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Discrete response patterns in the upper range of hypnotic suggestibility: A latent profile analysis

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Abstract

High hypnotic suggestibility is a heterogeneous condition and there is accumulating evidence that highly suggestible individuals may be comprised of discrete subtypes with dissimilar cognitive and phenomenological profiles. This study applied latent profile analysis to response patterns on a diverse battery of difficult hypnotic suggestions in a sample of individuals in the upper range of hypnotic suggestibility. Comparisons among models indicated that a four-class model was optimal. One class was comprised of very highly suggestible (virtuoso) participants, two classes included highly suggestible participants who were alternately more responsive to inhibitory cognitive suggestions or posthypnotic amnesia suggestions, and the fourth class consisted primarily of medium suggestible participants. These results indicate that there are discrete response profiles in high hypnotic suggestibility. They further provide a number of insights regarding the optimization of hypnotic suggestibility measurement and have implications for the instrumental use of hypnosis for the modeling of different psychological conditions.

Keywords: finite mixture modeling, heterogeneity, hypnosis, typology

A perennial question in the study of hypnosis is whether responses to different hypnotic suggestions are implemented through a uniform set of mechanisms across individuals (Hilgard, 1965; Woody & Barnier, 2008). A factor analysis of the two most commonly-used hypnotic suggestibility scales, the *Harvard Group Scale of Hypnotic Susceptibility, Form A* (HGSHS:A Shor & Orne, 1962) and the *Stanford Hypnotic Susceptibility Scale, Form C* (SHSS:C Weitzenhoffer & Hilgard, 1962) revealed that their (combined) latent structure consists of a single higher-order factor, suggesting a core ability, and four secondary factors, which may reflect ancillary, *componential* abilities (Woody, Barnier, & McConkey, 2005). These results suggest that hypnotic suggestions comprise a relatively uniform structure and except for variability in componential abilities, contemporary theories of hypnosis largely assume that highly suggestible (HS) individuals are a uniform population (Barnier, Dienes, & Mitchell, 2008; Jamieson & Woody, 2007; Lynn, Kirsch, & Hallquist, 2008; but see Woody & Sadler, 2008).

Standard measures of hypnotic suggestibility include a variety of suggestions that can be classified on the basis of the psychological function targeted and the type of suggestion (Woody & Barnier, 2008). Specifically, most hypnotic suggestions target motor (e.g., ideomotor movements), cognitive (e.g., amnesia), or perceptual (e.g., auditory hallucinations) functions; these suggestions may be either facilitative (e.g., an auditory hallucination of a voice) or inhibitory (e.g., the inability to remember previously-learned information). Motor suggestions are the easiest to respond to and the most well-represented on the HGSHS:A, SHSS:C, and the *Waterloo-Stanford Group C Scale of Hypnotic Susceptibility* (WSGC; Bowers, 1993). In contrast, cognitive and perceptual suggestions are those to which HS individuals most greatly vary and are under-represented on these scales (McConkey & Barnier, 2004). This may give rise to restriction of range in the upper range of hypnotic suggestibility, as measured by these scales, and the false impression that HS individuals are relatively uniform in their response patterns to hypnotic suggestions.

The putative uniformity of hypnotic responding among HS individuals typically assumed by contemporary theories of hypnosis is challenged by growing evidence for heterogeneity in this population. HS individuals display marked variability in the types of hypnotic suggestions to which they respond (McConkey & Barnier, 2004; Terhune, Cardeña, & Lindgren, 2011b) and, more crucially, the strategies and attentional mechanisms underlying their responses (Galea, Woody, Szechtman, & Pierrynowski, 2010; King & Council, 1998). These and other results suggest that there are two discrete subtypes of HS individuals: a dissociative subtype that experiences greater involuntariness during hypnotic responding and exhibits impaired working memory at baseline, disrupted cognitive control following a hypnotic induction, and uses minimal attentional resources to respond to suggestions; and a non-dissociative subtype that experiences greater voluntariness during hypnotic responding (but still less than low suggestible individuals), a normal cognitive profile, and requires attention to respond to suggestions (King & Council, 1998; Terhune, Cardeña, & Lindgren, 2011a; Terhune, et al., 2011b). However, despite the accumulating evidence for this bifurcated typology, it remains unclear whether heterogeneity in HS individuals reflects continua-like diversity on one or more dimensions or the presence of fundamentally discrete categories of respondents.

