with the crucial test.

The main results revealed that volitionally induced control by imagining the words as meaningless characters did not enhance performance on the Stroop task to the same extent as the post-hypnotic suggestion. The evidence remained insensitive regarding the efficiency of voluntary control. Theories of hypnosis that regard the unique hypnotic nature of a response is constituted simply by a change in monitoring HOTs, such as the simplest versions of the cold control theory, cannot account for these data as it seems that the suggestion allowed highly suggestible people to more efficiently resolve conflict than it was possible for them through non-hypnotic means. Thus, retaining the assumption of cold control that hypnotic vs non-hypnotic action differ primarily in accurate HOTs of intending, it seems HOTs of intention, at least the intention to create the experience of meaninglessness, can disrupt task performance; thus, HOTs can have causal effects on first-order states (cf. Rosenthal, 2008). Incidentally, this finding depicts a counterexample for the concept that conscious cognitive control processes are superior to unconscious ones (Cleeremans, 2006), given the assumption that the hypnotic and volitional processes differ in the conscious status of the intentions.

A plausible candidate that can influence the two types of control to produce different results is the expectation about their efficiency, which is a well-known predictor of behaviors elicited by suggestions (Kirsch, 1985; Braffman & Kirsch, 1999). Our scale measuring the participants` expectations emphasised the experience of `word meaninglessness` and the results derived from these data indicate that expectancy was the same in the volitional and the suggestion condition, implying that expectancies of meaninglessness alone cannot account for the difference in the effectiveness in producing the word blindness effect in the two conditions. However, the underlying mechanism of the word blindness suggestion may not be related or restricted to visual processing, which would call into question the relevance of the scale we used in gauging expectations. Recent behavioral and neural studies of the word blindness suggestion provide evidence for the notion that the suggestion affects cognitive control processes rather than the visual input stream, thus, the successfulness of the suggestion might lie in the enhanced conflict resolution and not in the dampened perception of the meaning of the words (Casiglia et al., 2010; Augustinova & Ferrand, 2012; Parris et al., 2013; Zahedi, Stuermer, Hatami, Rostami & Sommer, 2017)[10]. In line with this view, the suggestion, in our experiment, seemed to influence the performance mostly on the incongruent trials by reducing it compared to the no suggestion and volition conditions. Therefore, a measure of the expectations should aim to assess the beliefs of people about the efficiency of voluntary and involuntary control and not solely focus on the experience of meaningfulness. Incidentally, this new design will also allow us to critically evaluate the simplest form of the response expectancy theory (Kirsch, 1985), which claims that expectations are the single driving factors of hypnotic

[10] Note that a study recording event-related brain potential components demonstrated that the word blindness suggestion modulated P100, which known to be related to the processing of visual stimuli (Raz, Fan, & Posner, 2005)

responses. Were the extent of interference different in volition and suggestion conditions while the expectations to see the words as meaningless characters, and to exert control be comparable in the two conditions, the response expectancy theory will need to be revised.

Cold control theory asserts that to create the experience of meaninglessness the subjects need to have a first-order intention to produce it by engaging in an active strategy. The exact mechanism of this strategy is a mystery currently, but several empirical studies have been conducted on this issue that can help us exclude possible explanations. For instance, as mentioned above, it has been demonstrated that neither the dampening of the visual input (Raz et al., 2003), nor the inhibition of meaning processing can be responsible for the whole word blindness effect (Augustinova & Ferrand, 2012; Parris et al., 2013; Zahedi, et al., 2017). These findings are in consonance with the fact that a posthypnotic suggestion that specifically requires highs to lose the ability of reading did not result in the reduction of the Stroop interference effect; it appears that the suggestion needs to include a phrase such as "words are meaningless gibberish" to be successful in enhancing performance (MacLeod, 2011). Consequently, the meaning of the words must be processed to some extent even in the suggestion condition indicating that the information that the scripts of the stimuli are in fact meaningful is available to the participants. This strikes a chord with the idea that highs need to hold two models of reality in the suggestion condition as they do in the volition one. In one model, the meaning can be extracted from the words, as they are meaningful, whereas in the other counterfactual model, this is not possible. Entertaining multiple models is the basis of pretence and imagination (Perner, 1991); not being aware that one intended to engage in pretence or imagination would, according to cold control theory, lead to the experience of hallucination or delusion.

Pre-registered Experiment

In this experiment, we intend to replicate the pilot experiment as a multi-lab pre-registered replication project to increase the evidential value (by virtue of a larger sample) of our data. Moreover, we introduce a new item measuring the participants` expectations to how easily they can overcome the interference in each condition. With this, we aim to address more thoroughly whether involuntary control can be more efficient than the voluntary counterpart beyond the influence of expectations. In addition, we measure the depth of hypnosis during induction and after de-induction to provide the participants a baseline against which they may compare their experienced depth of hypnosis during the Stroop task.

The questions that will be addressed are those of the pilot study: (a) Outcome neutral test: Was there a Stroop effect and did the suggestion work?; (b) Outcome neutral test: Did suggestion and volition conditions differ in experienced degree of control?; (c) Crucial test: Is the suggestion equally effective for suggestion and volition conditions in reducing Stroop interference as measured in RTs (taking into account expectations)?; (d) Supporting test of interest: Do suggestions and volitional requests produce the same subjective response?; (e) Side interest: Do highs experience being in a hypnotic state when they respond to the post-hypnotic suggestion? Is the depth of hypnosis different for the suggestion and volition conditions? In addition, we will explore whether the post-hypnotic suggestion produces a subjective

experience of being in hypnosis while it is activated: Traditionally it is assumed that a post-hypnotic suggestion, by virtue of being post-hypnotic, does not involve the experience of being in a hypnotic state at the time of responding. Furthermore, we will estimate the extent to which self-reported measures of the feeling of voluntariness converge to assess their validity. Finally, we will run an exploratory correlation analysis to estimate the extent to which the participants are engaging in the same cognitive strategy in the volition and suggestion conditions. The results of this analysis can be used to estimate the sample size of a future study that aims to reach a good enough evidence supporting the idea that the underlying mechanisms of the responses are either the same or different in the two conditions.[11]

Methods

Participants. Labs from the following institutions recruited participants throughout the academic years of 2018-19 and 2019-20: University of Sussex, School of Psychology (US) Lancaster University Department of Psychology (LaU).[12] We invited highly suggestible students who are proficient readers of English to attend the experiment in exchange for course credits or payment. The amount of payment and course credits will be in line with the regulations of the local universities (£10 at US, £7 at LaU). The suggestibility of the students was gauged by the Sussex Waterloo Susceptibility to Hypnosis scale (SWASH; Lush, Moga, McLatchie & Dienes, 2018) prior to participation and the threshold of high suggestibility was based on the composite SWASH score (top 15% of the population) of the first year psychology students at US (year 2018)(matching typical percentages used to define "high" in the literature; Barnier & McConkey, 2004; Anlló, Becchio & Sackur, 2017). This score was 5.35 on a scale from 0 to 10, which is in harmony with the results of Lush and his colleagues (2018) who found in a large sample of students that 15% of the participants scored 5 or above on the SWASH. The students at LaU were also screened by the SWASH and the threshold defined at US was used to identify highs. The participants were asked to read an information sheet about the study and consent to the terms of participation before starting the experiment. The local Ethical Committees have approved the study.

Since we relied solely on Bayes factors to draw statistical inference, we used optional stopping (Rouder, 2014). The minimum sample size was set at 20 and then we conducted all of the crucial analyses after roughly every subject (as different labs are involved there were some clumping). We stopped collecting data when all outcome neutral tests provided at least moderate evidence supporting that they have been successful, or else have failed, and when the main test of the study, comparing volition and suggestion conditions, also became sensitive (i.e. the B either larger than 3 or smaller than 1/3). A sample size estimation based on the data of the pilot study suggested that we need around 40 participants to show supporting evidence for the null, if the difference between the samples is 0 ms and if the standard deviation of the crucial measure is the same in this study as observed in the pilot study (See Supplementary Materials for details of the analysis). We registered that if any of the four analyses remain insensitive with 60 participants, we desist from recruiting more participants. We began to

[11] Thanks to an anonymous reviewer for suggesting this analysis.

[12] We planned to recruit participants at the University of Bournemouth (UB) and at Lund University (LuU); however, for various reasons we did not manage to collect data at these universities.

recruit participants after the date of in-principle acceptance (autumn term of 2018) and stopped when all of the specified analyses reached sensitivity).

