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Dissociative tendencies and individual differences in high hypnotic suggestibility

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## Abstract

*Introduction:* Inconsistencies in the relationship between dissociation and hypnosis may result from heterogeneity among highly suggestible individuals, in particular the existence of distinct highly suggestible subtypes that are of relevance to models of psychopathology and the consequences of trauma. This study contrasted highly suggestible subtypes high or low in dissociation on measures of hypnotic responding, cognitive functioning, and psychopathology.

*Methods:* Twenty-one low suggestible (LS), 19 low dissociative highly suggestible (LDHS), and 11 high dissociative highly suggestible (HDHS) participants were administered hypnotic suggestibility scales and completed measures of free recall, working memory capacity, imagery, fantasy-proneness, psychopathology, and exposure to stressful life events.

*Results:* HDHS participants were more responsive to positive and negative hallucination suggestions and experienced greater involuntariness during hypnotic responding. They also exhibited impaired working memory capacity, elevated pathological fantasy and dissociative symptomatology, and a greater incidence of exposure to stressful life events. In contrast, LDHS participants displayed superior object visual imagery.

*Conclusions:* These results provide further evidence for two highly suggestible subtypes: a dissociative subtype characterized by deficits in executive functioning and a predisposition to psychopathology and a subtype that exhibits superior imagery and no observable deficits in functioning.

*Keywords:* dissociation, executive functioning, heterogeneity, hypnosis, hypnotic suggestibility, imagery, involuntariness, psychopathology

## Introduction

High hypnotic suggestibility, which is associated with responsiveness to a variety of hypnotic suggestions for alterations in affect, cognition, and perception, was regarded as a pathological condition associated with “hysteria” and other forms of dissociation by leading psychiatrists of the late 19th and early 20th century, including Charcot and Janet (Ellenberger, 1970). This position was subsequently abandoned in favor of an explanation of hypnosis as heightened suggestibility, the stance favored by the Nancy school (cf. Hull, 1933). More recently, a number of accounts have proposed that dissociative experiences and responses to hypnotic suggestions, which share many features including pronounced disruptions in agency and awareness (Kirsch & Lynn, 1998), possess similar mechanisms (for a review, see Woody & Sadler, 2008). This and related work on acute stress and post-traumatic stress disorders led to the refined hypothesis that high hypnotic suggestibility is a predisposing factor for dissociative psychopathology (Butler, Duran, Jasiukaitis, Koopman, & Spiegel, 1996). Attempts to test the hypothesized relationship between dissociative tendencies and hypnotic suggestibility in non-clinical samples have been mixed (e.g., Butler & Bryant, 1997; Dienes, Brown, Hutton, Kirsch, Mazzoni, & Wright, 2009), whereas patients reporting dissociative symptomatology have consistently displayed higher hypnotic suggestibility than control samples (Bryant, Guthrie, & Moulds, 2001; Roelofs, Hoogduin, Keijsers, Naring, Moene, & Sandijck, 2002; Spiegel, Hunt, & Dondershine, 1988; but see Litwin & Cardena, 2000). These disparities may reflect the circuitous route by which dissociative tendencies influence hypnotic responding.

Heterogeneity among highly suggestible (HS) individuals may partly account for the inconsistent relationship between dissociation and hypnotic suggestibility (Dell, 2009). HS individuals display considerable variability in responsiveness to cognitive-perceptual suggestions (e.g., positive hallucinations) as well as involuntariness during hypnotic responses (McConkey & Barnier, 2004). The capacity for generating and manipulating imagery has been found to markedly vary in this population (Sheehan & Robertson, 1996) and to predict responsiveness to particular suggestions (Laurence, Beaulieu-Prévost, & du Chéné, 2008). Moghrabi (2004) similarly found that working memory capacity negatively correlated with responsiveness to cognitive-perceptual suggestions, indicating that impaired working memory may facilitate hypnotic responding in HS individuals. Insofar as working memory is critical for online attributions of agency (i.e., intention-action matches), deficits in working memory and other executive functions may also contribute to involuntariness during hypnotic responding as well as individual differences in hypnotic responding among HS individuals (Brown & Oakley, 2004; Terhune, Cardena, & Lindgren, 2009).