Most of the evidence marshaled for a HS typology thus far (see also Galea, et al., 2010; King & Council, 1998; Terhune, et al., 2011a, 2011b) has come from small-sample studies (*N*s < 30) in which HS subtypes were demarcated using independent theoretical discriminators (e.g., a measure of dissociative tendencies). Moreover, these studies have largely neglected variegation in hypnotic responding in favor of analyses of other behavioural, cognitive, or physiological variables. Identifying subtypes on the basis of behavioural response patterns to measures of hypnotic responding with larger samples represents a more rigorous approach because it is less constrained by assumptions pertaining to particular theories, it ensures greater sample sizes for derived classes, and it can yield clearer evidence as to whether derived subtypes are discrete groups or merely respondents who occupy different positions on one or more continua.

At least four studies with samples in excess of 100 participants have presented results that bear on the issue of whether HS individuals are comprised of discrete subtypes. One study, which applied taxometric analysis to responses on the HGSHS:A and the WSGC, found evidence for a latent taxon of

HS individuals, suggesting that hypnotic suggestibility is categorical and that HS individuals are a discrete subgroup (Oakman & Woody, 1996). However, a significant limitation of taxometric analysis is that it's unable to discriminate between multimodal models (Ruscio, Ruscio, & Carney, 2011), namely whether hypnotic suggestibility is best modeled as being comprised of more than two subgroups. Accordingly, although it suggests that HS individuals are distinct from the remainder of the population, this study is unable to provide information as to whether HS individuals are better represented as a homogeneous group or a family of discrete classes.

A second study (Hallquist, Lynn, & Barnes, 2008) applied latent class analysis (LCA), a finite mixture modeling method that is able to discriminate between different multimodal models, to response patterns on the *Carleton University Responsiveness to Suggestions Scale* (CURSS; Spanos, Radtke, Hodgins, Stam, & Bertrand, 1983). The LCA revealed that a four-class model, which included a low suggestible class, two medium suggestible classes, and a single class of HS individuals, best fit the data. Insofar as HS individuals comprised a discrete category in this study, it goes against proposals for a bifurcated or trifurcated HS typology (Barber, 1999; Terhune, et al., 2011b) and is consistent with the results of Oakman and Woody (1996). However, the CURSS suffers from the same limitation as the HGSHS:A, SHSS:C, and WSGC – the underrepresentation of *difficult* (e.g., cognitive or perceptual) hypnotic suggestions, which are those on which HS individuals are most frequently found to vary (McConkey & Barnier, 2004). That is, the CURSS does not possess sufficient sensitivity to measure individual differences in the upper range of hypnotic responding and thus an analysis of response patterns on this scale is unable to provide substantive information regarding variability among HS individuals.

A study by Brenneman and Kihlstrom (1988; Kihlstrom, 2008) circumvented the content limitation present in the two previous studies. These authors applied cluster analysis to the response patterns of medium and HS individuals on the *Stanford Profile Scales of Hypnotic Susceptibility* (SPSs; Weitzenhoffer & Hilgard, 1963). These scales include a diverse set of motor, cognitive, and perceptual suggestions and are thereby much better suited to investigate individual differences in the upper range of hypnotic responding than the standard scales widely used by hypnosis researchers (for a comparison, see Barnier & McConkey, 2004). The cluster analysis revealed the presence of 12 subgroups, suggesting a complex pattern of discrete classes of participants. However, this analysis is ambiguous because there is no consensus regarding reliable analytic techniques for class enumeration in cluster analysis, i.e., the determination of the optimal number of clusters in a sample. This renders cluster analysis inferior to finite mixture modeling techniques, such as LCA and latent profile analysis (LPA), which utilize strict criteria for class enumeration and are widely regarded as superior for the identification of latent classes (Vermunt & Magidson, 2002). Terhune and Cardeña (2010a) applied LPA to participants' spontaneous experiential responses to a hypnotic induction and found evidence for four response classes, two of which included HS participants. Notably, the two classes that included HS participants corresponded to the dissociative and non-dissociative subtypes found in other studies (King & Council, 1998; Terhune, et al., 2011a, 2011b) and thereby provide convergent evidence for a bifurcated typology. However, the extent to which these subtypes can be identified on the basis of response patterns to different hypnotic suggestions remains unknown.

