# Variations in the sense of agency during hypnotic responding: Insights from latent profile analysis

Devin B. Terhune,[a,b] Vince Polito,[c] Amanda J. Barnier,[c] & Erik Z. Woody[d]

[a] *Department of Experimental Psychology, University of Oxford, Oxford, UK*

[b] *Department of Psychology, Goldsmiths, University of London, London, UK*

[c] *ARC Centre of Excellence in Cognition and its Disorders and Department of Cognitive Science, Macquarie University, Sydney, Australia*

[d] *Department of Psychology, University of Waterloo, Waterloo, Ontario, Canada*

**Corresponding author:**
Devin B. Terhune
Department of Psychology
Goldsmiths, University of London
New Cross, London, UK SE14 6NW
Tel: +44 (0) 207 078 5148
Email: d.terhune@gold.ac.uk

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## Abstract

The primary phenomenological feature of a response to hypnotic suggestion is the perception that a person is not the author of their actions and experiences. This distortion in volition during hypnotic responding, known as the *classic suggestion effect*, has the potential to illuminate the neurocognitive mechanisms underlying hypnosis and inform broader models of agency. Here we sought to clarify inter-individual differences in the patterns of agency that participants experience during hypnosis. We applied latent profile analysis, a finite mixture modeling method for partitioning participants into homogeneous classes, to participants' responses to a standardized behavioral measure of hypnotic suggestibility and an experiential measure of sense of agency during hypnotic responding. The best fitting model suggested that there were four discrete response patterns: a low suggestible class, two medium suggestible classes, and one highly suggestible class. The two medium suggestible classes displayed nearly equivalent patterns of behavioural hypnotic responding but diverged in their experience of agency during hypnotic responding: one class experienced greater *involuntariness* during responding whereas the other experienced greater *effortlessness* during responding. These results reinforce previous research highlighting differential patterns of hypnotic responding and complement work suggesting that there may be two or more phenomenologically distinct modes of hypnotic responding. They also have a number of implications for the measurement of hypnotic responding and for the use of low and medium suggestible individuals in experimental hypnosis research designs.

**Keywords:** heterogeneity; hypnosis; hypnotizability; phenomenology; suggestion; typology; volition

## Introduction

An individual's experience of authorship over their actions and thoughts represents one of the most basic, but elusive, features of conscious experience (Wegner, 2002). This perception, referred to as the *sense of agency*, is impaired in a very salient manner in a number of clinical conditions including schizophrenia (Metcalfe, Van Snellenberg, DeRosse, Balsam, & Malhotra, 2012) and the dissociative disorders (Spiegel et al., 2013). Similar distortions also occur in healthy individuals in a range of phenomena from facilitated communication (Burgess et al., 1998) to glossolalia (Newberg, Wintering, Morgan, & Waldman, 2006). One of the more striking instances of distorted volition in healthy individuals is evidenced in the phenomenon of hypnosis, in which individuals, particularly those displaying high hypnotic suggestibility (henceforth, *highs*), reliably experience a compelling perception that they did not execute or author a suggested response or experience (Bowers, 1981; Weitzenhoffer, 1974, 1980).

This compelling experience of distorted volition, known as the *classic suggestion effect*, is widely regarded as the primary phenomenological characteristic of a hypnotic response (Weitzenhoffer, 1974) and thus one of the principal explananda in the domain of hypnosis (Kihlstrom, 2008; Woody & Szechtman, 2007). A previous study that compared the *perceived* time at which voluntary, involuntary, and hypnotically-suggested involuntary motor movements were executed showed that suggested involuntary responses more closely resembled truly involuntary than truly voluntary responses (Haggard, Cartledge, Dafydd, & Oakley, 2004). Further research with a self-report measure of sense of agency has shown that distortions in agency during hypnotic responding among highs appear to be as strong in magnitude as those experienced by patients with schizophrenia (Polito, Langdon, & Barnier, 2015). These data suggest that studying the classic suggestion effect during response to hypnotic suggestions can offer insights into the characteristics and mechanisms of hypnotic responding and has the potential to reveal broader insights into sense of agency.