Heterogeneity among HS individuals and the relationship between dissociation and hypnotic responding are jointly addressed by dissociative typological models (e.g., Barber, 1999; Barrett, 1996; Cardena, 1996; Carlson & Putnam, 1989; Kunzendorf & Boisvert, 1996; Perry, 2004). These models propose that there is a HS subtype that experiences hypnotic responses through dissociative mechanisms such as the

inhibition of information from awareness, impaired monitoring of response intentions, or the weakening of executive control (e.g., Brown & Oakley, 2004; see also Woody & Sadler, 2008). In contrast, the responses of a second subtype are argued to be facilitated by superior imagery and flexible utilization of cognitive strategies (Barber, 1999; Brown & Oakley, 2004; Carlson & Putnam, 1989; Kunzendorf & Boisvert, 1996).

A number of studies have corroborated the central predictions of these models. King and Council (1998) found that completion of a secondary attentional task impaired responsiveness to an alexia suggestion in low dissociative HS (LDHS) participants, but not high dissociative HS (HDHS) participants, despite equivalent performance in the absence of a cognitive load. In the same sample as the present study, we found that a hypnotic induction attenuates cognitive control in HDHS participants, but marginally augments control in LDHS participants (Terhune et al., 2009). These findings are consistent with the hypotheses that HDHS participants experience deficits in executive control during hypnosis, yet require only minimal attention for hypnotic responding, whereas LDHS participants maintain flexible use of effortful strategies and actively utilize attentional resources during responding (Barber, 1999; Brown & Oakley, 2004). On the basis of a latent profile analysis of spontaneous phenomenological responses to a hypnotic induction, we also found evidence for a dissociative HS subtype that experienced marked distortions in volition and an inward-attention subtype characterized by greater endogenously-directed attention and vivid imagery (Terhune & Cardeña, in press; see also Pekala & Kumar, 2007). Further evidence for comparable bifurcated typologies has been reported elsewhere (e.g., Galea, Woody, Szechtman, & Pierrynowski, 2010; McConkey, Glisky, & Kihlstrom, 1989).

The possibility of a HDHS subtype may shed further light on the relationships between hypnotic suggestibility, psychopathology, and trauma (Barber, 1999; Lynn, Lilienfeld, & Rhue, 1999). Hypnotic suggestibility has previously been found to correlate with various ostensibly pathological symptoms such as perceptual distortions (Gruzelier, De Pascalis, Jamieson, et al., 2004; Jamieson & Gruzelier, 2001) and to be associated with exposure to abuse or severe punishment (J. R. Hilgard, 1979; Nash & Lynn, 1985-86; Nash, Lynn, & Givens, 1984). Research has suggested that individuals exhibiting pathological dissociation may form a taxon or latent subtype (Waller, Putnam, & Carlson, 1996). Lynn and colleagues (1999) speculated that the HDHS subtype proposed in the typological models may belong to this dissociative taxon. Crucially, in our previous study, the HDHS subtype reported more spontaneous negative affect during hypnosis (Terhune & Cardeña, in press). This finding may point to impaired emotion regulation and a predisposition to psychopathology in this subtype, which may be based in repeated experience of stressful events, as hypothesized by Barber (1999).