The present study examined whether HS individuals display uniform behavioural responding to a diverse set of difficult hypnotic suggestions by applying LPA to the response patterns on the SPSs of individuals in the medium to high range of hypnotic suggestibility. If HS individuals are a uniform population, they should either fall into a single class that is distinct from medium suggestible individuals or possibly multiple classes that linearly differ in hypnotic suggestibility irrespective of suggestion profiles. For instance, this may be reflected in one class that displays high hypnotic suggestibility and a second class of virtuosos that exhibits ceiling or near-ceiling effects on the hypnotic suggestibility scales. In contrast, if heterogeneity among HS individuals reflects a bifurcated or trifurcated typology, a model with two or more HS classes that differ in suggestion profile response patterns, rather than in overall hypnotic suggestibility, would be expected.

Method

Participants

This study analyzed the standardization data of the SPSs (Lauer, 1966). The data set included the responses of 112 students, 63 (56%) of whom were female (age data was unavailable). All participants had previously completed the *Stanford Hypnotic Susceptibility Scale, Form A* (SHSS:A; Weitzenhoffer & Hilgard, 1959) and the SHSS:C (Weitzenhoffer & Hilgard, 1962), having scored four or greater on the former. Fifty-two (46%) participants displayed medium hypnotic suggestibility (4 ≤ SHSS:A ≤ 7) whereas the remaining 60 (54%) participants were HS (SHSS:A ≥ 8).

Materials

The SPSs (Weitzenhoffer & Hilgard, 1963) are two nine-item scales that are administered individually and which are comprised of a wide variety of hypnotic suggestions, most of which target cognitive and perceptual functions. In conjunction with motor and posthypnotic amnesia items drawn from the SHSS:A and SHSS:C, the SPSs comprise six response profiles: agnosia and cognitive distortions (AG), positive hallucinations (PH), negative hallucinations (NH), dreams and regressions (DR), amnesia and posthypnotic suggestions (AM), and motor control suggestions (MC) (SHSS:A and SHSS:C items are included in the AM and MC profiles). The AG profile includes suggestions for being unable to understand particular words (e.g., scissors) and experiencing impaired cognitive functioning. The HP profile includes suggestions for experiencing a stimulus that is not physically present (e.g., a sound) and taps four sensory domains (auditory, visual, somatic, and olfactory). The NP profile includes suggestions for the inability to experience a stimulus that is physically present (e.g., a smell) and taps the same four sensory domains as the HP profile. The DR profile includes suggestions to have a dream and to recall information about a previous lived event. The AM profile includes suggestions to forget a series of previous events and to perform certain actions outside of the context of hypnosis without awareness of the original instruction. The MC profile includes facilitative (e.g., eyes closing) and inhibitory (e.g., arm paralysis) suggestions for different motor responses. An experimenter observed participants' responses to different instructions after the suggestion (e.g., to pick up and use a scissors for the scissors agnosia suggestion in the AG profile) and judged the extent to which they responded to the suggestion on a scale from 0 to 3 (SPS suggestions; Weitzenhoffer & Hilgard, 1963) or 0 to 1 (SHSS:A and SHSS:C suggestions; Weitzenhoffer & Hilgard, 1959, 1962). The sum of scores for all suggestions within a profile provided the outcome profile score; profile scores ranged from 0 to 9 for the AG profile (one suggestion was omitted because of poor loadings on a factor comprised of the other AG profile suggestions) (Weitzenhoffer & Hilgard, 1967) and 0 to 12 for the remaining profiles. The six profiles displayed acceptable internal reliability (Cronbach's αs: AG: .83; PH: .73; NH: .71; DR: .75; AM: .76; MC: .80).