Stimuli and apparatus. The materials of the registered experiment were identical to those used in the pilot. We employed OpenSesame (Mathôt, Schreij, & Theeuwes, 2012) to compile and run the Stroop task part of our experiment. The resolution of the applied computer screens was either 1280x1024 or adjusted to these values so that the size of the presented stimuli remained constant across labs.

Design and procedure. The design and procedure of the registered experiment was in accordance with those of the pilot experiment. To ensure that none of our participants possesses color vision deficiency, we included a statement in the recruitment letter that only people with intact color vision can attend the study. In addition, we made three modifications in the instruction of the volition condition. Namely, we put the sentence "You have the ability to do that anytime you please, under your control, as effectively as you just did." before the following two sentences "You have the ability to do that anytime you please, under your control, as effectively as you just did. You'll notice we have not initiated a suggestion by clapping or giving any other cue.", in order to avoid the implication that the participants have the ability to activate the suggestion without the clap even in the volition condition. Moreover, we replaced the "as effectively as you just did" part with "as effectively as you did it during the hypnotic induction" to make it clear that we refer to the word blindness test that was done during the induction procedure. In addition, we added an extra sentence highlighting that the outcome of a suggestion can be achieved through voluntary means. See Appendix C for the final instruction of the volition condition.

In addition, we introduced four amendments in the self-report measures: (a) we included a new item at the beginning of each Stroop condition measuring the expectations about the efficiency to control the interfering information; (b) we replaced the dichotomous answer option of the question measuring the experienced nature of meaninglessness by a continuous scale; (c) we omitted the question concerning the recall of the words; (d) we replaced the item measuring the depth of hypnosis to the one which is used in the SWASH (2018). See Appendix D for the new items.

Data analysis

The steps of the data analysis closely followed those of the pilot experiment, including the exclusion criterion regarding RT data and how we draw conclusions based on the results of the Bayes factors (e.g., outcome neutral tests and the crucial test).

In terms of Bayes factor calculation, we retained the parameters of the H1 models of the analyses with RTs. However, to increase the sensitivity of our tests with the self-report measures in comparing the suggestion and volition conditions, we were informed by the results of the pilot experiment. Specifically, given the score of pilot subjects in the volition condition we can determine the maximum predicted change allowed with respect to the suggestion condition. For example on a 0-3 scale of experienced control (0 = no control, 3 = complete control), the volition condition in the pilot study scored 2.0, so the suggestion condition could

experience up to 2 rating units of less control (as it is expected to be smaller than the mean of the volition condition). The maximum difference between conditions was thus estimated as about 2 for the new experiment, and the SD of the half normal was set as max/2 = 1 rating unit (Dienes, 2014). For expectations (both questions), the SD was set at 1.4 by this process, and the SD for four items assessing subjective experiences as meaningless was set at 30.

We had three outcome neutral tests to ensure that our experiment is able to test the proposed question. All of these tests had to provide evidence favouring the alternative hypotheses to allow us to carry on with the main analyses. We tested the presence of the Stroop interference effect while ignoring the influence of the type of the control. We tested that the experienced degrees of control is higher in the volition than in the suggestion condition. Finally, we assessed whether the suggestion reproduced the word blindness effect by reducing the extent of Stroop interference in the suggestion condition compared to the no suggestion condition.

The crucial test of the experiment was the comparison of the suggestion and volition conditions in terms of the extent of Stroop interference. Thus, we based our final conclusion on this statistical test. In addition, we planned to run a further analysis to control for the effect of expectations, conditional on the test of difference in expectations between the volition and suggestion conditions. If the evidence does not reach ⅓ to support the claim that the beliefs about the efficiency of suggestion and volition are identical, we would conduct the following secondary test. We would use a regression model with the difference in the interference score between conditions (suggestion vs. volition) as the dependent variable and the difference for expectations (suggestion vs. volition) as independent variables (if none of the expectation measures provide evidence for the null then the outlined analysis would be done as a multiple regression with both of the measures as predictors in the model). To conduct the crucial analysis while partialling out the effect of expectations, we would test the intercept of the regression line against zero. By this, we could examine the difference between the suggestion and volition effects while controlling for the effect of expectations. The parameters of this Bayes factor analysis would be the same as the one testing the main question of the study.

The following are not the main point of the experiment and are thus of secondary interest. We tested whether post-hypnotic suggestion and volitional request produce the same subjective responses in exactly the same way as was done in the pilot. We estimated hypnotic depth for no suggestion, suggestion and volition conditionswith 95% CIs assuming a uniform prior over the scale range. To explore whether these conditions differ in hypnotic depth, we calculated the Bayes factor for the following comparisons: difference between no suggestion, suggestion and volition conditions. We modelled H1 with a half-normal, and SD of 0.86 rating unit based on the difference between suggestion and volition conditions in the pilot (we used the difference between the volition and suggestion condition means after adjusting it according to the lengths of the new and old scales).

To estimate the convergent validity of the self-report measures of involuntariness, we calculated the correlation and 95% CIs of the “level of control” and “experienced nature of meaninglessness” items on the difference scores of the volition and suggestion conditions. We

can assess whether people changed the conscious status of the intention to imagine by the difference between volition and suggestion conditions in the experienced nature of meaninglessness item (i.e. experienced as imagination vs perception). As "imagination" is not mentioned in the volition instructions (unlike in the pilot), this item tests whether subjects report a change that was not directly instructed but should still occur according to cold control theory. As this item has a 4-point scale as the degree of control scale does, we tested with the same model of H1 (i.e. SD = 1 unit). We calculated the correlation and 95% CI between the extent to which subjects can reduce the interference in the suggestion and volition conditions.

Results

Data transformation. In total, we recruited 66 participants from which we needed to exclude 18 participants for multiple reasons. For the first 9 participants, we did not use the appropriate item to measure their experienced control over their response. The exclusion of these participants and the update of the control item were approved by the editor (for the final item of the control measure see Appendix D.). Moreover, we needed to omit one more person as their RT data file was corrupted, and 8 people who were not highs and were erroneously recruited due to a mistake in one of the SWASH databases. All analyses are done on the data of the remaining 48 highly suggestible people (36 females, 1 unknown, M_{age} = 20.32, SD_{age} = 4.07) from which 44 were recruited at US and 4 at LaU.

Following the steps of the analysis of the pilot experiment, trials with errors were excluded from the analysis of the response times (RTs) data (6.9% in total from which 2.10% from the no suggestion, 2.06% from the suggestion and 2.09% from the volition conditions). Again, we omitted RTs that were at least 3 standard deviations either above or below the mean (1.04% of the correct trials from which 0.31% from the no suggestion, 0.37% from the suggestion and 0.36% from the volition conditions). Finally, we subtracted one from the responses to the items of the questionnaires with scales starting with 1, so that all scales start from 0.

Outcome neutral tests 1: Was there a Stroop interference effect and did the suggestion work? The pattern of the RTs followed that of the pilot experiment. The RTs were the longest in the incongruent (M = 816, SD = 139) followed by the neutral trials (M = 735, SD = 108) and the quickest in the congruent trials (M = 697, SD = 109). We found evidence for the Stroop interference ($t(47) = 10.52$, $p < .001$, M_{diff} = 80 ms, $d_z = 0.53$, $B_{H(0, 62)} = 4.40*10^{11}$, RR[3, $2.89*10^4$]) and for the Stroop effects ($t(47) = 14.01$, $p < .001$, M_{diff} = 118 ms, $d_z = 0.82$, $B_{H(0, 90)} = 1.39*10^{16}$, RR [4, $4.34*10^4$]). Comparing the extent of the Stroop interference effect in the no suggestion and suggestion conditions revealed moderately strong evidence for the classical word blindness effect ($t(47) = 2.06$, $p = .045$, M_{diff} = 28 ms, $d_z = 0.35$, $B_{H(0, 30)} = 4.42$, RR [11, 62]).The Stroop interference was 100 ms in the former and 72 ms in the latter condition.