We recently developed a self-report measure, the *Sense of Agency Rating Scale* (SOARS; Polito, Barnier, & Woody, 2013; Polito et al., 2015), to help clarify the different phenomenological components of sense of agency during hypnotic responding and other contexts. A principal components analysis of the SOARS, which participants completed in reference to a standardized measure of hypnotic responding, revealed two

weakly related factors that were interpreted as indexing *involuntariness* and *effortlessness*. The former maps closely onto the disruption of volition characterizing the classic suggestion effect, whereas the latter taps feelings of ease, spontaneity, and absorption in participant's responses to suggestions (Bowers, 1982; Bowers, Laurence, & Hart, 1988). However, the relations of these factors to different features of hypnotic responding remain poorly understood.

Individual differences in hypnotic suggestibility have traditionally been conceptualized in a unidimensional way, such that variability in various components of hypnotic responding covaries with an underlying trait of hypnotic suggestibility. In contrast, a range of studies highlight pronounced variability in different facets of hypnotic responding, including strategy utilization during responding, associated phenomenology, and cognitive profiles among mediums and highs (Galea, Woody, Szechtman, & Pierrynowski, 2010; Pekala & Kumar, 2007; Sheehan & McConkey, 1982; Terhune & Cardeña, 2010; Terhune, Cardeña, & Lindgren, 2011b) (for a review, see McConkey & Barnier, 2004). One study by King and Council (1998) investigated whether heterogeneity among highs could be explained in part by individual differences in dissociative tendencies – the propensity to experience disruptions between normally integrated psychological functions, such as states of depersonalization. They found that high dissociative highs required fewer executive resources, typically associated with attentional effort, when responding to a hypnotic suggestion than low dissociative highs. Similarly, Terhune and colleagues found that high dissociative highs experienced greater involuntariness during hypnotic responding than low dissociative highs (Terhune et al., 2011b). Taken together, these results suggest that a subset of participants in the upper range of hypnotic responding experience hypnotic suggestions with *less* effort and *greater* involuntariness. This implies that effortlessness and involuntariness linearly relate to each other, but do not covary with hypnotic suggestibility in a linear fashion. In the present study we sought to shed light on patterns of distorted volition during hypnotic responding by applying latent profile analysis (LPA) to patterns of involuntariness and effortlessness during hypnotic responding. LPA is a finite mixture modeling technique that can be used to partition multivariate data into homogeneous classes (McCutcheon, 1987; Vermunt & Magidson, 2002) and may help to clarify discrete patterns of hypnotic responding.

## Method

*Participants*

This study re-analyzed the data of 370 participants whose data was previously described (Polito et al., 2013). After the exclusion of participants with missing data (<4%), the data of 356 participants ($M_{Age}$=21.3, *SD*=5.4, 64% female) were analyzed. All participants consented to participate in accordance with local ethical approval.

*Materials and Procedure*

Participants were first administered the *Harvard Group Scale of Hypnotic Suggestibility, Form A* (HGSHS:A; Shor & Orne, 1962), the most widely-used group scale of hypnotic suggestibility. The 12-item measure includes a hypnotic induction followed by a series of suggestions. Administration of the scale in this study omitted two items (arm rigidity and arm immobilization) to reduce administration time (Polito et al., 2013). Participants self-scored their responses after a de-induction and were classified as low suggestible (henceforth *lows*) if they responded to fewer than 3 suggestions on the HGSHS:A, mediums if they responded to between 3 and 7 suggestions, and highs if they responded to more than 7 suggestions. The scale displayed satisfactory internal consistency (Cronbach's α: .62).

After the HGSHS:A, participants completed the *Sense of Agency Rating Scale* (SOARS; Polito et al., 2013), a 10-item measure of sense of agency, once in reference to the full set of HGSHS:A suggestions. Each item is rated on a 7-point likert scale with anchors at "Strongly disagree" and "Strongly agree". The scale is comprised of two five-item subscales: Involuntariness and Effortlessness. Representative items include "I felt that my experiences and actions were not caused by me" and "I embraced the suggestions freely," respectively. Both subscales displayed acceptable internal consistency (Cronbach's αs: .75, .67, respectively).

