Differential patterns of spontaneous experiential response to a hypnotic induction: A latent profile analysis

Devin Blair Terhune*, Etzel Cardeña

Department of Psychology, Lund University, 22100 Lund, Sweden

* Corresponding author. E-mail address: devin.terhune@psychology.lu.se (D.B. Terhune).

Abstract

A hypnotic induction produces different patterns of spontaneous experiences across individuals. The magnitude and characteristics of these responses covary moderately with hypnotic suggestibility, but also differ within levels of hypnotic suggestibility. This study sought to identify discrete phenomenological profiles in response to a hypnotic induction and assess whether experiential variability among highly suggestible individuals matches the phenomenological profiles predicted by dissociative typological models of high hypnotic suggestibility. Phenomenological state scores indexed in reference to a resting epoch during hypnosis were submitted to a latent profile analysis. The profiles in the derived four-class solution differed in multiple experiential dimensions and hypnotic suggestibility. Highly suggestible individuals were distributed across two classes that exhibited response patterns suggesting an inward attention subtype and a dissociative subtype. These results provide support for dissociative typological models of high hypnotic suggestibility and indicate that highly suggestible individuals do not display a uniform response to a hypnotic induction.

1. Introduction

Although considerable attention has been devoted to the striking distortions in agency induced by suggestions administered during hypnosis, a hypnotic induction alone is capable of producing profound alterations in a variety of dimensions of consciousness. A hypnotic induction consists of a set of instructions and suggestions to help a participant become absorbed in the experimenter's words and reduce their awareness of exogenous stimuli (e.g., Oakley & Halligan, 2009). Unusual spontaneous experiences following a hypnotic induction, omitting particular suggestions, are commonplace but remain under- studied (Cardeña, 2005; Pekala & Kumar, 2007; Rainville & Price, 2003). Many individuals, in particular those of high hypnotic suggestibility, frequently report various types of alterations in core phenomenological dimensions of conscious- ness. Such experiences include vestibular perceptions of floating, marked changes in temporal perception, affect, and internal dialogue, and increased amounts of fantasy-based visual imagery. Some of the variance in these dimensions is attributable to participants' response expectancies (Henry, 1985; as cited in Kirsch, 1990; Pekala, Kumar, & Hand, 1993). However, alterations in these experiential dimensions are still reported among highly suggestible (HS) individuals when a neutral hypnotic induction, which excludes experience-specific suggestions (e.g., for relaxation), is used (Cardeña, 2005).

A consistently replicated finding is that variability in spontaneous experiences during hypnosis covaries with hypnotic suggestibility (Pekala & Kumar, 2007). For instance, HS individuals reliably report greater magnitude alterations in a variety of experiential dimensions than their medium and low suggestible counterparts (Kumar & Pekala, 1988; 1989). However, some studies have observed marked differences in this population (e.g., Barrett, 1996; Pekala & Kumar, 2007). For instance, Barrett (1996) presented evidence for two subtypes of HS individuals, one of which experienced greater alterations in aware- ness and increased involuntariness during hypnotic responding. HS individuals also exhibit considerable variability in the types of suggestions to which they respond and the strategies they utilize to facilitate responding (e.g., McConkey & Barnier, 2004).

In order to resolve outstanding questions regarding heterogeneity in this population, various

models have proposed that HS individuals are comprised of distinct subtypes of respondents (e.g., Barber, 1999a; Brown & Oakley, 2004; Kunzendorf & Boisvert, 1996). These subtypes are hypothesized to experience hypnosis through different mechanisms and concomitantly exhibit dis- similar experiential response patterns following a hypnotic induction. Dissociative typological models of high hypnotic suggestibility propose that HS individuals are comprised of dissociative and fantasy-prone respondents (Barber, 1999a; Barrett, 1996; Cardeña, 1996; Carlson & Putnam, 1989; Perry, 2004); Barber (1999a) has also proposed a third subtype: positively-set respondents. According to these models, a hypnotic induction produces a state of experiential detachment in dissociative respondents that is characterized by reduced awareness, attention, episodic memory, imagery, and volitional control relative to other HS individuals. In contrast, fantasy-prone respondents are hypothesized to exhibit alterations in awareness during hypnosis of lower magnitude than dissociative respondents, but to experience greater attentional involvement (absorption), imagery, episodic memory, and volitional control. Positively-set respondents are hypothesized to exhibit relatively minor spontaneous alterations in experiential dimensions of consciousness that do not differ substantially from individuals of low hypnotic suggestibility. (For critical reviews of these models, see Barber (1999b) and accompanying commentaries.)

Support for the experiential predictions of the typological models has been provided by cluster analysis studies (Forbes & Pekala, 1996; Pekala, 1991b; Pekala & Forbes, 1997; Pekala, Kumar, & Marcano, 1995; for a review see Pekala & Kumar, 2007). In these studies, participants experienced a short resting epoch embedded within a standardized behavioral measure of hypnotic suggestibility. Participants subsequently completed the Phenomenology of Consciousness Inventory (PCI; Pekala, 1991a) in reference to their spontaneous experiences during the resting epoch. The PCI taps a wide variety of experiential dimensions including body image, temporal perception, positive affect, attentional absorption, and visual imagery.