Outcome neutral tests 2: Did suggestion and volition conditions differ in experienced degree of control? We found strong evidence supporting that the participants experienced more control over the meaningfulness of the words when they responded to the volitional request than when they responded to the suggestion ($t(47) = 4.64$, $p < .001$, M_{diff} =

0.58, d_z = 0.76, $B_{H(0, 1)}$ = 1.8*10^3, RR [0.05, 172]). Moreover, the participants experienced the effect of the meaninglessness in the suggestion condition mostly as *perception*, whereas they experienced it in the volition condition mostly as *imagination* (See Table 3 for descriptive statistics). Nonetheless, we only found anecdotal evidence for the difference between the volition and the suggestion conditions (t(47) = 2.12, p = .039, M_{diff} = 0.32, d_z = 0.31, $B_{H(0, 1)}$ = 2.53, RR [0.82, 8.06]). Finally, we estimated the correlation of the two experience of control measures using the Kendall`s τ method as it is robust to the violation of the assumption of normality. We computed the 95% Credibille Interval of the estimate with the *credibleIntervalKendallTau* R function (van Doorn, Ly, Marsman, and Wagenmakers, 2016). The two items measuring whether the participants experienced control over their responses were associated only to a small extent and the possible population effect sizes lie within a rather wide range of values (τ =.07, 95% CI [-.12, .25]).

Crucial test: Is the suggestion equally effective for suggestion and volition conditions? To test a central prediction of the cold control theory, we compared the extent of the Stroop interference effect between the suggestion and the volition conditions. The test yielded good-enough evidence supporting the model predicting no difference (t(47) = -0.38, p = .706, M_{diff} = -4 ms, d_z = -0.07, $B_{H(0, 30)}$ = 0.27, RR[23, Inf]). Moreover, there is good enough evidence regarding the difference between the volition and the no suggestion conditions (t(47) = 2.17, p = .035, M_{diff} = 32 ms, d_z = 0.38, $B_{H(0, 30)}$ = 5.35, RR[11, 88]). Table 3 shows the means and SDs of the RTs in the congruency conditions broken down by the experimental conditions. Figure 2 depicts the distribution of the interference scores in the three experimental conditions. For a violin plot demonstrating RTs broken down by the experiemental conditions and congruency types, see the Supplementary materials (Figure S2).

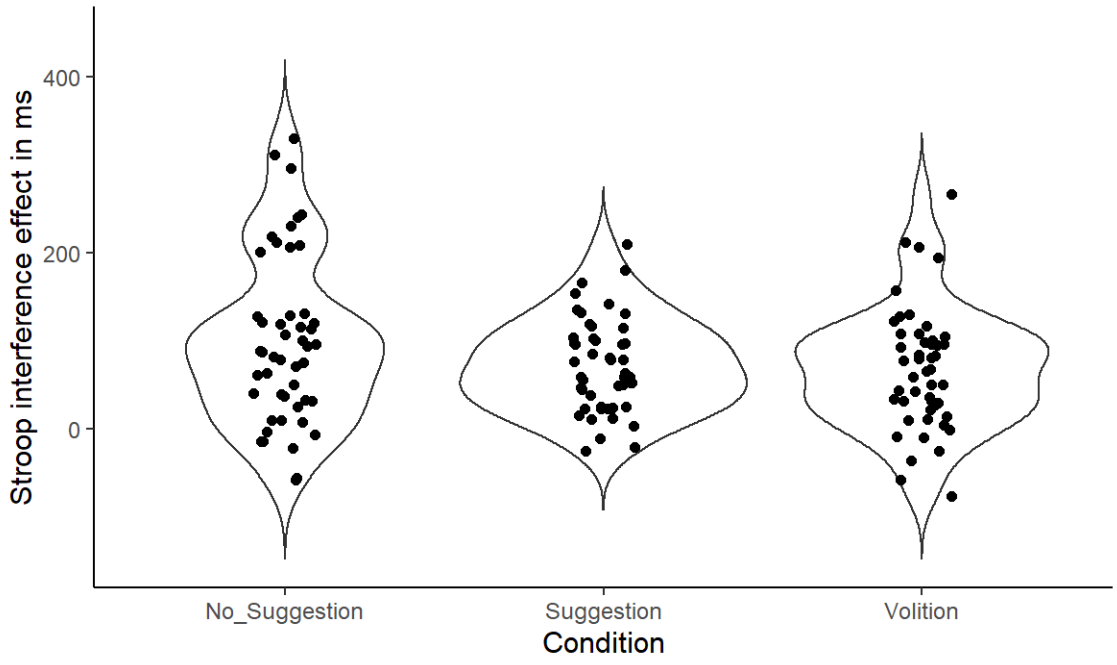

Figure 2. Violin plot depicting the distribution of interference scores in the three experimental conditions.

Importantly, we did not need to partial out the effect of the expectancies since we found supporting evidence for no difference between the suggestion and the volition conditions for both items. For the item measuring the expectations to experience the words as meaningless: $t(47) = -0.33$, $p = .743$, $M_{diff} = -0.06$, $B_{H(0, 1.4)} = 0.10$, RR[0.5, Inf]. For the item gauging the expectations that naming the color of the words will be easy: $t(47) = -0.99$, $p = .328$, $M_{diff} = -0.19$, $B_{H(0, 1.4)} = 0.07$, RR[0.3, Inf]. For the first item, both the suggestion ($t(47) = 7.05$, $p < .001$, $M_{diff} = 1.58$, $B_{H(0, 1.4)} = 5.74*10^6$, RR[0.1, $5.47*10^2$]) and the volitional request ($t(47) = 9.41$, $p < .001$, $M_{diff} = 1.65$, $B_{H(0, 1.4)} = 1.40*10^{10}$, RR[0.1, $5.90*10^2$]) elevated the expectations compared to the no suggestion condition. See Table 3 for the descriptive statistics. For the second item, the evidence remained insensitive for both the suggestion ($t(47) = 0.39$, $p = .698$, $M_{diff} = 0.09$, $B_{H(0, 1.4)} = 0.24$, RR[1.0, Inf]) and the volitional request ($t(47) = 1.58$, $p = .121$, $M_{diff} = 0.28$, , $B_{H(0, 1.4)} = 0.81$, RR[0, 3.4]) in raising the expectations compared to the no suggestion condition.

Supporting test of interest: Do suggestions and volitional requests produce the same subjective response? We tested whether responding to the suggestion and to the volitional request was accompanied by a comparable phenomenology, namely the subjective experience of meaninglessness. The results of the subjective reports were mostly in line with the RTs as we found strong evidence for all four measures that the experience of meaninglessness was elevated by the suggestion and the volitional request compared to the no suggestion baseline. The tests revealed evidence supporting the claim that one experiences the same level of meaninglessness while responding to the suggestion and to the volitional request.

Q1. "*Was the meaning of the words on the screen completely clear to you*?" We found strong evidence for a difference between the no suggestion and the suggestion conditions ($t(47) = 6.47$, $p < .001$, $M_{diff} = 29.8\%$, $B_{H(0, 30)} = 8.27*10^5$, RR[2, $1.01*10^4$]), and between the no suggestion and the volition conditions ($t(47) = 6.91$, $p < .001$, $M_{diff} = 30.8\%$, $B_{H(0, 30)} = 3.62*10^6$, RR[2, $1.06*10^4$]). Moreover, there was evidence supporting the null effect in respect of the difference between the suggestion and the volition conditions ($t(47) = -0.34$, $p = .737$, $M_{diff} = -0.99\%$, $B_{H(0, 30)} = 0.13$, RR[12, Inf]).

Q2. "*Were you aware of only an unclear meaning of the words on the screen*?" Again, the results indicate strong evidence in favour of the difference between the no suggestion and the suggestion conditions ($t(47) = 6.26$, $p < .001$, $M_{diff} = 29.4\%$, $B_{H(0, 30)} = 4.05*10^5$, RR[2, $9.89*10^4$]), and between the no suggestion and the volition conditions ($t(47) = 7.16$, $p < .001$, $M_{diff} = 28.7\%$, $B_{H(0, 30)} = 8.17*10^6$, RR[2, $9.93*10^3$]). We found strong evidence supporting that the suggestion and the volition conditions do not differ ($t(47) = -0.19$, $p = .848$, $M_{diff} = 0.7\%$, $B_{H(0, 30)} = 0.14$, RR[13, Inf]).

Q3. "*Were you just aware of the color and had no idea of what script of the words were written in?*" The comparisons revealed strong evidence favouring a difference between the no suggestion and the suggestion conditions ($t(47) = 4.41$, $p < .001$, $M_{diff} = 22.8\%$, $B_{H(0, 30)} =$

$1.04*10^3$, RR[2, $6.47*10^3$]), as well as between the no suggestion and the volition conditions ($t(47) = 4.71$, $p < .001$, $M_{diff} = 22.9\%$, $B_{H(0, 30)} = 2.54*10^3$, RR[2, $6.84*10^3$]). We found moderate evidence for no difference between the suggestion and the volition conditions ($t(47) = 0.01$, $p = .995$, $M_{diff} = 0.0\%$, $B_{H(0, 30)} = 0.12$, RR[10, Inf]).