*Analyses*

The 10 items of the HGSHS:A and 10 items of the SOARS were included as indicators in a LPA aiming to identify different classes of respondents. LPA uses maximum likelihood estimation to probabilistically assign

participants to latent classes on the basis of the covariance matrices among indicator variables. No restrictions were imposed on covariance between observable indicators because restricted models, which restrict inter-indicator covariance to 0, often overestimate the number of classes and provide less parsimonious solutions (Vermunt & Magidson, 2002). The fit of two-class through five-class unrestricted models was evaluated using the Bayesian information criterion (BIC; Schwartz, 1978), for which lower values reflect superior model fit (Vermunt & Magidson, 2002). The Bootstrap likelihood-ratio test (BLRT; McLachlan & Peel, 2000) was used to further adjudicate between nested models; a significant *p*-value indicates that a model has superior fit than the model with one fewer class. Previous research indicates that the BIC and BLRT are the most robust and reliable metrics for class enumeration in finite mixture modeling (for a comparison, see Nylund, Asparouhov, & Muthén, 2007). A last measure of participant classification, entropy, was calculated on the basis of each model's posterior probabilities for group membership; values range from 0 to 1 with greater values reflecting superior classification of participants (Ramaswamy, Desarbo, Reibstein, & Robinson, 1993). The LPA was performed using MPLUS v. 7.3 (Muthén & Muthén, 1998-2012).

In a secondary set of analyses, we contrasted participants as a function of Class and Hypnotic suggestibility using chi-squared analyses and analyses of variance (ANOVAs). The primary analyses focused on HGSHS:A scores and the two SOARS subscales (Involuntariness and Effortlessness) (Polito et al., 2013). Subsidiary *post hoc* contrasts were performed using Tukey HSD tests. Confidence intervals for effect sizes (and means in Fig. 1) were estimated using bootstrap resampling (10,000 samples; bias-corrected and accelerated percentile method; Efron, 1987). Analyses were performed in MATLAB 2014a (The MathWorks Inc., Natick, MA, USA).

## Results

### Relations among measures

HGSHS:A scores covered the entire range of possible values (0 to 10), with participants responding on

average to more than four suggestions (*M*=4.48, *SD*=2.17). The data were slightly negatively skewed with 33%, 50%, and 16% being classified as lows, mediums, and highs, respectively. Scores on the SOARS subscales, Involuntariness and Effortlessness, covered the entire range of possible values (5 to 35), although the former tended to be lower and more variable (*M*=17.59, *SD*=7.11) than the latter (*M*=22.74, *SD*=5.49). As previously reported (Polito et al., 2013), the SOARS subscales were moderately correlated, $r(356)=.40$, $p<.001$ [.29, .49]. However, HGSHS:A scores correlated more strongly with Involuntariness, $r(356)=.54$, $p<.001$ [.46, .61], than Effortlessness, $r(356)=.40$, $p<.001$ [.30, .48], scores, median difference = .14 [.03, .25]. This suggests that involuntariness may be a more fundamental feature of hypnotic responding than effortlessness.

## Class solution

The LPA indicated that a four-class model displayed the strongest fit to the 20 items of the HGSHS:A and SOARS (Table 1). This model exhibited a lower BIC value than the other models, and a significant BLRT, demonstrating its superior fit relative to a 3-class model. The 5-class model, in contrast, did not replicate even with increased starting values. The 4-class model also had a high entropy value, suggesting strong participant classification.