Statistical analyses

The six suggestion profiles of the SPSs were used as indicators for the derivation of response classes using LPA. LPA uses maximum likelihood estimation to probabilistically assign participants to latent classes (profiles)[1]. 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 three information criterion indices: the Akaike information criterion (AIC; Akaike, 1987), the Bayesian information criterion (BIC; Schwartz, 1978), and the sample-size adjusted BIC (SSABIC; Sclove, 1987). In each case, *lower* values reflect superior model fit (Vermunt & Magidson, 2002). Two likelihood-ratio based tests were used: the Lo-Mendell-Rubin likelihood-ratio test (LMR-LRT; Lo, Mendell, & Rubin, 2001) and the Bootstrap likelihood-ratio test (BLRT; McLachlan & Peel, 2000). These tests are used to further adjudicate between nested models. In both cases, a non-significant value indicates that a model has poorer fit than the model with one less class. Following previous findings demonstrating their robustness (for a comparison, see Nylund, Asparouhov, & Muthén, 2007), the BIC and BLRT were given preference in class enumeration.

[1] I use the term class rather than profile throughout so as to reduce confusion pertaining to the suggestion profiles.

Finally, *entropy*, a measure of participant classification, 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 analysis was performed using MPLUS v. 5.0 (Muthén & Muthén, 1998–2007).

Subsequent analyses on the characteristics of the response classes were conducted with chi-square analyses, independent *t*-tests, and one-way between-groups analyses of variance (ANOVAs). Welch's (1951) unequal-variance test was used to analyze data that were heteroscedastic. Subsidiary *post hoc* contrasts were performed using Tukey HSD tests or Welch tests as appropriate. Confidence intervals for effect sizes (and means in Figure 2) 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

Class Solution

The fit statistics for the different models are presented in Table 1. The analysis clearly indicated that the four-class model displayed the strongest fit to the data. This model exhibited lower AIC, BIC, and SSABIC values than the three-class model, as well as a marginally significant LMR-LRT and a significant BLRT, which indicate its superior fit relative to the three-class model. The five-class model had marginally lower AIC and SSABIC values than the four-class model, but a higher BIC value, suggesting poorer fit. Critically, neither the LMR-LRT nor the BLRT for the five-class model achieved significance. Accordingly, the four-class model was selected as the optimal model. This model, along with all others, displayed a high level of entropy, indicating robust participant classification.

Table 1

Evaluation indices and model comparison tests for the latent profile analysis of the SPSs

Model	AIC	BIC	SSABIC	LMR-LRT	*p*	BLRT	*p*	Entropy
2-class	3308	3360	3300	248.24	.017	255.76	< .001	.91
3-class	3221	3292	3209	98.26	.006	101.23	< .001	.91
4-class	**3189**	**3279**	**3174**	**44.74**	**.06**	**46.09**	**< .001**	**.92**
5-class	3185	3294	3167	17.35	.45	17.88	.24	.92

Note. SPSs = *Stanford Profile Scales of Hypnotic Susceptibility*; AIC = Akaike information criterion; BIC = Bayesian information criterion; SSABIC = sample-size adjusted BIC; LMR-LRT = Lo-Mendell-Rubin likelihood-ratio test; BLRT = Bootstrap likelihood-ratio test; the optimal model is in bold.

Class Characteristics

Class information and descriptive and inferential statistics for the indicator variables in the four classes are presented in Table 2. The classes did not differ in sex distributions, but main effects of Class were found for all six suggestion profiles. Class 4 displayed uniformly high responding across profiles and was more responsive to all profiles, except the DR profile, than the other three classes, suggesting that it constitutes a virtuoso class. Virtuosos are individuals who display a pronounced level of hypnotic responding that is reflected in ceiling or near-ceiling effects on hypnotic suggestibility scales. Classes 1 and 2 exhibited a moderate level of responding across profiles, reflecting two highly suggestible classes, although the latter displayed greater responsiveness to the AG profile. Finally, class 3 was less responsive to all suggestion profiles than the other classes except for comparable responsiveness to class 1 on the NH profile and thereby was interpreted as a medium hypnotic suggestibility class.