Q4. "*Were the words on the screen written in a clear yet meaningless script*?" Similarly to the other measures, there was strong evidence supporting the difference between the no suggestion and the suggestion conditions ($t(47) = 5.32$, $p < .001$, $M_{diff} = 28.5\%$, $B_{H(0, 30)} = 1.89*10^4$, RR[2, $9.12*10^3$]), moderate evidence for a difference between the no suggestion and the volition conditions ($t(47) = 5.34$, $p < .001$, $M_{diff} = 25.7\%$, $B_{H(0, 30)} = 1.96*10^4$, RR[2, $8.23*10^3$]), and there was evidence for the absence of the difference between the suggestion and the volition conditions ($t(47) = 0.51$, $p = .611$, $M_{diff} = 2.8\%$, $B_{H(0, 30)} = 0.26$, RR[23, Inf]).

Exploration 1: Do highs experience being in a hypnotic state when they respond to the post-hypnotic suggestion? Applying the new measure of hypnotic depth, we found again that the reported level of hypnotic depth was the lowest in the no suggestion condition ($M = 0.95$, 95% CI[0.64 – 1.26]), followed by the volition condition ($M = 1.84$, 95% CI[1.44 – 2.25]), and it was the highest in the suggestion condition ($M = 2.47$, 95% CI[2.12 – 2.82]). Similarly to the pilot study, these results imply that the participants' responses to the suggestion might not have been *post*-hypnotic as they reported themselves to be stronger than slightly hypnotised during the Stroop task. Interestingly, the participants also reported to be slightly hypnotised in the volition condition. Comparing the conditions revealed strong evidence supporting that all three conditions differ from one another. No suggestion and suggestion ($t(47) = 6.25$, $p < .001$, $M_{diff} = 1.52$, $d_z = 1.33$, $B_{H(0, 0.86)} = 2.63*10^5$, RR[0.08, 512]), no suggestion and volition ($t(47) = 3.68$, $p < .001$, $M_{diff} = 0.90$, $d_z = 0.72$, $B_{H(0, 0.86)} = 143$, RR[0.10, 70.33]), and suggestion and volition conditions ($t(47) = 3.47$, $p = .001$, $M_{diff} = 0.63$, $d_z = 0.48$, $B_{H(0, 0.86)} = 76.07$, RR[0.08, 28.65]).

Exploration 2: To what extent does the magnitude of the reduction in the Stroop interference effect by the suggestion and by the volitional request correlate? The extent by which the participants managed to reduce Stroop interference while responding to the suggestion correlated strongly with their response to the volitional request ($r = .70$, 95% CI [.52, .82]). The plausible population effect sizes range among the large effect sizes as one can be 97.5% confident that the effect size is not smaller than .52.

Exploration 3: Is there any relationship between the subjective responses of the participants and the extent to which they reduced Stroop interference? We explored whether or not the subjective ratings of meaninglessness and objective meaninglessness (reduction in Stroop interference) are related. We conducted the analysis of regression slopes where the predictors were the difference scores of subjective ratings (either the difference between the scores of the no suggestion and the suggestion conditions, or the difference between the no suggestion and the volition conditions) and the outcome variable was the reduction in Stroop interference either by the suggestion or by the volitional request. We ran

regression analyses for all four subjective meaninglessness items and modelled the predictions of H1 (asserting a positive relationship) with a half-normal distribution with a mode of zero and SD of 0.6. This latter value was obtained by dividing the maximum expected word blindness effect (60ms) with the maximum expected subjective meaninglessness (100%). The analysis of regression slopes revealed good enough evidence for H1 in all cases when volition and no suggestion conditions were compared (Bs > 4.03, *b*s > 1.08), supporting the idea that there is a positive relationship between subjective experience of meaninglessness and the extent to which participants reduced Stroop interference. However, the comparison of suggestion and no suggestion conditions resulted in data insensitivity for three regression slopes (2.48 > Bs > 1.48, *b*s > 0.48) and revealed good enough evidence for H1 in only one case. Table 5 presents the results of the regression analyses.

In order to compare the steepness of the slopes, we conducted a multilevel linear regression using the same data but included the block (volition or suggestion) as an additional predictor next to the subjective response variable. In all cases, the estimation of the interaction between the block and the subjective responses revealed that the plausible effect sizes lie across a wide range of values, but almost all of them indicate stronger relationship in the volition than in the suggestion condition. The estimated difference between the slopes was the largest for Q1 (*b* = -0.81, 95% CI [-1.49, -0.14]), followed by Q4 (*b* = -0.77, 95% CI [-1.45, -0.09]), then Q3 (*b* = -0.73, 95% CI [-1.37, -0.10]), and it was the smallest for Q2 (*b* = -0.54, 95% CI [-1.33, 0.25]). As there are no hypotheses predicting difference between the slopes one way or the other, we did not conduct hypothesis testing.

Table 3

Summary Table about the Means of the RTs and Self-report Measures in the three Experimental Conditions

Category	Item (scale)	Experimental condition		
		No Suggestion	Suggestion	Volition
Response times (RTs)	Incongruent (ms)	868 (176)	791 (128)	788 (169)
	Neutral (ms)	768 (113)	719 (112)	720 (131)
	Congruent (ms)	716 (114)	686 (117)	690 (133)
Expectations	Expecting the words to be meaningless (0-5)	0.75 (1.02)	2.33 (1.15)	2.40 (1.08)
	Expecting to name the color easily (0-5)	2.61 (1.24)	2.71 (1.18)	2.90 (1.16)
Experienced Control	Control over meaningfulness (0-3)	2.44 (0.68)	1.48 (0.80)	2.06 (0.87)
	Experienced nature of meaningfulness (0-3)	-	1.49 (0.87)	1.81 (1.14)
Depth of hypnosis	Depth of hypnosis during the task (0-5)	0.95 (1.07)	2.47 (1.21)	1.84 (1.40)

Note. The Standard Deviations (SD) of the means are shown within the brackets.

Table 4

Summary Table of the four Items Measuring the Subjective Experience of Meaninglessness

Item	Experimental condition		
	No suggestion	Suggestion	Volition
Q1: **"**Was the meaning of the words on the screen completely clear to you**"**	84.2% (17.9)	54.3% (26.7)	53.3% (26.7)
Q2: **"**Were you aware of only an unclear meaning of the words on the screen**"**	13.1% (16.9)	42.4% (27.0)	41.8% (25.1)
Q3: **"**Were you just aware of the color and had no idea of what script of the words were written in**"**	25.6% (28.0)	48.4% (29.0)	48.4% (27.5)
Q4: **"**Were the words on the screen written in a clear yet meaningless script**"**	16.9% (23.7)	45.4% (30.5)	42.6% (28.9)

Note. The Standard Deviations (SD) of the means are shown within the brackets.

Table 5.

Results of the Regression Models Predicting Stroop Interference Based on Subjects` Experience of Word Meaninglessness

		Statistics					
Item	Comparison	*b* (ms/%)	β	*t*	*p*	$B_{H(0, 0.6)}$	RR
Q1	Suggestion	0.82	0.28	1.98	.053	3.92	0.35, 1.58
	Volition	1.77	0.53	4.29	<.001	$1.69*10^2$	0.15, $4.88*10^2$
Q2	Suggestion	0.48	0.17	1.15	.256	1.48	0, 4.24
	Volition	1.08	0.29	2.08	.043	4.03	0.40, 2.52
Q3	Suggestion	0.59	0.22	1.56	.13	2.28	0, 7.08
	Volition	1.35	0.44	3.36	.002	34.15	0.17, 46.89
Q4	Suggestion	0.59	0.23	1.63	.11	2.48	0, 7.68
	Volition	1.66	0.54	4.34	<.001	$2.38*10^2$	0.14, $4.62*10^2$

Note. The raw slopes are indicated by *b*, whereas the standardised regressions slopes are indicated by β.

Exploration 4: Order effect – Does the difference between the suggestion and the volition conditions in terms of the reduction of Stroop interference depend on the order in which the conditions were presented? Finally, we investigated whether or not the order of the presentation of the volitional request and the word blindness suggestion had any effect on the extent to which highs reduced Stroop interference. We conducted this analysis to explore whether highs held back in the suggestion condition when the volitional request was observed before the suggestion. When the suggestion was first, subjects were not aware there would be a volition condition. The results revealed no evidence for such a hold back effect. Contrary, there is weak evidence that the difference between the volition and suggestion conditions do not depend on the order in which they were presented ($t(44.15) = 0.72$, $p = .474$, $M_{diff} = -16$ ms, $B_{H(0, 30)} = 0.40$, RR[0, 37]). When suggestion was introduced before the volitional request, the suggestion effect was 10ms and the volition effect was 22ms. When the volitional request came first, the suggestion effect was 47ms and the volition effect was 43ms.