**Table 1.**

Evaluation indices and model comparison tests for the LPAs including the HGSHS:A and SOARS items (*N*=356).

| Model | BIC | BLRT | Entropy |
|---|---|---|---|
| 2-class | 16709 | 1120* | .91 |
| 3-class | 16543 | 290* | .88 |
| **4-class** | **16444** | **222*** | **.89** |
| 5-class | 27378 | - | .89 |

*Note*. HGSHS:A=*Harvard Group Scale of Hypnotic Susceptibility: Form A*; SOARS=*Sense of Agency Rating Scale*; BIC=Bayesian information criterion; BLRT=Bootstrap likelihood-ratio test; the BLRT for the 4-class model was not replicated; the optimal model is in **bold**.

* $p<.001$

### Class characteristics

Class information and descriptive and inferential statistics for the HGSHS:A and the SOARS subscales in the four classes are presented in Table 2 and Figure 1. The classes included a minimum of 10% and a maximum of 37% of participants from the entire sample. They did not differ in age but varied in gender distributions with class 1 displaying the greatest disparity. Class 1 was comprised almost entirely of mediums and highs, including nearly half of the former and over 80% of the latter. In contrast, classes 2 and 3 were both made up of mostly lows and mediums with small numbers of highs. Finally, class 4 was almost wholly comprised of lows. This indicates that highs displayed a relatively homogeneous response pattern of hypnotic responding whereas the response patterns of lows and mediums were far more diverse with a sizeable proportion (>20%) of each group present in three different classes.

Analyses of the HGSHS:A and the SOARS subscales corroborated these patterns. As can be seen in Table 2 and Figure 1, class 1 was the most responsive class characterized by the highest levels of behavioural hypnotic responding, involuntariness, and effortless. Classes 2 and 3 displayed roughly equivalent patterns of hypnotic responding on the HGSHS:A, but exhibited a double dissociation in the SOARS subscales. Specifically, whereas class 2 displayed greater involuntariness, class 3 displayed greater effortlessness; notably, the magnitude of effortlessness in the latter group was not significantly different from that in class 1.

### Response pattern variability in the upper range of hypnotic responding

The principal goal of this study was to clarify patterns of altered volition in the upper range of hypnotic responding, which is the primary focus of most hypnosis research (Barnier, Cox, & McConkey, 2014). Hence, we reanalyzed class effects on HGSHS:A and SOARS subscales, restricting the analyses to mediums and highs and omitting class 4 from this analysis due to the near absence of mediums and highs in this class (see Table 2). The analyses largely corroborated those in the entire sample. The results also corroborate the double dissociation between involuntariness and effortlessness in classes 2 and 3, suggesting that this was not an artifact of the inclusion of lows in the primary analyses.

**Table 2.**

Cell counts, demographics, and descriptive [*M* and (*SD*)] and inferential statistics for HGSHS:A and SOARS subscales as a function of class.

| | Class | | | | Test (*df*) | Effect size |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | $F(3, 343)^{\#}$ | $\eta^2$ [95% CIs] |
| *n* (%) | 130 (37%) | 118 (33%) | 72 (20%) | 36 (10%) | | |
| Age | 20.68 (5.07) | 21.72 (6.09) | 21.33 (4.20) | 21.83 (5.93) | 0.91 | <.01 [.00, .03] |
| | | | | | $\chi^2(3)$ | $\phi$ [95% CIs] |
| Gender (female:male) | 101:22 | 67:33 | 37:28 | 24:7 | 15.18* | .22 [.10, .31] |
| Hypnotic suggestibility: *n* (%) | | | | | 141.96** | .63 [.55, .69] |
| Low | 6 (5%) | 51 (43%) | 29 (24%) | 33 (28%) | | |
| Medium | 76 (43%) | 62 (35%) | 38 (21%) | 3 (2%) | | |
| High | 48 (83%) | 5 (9%) | 5 (9%) | 0 (0%) | | |
| | | | | | $F(3, 352)$ | $\eta^2$ [95% CIs] |
| HGSHS:A | 6.04 (1.62)$^a$ | 3.96 (1.70)$^b$ | 3.90 (2.01)$^b$ | 1.72 (1.23)$^c$ | 74.64** | .39 [.31, .45] |
| SOARS | | | | | | |
| Involuntariness | 24.94 (3.41)$^a$ | 17.19 (2.71)$^b$ | 10.11 (2.91)$^c$ | 7.36 (2.11)$^d$ | 558.75** | .83 [.80, .85] |
| Effortlessness | 26.06 (3.82)$^a$ | 20.05 (4.25)$^b$ | 25.28 (3.76)$^a$ | 14.44 (3.66)$^c$ | 112.35** | .49 [.41, .55] |
| Analyses excluding lows | | | | | $F(2, 231)$ | |
| HGSHS:A | 6.20 (1.47)$^a$ | 5.18 (1.09)$^b$ | 5.23 (1.31)$^b$ | - | 16.28** | .12 [.05, .20] |
| SOARS | | | | | | |
| Involuntariness | 25.02 (3.45)$^a$ | 17.09 (2.65)$^b$ | 10.56 (2.68)$^c$ | - | 389.79** | .77 [.72, .81] |
| Effortlessness | 26.11 (3.80)$^a$ | 19.94 (4.27)$^b$ | 25.07 (4.01)$^a$ | - | 53.74** | .32 [.22, .41] |