In four studies, Pekala and colleagues used K-means cluster analyses to derive discrete types of respondents at multiple levels of hypnotic suggestibility on the basis of PCI dimension scores (Pekala & Kumar, 2007). In the first study, Pekala (1991b) derived two types of HS participants, labelled fantasy

and classic types, both of which were subsequently replicated by Pekala and Forbes (1997). The principal features of the fantasy type's experiential response were vivid imagery, positive affect, and mild reductions in awareness and memory, whereas the classic type experienced less vivid imagery, reduced control and memory, and greater alterations in awareness. In another study, Pekala et al. (1995) derived two types of HS participants, one that corresponded to the classic type and another labelled compliant, which was similar to the fantasy type except that it exhibited less imagery and positive affect and more internal dialogue. A final study replicated the classic type and found a second type interpreted as a hybrid of the fantasy and compliant types (Forbes & Pekala, 1996) and, in a separate seven-cluster solution, replicated the fantasy and classic types and observed a small percentage of HS participants classified in another cluster who exhibited minor alterations in the measured experiential dimensions.

These studies have been criticized for a lack of consistently derived cluster solutions (Lynn Meyer, & Schindler, 2004), but, collectively, provide evidence for distinct patterns of phenomenological response to a hypnotic induction among HS individuals. Further, they suggest that such patterns may be grounded in a latent typology. The classic type was consistently replicated, whereas the characteristics of a second (and possibly third) type are equivocal. Notwithstanding this issue, there are clear parallels between the phenomenological response of the different clusters and the experiential profiles predicted by the dissociative typological models (e.g., Barber, 1999a). The results, however, appear to provide greater support for bifurcated (Barrett, 1996; Brown & Oakley, 2004; Carlson & Putnam, 1989; Kunzendorf & Boisvert, 1996) than trifurcated (Barber, 1999a) typological models.

Lack of consistency is neither the only nor most salient limitation of these studies. Although some of the analyses were undertaken on the entire sample, many of the derived cluster solutions were generated by cluster analyses performed on relatively small sample sizes of HS participants ($ns < 100$). The analyses could also have been strengthened by a validation check of the different types using an independent measure of theoretical significance. Furthermore, the hypnotic suggestibility of the derived types was not contrasted in order to identify their behavioral correlates. Barber (1999a), for instance, proposes that the dissociative subtype is more responsive to posthypnotic amnesia suggestions. A final

limitation of these analyses is the use of K-means cluster analysis. Despite its pervasive use, there exists no consensus regarding analytic techniques for class enumeration, that is, the determination of an optimal number of clusters, in a sample using this method (Ruscio & Ruscio, 2008; Vermunt & Magidson, 2002). It follows that the reliability and validity of the derived cluster solutions in these studies may be suspect.

Many of the limitations of K-means cluster analysis are circumvented by latent variable modelling techniques such as latent profile analysis (LPA; Goodman, 2002; see also McCutcheon, 1987, 2002). LPA is a method for identifying homogeneous profiles in multivariate continuous data. The central assumption of LPA is that variability in a set of continuous indicator (observed) variables stems from a set of patterns determined by an underlying categorical latent (unobserved) variable comprised of multiple profiles (Vermunt & Magidson, 2002). The principal strength of LPA is that it allows for the computation of model fit statistics that render the process of class enumeration less arbitrary than K-means cluster analysis. In addition, LPA enables the testing of more complex models, such as ones that free restrictions on indicator covariance (Vermunt & Magidson, 2002). In multiple comparative assessments, LPA consistently exhibited superior performance than K- means cluster analysis (Magidson & Vermunt, 2002).

The present study

There has been relatively little research on spontaneous phenomenological alterations during hypnosis and their under- lying mechanisms (Rainville & Price, 2003). Spontaneous alterations in experiential dimensions of consciousness may reflect mind-wandering and a consequent weakening of executive functioning (Smallwood, Beach, Schooler, & Handy, 2008). Impaired executive functioning during hypnosis has been argued to modulate hypnotic suggestibility and play a critical role in mediating responsiveness to hypnotic suggestions (Egner, Jamieson, & Gruzelier, 2005; Woody & Bowers, 1994; Woody & Sadler, 2008). Accordingly, the examination of individual differences in spontaneous experiential response profiles among HS individuals and whether they exhibit a typological pattern represents a critically important endeavour for understanding the nature of hypnosis and hypnotic

suggestibility.

This study used LPA to identify the optimal number and principal characteristics of different experiential response pro- files following a hypnotic induction. Participants were administered a standardized group measure of hypnotic suggestibility within which was embedded a resting epoch. Following a de-induction, participants retrospectively completed the PCI (Pekala, 1991a) and the Inventory Scale of Hypnotic Depth (ISHD; Field, 1965). The ISHD is a measure of experiential involvement and involuntariness during hypnotic responding and was included to independently validate the dissociative typology because it has been argued to discriminate dissociative and fantasy-prone HS individuals (Barrett, 1996). In addition to predicting that LPA would discern a poly-class solution of experiential profiles on the basis of PCI factor-based scores, we expected HS individuals to fall into two or three phenomenological classes that would exhibit dissimilar experiential profiles, suggesting a typological distribution. Finally, we tested the prediction that the experiential response patterns of the derived profiles would correspond to those predicted by the bifurcated and trifurcated dissociative typological models (Barber, 1999a; Barrett, 1996; Cardeña, 1996; Carlson & Putnam, 1989; Perry, 2004).

3. Method

3.1. Participants

Six hundred and forty individuals (375 females [59%]), whose ages ranged from 18 to 65 ($M = 23.71$, $SD = 5.62$), consented to participate in this study. Women ($M_{Age} = 23.55$, $SD = 5.56$) and men ($M_{Age} = 23.93$, $SD = 5.71$) did not differ in age, $t < 1$. Participants were recruited through advertisements at Lund University and in the city of Lund or volunteered as part of an introductory psychology course. This study was approved by the local ethics committee.