The dissociative typological models possess considerable overlap but differ in the variables proposed to discriminate the subtypes as well as the subtypes' principal characteristics. Barber (1999) argued that the HDHS subtype is characterized by episodic memory deficits, in particular spontaneous posthypnotic amnesia. This pre-

diction is controversial because it is difficult to reconcile with the repeated finding that spontaneous posthypnotic amnesia is rare (Kihlstrom & Schachter, 1995) and our own finding of no difference in the frequency of spontaneous amnestic episodes during hypnosis between the two HS subtypes (Terhune & Cardena, in press). Other typological models (e.g., Brown & Oakley, 2004; Kunzendorf & Boisvert, 1996) focus on executive functions and argue that the dissociative subtype exhibits impairments in executive monitoring and/or control (see also Woody & Sadler, 2008). Although nearly all of the models agree that the LDHS subtype will display superior imagery abilities (e.g., Barber, 1999; Kunzendorf & Boisvert, 1996), only some of the models explicitly identify this subtype as fantasy-prone (Barber, 1999; Barrett, 1996). These divergent predictions allow for refined tests of the characteristic features of these subtypes. The present study examined whether dissociative tendencies modulate individual differences in high hypnotic suggestibility by stratifying HS participants on the basis of dissociative tendencies and comparing LDHS and HDHS participants in hypnotic responding, cognitive functioning, and psychopathology.

LS and HS participants were administered two indices that measure five hypnotic suggestion *profiles*: agnosia and cognitive distortions, positive hallucinations, negative hallucinations, dreams and regressions, and posthypnotic compulsions (Weitzenhoffer & Hilgard, 1967). The hypothesized superior inhibitory abilities of HDHS participants (Barber, 1999) should support increased responsiveness to the negative hallucination and agnosia and cognitive distortion profiles, which require the inhibition of sensory and semantic information and motor representations, respectively. In contrast, LDHS participants have been argued to be more responsive to dreams and regressions and positive hallucinations profiles, which may require greater utilization of fantasy and imagery and depend upon strong episodic retrieval strategies (Barber, 1999; Hilgard, 1964). Alternatively, if the HDHS subtype is characterized by a monitoring deficit during hypnosis (Kunzendorf & Boisvert, 1996), they may be more responsive to hallucination suggestions because of impaired monitoring of the source of perceptual representations and the concomitant misattribution of the content to the environment (Bentall, 1990; see also Brown & Oakley, 2004). Finally, if HDHS participants possess a greater propensity for automatizing behavior and compartmentalizing information (Barber, 1999), they would be expected to exhibit greater responsiveness to the posthypnotic compulsions profile, which may depend on the execution of implementation intentions outside of awareness.

Our previous finding of attenuated cognitive control among HDHS participants following a hypnotic induction (Terhune et al., 2009) points to the depletion of flexible strategy utilization in this subtype (Brown & Oakley, 2004). Insofar as expending cognitive effort during a task facilitates self-agency attributions (Johnson, Hashtroudi, & Lindsay, 1993), HDHS participants were expected to experience greater involuntariness during hypnotic responding (Carlson & Putnam, 1989; Terhune & Cardena, in press; see also Dell, 2010).

Our investigation of individual differences in cognitive functioning focused on memory and imagery. We first tested Barber's (1999) prediction of spontaneous

posthypnotic amnesia by examining posthypnotic recall of hypnotic suggestions and recall organization (Evans & Kihlstrom, 1973; Radtke & Spanos, 1981). In line with our previous study and the extant literature, we expected that the two HS subtypes wouldn't differ in spontaneous amnesia. We also sought to replicate Farvolden and Woody's (2004) finding of impaired free recall among HS participants, but expected this effect to be restricted to HDHS participants. On the assumption that this finding reflects weakened executive functioning, we included a measure of working memory capacity to further corroborate this supposition. Finally, we sought to replicate the previous finding of a HS imagery subtype (Kunzendorf & Boisvert, 1996; Terhune & Cardeña, in press) by administering a behavioral measure of object visual imagery with the expectation that LDHS participants would display superior imagery.

Our third series of analyses concerned psychopathology. Participants completed measures of normal and pathological fantasy-proneness to assess the claim that LDHS participants represent a fantasy-prone subtype (Barber, 1999) and measures of global and dissociative psychopathology to examine whether HDHS participants belong to the pathological dissociative taxon (Lynn et al., 1999). Finally, we tested the prediction that HDHS participants would report a greater incidence of stressful life events (Barber, 1999).