*Note*. HGSHS:A=*Harvard Group Scale of Hypnotic Susceptibility: Form A*; SOARS=*Sense of Agency Rating Scale*. Different superscripted letters reflect significant differences ($p<.05$; *post hoc* Tukey HSD tests). CIs = bootstrap 95% confidence intervals (10,000 samples). $^{\#}$ Age data were missing for *n* = 1, 4, 3, and 1 in the four classes, respectively. *$p<.01$ **$p<.001$

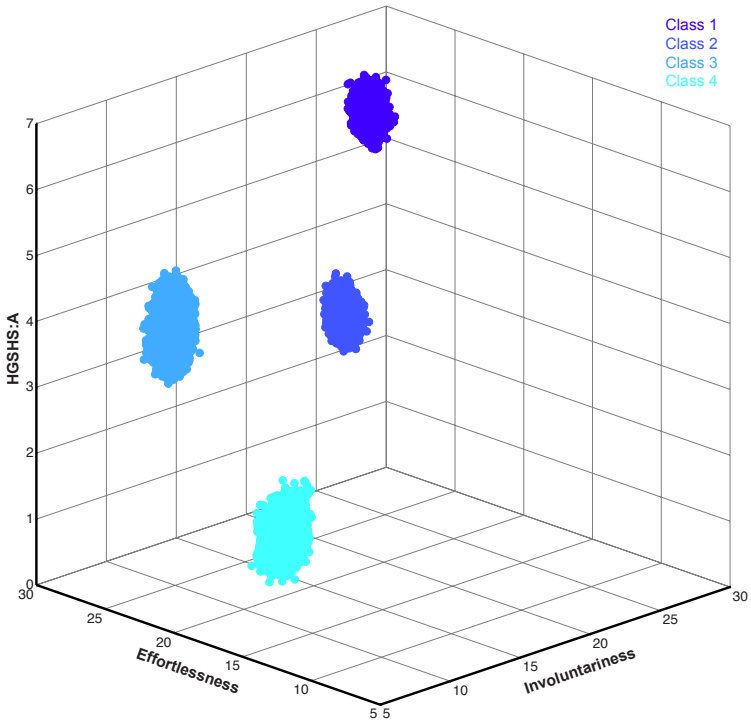


**Figure 1.** Scatterplot depicting mean HGSHS:A and SOARS subscale scores as a function of class. Data represent 10,000 bootstrap resamples of the means for each variable.

## Discussion

Applying LPA to participants' behavioural responses and sense of agency in response to hypnotic suggestions, we observed four discrete classes of individuals. One class displayed low hypnotic suggestibility and modest changes in their volition during hypnotic responding. Two classes exhibited moderate levels of hypnotic suggestibility, but alternately higher levels of involuntariness or effortlessness during hypnotic responding. A final class displayed moderate-to-high hypnotic suggestibility and both elevated involuntariness and effortlessness during responding. These results call attention to the pronounced variability in the sense of agency during hypnotic responding, particularly among lows and mediums, and its importance for understanding individual differences in response to suggestion.