3.2. Materials

3.2.1. Hypnotic suggestibility The Waterloo-Stanford Group Scale of Hypnotic Susceptibility, Form C (WSGC; Bowers, 1993, 1998) was used to measure responsiveness to hypnotic suggestions. The WSGC

is a group adaptation of the individually-administered Stanford Hypnotic Susceptibility Scale, Form C (Weitzenhoffer & Hilgard, 1962) and consists of 12 dichotomously-scored items including direct ideomotor (e.g., arm heaviness), challenge motor (e.g., arm immobilization), and cognitive-perceptual (e.g., auditory hallucination) suggestions, with scores ranging from 0 to 12. This measure has strong psychometric properties (Bowers, 1993, 1998).

3.2.2. Experiential dimensions of consciousness

The PCI (Pekala, 1991a) is a 53-item self-report scale measuring different dimensions of consciousness that is completed retrospectively in reference to a preceding interval. Each item consists of a pair of bipolar statements anchored on a seven-point Likert scale. The PCI consists of 12 dimensions (and 14 sub-dimensions): altered experience (body image, time sense, perception, and meaning); positive affect (joy, sexual excitement, and love); negative affect (anger, sadness, and fear); attention (direction and absorption); imagery (amount and vividness); self awareness; altered state of awareness; arousal; rationality; volitional control; memory; and internal dialogue. Kumar, Pekala, and Cummings (1996) derived five PCI factors: attention to internal processes, dissociated control, negative affect, positive affect, and visual imagery.

3.2.3. Experiential involvement and involuntariness

The ISHD (Field, 1965) is a self-report scale composed of 38 dichotomous (true/false) items that measure alterations in awareness, perception, and volition during hypnosis. Representative items include: ‘‘At times I felt completely unaware of being in an experiment” and ‘‘Parts of my body moved without my conscious assistance.” The scale exhibited strong internal consistency in this sample (Cronbach’s a = .89).

3.3. Procedure

Participants completed the WSGC in groups ranging in size from four to 40. A clinically-trained consultant was present during all sessions (see Cardeña & Terhune, 2009). A two-minute resting epoch

was embedded within the WSGC prior to the administration of items 11 and 12. Prior to the epoch, participants were instructed to sit quietly with their eyes closed and continue to experience hypnosis. Following the de-induction, participants completed the WSGC response booklet, the PCI in reference to the rest epoch, and the ISHD in reference to the whole session.

3.4. Statistical analyses

The five PCI state factor-based scores (Kumar, Pekala, & Cummings, 1996) were used as the observable indicators for the derivation of the profiles using LPA. The fit of multiple models (two-class through five-class) was assessed. For each class solution, restricted and unrestricted models were evaluated. In the former, the covariance among indicators is restricted to zero, whereas in the latter it is allowed to be free. Restricted models commonly overestimate the number of profiles and provide less parsimonious solutions (Vermunt & Magidson, 2002). The selection of variables allowed to covary in the unrestricted models was made on the basis of the significance of the correlations among the indicator variables in Table 1. Statistical fit of the different models was evaluated using three information criterion indices: Akaike information criterion (AIC; Akaike, 1987), 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). LMR-LRT and BLRT are used to adjudicate between nested models. For both, a non-significant value indicates that a model does not have superior fit than the corresponding model with one less class. The BLRT has consistently outperformed the LMR-LRT in comparative assessments (Nylund, Asparouhov, & Muthén, 2007) and was given preference in class enumeration. Entropy values were calculated on the basis of each model's posterior probabilities for group membership and range from 0 to 1 with low values indicating poor classification of participants (Ramaswamy, Desarbo, Reibstein, & Robinson, 1993). The analyses were conducted with MPLUS v. 5.0 (Muthén & Muthén, 1998–2007) with secondary analyses performed with SPSS v. 16.0. Non-parametric tests were

used for many of the secondary analyses due to violations of the assumptions of homogeneity of variance. Outliers (M ± 2 SDs) were excluded for contrasts among the different profiles.

4. Results

4.1. Intra-test reliability

The PCI includes a set of items that allow for the computation of a reliability index (Pekala, 1991a). Twenty-five participants (4%) exhibited unacceptable values (>2); this compares favorably to a previous study (9%; Kumar, Pekala, & Cummings, 1996). These individuals' data were excluded from the analyses, which thereafter included 615 participants.

4.2. Descriptive statistics

Descriptive statistics and correlation coefficients for the research measures are presented in Table 1. All of the correlations were positive. WSGC scores were moderately correlated with ISHD scores and dissociated control, positive affect, and attention to internal processes, weakly correlated with visual imagery, and uncorrelated with negative affect. All other correlations were significant except for that between negative affect and visual imagery.

Table 1
Descriptive statistics and correlation matrix for the research measures.

Variable	*M* (*SD*)	1	2	3	4	5	6	7
1. WSGC	4.41 (2.18)		.57**	.53**	.42**	.07	.29**	.49**
2. ISHD	15.26 (7.83)			.80**	.53**	.15**	.30**	.74**
3. Dissociated control	−8.43 (5.21)				.63**	.25**	.35**	.77**
4. Positive affect	4.24 (3.26)					.21**	.38**	.58**
5. Negative affect	1.30 (2.16)						.08	.10*
6. Visual imagery	3.32 (1.94)							.28**
7. Attention to internal processes	6.47 (2.33)							

Note: WSGC = Waterloo-Stanford Group scale of Hypnotic Susceptibility, Form C; ISHD = Inventory Scale of Hypnotic Depth.
* $p < .05$.
** $p < .001$.