## Method

### *Participants*

Sixty-four individuals (48 females) ranging in age from 18 to 33 ( $M = 23.47$ ,  $SD = 3.02$ ) with normal or corrected-to-normal vision were recruited from a larger group hypnosis study ( $N = 640$ ; Terhune & Cardeña, in press). Participants provided informed written consent and were compensated for their participation. This study was approved by a local ethics committee. Hypnotic suggestibility was measured in group sessions using the *Waterloo-Stanford Group Scale of Hypnotic Susceptibility, Form C* (WSGC; Bowers, 1993) and in two individual sessions with the *Revised Stanford Profile Scales of Hypnotic Susceptibility* (RSPSs; Weitzenhoffer & Hilgard, 1967). Participants were selected for the present study on the basis of their WSGC scores (high  $\geq 8$ ;  $n = 42$ ; low  $\leq 4$ ;  $n = 22$ ) and HS individuals were further selected according to their RSPS scores (mean RSPS score  $\geq 10$ ;  $n = 31$ ).<sup>1</sup> Two participants (one LS, one HS) dropped out of the study, resulting in 21 LS and 30 HS individuals. The HS participants ( $M = 8.67$ ,  $SD = 0.99$ ) exhibited higher WSGC scores than the LS participants ( $M = 2.52$ ,  $SD = 0.68$ ),  $F(1, 49) > 100$ ,  $p < .001$ .

High dissociation was established through a cut-off criterion of 20 on the *Swedish Dissociative Experiences Scale* (S-DES; Körlin, Edman, & Nybäck, 2007), corresponding to the 75th percentile for the sample. This criterion is commonly used (Cardeña, 2008; Chiu, Yeh, Huang, Wu, & Chiu, 2009; Giesbrecht & Merckelbach, 2009) and

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<sup>1</sup>This criterion was established prior to data collection on the basis of the scale norms (Weitzenhoffer & Hilgard, 1967) and our previous use of the scales (e.g., Cardeña, 2005).

yielded 11 HDHS and 19 LDHS participants (see Table 2 for descriptive statistics). Dissociative tendencies and hypnotic suggestibility were correlated in the sample, resulting in only two (10%) LS participants meeting the criterion for high dissociation as compared with 11 (37%) HS participants. HDHS participants exhibited greater S-DES scores than LS participants and LDHS participants,  $U_s < 12$ ,  $Z_s > 4$ ,  $ps < .001$ , but the latter two didn't differ,  $t < 1$ . The three groups did not differ in age (HDHS:  $M = 23.82$ ,  $SD = 3.60$ ; LDHS:  $M = 23.68$ ,  $SD = 3.11$ ; LS:  $M = 22.86$ ,  $SD = 2.33$ ),  $F < 1$ , or sex distributions (HDHS: 9/11 females; LDHS: 13/19 females; LS: 16/21 females),  $\chi^2(2) < 1$ . HDHS ( $M = 8.73$ ,  $SD = 1.01$ ) and LDHS ( $M = 8.63$ ,  $SD = 1.01$ ) did not differ on the WSGC,  $t < 0.5$ .

### Materials

Participants completed the S-DES (Körlin et al., 2007), a 28-item scale in which they rated the percentage of the time they had different dissociative experiences. Using taxometric analysis, Waller and colleagues presented evidence that an eight-item subset of the DES provides an index of membership in a pathological dissociative taxon (DES-T; Waller et al., 1996), although subsequent research has qualified this proposal (Cardena, 2008). Individuals falling into the taxon are argued to experience, or have a heightened predisposition to, dissociative psychopathology. Average DES scores, DES-T scores, and the Bayesian probability of membership in the taxon (Waller & Ross, 1997) were computed. We used a categorical probability cut-off of .5 (e.g., Watson, 2003) for nominal inclusion in the taxon.