Discussion

The purpose of this pre-registered experiment was to test a crucial prediction of the cold control theory, namely, whether highly suggestible people can produce a comparable word-blindness effect when they respond to a post-hypnotic suggestion to see words as meaningless characters and when they respond to a voluntary request to imagine words as meaningless. Importantly, all outcome neutral tests of the experimental manipulation were fulfilled. We replicated the classical word-blindness effect (i.e., lower Stroop interference in the suggestion than in the no suggestion condition), and we found a numerically similar effect size in the pre-registered (28 ms) and in the pilot experiment (34 ms). Moreover, there was strong evidence supporting the notion that the participants experienced their responses as less voluntary in the suggestion than in the volition and in the no suggestion conditions. Finally, we did not define the comparisons of the level of expectations as outcome neutral tests since there is a way to partial out their effect if we were to find a difference between the suggestion and the volition conditions. Nonetheless, the tests revealed moderate evidence supporting no difference between the

suggestion and the volition conditions for both of the expectancy measures allowing us to rule out the response expectancy theory (Kirsch, 1985; Kirsch & Lynn, 1997) as an alternative explanation if we were to find any difference between these conditions in terms of the magnitude of the word blindness effect.

The cold control theory asserts that hypnosis influences the HOTs of intentions, inducing one to believe that their action is not voluntary while leaving the first order intention itself unaffected. Hence the prediction that if a first-order intention is sufficient to produce a certain response (e.g., the word blindness effect), one should be able to respond equally to a (post)hypnotic suggestion and to a volitional request. Importantly, the result of the crucial test is in line with this central prediction. There is good enough evidence (B = 0.27) supporting that there is no difference between the suggestion and the volition conditions in the extent of the reduction of the Stroop interference effect. Interestingly, this finding contradicts that of the pilot experiment in which we demonstrated good enough evidence (B = 4.00) favouring that highs reduce Stroop interference to a larger extent when they respond to the suggestion than to the volitional request. Although, the crucial tests of the experiments revealed conflicting results, the patterns of the RT results were mostly consistent across the experiments. The most crucial difference between the two experiments was that highs decreased the Stroop interference effect, specifically via the reduction of incongruent RTs, when they responded to the volitional request more in the pre-registered experiment than in the pilot experiment (Note that the attenuation of the Stroop interference effect by the reduction of incongruent RTs is a core feature of the word blindness effect). This implies that highs may have been more motivated or more informed on how to attenuate Stroop interference in the pre-registered than in the pilot experiment. Indeed, we amended the instruction of the volition condition precisely to make it clear that the participants should be able to use the same strategy voluntarily that they used hypnotically (for the specific modifications, see the Design and procedure subsection of the Methods section).

Investigating whether there is a positive relationship between the extent to which highs reduce the Stroop interference in the suggestion and in the volition conditions can be a severe test of another core assumption of the cold control theory. This test examines whether the underlying mechanism of the response, or in other words the strategy used by the subjects, is the same when the subjects respond hypnotically and voluntarily. Although this analysis was defined as an exploratory one in the pre-registration with the aim to help the sample size estimation of a future study, the results of the analysis are in line with the existence of a strong relationship, further corroborating the idea that the subjects were indeed engaged in the same strategy in the suggestion and the volition conditions, while they responded hypnotically in the former and voluntarily in the latter.

The reported findings imply that the simplest form of cold control theory can account for the hypnotic phenomenon. That is, the sole difference between a hypnotic and a non-hypnotic (or voluntary) response is the form of the accompanying HOT of the intention. Hence, unconscious intentions are no more efficient than conscious ones, or more generally speaking, HOTs have limited or no causal power over first-order states (Rosenthal, 2008). Nonetheless, the results still beg the question of what strategy it is that highs are using to reduce the Stroop

interference effect. For instance, it has been demonstrated that highs can still reduce the Stroop effect when their ability to blur their vision was disrupted and they could not simply look away from the screen to blunt their visual input (Raz et al., 2003). In a recent study of ours, we also found evidence supporting the notion that none of these strategies can be the underlying mechanisms of the word blindness suggestion (Palfi, Parris, Collins, & Dienes, 2020). We demonstrated in two experiments conducted outside of the hypnotic context that the subjects could diminish the extent of the Stroop effect via looking-away or blurring their vision, however, the RT pattern of the strategies did not follow the RT pattern typically produced by the word blindness suggestion. As mentioned earlier, a defining characteristic of the word blindness suggestion is that it decreases both the interference effect and the RTs of incongruent trials. However, these strategies failed to reduce the RTs of the incongruent trials. Moreover, we tested two additional candidate strategies in the first experiment: internal rehearsal of the target of the task ("displayed color") and focusing only on a single letter of the presented word (for comparable strategies used in and out of hypnosis see Sheehan, Donovan, & Macload, 1988). The former strategy may improve task performance through enhancing goal-maintenance (De Jong, Berendsen, & Cools, 1999), whereas the latter one may facilitate the resolution of response conflict analogously to the single-letter coloring design, in which coloring solely the last letter of the Stroop word induces a smaller Stroop interference effect than coloring one of the letters in the middle of the word (Besner, Stolz, & Boutilier, 1997; for a review see Flaudias & Llorca, 2014). The evidence was insensitive concerning the reduction of Stroop interference, and neither of these strategies reduced the RTs of the incongruent trials rendering these strategies unlikely to be the underlying mechanism of the word blindness effect.

Another idea is that highs might follow the instructions of the suggestion and the volitional request tightly and the strategy that they use may be imagination itself. Perhaps, imagining the words as being meaningless is enough by itself to reduce Stroop interference. Here the term imagination should be considered in a very broad sense in which it is defined as the formulation and engagement in a counterfactual model of reality (Perner, 1993). Hence, the imagination hypothesis asserts that an imaginative strategy would only require subjects to entertain a counterfactual model of the world in which words are meaningless. Engaging in this model might reset top-down cognitive control and facilitate the resolution of conflict. The imagination hypothesis is consistent with the findings that the suggestion reduces response conflict and leaves the visual input stream untouched as imagination is not limited to visual or mental imagery (Currie and Ravenscroft, 2002). Engaging in imagination does not necessarily mean that highs experience a visual hallucination (i.e., see the script written differently than presented), they may experience meaninglessness as a conceptual or propositional hallucination. In other words, highs may see the words as they are presented on the screen but they may experience the words as if they are written in a foreign language to them due to which they cannot understand those words. The results of Exploration 3, in which we found evidence for a positive relationship between the subjective experience of meaninglessness and the reduction of Stroop interference, are in line with this hypothesis. The more frequently subjects experienced meaninglessness when they responded to the suggestion or to the volitional request, the more efficiently they alleviated Stroop interference (note that when participants

responded to the suggestion, the evidence was only good enough for one of the four items). Nonetheless, further research is needed to provide an experimental test of this strategy.[13]

The cold control theory, in its simplest form, postulates that the sole difference between highs and lows lies in their metacognitive skills (which may or may not be limited to the domain of intentions). From this assertion, it follows that lows can create the first order states requested by suggestions that highs are able to formulate (e.g., both lows and highs are able to imagine the buzzing of a mosquito). This claim is corroborated by empirical evidence demonstrating no difference between highs and lows in first-order executive functions (Dienes, et al., 2009; Parris, 2017; Varga, Németh, & Szekely, 2011). The reason why lows respond poorly to hypnotic suggestions, according to the theory, is that they cannot experience the intentional acts as involuntary due to being aware of their first order intentions (e.g., lows tend experience the buzzing as imagined, whereas highs can control whether they experience it as imagined or as perceived). The assumption of the cold control theory that lows and highs only differ in their metacognitive skills is yet to be tested in the context of the word blindness effect. To confirm this assumption, it would need to be demonstrated that lows (and mediums) can reduce Stroop interference to the same extent as highs when they are requested to voluntarily entertain a counterfactual model of reality, in which words are meaningless (granted that lows are sufficiently motivated to do so and they believe that their response to this volitional request can be effective). Such an outcome would confirm that lows and highs do not differ in their ability to create word blindness only in the ability to experience word blindness as if it happened by itself, involuntarily.