4.3. Phenomenological profiles

All models exhibited high entropy values, indicating acceptable participant classification. Unrestricted

models exhibited superior fit to the data for all class solutions, as reflected by lower information criteria values, than restricted models (see Table 2). The four-class unrestricted model had a comparable BIC value to the three-class unrestricted model and lower AIC and SSABIC values, indicating its superior fit. In addition, the former model had a significant BLRT value, indicating that it is a better model than the latter. The unrestricted five-class model had superior AIC and SSABIC values than the four-class unrestricted model. However, its BIC was lower and its BLRT value was not consistently replicated, indicating its instability and the unreliability of its p-value. Moreover, the replicability of BLRT values declined with the inclusion of increased starting values. Because of these replicability failures and for the sake of parsimony, we selected the four-class unrestricted model as the optimal model.

Table 2
Evaluation indices and model comparison tests for the latent profile analysis of experiential dimensions during hypnosis.

Model	AIC	BIC	SSABIC	LMR LRT	*p*	BLRT	*p*	Entropy
2-class R	14,263	14,334	14,283	760.92	<.001	780.67	<.001	.82
2-class UR	13,903	14,018	13,936	110.26	<.04	113.12	<.001	.82
3-class R	14,049	14,146	14,076	220.74	<.001	226.47	<.001	.80
3-class UR	13,489	13,719	13,554	166.85	.03	169.21	<.001	.81
4-class R	13,920	14,044	13,955	137.29	.08	140.85	<.001	.81
4-class UR	**13,445**	**13,724**	**13,524**	**174.36**	**.11**	**176.83**	**<.001**	**.77**
5-class R	13,851	14,001	13,893	79.11	.05	81.16	<.001	.83
5-class UR	13,404	13,731	13,496	62.72	.12	–	–	–

Note. 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; R = restricted; UR = unrestricted; BLRT values for the 5-class unrestricted model failed to replicate and are not provided; the optimal model is in **bold**.

Participants were assigned to a profile on the basis of posterior probabilities. Table 3 presents descriptive statistics for the different profiles. Profile 2 was the largest class, whereas the rest exhibited comparable sample sizes. The profiles did not differ in age, $F < 2.5$, but there was a significant relationship between sex and profile, χ^2 (3, N = 615) = 25.20, $p < .001$. Profile 2 had a greater proportion of women than the other profiles, profiles 1 and 3 had comparable sex distributions, and profile 4 had the largest proportion of males. The profiles were also found to differ as a function of categorical hypnotic suggestibility level (low, medium, high), χ^2 (6, N = 615) = 87.27, $p < .001$. Profiles 1 and 2 were primarily comprised of participants in the medium range of hypnotic suggestibility, whereas profiles 3 and 4 were primarily comprised of those in the low range of hypnotic suggestibility. HS participants were

distributed across profiles 1 and 2 with none in profile 3 and two in profile 4.[1]

Table 3
Distributional data and descriptive statistics for PCI state factor scores in the four profiles: number or mean (percentage or standard deviation).

Variable	Profile			
	Inward attention 1 (n = 131)	Dissociative 2 (n = 258)	Minimal response 3 (n = 127)	Moderate response 4 (n = 99)
Sex (female)	70 (53%)	177 (69%)	65 (51%)	42 (42%)
Hypnotic suggestibility				
Low	29 (22%)	68 (26%)	78 (61%)	55 (56%)
Medium	78 (60%)	157 (61%)	49 (39%)	42 (42%)
High	24 (18%)	33 (12%)	0 (0%)	2 (2%)
Dissociated control	−5.42 (3.07)[a]	−5.73 (4.58)[a]	−13.89 (2.91)[b]	−12.44 (2.25)[c]
Positive affect	5.44 (3.06)[a]	5.99 (3.01)[a]	0.66 (0.53)[b]	2.67 (1.00)[c]
Negative affect	−0.33 (0.29)[a]	2.94 (2.32)[b]	−0.04 (0.70)[c]	0.86 (1.15)[d]
Visual imagery	3.88 (2.02)[a]	3.80 (1.82)[a]	2.43 (1.79)[b]	2.47 (1.61)[b]
Attention to internal processes	8.25 (1.23)[a]	7.26 (2.05)[b]	4.34 (1.68)[c]	4.78 (1.68)[c]

Note: Different superscripted letters indicate cell means significantly differ according to Mann-Whitney Tests after a Bonferroni correction (α = .002).

To identify their characteristic features, we first contrasted the four profiles on the five PCI state scores. Kruskal–Wallis tests yielded main effects of Profile for all five PCI state scores: dissociated control, $H(3) = 332.52$, $p < .001$, positive affect, $H(3) = 327.81$, $p < .001$, negative affect, $H(3) = 334.58$, $p < .001$, visual imagery, $H(3) = 67.38$, $p < .001$, and attention to internal process, $H(3) = 279.24$, $p < .001$. Bonferroni-corrected post hoc Mann–Whitney tests indicated a clear demarcation be- tween the first two and last two profiles, that is, profiles 1 and 2 differed from 3 and 4, on all five PCI state scores. Profile 1 was found to have lower negative affect and greater attention to internal processes than profile 2, whereas profile 4 exhibited greater dissociated control, positive affect and negative affect than profile 3. These findings indicate that profiles 1 and 2 represent participants who exhibited marked experiential responses to a hypnotic induction, whereas profiles 3 and 4 were comprised of participants who experienced relatively minimal and moderate responses, respectively.