We administered the *Inventory of Childhood Memories and Imaginings* (ICMI; Wilson & Barber, 1983) to participants as a measure of fantasy-proneness. The 52-item ICMI has two subscales; the first is associated with a variety of forms of psychopathology, in particular difficulty monitoring the boundaries between fantasy and reality, whereas the second measures non-pathological imaginative involvement (Klinger, Henning, & Janssen, 2009).

Participants also completed the 53-item *Brief Symptom Inventory* (BSI; Derogatis, 1993), a general measure of the incidence of psychopathological symptomatology. The mean value, with a range of 0 to 4, was used as a global measure of psychopathology.

Finally, participants completed the *Life Stressors Checklist-Revised* (LSCR; Wolfe, Kimerling, Brown, Chrestman, & K., 1996). The LSC-R is a 30-item scale that measures the incidence of stressful events that meet DSM-IV criteria for trauma and six event features for experienced stressful events (age at onset, age at end, fear of serious harm [yes/no], feeling of helplessness [yes/no], emotional distress [1 (not at all) - 5 (extremely)], and effect on current life [1 (not at all) - 5 (extremely)]), with average scores used as the outcome measures.

All of the self-report measures have recognized psychometric properties and exhibited strong internal consistency in this sample (Cronbach's [1951]  $\alpha$ ; S-DES: .94, ICMI: .94; BSI: .95; LSCR: .78).

Hypnotic suggestibility was measured using the RSPS I & II (Weitzenhoffer, &

Hilgard, 1967). Their combined 18 items comprise five response profiles (scoring range and Cronbach's  $\alpha$ ): agnosia and cognitive distortions (0 - 12;  $\alpha = .89$ ), dreams and regressions (0 - 12;  $\alpha = .91$ ), negative hallucinations (0 - 12;  $\alpha = .75$ ), positive hallucinations (0 - 12;  $\alpha = .85$ ), and posthypnotic compulsions (0 - 6;  $\alpha = .72$ ).

Free recall was measured with Farvolden and Woody's (2004) modified version of the *Auditory Verbal Learning Test* (AVLT; Crawford, Stewart, & Moore, 1989; Lezak, 1995). In the AVLT, an experimenter recited fifteen words at a rate of one per second. Following completion of the list, participants were given thirty seconds to recall as many of the words as possible. Five study and recall trials were completed, with number of words recalled on the fifth trial acting as the dependent measure (see Farvolden & Woody, 2004).

Working memory capacity was measured with the *Counting Span* (CSPAN) task (Kane, Hambrick, Tuholski, Wilhelm, Payne, & Engle, 2004). In the CSPAN, participants viewed visual displays consisting of geometric targets (dark blue circles) presented amongst distracters (dark blue squares and light green circles) on a gray background. Participants counted the targets in each successive display and repeated the sum, after which there was a 500 ms inter-stimulus interval. Following a variable number of displays, participants recalled the successive sums of targets in serial order. The number of targets per display varied from 3 to 9 and the number of displays per trial varied from 2 to 6. Participants completed two practice and 15 experimental trials. Stimuli were presented with E-Prime v. 1.2 (Psychology Software Tools, Pittsburgh, PA) on a PC computer. The dependent measure was the mean percentage of correct responses in the correct serial position per trial (Kane et al., 2004).

Object visual imagery was measured with the *Degraded Films Task*. This task consisted of one-minute films depicting a single common object (e.g., an acoustic guitar) embedded within visual white noise becoming progressively *less* degraded over time. Participants were instructed to name each object as quickly as possible and completed one practice trial and 15 experimental trials with inter-stimulus intervals of 5000 ms. Stimulus presentation and response recording were done using MATLAB v. 7.3 (The Mathworks, Natick, MA) on a PC computer. The dependent measures for this task were mean response time for correct trials and error percentage. This task is based on the *Degraded Pictures Task* (Kozhevnikov, Kosslyn, & Shephard, 2005), a measure of object visual imagery comprised of static degraded objects. In a pilot study, we found that response times on the *Degraded Films Task* were negatively correlated with a measure of object visual imagery, but not spatial visual imagery (Blaženková, Kozhevnikov, & Motes, 2006), thereby demonstrating the specificity of this task as a measure of the former.