Demand characteristics apparent in our design may limit the interpretation of the main findings. Our participants were explicitly told that they should be able to match their performance in the volition and suggestion conditions, and they may have achieved this by holding back in the suggestion condition so that their response in the volition condition can be comparable. Fortunately, this possibility can be tested in our data as the participants were only told about the expectation of matched performance at the beginning of the volition condition, which followed the suggestion condition for half of the participants. A test (Exploration 4) confirmed that the order in which highs engaged in the volition and suggestion conditions did not influence the difference between the conditions, rendering it unlikely that the participants held back during the suggestion condition to comply with the expectations. However, another way in which participants may have achieved the expected outcome is that they responded hypnotically in both of the suggestion and volition conditions, but they reported their feeling of voluntariness according to the demands of the corresponding condition. There were two items measuring the feeling of voluntariness in these conditions. The first item directly asked about the level of control and so the participants could easily unravel the expected response.

[13] It has been demonstrated by independent researchers that the social priming of dyslexia (i.e., asking participants to imagine what it is like to be someone who has dyslexia) can help participants reduce Stroop interference (Augustinova & Ferrand, 2014; Goldfarb, Aisenberg, & Henik, 2011). One can argue that the imagination strategy outlined in the paragraph may be the underlying mechanism both of the word blindness suggestion and the social priming of dyslexia. The participants are asked in both cases to imagine that words are meaningless for them, which mat help them in return decrease Stroop interference (for a more detailed argument see Palfi, Parris, Collins & Dienes, 2020).

However, the second item asked about the nature of their experience, whether it felt more like perception or imagination. Importantly, these concepts were not mentioned in the instructions of the conditions, rendering it less likely that the responses simply represent compliance with the expectations of the experiment and the experimenter. Note that the evidence supporting this latter finding was weak (B = 2.53).

A seminal theory of hypnotic responding, the response expectancy theory (Kirsch, 1985), is also in accordance with the main findings of the pre-registered experiment. Interestingly, this theory is not part of the metacognitive class of theories as it assumes that the creation of a hypnotic response does not require the involvement of intentional cognitive control processes. The mere existence of the expectancies is enough to produce the responses and these responses are accompanied by the feeling of involuntariness by virtue of not being intentional. Therefore, the response expectancy theory predicts that the extent to which highs expect to see meaningless words is related to the extent to which they can reduce Stroop interference. This is precisely what we found in an exploratory analysis in both the suggestion and volition conditions (for more details, see the Supplementary Materials Exploration S1). However, it is important to note that the cold control theory and the response expectancy theory are not mutually exclusive, hypnotic responses might be generated in multiple ways, and the current experiment did not aim to distinguish between these two theories. Finally, the special process theories of hypnosis that presume the existence of processes other than the relinquished metacognition over one`s intentions, expectations and beliefs are not in accordance with these findings. For instance, the integrative cognitive theory of hypnosis (Brown & Oakley, 2004) and many of the dissociation theories, such as the early version of the neodissociation theory (Hilgard, 1977), the dissociated control theory (Bowers, 1992; Woody & Bowers, 1994) and the integrative model of dissociation theories (Woody & Sadler, 2008) surmise differential outcomes for responses to suggestions and volitional requests. In a nutshell, the results corroborate the cold control class of theories of hypnosis. The findings are also compatible with the response expectancy theory of hypnosis, while they challenge the special process account of the word blindness effect that surmise that hypnosis can give rise to objective responses that cannot be induced via non-hypnotic means.

Retaining the simplest form of cold control theory has clear and profound implications for the clinical application of hypnosis. Strictly speaking, applying hypnosis on its own or using it in tandem with therapeutic approaches, such as cognitive behavioral therapy (Kirsch, Capafons, Cardeña-Buelna, & Amigó, 1999) or suggestions (e.g., indirect suggestions of Erickson and his colleagues [1976]) should produce the same outcome as an appropriate control technique. According to cold control theory, a technique can be deemed an appropriate control when the sole difference between the hypnosis and the control technique lies in the nature of the accompanying HOT of the behaviors of the clients engaged in the therapy. Meta-analyses concluding that the application of hypnosis has beneficial effects usually compare hypnosis to standard care groups, which is a mixture of various groups such as no treatment, standard treatment as well as waiting-list controls. However, the advancements in the outcome measures tend to reduce or even disappear once hypnosis is compared to a therapeutic control group, which is a more adequate control than no treatment or standard treatment (e.g., biofeedback

therapy in irritable bowel syndrome [Schaefert, Klose, Moser, & Häuser, 2014], and various psychological interventions in chronic pain studies [Adachi, Fujino, Nakae, Mashimo & Sasaki, 2014]). Interestingly, there is evidence that hypnosis can improve the efficacy of some cognitive-behavioral treatments when the sole difference between the instructions of the hypnotic and non-hypnotic groups was the usage of the term hypnosis in the former (Kirsch, Montgomery, & Sapirstein, 1995). Nonetheless, as argued earlier in this paper, the inclusion of the word hypnosis in the instructions can give rise to confounding factors through elevating expectations and motivation.[14] One needs to carefully phrase the instructions used in the control group to make sure that people believe that their voluntary response can be just as efficient as their hypnotic one, and that people use the same strategy when they respond voluntarily and hypnotically. Note that this latter criterion is not emphasised by the response expectancy theory, highlighting that the implications of the cold control and the response expectancy theory are not necessarily aligned. This differential prediction of the two theories should be tested in a future experiment. To benefit just as much from the non-hypnotic than from the hypnotic treatment, according to the cold control theory, we need to ensure that our clients not only believe that their response to a volitional request will be efficient but that they are also using the right strategy. However, hypnotherapy may be useful precisely because people have powerful expectations regarding hypnosis: Hypnosis may be a non-deceptive placebo in therapy (Kirsch, 1999). Further, a client may want the pain to go away by itself, so the hypnotic rather than voluntary experience of a suggested effect may be more desirable. Moreover, the experience of effects happening by themselves may allow the client to have these experiences when they would not have allowed themselves otherwise (indeed, a clinical problem may have been produced by cold control because the person did not want to take responsibility for it). Thus, in applying our conclusions to the therapeutic context, the full subtleties of the therapeutic context need to be considered.

Experience of hypnotic depth. Although it was not related to the main point of the current paper, we aimed to explore whether highly suggestible people report the experience of hypnotic depth while they respond to a post-hypnotic suggestion. In principle, post-hypnotic suggestions are preferred over hypnotic ones in experimental settings as they can control for the influence of the hypnotic induction (e.g., Terhune, Luke & Cohen Kadosh, 2017). An example can be the experience of being in a hypnotic state that is usually measured via asking the participants to report about the hypnotic depth they experienced (e.g., Hilgard & Tart, 1966). Participants are told at the end of the induction procedure that they should be awake and should not feel hypnotised anymore. However, participants might interpret the situational needs otherwise and they still create the experience of being in a hypnotic state when the post-hypnotic suggestion is reactivated. Our findings are partly in line with this latter assumption. We observed that the participants report stronger hypnotic depth experience in the suggestion than in the no suggestion condition and that the plausible effect size lies within the range of 1.91 – 2.76 Likert units on a scale from 0 to 5 (where 1 means slightly hypnotized, and 5 indicates deeply hypnotized). Interestingly, we found that the participants on average report to be slightly hypnotised when they respond to the volitional request (the plausible effect size lies

[14] A similar point is made by Lynn et al. (2019) and Terhune et al. (2017) in their recent papers in which they reviewed the strength of the empirical evidence underlying the efficiency of hypnotherapies.

within the range of 1.44 – 2.25 Likert units), although they report weaker hypnotic depth experience than when they respond to the suggestion. Crucially, according to cold control theory, it is not the experience of a hypnotic state (as interpreted by the participants) that defines a hypnotic response, but the lack of awareness of relevant HOTs of intending, which can be measured, for instance, by the experience of control over meaningfulness. Evidence from both control measures indicate that highs responded voluntarily to the volitional request, as they reported to have almost complete control over the meaningfulness of the words, and they reported that it felt more like that they imagined rather than perceived the script as meaningless.