Next, we sought to further examine variability in PCI state scores between the first two profiles as a function of hypnotic suggestibility. We restricted this analysis to profiles 1 (inward attention) and 2 (dissociative), which were the only two pro- files that included HS participants (see Table 4 for descriptive statistics). A 2 (Profile: inward attention v. dissociative) x 3 (Hypnotic suggestibility: low, medium, high) multivariate analysis of variance on the five PCI state factors revealed main effects of

Profile, $F(5, 379) = 43.64$, $p < .001$, $g^2 = .37$, and Hypnotic suggestibility, $F(10, 758) = 4.93$, $p < .001$, $g^2 = .06$, but no interaction, $F < 2$. In addition to the main effects of Profile on negative affect and attention to internal processes reported above, main effects of Hypnotic suggestibility were found for dissociated control, positive affect, visual imagery, and atten- tion to internal processes, all $Fs > 5$, all $ps < .007$, g^2 range: .03–.09. These effects were mediated by Profile x Hypnotic suggestibility interactions for dissociated control, visual imagery, and attention to internal processes, all $Fs > 3$, all $ps < .05$, all $g^2s = .02$. In the inward attention profile, medium suggestible and HS participants exhibited greater dissociated control than low suggestible participants, but the former two did not differ from one another. HS participants in this profile also exhibited greater visual imagery than low suggestible participants, but did not differ from medium suggestible participants. No differences were found for attention to internal processes in this profile. In contrast, dissociated control and attention to internal processes increased in a significant linear fashion as a function of hypnotic suggestibility in the dissociative profile, whereas visual imagery increased from low to medium hypnotic suggestibility and did not differ between medium suggestible and HS participants. This indicates that variability in dissociated control, visual imagery, and attention to internal processes is differentially influenced by hypnotic suggestibility in the two profiles.

Table 4
Descriptive statistics (Mean and Standard Deviation) for PCI state factor scores in the inward attention and dissociative profiles as a function of hypnotic suggestibility.

PCI state factor	Profile					
	Inward attention			Dissociative		
	Low	Medium	High	Low	Medium	High
Dissociated control	−7.08 (2.72)[a]	−4.97 (3.12)[b]	−4.86 (2.69)[b]	−8.22 (4.75)[a]	−5.29 (4.07)[b]	−2.75 (4.20)[c]
Positive affect	4.75 (2.73)	5.60 (3.20)	5.74 (2.99)	4.79 (2.91)	6.26 (2.95)	7.17 (2.74)
Negative affect	−0.34 (0.24)	−0.33 (0.31)	−0.29 (0.31)	3.07 (2.28)	2.90 (2.29)	2.86 (2.59)
Visual imagery	3.90 (2.00)[a,b]	3.58 (2.01)[a]	4.85 (1.86)[b]	3.17 (1.83)[a]	3.98 (1.77)[b]	4.23 (1.78)[b]
Attention to internal processes	7.79 (1.51)[a]	8.34 (1.10)[a]	8.48 (1.18)[a]	6.27 (2.03)[a]	7.43 (1.88)[b]	8.52 (2.02)[c]

Note: Different superscripted letters indicate cell means in each profile significantly differ according to Tukey HSD tests.

4.4. Assessment of the typological models

As profile 1 exhibited greater internally-directed attention and lower negative affect than profile 2, and the two profiles included all of the HS participants, we next examined whether they exhibited experiential response patterns consonant with the fantasy-prone and dissociative types, respectively. We tested

specific directional predictions of the dissociative typological models in HS participants using PCI dimensions and sub-dimensions (see Table 5). The dissociative profile was expected to exhibit greater distortions of awareness and reduced attention, imagery, memory, and volitional control than the inward attention profile. In line with these predictions, the dissociative profile exhibited greater scores on the altered experience dimension, $F(1, 55) = 4.35$, $p < .05$, $g^2 = .07$, and lower scores on attention, $F(1, 55) = 4.25$, $p < .05$, $g^2 = .07$, including direction of attention, $F(1, 55) = 4.27$, $p < .05$, $g^2 = .07$, but not absorption, $F < 1.5$. The inward attention profile displayed greater imagery vividness, $F(1, 54) = 4.88$, $p < .05$, $g^2 = .08$, but did not score higher on the general imagery dimension, nor amount of imagery, $Fs < 1$. The dissociative profile was also found to exhibit suggestively lower volitional control than the inward atten- tion profile, $F(1, 55) = 3.84$, $p = .055$, $g^2 = .07$. However, in contrast with the predictions of some variants of the dissociative typological model (Barber, 1999a; Barrett, 1996), the two profiles did not differ in memory, $F < 2$.

Table 5
Descriptive statistics (Mean and Standard Deviation) for the PCI dimensions and sub-dimensions in the two profiles of highly suggestible participants.

Variable	Profile	
	Inward attention ($n = 24$)	Dissociative ($n = 33$)
Altered experience	2.42 (0.70)	2.93 (1.02)
Attention	4.58 (0.80)	4.00 (1.19)
Direction	4.76 (0.80)	4.07 (1.50)
Absorption	4.31 (1.04)	3.91 (1.41)
Imagery	3.40 (1.29)	3.06 (1.25)
Amount	3.60 (1.51)	3.53 (1.53)
Vividness	3.33 (1.19)	2.59 (1.25)
Memory	3.83 (1.15)	3.53 (1.05)
Volitional control	2.91 (1.10)	2.30 (1.18)
Positive affect	0.38 (1.01)	0.70 (0.90)
Negative affect	−0.70 (0.09)	0.74 (1.19)