### *Procedure*

Different experimenters, who were masked to participants' group, administered the RSPS I and II on separate days. Following the de-induction in both sessions, without forewarning, participants were administered a recall test in which they were given two

minutes to report everything that occurred during the session. The mean spearman  $\rho$  between the recall order and actual order of the suggestions across the two sessions was used as an index of recall organization. Participants subsequently rated the involuntariness with which they experienced each suggestion to which they responded according to the following scale: 1: “completely voluntary” to 5: “completely involuntary” (Bowers, 1981).

Participants completed the CSPAN, AVLTL, and *Degraded Films Task*, in randomized order in a third session for which they were recruited separately. The experimenter was masked to group status and the hypotheses under test and no mention of hypnosis was made. The questionnaire measures were administered to participants during this session and they returned them to the experimenter at a later date.

### *Statistical analyses*

Kruskal-Wallis and Mann-Whitney tests were used for the analyses of RSPS profiles and involuntariness scores, the BSI, the DES-T, and the LSCR, for which the data violated the assumptions of distribution normality and/or homogeneity of variance across groups. Analyses of variance (ANOVAs) were used for all other between-group analyses. ANOVAs were followed up with planned comparisons for directional predictions and Tukey HSD tests for *post hoc* contrasts. Linear associations were computed with Pearson’s correlation coefficient.

## Results

### *Hypnotic Responding*

As can be seen in Table 1 and Figure 1A, main effects of Group were found for each of the five RSPS profiles. LS participants scored lower on all of the profiles relative to HDHS and LDHS participants, all  $U_s < 70$ , all  $Z_s > 4$ , all  $p_s < .001$ ,  $d_s$ : 1.91 to 3.33. HDHS participants were more responsive than LDHS participants to the positive hallucinations,  $U = 39$ ,  $Z = 2.85$ ,  $p = .004$ ,  $d = 1.22$ , and negative hallucinations,  $U = 47$ ,  $Z = 2.51$ ,  $p = .012$ ,  $d = 1.17$ , profiles, but to none of the other profiles,  $Z_s < 1.96$ .

Mean involuntariness differed across groups (see Figure 1B). HDHS participants experienced greater involuntariness than LDHS participants,  $U = 42$ ,  $Z = 2.71$ ,  $p = .007$ ,  $d = 1.11$ , and both reported greater involuntariness than LS participants,  $U_s < 70$ ,  $Z_s > 3$ ,  $p_s < .005$ ,  $d_s = 1.27$  to 1.73. Analyses of involuntariness for individual profiles revealed main effects for the positive hallucinations and dreams and regressions profiles, but for none of the other profiles. HDHS and LDHS participants exhibited greater involuntariness than LS participants for both profiles,  $U_s < 53$ ,  $Z > 2.15$ ,  $p_s < .035$ ,  $d_s = 1.17$  to 2.06. HDHS participants also reported greater involuntariness than LDHS participants during the positive hallucinations,  $U = 54$ ,  $Z = 2.06$ ,  $p = .040$ ,  $d = 0.85$ , and dream and regressions,  $U = 31$ ,  $Z = 3.23$ ,  $p = .001$ ,  $d = 1.35$ , profiles. LS participants were not included in the analysis on involuntariness

Table 1  
*Descriptive (Mean, (Standard Deviation), and [Sample Size]) and Inferential Statistics for the Measures of Hypnotic Responding as a Function of Group*