Table 2

Cell counts and descriptive [M and (SD)] and inferential statistics for the research measures as a function of class

	Class					
	1	2	3	4	χ^2 (*df*)	*phi* [95% CIs]
n (%)	26 (23%)	23 (21%)	43 (38%)	20 (18%)		
Sex (female: male)	16:10	14:9	22:21	11:9	0.96 (3)	0.09 [0, .14]
Hypnotic suggestibility					126.98 (6)*	1.07 [.92, 1.18]
Medium	9	1	41	0		
High	17	21	2	7		
Virtuoso	0	1	0	13		
SPS profiles					*F*	η^2 [95% CIs]
AG	3.50 (1.21)^{a}	7.65 (1.19)^{b}	0.88 (1.03)^{c}	8.60 (0.60)^{d}	503.49*	.91 [.87, .93]
PH	4.12 (2.69)^{a}	5.48 (2.43)^{a}	2.35 (2.11)^{b}	8.70 (2.60)^{c}	33.19*	.48 [.32, .60]
NH	3.54 (2.55)^{a,b}	4.91 (2.59)^{b}	2.28 (2.15)^{a}	9.60 (2.54)^{c}	43.56*	.55 [.39, .66]
DR	9.04 (2.66)^{a}	9.48 (1.97)^{a}	3.98 (2.45)^{b}	10.45 (2.24)^{a}	50.81*	.59 [.45, .68]
AM	3.92 (2.65)^{a}	2.83 (2.19)^{a}	1.35 (1.72)^{b}	9.85 (1.63)^{c}	118.99*	.69 [.56, .78]
MC	9.19 (2.61)^{a}	9.09 (2.17)^{a}	6.95 (2.55)^{b}	10.80 (1.54)^{c}	17.80*	.28 [.14, .40]

Note. Different superscripted letters indicate cell means significantly differ according to *post hoc* Tukey or unequal-variance Welch tests.

* p<.001

One of the motivations for this research was to determine whether HS individuals are a uniform population or comprised of discrete subtypes. This question was addressed by examining distributions of categorical hypnotic suggestibility in the four classes. Participants with total scores ≥ 40 on the combined 17-item suggestion pool of the SPSs (excluding SHSS:A and SHSS:C scores) were coded as virtuosos (Hilgard, 1986), those with scores between 20 and 40 were coded as HS (Terhune, et al., 2011b), and those with scores less than 20 were interpreted as falling in the medium range. The results show a number of differences in the composition of the classes (see Table 2): all classes differed in their compositions of suggestibility subroups, all χ^2s>18, *p*s<.001, *phi*s=.65-.94 [CIs: .40, 1.00], except classes 1 and 2, $\chi^2(2)=7.67$, *p*=.022, *phi*=.40 [CIs: .16, .56], which did not differ after a Bonferroni correction for multiple analyses (α=.008). All of the virtuosos, except one, were members of class 4, whereas HS participants were distributed across classes 1 (36%), 2 (45%), and 4 (15%). In contrast, the majority of participants in the medium range were members of class 3 (80%) with a subset in class 1 (18%), and 1 (2%) in class 2. Cumulatively, these results indicate that classes 3 and 4 were comprised of medium suggestible and virtuoso HS participants, respectively, whereas classes 1 and 2 included HS individuals with different response patterns on the suggestion profiles. These results are at odds with the hypothesis that HS participants exhibit uniform patterns of hypnotic responding.

Response pattern variability among HS individuals

Differences in hypnotic responding on the SPS suggestion profiles between participants across classes are confounded by the differential difficulty of the profiles; accordingly, these differences may be artifactual of the greater incidence of medium suggestible participants in particular classes rather than actual differences in the response patterns across HS participants in the classes. To investigate this possibility, the Class analyses on the SPS profiles were repeated following the exclusion of class 3, which was comprised of 95% medium suggestible participants, and all other participants in the medium range (see Figure 1). Main effects of Class were replicated for all profiles, *F*s(2,56)>6, *p*s<.006, η^2s=.14-.82 [CIs: .02, .88], except DR, $F(2,56)=0.85$, *p*=.43, η^2=.03 [CIs: .00, .11]. Subsidiary analyses revealed that class 4 was more responsive to all suggestion profiles (except DR) than classes 1 and 2, *p*s<.04, *ds*=0.88-5.57 [CIs: .24, 8.48]. Critically, class 2 was more responsive to AG suggestions than class 1, *p*<.001, *d*=3.47

[CIs: 2.73, 4.85], whereas class 1 was more responsive to AM suggestions than class 2, p=.014, d=0.86 [CIs: .23, 1.65]. These two classes didn't differ on the other profiles, ps>.67 ds=0.06-.27 [CIs: -.59, .96]. In order to clarify whether classes 1 and 2 differed on posthypnotic amnesia or posthypnotic motor suggestion items (both of which are included in the AM profile), they were independently contrasted on these two item subsets. Class 1 was more responsive to the posthypnotic amnesia suggestions (M=2.41, SD=1.97) than class 2 (M=0.86, SD=1.32), Welch's $t(27)$=2.79, p=.010, d=0.95 [CIs: .29, 1.79], whereas the two classes did not differ on the posthypnotic motor suggestions (class 1: M=2.47, SD=1.81; class 2: M=2.05, SD=1.86), $t(37)$=0.72, p=.48, d=0.23 [CIs: -.40, .90].