Barrett (1996) presented evidence indicating that dissociative HS individuals exhibit greater ISHD scores than their non- dissociative counterparts. We next sought to test the effectiveness of the ISHD for discriminating the two profiles of HS participants. In line with Barrett's findings, HS participants in the dissociative profile exhibited significantly greater ISHD scores ($M = 24.77$, $SD = 5.10$) than those in the inward attention profile ($M = 21.76$, $SD = 4.55$), $F(1, 54) = 5.21$, $p < .05$, $g^2 = .09$. This

finding was followed up with a 2 (Profile) x 3 (Hypnotic suggestibility) analysis of variance (ANOVA) on ISHD scores to examine whether the relationship between involuntariness and hypnotic suggestibility differs across profiles. There was no main effect of Profile, $F < 1.5$, but a main effect of Hypnotic suggestibility, $F(2, 383) = 26.10$, $p < .001$, $g^2 = .12$, which was qualified by a Profile x Hypnotic suggestibility interaction, $F(2, 383) = 4.18$, $p < .05$, $g^2 = .02$. Subsidiary one-way ANO- VAs revealed main effects of Hypnotic suggestibility in the inward attention, $F(2, 128)$, $p < .001$, $g^2 = .10$, and dissociative, $F(2, 255) = 29.41$, $p < .001$, $g^2 = .19$, profiles. Although low suggestible participants ($M = 17.35$, $SD = 4.45$) in the inward attention profile exhibited lower ISHD scores than medium ($M = 20.51$, $SD = 4.74$) and HS participants, $ps < .01$, the latter two did not differ, $p > .05$. In contrast, low ($M = 13.63$, $SD = 7.57$) and medium ($M = 19.00$, $SD = 6.61$) suggestible participants in the dissociative profile differed from one another as well as HS participants, $ps < .001$. This indicates that the relationship between hypnotic suggestibility and involuntariness during hypnotic responding is linear in the dissociative profile but plateaus in the inward attention profile in medium to high levels of hypnotic suggestibility.

We next report analyses examining differential affective response between the two subtypes of HS participants. A mixed- model ANOVA with Affect as a repeated-measures variable (positive vs. negative) and Profile (inward attention vs. dissociative) as a between-groups variable using Z-score transformed values for the PCI dimension scores revealed main effects of Affect, $F(1, 55) = 7.85$, $p < .01$, $g^2 = .13$, Profile, $F(1, 55) = 27.60$, $p < .001$, $g^2 = .33$, and an Affect x Profile interaction, $F(1, 55) = 9.06$, $p < .01$, $g^2 = .14$. Follow-up repeated measures ANOVAs revealed a main effect of Affect in the inward attention profile, with lower negative than positive affect, $F(1, 23) = 26.91$, $p < .001$, $g^2 = .54$, but no effect in the dissociative pro- file, $F < 0.5$. These findings indicate that the dissociative profile exhibits an elevated level of general affect, relative to participants in profiles 3 and 4, whereas the inward attention profile only exhibits elevated positive affect.

4.5. Hypnotic suggestibility as a function of profile

We finally undertook a series of exploratory analyses to discern differences in hypnotic suggestibility between the two profiles. The inward attention profile exhibited significantly greater WSGC total scores ($M = 5.41$, $SD = 2.14$) than the dissociative profile ($M = 4.94$, $SD = 2.14$), $F(1, 387) = 4.20$, $p < .05$, but the magnitude of this difference was negligible: $g^2 = .01$. After a Bonferroni correction ($a = .004$), the inward attention profile was found to more frequently respond to the direct ideo-motor (arm heaviness) suggestion (90%) than the dissociative profile (74%), $\chi^2(1, N = 389) = 13.16$, $p < .001$, phi = .18. There were also trends for the inward attention profile (44%) to exhibit greater responsiveness than the dissociative profile (34%) on the posthypnotic drawing item, $\chi^2(1, N = 389) = 3.83$, $p = .050$, phi = .10, but less responsiveness to the negative visual hallucination item (inward attention: 17%, dissociative: 25%), $\chi^2(1, N = 389) = 3.24$, $p = .072$, phi = .09. The two profiles did not differ on WSGC total scores or any individual WSGC items when the analyses were restricted to HS participants.

5. Discussion

This study sought to identify discrete experiential profiles in response to a hypnotic induction and examine whether the profiles of HS participants corresponded to the patterns predicted by dissociative typological models of high hypnotic suggestibility (e.g., Barber, 1999a). The results indicate that phenomenological response to hypnosis can be classified in terms of four experiential profiles. Two involve marked alterations in a variety of experiential dimensions, whereas the other two are characterized by relatively minor experiential shifts. All HS participants fell into the first two profiles, whereas medium and low suggestible participants were distributed among the four profiles. The first two profiles differed in endogenous attention and negative affect, suggesting that they corresponded to the fantasy-prone and dissociative subtypes, respectively, predicted by the dissociative typological models (e.g., Barber, 1999a; Barrett, 1996). Upon closer inspection, HS participants in these two profiles were found to exhibit differential levels of awareness, affect, attention, imagery, and volitional control. All

observed findings were in the direction predicted by the dissociative typological models (Barber, 1999a; Barrett, 1996; Carlson & Putnam, 1989). Critically, in replication of a previous finding (Barrett, 1996), the two subtypes were also found to differ in involuntariness during hypnotic responding, as measured by the ISHD. In particular, the fact that the ISHD correlated strongly with dissociated control, but only weakly with imagery scores provides further support for the utility of this measure for discriminating the two subtypes (Barrett, 1996). The results also corroborate many of the findings of previous cluster analyses on spontaneous experiential response to a hypnotic induction (Pekala & Kumar, 2007), as well as the relationships between hypnotic suggestibility and the PCI state scores (Kumar, Pekala, and Cummings, 1996; Kumar, Pekala, and Marcano, 1996). In sum, the results provide strong support for the proposal that HS individuals are comprised of two distinct subtypes of respondents.