Variable	Group		$H_{[2]}$	$p$	$\eta^2$
	LS	LDHS			
RSPS					
AG	0.67 (0.66) <sup>a</sup>	6.53 (3.22) <sup>b</sup>	8.45 (3.62) <sup>b</sup>	32.27	< .001
PH	1.76 (1.79) <sup>a</sup>	6.32 (3.02) <sup>b</sup>	9.55 (2.16) <sup>c</sup>	32.95	< .001
NH	0.81 (1.33) <sup>a</sup>	4.42 (2.43) <sup>b</sup>	7.36 (2.87) <sup>c</sup>	32.76	< .001
DR	2.33 (2.01) <sup>a</sup>	10.68 (1.25) <sup>b</sup>	11.27 (0.65) <sup>b</sup>	37.68	< .001
PC	0.10 (0.44) <sup>a</sup>	2.37 (2.03) <sup>b</sup>	2.73 (2.24) <sup>b</sup>	22	< .001
Involuntariness	2.55 (1.14) [18] <sup>a</sup>	3.70 (0.56) [19] <sup>b</sup>	4.25 (0.41) [11] <sup>c</sup>	19.83	< .001
AG	3.00 (1.00) [3]	3.96 (1.00) [17]	4.05 (1.17) [11]	3.26	.20
PH	2.50 (1.09) [9] <sup>a</sup>	3.49 (0.76) [18] <sup>b</sup>	4.03 (0.52) [11] <sup>c</sup>	10.83	.004
NH	2.92 (1.20) [6]	3.64 (1.15) [17]	4.00 (0.67) [11]	3.23	.20
DR	2.56 (1.19) [14] <sup>a</sup>	3.69 (0.64) [19] <sup>b</sup>	4.57 (0.73) [11] <sup>c</sup>	19.11	< .001
PC	1.00 [1]	3.79 (0.92) [12] <sup>a</sup>	4.64 (0.48) [7] <sup>b</sup>	-	-

Note. LS = low suggestible; LDHS = low dissociative highly suggestible; HDHS = high dissociative highly suggestible; RSPS = *Revised Stanford Profile Scales of Hypnotic Susceptibility*; AG = agnosia and cognitive distortions; PH = positive hallucinations; NH = negative hallucinations; DR = dreams and regressions; PC = posthypnotic compulsions; different superscripted letters indicate cell means significantly differ (see text for inferential statistics).