A commonly observed pattern is that the magnitude of disruption in one's perceived control over one's actions and experience during hypnotic responding is linearly associated with hypnotic suggestibility (Bowers, 1981; Polito et al., 2015). Although class 1, comprised of mediums and highs, displayed high levels

of involuntariness and effortlessness and class 4, comprised of lows, displayed low levels of both, our results suggest a more nuanced association among mediums. Classes 2 and 3 displayed similar (moderate) levels of hypnotic suggestibility but class 2 exhibited greater involuntariness (still lower than class 1), whereas class 3 reported greater effortlessness (equivalent to class 1). One possible explanation for these differences is that they arise from the exertion of effort at different stages of the suggestion phase; for instance, class 2 mediums may exert greater effort early but experience their subsequent response as more involuntary (Bowers et al., 1988; Polito et al., 2014). Irrespective of the mechanisms, these results suggest three qualitatively distinct phenomenological modes of hypnotic responding: a pronounced level of involuntariness and effortlessness (class 1) or a moderate-to-high level of one or the other (classes 2 and 3). If these different modes of responding are replicable and relate to variability in other features of cognition (Terhune, Cardeña, & Lindgren, 2011a; Terhune et al., 2011b) or strategy utilization during hypnotic responding (Galea et al., 2010; King & Council, 1998; McConkey, Glisky, & Kihlstrom, 1989; Sheehan & McConkey, 1982), it may be problematic to collapse participants into single groups as this will mask potentially important differences (Barnier & McConkey, 2003; Woody & Szechtman, 2003).

Although heterogeneity in hypnotic responding among mediums tends to be neglected, our results do have precedence. For example, in one study, one subset of mediums displayed trembling and increased bicep activation during a motor challenge (arm rigidity) suggestion, as recorded by electromyography, whereas another subset did not tremble and displayed lower bicep activation (Winkel, Younger, Tomcik, Borckardt, & Nash, 2006) (see also Galea et al., 2010). Thus, the two groups seem to have differed in the amount of effort exerted to counter the suggestion despite exhibiting comparable levels of behavioural responsiveness, and reporting similar levels of arm stiffness, to the suggestion. It is not yet clear to what extent this variability parallels the differences observed in the present study but it is plausible that the latter group corresponds to class 1 or 3 mediums whose response patterns were characterized by greater effortlessness. By contrast, there has been almost no research on variability in response to suggestion among lows, to our knowledge, although lows have been shown to exhibit pronounced variability in their spontaneous experiential response to an induction (Pekala & Kumar, 2007; Terhune & Cardeña, 2010).

Unlike in previous studies (Terhune, 2015; Terhune & Cardeña, 2010), we did not find clear evidence for two or more subtypes of highs. Although this seems to challenge typological models of high hypnotic suggestibility (for a review, see Terhune & Cardeña, 2015), various methodological features of the current study may have minimized our chances of corroborating a typological pattern. For example, our sample included a smaller number of highs than previous research. Nearly 20% of highs were not in class 1 but the overall small sample makes it unclear whether this variability in class membership reflects discrete subgroups or measurement error. Moreover, the HGSHS:A is poorly suited to the study of individual differences among highs due to its inclusion of relatively few cognitive-perceptual suggestions (McConkey & Barnier, 2004; Terhune, 2015; Woody & Barnier, 2008). Finally, a previous study that identified a subtype of highs characterized by high involuntariness (Terhune et al., 2011b) measured involuntariness for each individual suggestion (Bowers, 1981), whereas the SOARS indexes involuntariness across a set of suggestions (Polito et al., 2013; Polito, Barnier, Woody, & Connors, 2014). Each approach has its strengths and limitations, but it is possible that the former was better able to capitalize on variability in response to specific suggestions. Nevertheless, the variability among mediums resembles similar patterns observed elsewhere in highs (Galea et al., 2010; King & Council, 1998; McConkey et al., 1989; Sheehan & McConkey, 1982; Terhune et al., 2011b) and thus raises the question of whether this complementarity is indicative of different pathways of achieving moderate to high hypnotic responding.