Despite the support found for the dissociative typological models, our results diverge from the models' predictions in multiple respects that are worth considering. First, no evidence was found for a third HS subtype, positively-set respondents (Barber, 1999a). It is plausible that the inward attention and dissociative profiles had members with minimal alterations in awareness that correspond to the positively-set subtype but which were either too few in number or not sufficiently unique in their displayed experiential response patterns to be classified as a discrete phenomenological profile. This possibility notwithstanding, the results favor bifurcated variants of the dissociative typological model (Barrett, 1996; Cardeña, 1996; Carlson & Putnam, 1989; Perry, 2004) rather than the trifurcated version (Barber, 1999a). In addition, the dissociative profile did not exhibit reduced episodic memory during hypnosis, as predicted by Barber (1999a; see also Barrett, 1996), and found in previous cluster analyses (Pekala & Kumar, 2007). Further, despite reporting less vivid imagery than the inward attention profile, the dissociative profile still exhibited greater vividness of imagery than profiles 3 and 4. This finding is inconsistent with the hypothesis that this subtype experiences minimal imagery following a hypnotic induction (Barber, 1999a; see also Pekala & Kumar, 2007). These disparities may stem from cultural differences (e.g., expectancies) in our sample, relative to previous North American samples. Alternatively, a large proportion of cognitive-perceptual suggestions in the measure of hypnotic

suggestibility that we used (Bowers, 1993, 1998) may have invoked greater amounts of imagery, which carried over into the resting epoch. At the very least, these disparities suggest that HS individuals are comprised of two distinct subtypes and that spontaneous episodic memory deficits during hypnosis should not be regarded as a critical marker of typological variability in high hypnotic suggestibility.

A novel finding of this study is that the strongest discriminator of the experiential response profiles of the two types of HS participants was negative affect. Specifically, the dissociative profile exhibited greater negative affect following a hypnotic induction than the inward attention profile. Although previous cluster analyses of PCI dimension scores during hypnosis did not observe greater negative affect in the dissociative subtype of HS participants (Pekala & Kumar, 2007), dissociative tendencies have been found to predict negative affect during hypnosis (Kumar, Pekala, and Marcano, 1996; Pekala et al., 2009). More broadly, this may suggest a greater proneness to psychopathology in this profile (Pekala et al., 2009), as has been argued elsewhere (e.g., Lynn, Lilienfeld, & Rhue, 1999). One explanation for this finding is that the distortions in awareness produced by the hypnotic induction induced state-dependent memory intrusions in dissociative participants corresponding to negative events to which the participants had previously responded with experiential detachment (e.g., Spiegel & Cardeña, 1990). A second possibility is that greater negative affect may have resulted from participants' response expectancies (Kirsch, 1999; Lynn, Kirsch, & Hallquist, 2008). However, a recent study, which found that expectations for negative affect during hypnosis were unrelated to its occurrence during hypnosis after controlling for baseline negative affect (Cardeña, Jönsson, Terhune, & Lehmann, 2009), casts doubt on this interpretation.

A final explanation for increased negative affect during hypnosis in the dissociative profile is that the participants in the two profiles experienced increased general affect during hypnosis, but the dissociative profile was unable to sufficiently regulate negative affect due to weakened executive control. For instance, both profiles of HS participants experienced elevated positive affect, but only the dissociative profile experienced elevated negative affect. A finding in another study, that high dissociative HS participants displayed impaired cognitive control during hypnosis relative to a control condition,

whereas low dissociative HS participants exhibited marginally superior cognitive control (Terhune, Cardeña, & Lindgren, 2009), clearly supports this interpretation. Increased involuntariness during hypnotic responding among the dissociative profile is also consistent with weakened control during hypnosis in this subtype. In non-hypnotic contexts, a negative mood has been found to increase mind wandering (Smallwood, Fitzgerald, Miles, & Phillips, 2009), which is associated with attentional lapses (Smallwood et al., 2008). Future work should attempt to directly link impaired cognitive control during hypnosis in the dissociative profile with increases in negative affect.

Importantly, the present study failed to identify unequivocal behavioral signatures of the two subtypes of HS individuals. The only robust behavioral difference between the two profiles was the increased level of responsiveness to the direct ideomotor suggestion of the WSGC in the inward attention profile. This difference may have been caused by the fact that this suggestion was administered first, as dissociative HS individuals may require a longer hypnotic induction before achieving an optimal level of hypnotic suggestibility (Barber, 1999a; Barrett, 1996; Brown & Oakley, 2004). More broadly, the WSGC (and a group environment) may be insufficient for discerning differences among HS individuals. Measures of hypnotic suggestibility with larger proportions of cognitive-perceptual suggestions may be better suited to this task (Weitzenhoffer & Hilgard, 1967; Woody & Barnier, 2008). In addition, future research may consider measuring factorial invariance, that is, equivalence of factor structures, of hypnotic suggestibility scales across the two profiles. Another suitable place to look for differences between the two subtypes may be in their utilization of cognitive strategies during hypnotic responding. Studies on response strategy utilization have provided evidence for distinct subtypes of respondents (Danziger et al., 1998; Kunzendorf & Boisvert, 1996; Winkel, Younger, Tomcik, Borckardt, & Nash, 2006). For instance, Kunzendorf and Boisvert (1996) found that suggestions for negative hallucinations and hyperaesthesia modulated brainstem evoked potentials in only a subset of HS individuals despite the fact that all reported the phenomenal impression of responding to the suggestions. The reconciliation of individual differences in phenomenological response to a hypnotic induction with differential response strategy utilization should be afforded greater attention in future research (see also Brown & Oakley, 2004).