Unfortunately, we did not gauge the level of hypnotic depth during the induction and after the de-induction, which could have provided us with baselines on the scale (this was pre-registered, however, we failed to include it in the procedure). Nonetheless, we know from another project of ours in which we also used the word-blindness suggestion that the level of hypnotic depth is substantially smaller in the suggestion condition than during the induction, and more importantly, we did not find evidence that hypnotic depth is stronger during the execution of the suggestion than right after the de-induction (Palfi, Parris, Seth & Dienes, 2018). Taken together, these findings make it plausible that at least some of the subjects interpret the context as they need to create the experience of being in a hypnotic state while responding to the posthypnotic suggestion, and some of them may even create this experience when they respond to the volitional request. However, it is safe to assume that even if they do so they do not achieve the same level of hypnotic depth as they would during the hypnotic induction. Future studies could investigate the role of this experience in reducing the Stroop interference effect.

Conclusion

The cold control theory, which is perhaps the simplest theory of hypnotic responding, asserts that hypnosis is a metacognitive phenomenon and the sole difference between a response to a hypnotic suggestion and a volitional request lies in the nature of the accompanying HOT of the first-order intention. In a pre-registered multisite experiment, we tested a central prediction of the theory that objective responses (i.e., the word blindness effect) to suggestions and to volitional requests should be identical (after controlling for the effect of expectations). We presented Bayesian evidence supporting that highs reduce Stroop interference to the same extent when they respond to the word blindness suggestion and when they respond to its volitional request counterpart. These results are consistent with the cold control theory and with the notion that HOTs have limited or zero first order causal role (Rosenthal, 2008).

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Appendix A. Protocol of the Pilot Experiment

This is an example protocol in which the order of the condition was: (1) Suggestion, (2) No suggestion, (3) Volition. Note that the order of these conditions was counterbalanced across participants.

1. Instructions and consent form

Start script and provide the participant with the consent form

2. Practice

5 minutes of practice Stroop. Ends up with a screen asking to wait for the experimenter.

3. Induction, suggestion and test of suggestion

(O). Induction by Eye Closure.

(1). Now, please seat yourself comfortably and rest your hands in your lap. That's right. Rest your hands in your lap. Now look at your hands and find a spot on either hand and just focus on it. It doesn't matter what spot you choose; just select some spot to focus on. I will refer to the spot you have chosen as the target. That's right... hands relaxed... look directly at the target.

I am about to help you to relax, and meanwhile I will give you some instructions that will help you to gradually enter a state of hypnosis. Please look steadily at the target and while staring at it, keep listening to my words. You can become hypnotized if you are willing to do what I tell you to, and if you concentrate on the target and on what I say. You have already shown your willingness by coming here today, and so I am assuming that your presence here means that you want to experience all that you can. Just do your best to concentrate on the target -- pay close attention to my words, and let happen whatever you feel is going to take place. Just let yourself go. Pay close attention to what I tell you to think about; if your mind wanders, that will be okay; just bring your thoughts back to the target and my words, and you can easily experience more of what it's like to be hypnotized.

Hypnosis is perfectly normal and natural, and follows from the conditions of attention and suggestion we are using together. It is chiefly a matter of focusing sharply on some particular thing. Sometimes you experience something very much like hypnosis when driving along a straight highway and you are oblivious to the landmarks along the road. The relaxation in hypnosis is very much like the first stages of falling asleep, but you will not really be asleep in the ordinary sense, because you will continue to hear my voice and will be able to direct your thoughts to the topics that I suggest. What is important here today is your willingness to go along with the ideas I suggest and to let happen whatever is about to happen. Nothing will be done to embarrass you.

(2) Now take it easy and just let yourself relax. Keep looking at the target as steadily as you can, thinking only of it and my words. If your eyes drift away, don't let that bother you... just focus again on the target. Pay attention to how the target changes, how the shadows

play around it, how it is sometimes fuzzy, sometimes clear. Whatever you see is all right. Just let yourself experience whatever happens and keep staring at the target a little longer. After awhile, however, you will have stared long enough, and your eyes will feel very tired, and you will wish strongly that they were closed. Then they will close, as if by themselves. When this happens, just let it happen.

(3) As I continue to talk, you will find that you will become more and more drowsy. When the time comes that your eyes have closed, just let them remain closed.

You will find that you can relax completely, but at the same time sit up comfortably in your chair with little effort. You will be able to shift your position to make yourself comfortable as needed without it disturbing you. For now, just relax more and more. As you think of relaxing, your muscles will actually begin to relax. Starting with your right foot, relax the muscles of your right leg..... Now the muscles of your left leg..... Just relax all over. Relax your right hand... your forearm... upper arm... and shoulder.... That's right.... Now your left hand.... and forearm.... and upper arm.... and shoulder.... Relax your neck, and chest.... more and more relaxed.... completely relaxed.... completely relaxed.

(4) As you become relaxed, your body will feel deeply at ease.... comfortably heavy. You will begin to have this pleasant feeling of heaviness and comfort in your legs and feet.... in your hands and arms.... throughout your body.... as though you were settling deep into the chair. Your body feels comfortable and heavy.... Your eyelids feel heavy too, heavy and tired. You are beginning to feel very relaxed and comfortable. You are breathing freely and deeply, freely and deeply. You are becoming more and more deeply and comfortably relaxed. Your eyelids are becoming heavier, more and more heavy and difficult to keep open.

(5) Staring at the target so long has made your eyes very tired. Your eyes may hurt from staring and your eyelids feel very heavy. Soon you will no longer be able to keep your eyes open. Soon you will have stood the discomfort long enough; your eyes are tired from staring, and your eyelids will feel too tired to remain open. Perhaps your eyes are becoming moist from the strain. You are becoming more and more relaxed and comfortable. The strain in your eyes is getting greater and greater. It would be a relief just to let your eyes close and to relax completely, relax completely. The strain in your eyes will eventually be so great that you will welcome your eyes closing of themselves, of themselves.

(6) Your eyes are tired and your eyelids feel very heavy. Your whole body feels heavy and relaxed. You feel a pleasant warm tingling throughout your body as you become more and more deeply relaxed ... deeper ... deeper ... more relaxed ... completely relaxed and drifting down into a warm pleasant state of relaxation. Keep your thoughts on what I am saying; listen to my voice. Your eyes are getting blurred from straining. You can hardly see the target, your eyes are so strained. The strain is getting greater, greater and greater, greater and greater. Your eyelids are heavy. Very heavy. Getting heavier and heavier, heavier and heavier. They are pushing down, down, down. Your eyelids seem weighted and heavy, pulled down by the weight .... so heavy ... your eyes are blinking, blinking .... closing, closing ...

Your eyes may have closed by now, and if they have not, they would soon close of themselves. But there is no need to strain them more. You have concentrated well on the target, and have become very relaxed. Now we have come to the time when you may just let your eyes close. That's it, eyes closed now.

(7) You now feel very relaxed, but you are going to become even more relaxed. It is easier to relax completely now that your eyes are closed. You will keep them closed until I tell you to open them or until I tell you to become alert ... You feel pleasantly, deeply relaxed and very comfortable as you continue to hear my voice. Just let your thoughts dwell on what I'm saying. You are going to become even more relaxed and comfortable. Soon you will be deeply hypnotized, but you will have no trouble hearing me. You will remain deeply hypnotized until I tell you to awaken later on. Soon I shall begin to count from one to twenty. As I count, you will feel yourself going down further and further into a deeply relaxed, a deeply hypnotized state... but you will be able to do all sorts of things I ask you to do without waking up... One... you are going to become more deeply relaxed and hypnotized.... Two... down, down deeper, and deeper... Three... Four... more and more deeply hypnotized.... Five... Six... Seven... you are sinking deeper and deeper into hypnosis. Nothing will disturb you... Just let your thoughts focus on my voice and those things I tell you to think of. You are finding it easy just to listen to the things I tell you. Eight... Nine, Ten... halfway there... always deeper... Eleven... Twelve... Thirteen... Fourteen... Fifteen... although deeply hypnotized you can hear me clearly. You will always hear me distinctly no matter how deeply hypnotized you become. Sixteen... Seventeen... Eighteen... deeply hypnotized. Nothing will disturb you. You are going to experience many things that I will tell you to experience... Nineteen... Twenty. Deeply hypnotized now! You will not wake up until I tell you to. You will wish to remain relaxed and hypnotized and to have the experiences I describe to you.

Even though you are deeply relaxed and hypnotized, I want you to realize that you will be able to write, to move, and even to open your eyes if I ask you to do so, and still remain just as hypnotized and comfortable as you are now. It will not disturb you at all to open your eyes, move about, and write things. You will remain hypnotized until I tell you otherwise... All right, then....