Our interpretation of these data is limited because it is not yet fully clear what the involuntariness and effortlessness subscales of the SOARS are measuring. One possibility is that effortlessness is a more primary dispositional element of hypnotic responding, one that is necessary, but not sufficient, to produce moderate to high responding. As can be seen in Figure 1, no class was observed that displayed higher involuntariness than effortlessness. Effortlessness thus may reflect an experiential style or strategy that is necessary to respond to suggestions (see also Brown & Oakley, 1998; Jamieson & Sheehan, 2004; Sheehan & McConkey, 1982) whereas involuntariness may refer to the perceptual response to the suggestion *per se*. Our observation that hypnotic suggestibility relates more strongly to involuntariness than effortlessness is arguably consistent with this distinction. A further concern is that the Effortlessness subscale displayed substandard internal

consistency and this might have impacted some of our results. Nevertheless, clarifying the distinct and overlapping roles of effortlessness and involuntariness during hypnotic responding will be important in furthering our understanding of the classic suggestion effect and heterogeneity at different levels of hypnotic suggestibility.

Our observations of marked experiential variability among lows and mediums have potential implications for the inclusion of such individuals in experimental hypnosis research designs. Research that aims to enhance hypnotic responding through some type of manipulation primarily includes mediums to avoid ceiling effects (Dienes & Hutton, 2013; Gorassini, 2004; Whalley & Brooks, 2009) and thus may benefit from greater consideration of variability in this group. On the one hand, it is plausible that class 1 mediums will be more responsive to attempts to augment hypnotic suggestibility because they already experience the classic suggestion effect. On the other hand, mediums in classes 2 and 3 may be more responsive to modification attempts because they may have not yet reached their ceiling. In particular, if our proposed distinction between involuntariness and effortlessness holds, social cognitive (Lynn, Kirsch, & Hallquist, 2008) or experiential style (Brown, Antonova, Langley, & Oakley, 2001) manipulations may be more effective in class 2 participants, who displayed lower effortlessness. Variability among lows and mediums will also be important when including them as a control group (e.g., to avoid extreme-groups designs; Lynn, Kirsch, Knox, Fassler, & Lilienfeld, 2007); neglecting this variability may obscure or confound observations of similarities and differences between controls and highs.

The present results further attest to the importance of experiential indices in the measurement of hypnotic suggestibility. Despite the inclusion of ten items from each scale in the LPA, the SOARS was more sensitive to individual differences in hypnotic responding than the HGSHS:A, the most widely used measure of hypnotic suggestibility (Barnier & McConkey, 2004). This reinforces the positions that experiential responsiveness should be the primary explanandum in experimental hypnosis research (Kihlstrom, 2008; Woody & Szechtman, 2007) and may be superior to behavioural responsiveness in the search for the correlates of hypnotic suggestibility (Brown & Oakley, 1998; Cardeña & Terhune, 2014). The SOARS may similarly provide valuable information in clinical studies. Lows and mediums in different classes may

differentially benefit from suggestions in a therapeutic context. Accordingly, heterogeneous experiential response patterns may confound the relationship between hypnotic suggestibility and therapeutic response, giving rise to data suggesting the poor utility of hypnotic suggestibility in predicting treatment outcome (Montgomery, Schnur, & David, 2011). Experiential measures thus may allow a more nuanced perspective on how hypnotic suggestibility influences response to suggestion in such contexts. However, the reduced efficacy of the HGSHS:A may stem from its use of dichotomous scoring and its scant representation of difficult suggestions, which together reduce the precision of the measure and concomitantly our ability to measure individual differences among highs (Woody & Barnier, 2008). Thus, scoring format and suggestion content should be revisited in the development of the next generation of hypnotic suggestibility measures.

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