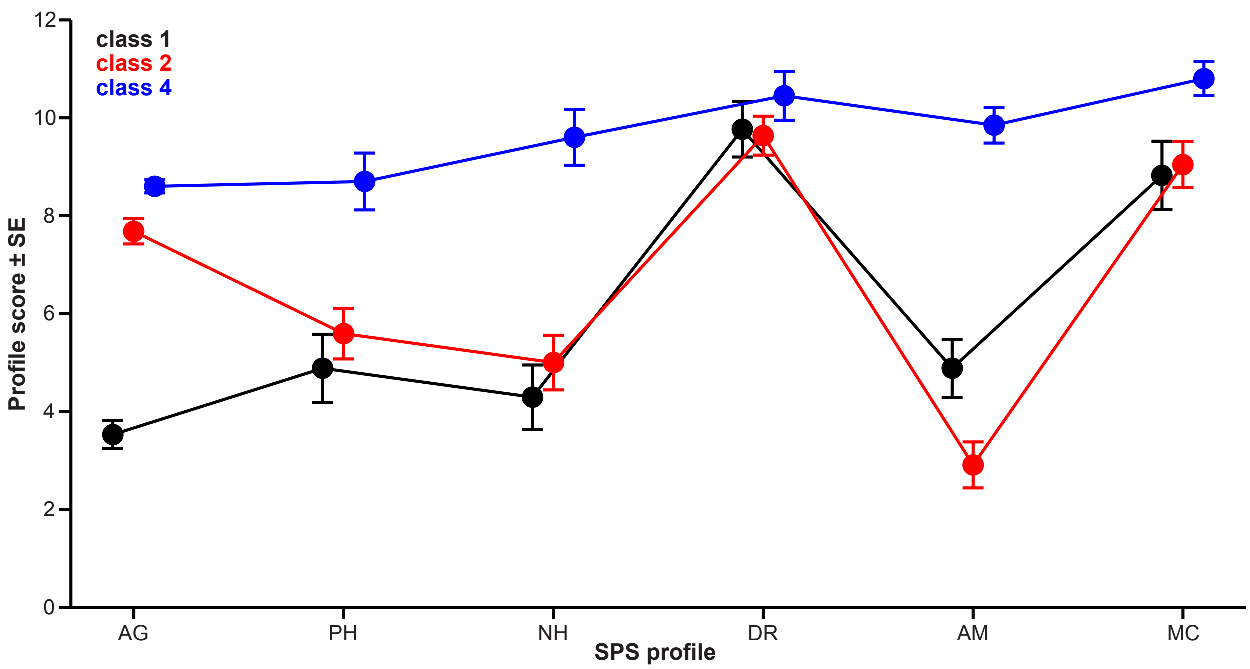

Figure 1. SPS profile scores among HS participants as a function of class. AG = agnosia and cognitive distortions; PH = positive hallucinations; NH = negative hallucinations; DR = dreams and regressions; AM = amnesia and posthypnotic suggestions; MC = motor control.

Figure 2 presents scatterplots depicting bootstrap resamples of the mean scores for each profile in the three classes in order to better highlight the discriminant validity of the different profiles. The scatterplot of the AG and AM profiles indicates that these profiles are able to adequately discriminate the three classes although the distributions of the means overlap slightly between classes 2 and 4 on the AG profile and classes 1 and 2 on the AM profile (the classes are still significantly different in both cases). In contrast, the hallucination profiles clearly discriminate class 4 (virtuosos) from classes 1 and 2, which are indistinguishable. Finally, the DR and MC profiles exhibited the poorest discriminant validity: the three classes overlapped in both profiles although class 4 was still discriminable from classes 1 and 2 in the MC profile despite clear distributional overlap.