A question raised by critics of the typological models is whether the different subtypes are dimensional, that is, extending from low to high hypnotic suggestibility or taxonic, that is, reflective of a discrete subtype of HS respondent (e.g., Lynn et al., 1999). Barber's (1999a) model is somewhat equivocal in this regard (see commentaries accompanying Barber, 1999b). Although by no means conclusive, the present results suggest that typological variability in experiential response is dimensional rather than taxonic. HS individuals were classified into two profiles, which also included participants of low and medium suggestibility, whereas a taxonic typological pattern would predict that HS individuals would form two or more distinct profiles. In so far as many of the participants in the dissociative profile exhibited low or medium hypnotic suggestibility, the present findings are also broadly consistent with previous research that demonstrated that high dissociative individuals uniformly experience high experiential involvement during hypnotic responding, but only some display high hypnotic suggestibility (Kumar, Pekala, and Marcano, 1996). However, the dimensional structure of each profile and in particular, its relationship to hypnotic responding, may differ. For instance, involuntariness during hypnotic responding, and dissociated control and attention to internal processes during the resting epoch, increased linearly as a function of hypnotic suggestibility in the dissociative profile, but did not increase from medium to high hypnotic suggestibility in the inward attention profile. These results could be interpreted as reflecting a taxonic distribution in the dissociative profile and a dimensional distribution in the inward attention profile. Dimensional and taxonic variants of the typological models, and their attendant predictions, require closer inspection in future studies.

An alternative to the typological models is the componential model (Woody & Barnier, 2008; Woody, Barnier, & McConkey, 2005). According to this account, hypnotic suggestibility is determined by a single latent factor and individual differences at specific levels of hypnotic suggestibility, in particular those among HS individuals, are modulated by ancillary 'componential' abilities. For instance, imagery ability may not correlate with general hypnotic suggestibility but may facilitate responsiveness to particular types of suggestions among HS individuals (see, e.g., Laurence, Beaulieu-Prévost, & du Chéné, 2008). On this account, the two experiential profiles of HS individuals observed in this study do not

constitute discrete subtypes per se, but rather different ancillary aptitudes (e.g., for altering awareness and agency) that, in turn, affect particular features of hypnotic responding (e.g., involuntariness), but which are not indicative of differential underlying mechanisms. Although the componential model is a valuable alternative to the typological models and warrants greater attention, the different abilities that con- tribute to individual differences among HS individuals remain underspecified (Woody et al., 2005; see also Laurence et al., 2008). This model requires refinement before it can generate testable predictions that clearly diverge from those of the typo- logical models.

The present study is limited in at least four respects. First, in so far as the results are dependent upon self-reports, some participants, particularly those in the dissociative profile, who exhibited greater distortions in awareness during hypnosis, may have had greater difficulty quantifying their experiential responses. Although the high level of inter-item reliability speaks against this limitation, it would be useful to corroborate self-reported lapses in attention with performance on a behavioral task (e.g., Smallwood et al., 2008; Terhune et al., 2009). Second, because there are no Swedish-language equivalents of the measures included in this study, all of the measures were administered in English. However, previous work indicates that deflation of hypnotic suggestibility because of English measurement with a Swedish sample is negligible (Cardeña, Kallio, Terhune, Buratti, & Lööf, 2007). Furthermore, our measures exhibited strong internal consistency and reliability and the observed WSGC scores are comparable to those of a recent study with a British sample (Dienes et al., 2009). This renders unlikely the possibility that English-language administration of the measures represents a serious confound. A third potential limitation stems from the selection of an LPA model that allowed for class-dependent unrestricted covariance matrices. Allowing local dependencies between indicator variables possesses a number of strengths, such as the prevention of selecting a model with too many profiles, but it may also function to hide additional meaningful profiles (Vermunt & Magidson, 2002). A final limitation concerns the small number of experiential dimensions included as indicator variables in the LPA models. The success of any clustering technique is dependent upon the extent to which the selected indicator variables measure the dimensions of interest. As a result, the present analyses may not have included all

relevant experiential dimensions that could discriminate among the different profiles. Future research should consider including a wider variety of experiential dimensions.

6. Conclusions

This study used LPA to identify discrete experiential profiles in response to a hypnotic induction to test the prediction that there are distinct subtypes of HS individuals (e.g., Barber, 1999a). We identified a homogeneous subset of dissociative HS participants who exhibit pronounced distortions in awareness, affect, and volitional control and reduced attention and imagery during hypnosis relative to a second profile of HS participants who were primarily characterized by endogenously-directed attention. The former was also found to exhibit increased involuntariness during hypnotic responding. We maintain that these experiential responses can be understood as reflecting a weakening of executive functioning following a hypnotic induction that is isolated to the dissociative profile (see also Barber, 1999a; Brown & Oakley, 2004). In so far as there is consensus that involuntariness is the core phenomenological feature of hypnotic responses and the primary explanandum of experimental hypnosis research (Kihlstrom, 2008; Kirsch & Lynn, 1998; Weitzenhoffer, 1980), these findings have critical implications. They indicate that the relationship between involuntariness and hypnotic suggestibility is modulated by (typo- logical) experiential response to a hypnotic induction. That is, increased hypnotic suggestibility among HS, relative to low and medium suggestible individuals, appears to only be coupled with increased involuntariness in the dissociative profile. These findings further suggest that the mechanisms underlying hypnotic responding in dissociative HS individuals are either different from or more pronounced than those underlying the responses of individuals in the inward attention subtype.

Note

1. In another study (Terhune, Cardeña, & Lindgren, 2010), the two HS participants in class 4 were both found to be false positives, that is, they failed to meet screening criteria for high hypnotic suggestibility as

measured by individually-administered scales (Weitzenhoffer & Hilgard, 1967).

Acknowledgment

This research was supported by Research Bursary 54/06 from the Bial Foundation and the David Caul Graduate Research Award from the International Society for the Study of Dissociation. The research assistance of Tina Koch is gratefully acknowledged.

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