Very soon you will be playing a computer game. When I clap my hands once, meaningless symbols will appear in the middle of the screen. They will feel like characters of a foreign language that you do not know, and you will not attempt to attribute any meaning to them. This gibberish will be printed in one of four ink colours: red, blue, green or yellow. Although you will only be able to attend to the symbols ink colour, you will look straight at the scrambled signs and crisply see all of them. Your job is to quickly and accurately depress the key that corresponds to the ink colour shown. You will find that you can play this game easily and effortlessly. When I clap my hands twice, you will regain your normal reading abilities.

[Clap to activate: "Now you see meaningless words on the screen]

[Show an example word and ask the participant to open her eyes and read out loud the following question with the answer options]

How strongly do you experience the word as meaningless?

1) The meaning of the word on the screen is completely clear to me
2) The meaning of the word on the screen is a little unclear
3) The meaning of the word on the screen is unclear
4) The meaning of the word on the screen is completely unclear

[If the participant has chosen 1 or 2 then read the following script otherwise jump it through]

"Notice how as you look at the word on the screen, you can look at it with the meaning fading to the background of your mind. We have found even when people consciously experience some meaning after this suggestion, they still process the words differently at a deeper level. You know you are capable of not reading meaningfully, remember how you have zoned out while reading a book."

[Clap twice to deactivate: "Now you see meaningful words on the screen"]

[Ask the participant to close her eyes]

Stay completely relaxed and pay close attention to what I'm going to tell you next. In a moment I shall begin counting backwards from twenty to one. You will awaken gradually, but for most of the count you will remain in the pleasant, relaxed state that you are now in. By the time I reach "five" you will open your eyes, but you will not be fully aroused. When I get to "one", you will be fully alert, in your normal state of wakefulness. You probably will have the impression that you have slept, because you will have difficulty in remembering all the things I have told you and all the things you did or felt, since you started looking at the target. In fact, you will find it so much of an effort to recall any of these things that you will have no wish to do so. It will be much easier simply to forget everything until I tell you that you can remember. You will remember nothing of what you did or felt from the time that you started looking at the target, until I say to you: "Now you can remember everything!" You will not remember anything you did until then. After you open your eyes you will feel fine. I shall now count backwards from twenty, and at "five", not sooner, you will open your eyes but not be fully aroused until I say "one". At "one" you will be awake ... Ready, now: 20...19...18... 17... 16... 15... 14... 13... 12... 11... 10, halfway... 9... 8... 7... 6... five... 4... 3... 2... 1. Wake up! Wide awake! Any remaining drowsiness which you may feel will quickly pass.

From now you won't feel hypnotised at all, but the suggestion will powerfully affect you when it is activated by the clap."

4. Suggestion condition

[Say the following]

[Clap to activate suggestion: "Now you see meaningless words on the screen"]

[Get the expectancy rating. Read out loud the question and provide the participant with the text format. Explain in detail if the participant has a question (same procedure for all of the other self-report measures)]

[Start the Stroop task]

[Ask about the subjective experience]

[Ask them to recall the meaning of the words]

[Ask about the depth of hypnosis]

[Ask about the level of control]

[Ask about how did they produce the effect of meaninglessness]

[Clap twice to deactivate suggestion: "Now you see meaningful words on the screen"]

5. No suggestion condition

[Say the following]

"For this part of the experiment no suggestion has been activated. It is important that you make no attempt to make the words seem like gibberish or word of foreign language. We would now like you to respond to the colour of the word on the screen as quickly and as accurately as you can"

[Get the expectancy rating]

[Start the Stroop task]

[Ask about the subjective experience]

[Ask them to recall the meaning of the words]

[Ask about the depth of hypnosis]

[Ask about the level of control]

6. Volition condition

[Say the following]

"Highly hypnotisable individuals such as you have been shown to be able to eliminate the interference from the irrelevant word when under the influence of the post-hypnotic suggestion and even when the suggestion is given without hypnosis. We would like you to voluntarily strongly and clearly imagine the irrelevant words as gibberish, words of a foreign language so that no meaning can be taken from them. This is not a hypnotic suggestion and we have not hypnotised you for this part of the task. You'll notice we have not initiated a suggestion by clapping or giving any other cue. You have the ability to do that anytime you please, under your control, as effectively as you just did. Please now voluntarily remove meaning from the words. You can do this so that it is under your control, just by exercising your imagination. You can be aware it is your imagination at the same time as it produces powerful effects."

[Have the participants look at a Stroop stimulus on the screen and ask them to make the word seem meaningless and then meaningful again. Tell them they can turn the control on and off.]

[Get the expectancy rating.]

[Start the Stroop task]

[Ask about the subjective experience]

[Ask them to recall the meaning of the words]

[Ask about the depth of hypnosis]

[Ask about the level of control]

[Ask about how did they produce the effect of meaninglessness]

[Finish]

7. Debrief and thank the participant

Appendix B. Items of the Pilot Experiment

Expectations
How strongly do you expect to experience the words as at least somewhat meaningless?

1. I know the meaning of the words on the screen will be completely clear to me
2. I have a little confidence that the meaning of the words on the screen will in some way be unclear
3. I am somewhat sure that the meaning of the words on the screen will in some way be unclear
4. I am fairly sure that the meaning of the words on the screen will in some way be unclear
5. I am almost certain that the meaning of the words on the screen will in some way be unclear
6. I am certain that the meaning of the words on the screen will in some way be unclear

Subjective experience questions
On what percentage of the trials:

1. Was the meaning of the words on the screen completely clear to you?
2. Were you aware of only an unclear meaning of the words on the screen?
3. Were you just aware of the colour and had no idea of what script the words were written in?
4. Were the words on the screen written in a clear yet completely meaningless script?

Recalling the meaning of the words
If you were aware of any words, can you recall them?

Depth of hypnosis scale
How deeply hypnotised were you during that game (Stroop task)?

1. Normal state
2. Relaxed
3. Hypnotized
4. Deeply hypnotized

Level of control
How much control did you have over how meaningful the words appeared to you?

1. I had no control
2. I had some control
3. I had almost complete control
4. I had complete control

Experienced nature of meaninglessness
How did you produce the effect of meaninglessness?

1. The script appearing meaningless was just me imagining it was meaningless
2. The script appearing meaningless was me perceiving the script as really meaningless

Appendix C. Instruction in the Volition condition of the Pre-registered Experiment

"Highly hypnotisable individuals such as you have been shown to be able to eliminate the interference from the irrelevant word when under the influence of the post-hypnotic suggestion and even when the suggestion is given without hypnosis. Notice that when a hypnotic suggestion is given it is always you who creates the response; thus you can achieve the full effect of a suggestion any time you wish. We would like you to voluntarily, strongly and clearly create the experience that the irrelevant words are gibberish, words of a foreign language so that no meaning can be taken from them. You have the ability to do that anytime you please, under your control, as effectively as you did it during the hypnotic induction. This is not a hypnotic suggestion and we have not hypnotised you for this part of the task. You'll notice we have not initiated a suggestion by clapping or giving any other cue. Please now voluntarily remove meaning from the words. You can do this so that it is under your control, just by exercising your every-day capacity to consider the world in different ways, while still knowing how the world really is. You can have complete control over the strategy you used hypnotically and use it without being hypnotised and produce the same powerful effects."

Appendix D. New items of the Pre-registered Experiment

Expectations 2.
How strongly do you expect that naming the colour of the words will be somewhat easy?

1. I know that naming the colour of the words on the screen will be hard to me
2. I have a little confidence that naming the colour of the words on the screen will in some way be easy
3. I am somewhat sure that naming the colour of the words on the screen will in some way be easy
4. I am fairly sure that naming the colour of the words on the screen will in some way be easy
5. I am almost certain that naming of the words on the screen will in some way be easy
6. I am certain that naming of the words on the screen will in some way be easy

Depth of hypnosis
On a scale from 0 to 5, to what degree did you enter a hypnotic state during the game? 0 means your general state of consciousness was just the same as normal, 1 means you were slightly hypnotized and 5 means you entered very deep hypnosis?

Normal State 0 – 1 – 2 – 3 – 4 – 5 Deep hypnosis

Level of control
How much control did you have over how meaningful the words appeared to you?

1. I had no control because the words were written in a meaningless script
2. I had some control because the words were written in a meaningless script
3. I had almost complete control over whether the script appeared meaningless or meaningful
4. I had complete control over whether the script appeared meaningless or meaningful

Experienced nature of meaninglessness
How did it seem the effect of meaninglessness came about?

The script appearing meaningless was me perceiving it as meaningless	1 – 2 – 3 – 4	The script appearing meaningless was me imagining it as meaningless