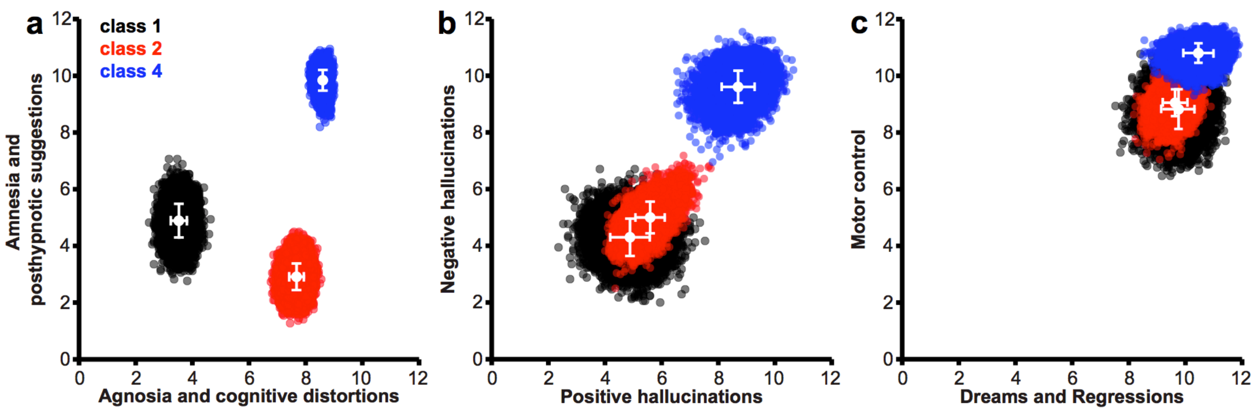

Figure 2. Scatterplots depicting mean SPS profile scores among HS participants as a function of class. **a**, Agnosia and cognitive distortions (AG) and amnesia and posthypnotic suggestions (AM) profiles. **b**, Positive (PH) and negative hallucinations (NH) profiles. **c**, Dreams and regressions (DR) and motor control (MC) profiles. Scatterplot data represent 10,000 bootstrap resamples of the means for each of two SPS profiles in each of the three classes that included HS participants. White markers represent M±1 SE.

Discussion

This study investigated the response patterns to a diverse set of hypnotic suggestions in order to elucidate the patterns underlying heterogeneity in the upper range of hypnotic suggestibility. The analyses produced evidence for four discrete classes of respondents. One class displayed a high level of responding uniformly across suggestions, reflecting a virtuoso subtype that is reliably distinct from the remaining classes. Two further classes included mostly HS participants but were less responsive to nearly all suggestions than the virtuoso subtype. A final class was comprised of medium suggestible individuals. These results have a number of implications for the delineation and modeling of response variability among HS individuals, the measurement of hypnotic suggestibility, and the instrumental use of hypnosis for modeling psychological and neurological phenomena.

The present results strengthen our understanding of response variability among HS individuals. The finding that nearly all of the virtuosos were members of a single subtype suggests that heterogeneity in hypnotic responding among HS individuals is restricted to the *lower range* of high hypnotic suggestibility. That is, despite the numerous possible response patterns by which members of this class can achieve virtuoso status, they appear to display this mode of responding in a relatively homogeneous manner through high responding across suggestion profiles. Relatedly, the small number of cognitive and perceptual suggestions included in the study of Hallquist et al. (2008) may explain why only one HS class was found. Further research is needed to ensure that greater diversity will not be found with larger samples of virtuosos or with a battery of more difficult suggestions. Two other classes included HS participants that were alternately more responsive than the other to agnosia and cognitive distortions and posthypnotic amnesia suggestions, both of which fall into the broader category of inhibitory cognitive suggestions. Insofar as the two classes responded similarly to non-amnesia posthypnotic suggestions, the observed differences are unlikely to be due to elevated responsiveness to posthypnotic suggestions in class 1. Rather, these differences suggest that class 1 is better at selectively inhibiting episodic information, whereas class 2 is better at inhibiting the *semantic* meaning of a word or object; these differences seems to parallel the dissociation between episodic and semantic memory. Cumulatively, these results demonstrate how three groups can achieve high hypnotic suggestibility through dissimilar patterns of hypnotic responding.

At this stage, it is necessary to clarify the mechanistic basis for class differences and integrate these findings with previous research on heterogeneity (Galea, et al., 2010; King & Council, 1998; Terhune & Cardeña, 2010a; Terhune, et al., 2011a, 2011b). The present results strongly suggest that HS participants display one of three patterns of hypnotic responding but it remains an open question whether they experience hypnotic responses through discrete mechanisms. For this reason, it would be advantageous to examine whether the derived subtypes can account for variability in response strategy utilization during hypnotic responding among HS individuals (Galea, et al., 2010; King & Council, 1998) and whether they relate to dissociative and non-dissociative HS subtypes (King & Council, 1998; Terhune, et al., 2011a). Insofar as highly dissociative individuals exhibit increased responsiveness to posthypnotic amnesia suggestions (Bryant, Guthrie, & Moulds, 2001; Frischholz, Braun, Lipman, & Sachs, 1992; Terhune & Brugger, 2011), and to positive and negative hallucination suggestions (Terhune, et al., 2011b), it could be argued that classes 1 and 4 are HS and virtuoso variants of the dissociative subtype although further research is clearly needed.

The results also provide valuable information regarding the measurement of hypnotic suggestibility. The failure of the DR profile to distinguish between different HS classes indicates that this measure is poorly suited to the task of measuring individual differences in the upper range of hypnotic responding. This result is notable because it is at odds with the recent proposal that the inclusion of a single hypnotic dream suggestion is sufficient for a clinical assessment of hypnotic suggestibility (Pekala et al., 2010) (for a critique, see Terhune & Cardeña, 2010b). In contrast, hallucination and posthypnotic suggestions were particularly robust at discriminating virtuosos from other HS individuals, which is consistent with another study showing that the positive and negative hallucination suggestion profiles were the best at discriminating between low and high dissociative HS individuals (Terhune, et al., 2011b). However, the AG profile displayed the greatest discriminative utility in the entire sample and, alongside the AM profile, clearly differentiated the three classes of HS participants. It is noteworthy that suggestions comparable to those in the AG profile are not represented on the HGSHS:A (Shor & Orne, 1962), SHSS:C (Weitzenhoffer & Hilgard, 1962), or WSGC (Bowers, 1993; see also Moran, Kurtz, & Strube, 2002), the most commonly used measures of hypnotic suggestibility, whereas the latter two scales include two items that are equivalent to suggestions on the DR profile, which was here shown to lack discriminant validity. In addition to reinforcing the claim that the standard scales of hypnotic suggestibility are poorly suited to the task of delineating individual differences in high hypnotic suggestibility (Terhune, et al., 2011b; Terhune & Cohen Kadosh, 2012), these results further suggest that greater representation of agnosia and inhibitory cognitive suggestions in future measures of hypnotic suggestibility will optimize the measurement of response variegation in this population.

In recent years, considerable attention has been devoted to the possibility of using hypnosis to model different psychological and neurological phenomena (Oakley & Halligan, 2009, 2013). For instance, hypnosis has been used to develop experimental analogues of synaesthesia (Cohen Kadosh, Henik, Catena, Walsh, & Fuentes, 2009), obsessive-compulsive disorder (Woody et al., 2005), and motor paralysis (Cojan et al., 2009). The value of such research is closely tied to the assumption that HS individuals respond to hypnotic suggestions through uniform mechanisms. If this assumption does not hold, the implications of instrumental hypnosis studies will be severely compromised. At the very least, some HS subtypes are clearly more responsive to particular suggestion profiles and thus more rigorous screening of participants for instrumental studies will be important in future research. For example, relative to each other, class 1 would probably be more responsive to an alexia suggestion (Raz, Fan, & Posner, 2005), class 2 would be more responsive to an amnesia suggestion (Mendelsohn, Chalamish, Solomonovich, & Dudai, 2008; Terhune & Brugger, 2011), and class 4 would probably display elevated responding to both suggestions. A more refined understanding of variegation in the upper range of hypnotic responding is likely to substantially improve the identification of participants for instrumental research.

Despite the clarity of the model, the small sample size of this study precludes strong generalizations. Nevertheless, the results are in line with previous research suggesting the existence of discrete HS subtypes and advance our understanding of differential response classes among HS individuals. The results also have implications for the measurement of hypnotic suggestibility and for the instrumental use of hypnosis.

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