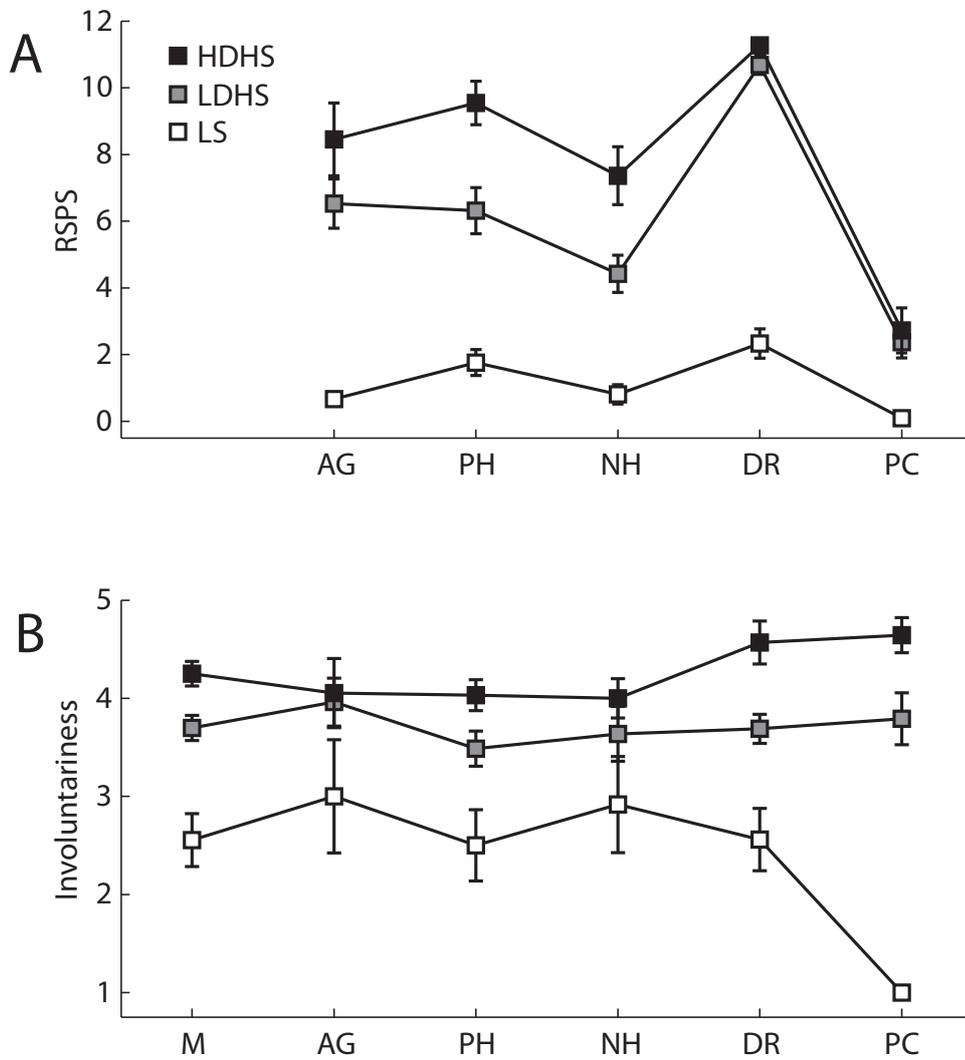


Figure 1. Hypnotic responding as a function of group. A: RSPS profiles. B: Involuntariness scores. M = Mean; AG = agnosia and cognitive distortions; PH = positive hallucinations; NH = negative hallucinations; DR = dreams and regressions; PC = posthypnotic compulsions. Error bars represent 95% confidence intervals.

during posthypnotic compulsions because only one participant was responsive to these suggestions; HDHS participants exhibited greater involuntariness than LDHS participants,  $U = 18$ ,  $Z = 2.11$ ,  $p = .035$ ,  $d = 1.11$ .

Table 2  
*Descriptive [Mean and (Standard Deviation)] and Inferential Statistics for the Cognitive Measures as a Function of Group*

Variable	Group			$F_{[2,48]}$	$p$	$\eta^2$
	LS	LDHS	HDHS			
AVLT	11.76 (1.81) <sub>a</sub>	11.11 (1.85) <sub>a,b</sub>	9.64 (3.11) <sub>b</sub>	3.50	.038	.13
CSPAN	0.73 (0.10) <sub>a</sub>	0.71 (0.14) <sub>a</sub>	0.61 (0.15) <sub>b</sub>	3.39	.042	.12
DFT: accuracy	0.09 (0.13)	0.12 (0.14)	0.13 (0.13)	0.35	.71	.01
DFT: latency	39.38 (2.15) <sub>a</sub>	37.45 (2.38) <sub>b</sub>	40.14 (2.51) <sub>a</sub>	5.71	.006	.19

*Note.* LS = low suggestible; LDHS = low dissociative highly suggestible; HDHS = high dissociative highly suggestible; AVLT = *Auditory Verbal Learning Test*; CSPAN = *Counting Span Task*; DFT = *Degraded Films Task*; different superscripted letters indicate cell means significantly differ (see text for inferential statistics).

### *Cognitive Functioning*

In contrast with the prediction of elevated spontaneous posthypnotic amnesia in HDHS participants (Barber, 1999), posthypnotic recall didn't differ across groups (HDHS:  $M = 6.14$ ,  $SD = 1.38$ ; LDHS:  $M = 6.55$ ,  $SD = 1.36$ ; LS:  $M = 6.74$ ,  $SD = 1.32$ ),  $F < 1$ . A suggestive main effect of Group was found for posthypnotic recall order,  $F(2, 48) = 3.07$ ,  $p = .056$ ,  $\eta^2 = .11$ , with HDHS participants ( $M = 0.25$ ,  $SD = 0.38$ ) displaying greater disorganization of recall than LS participants ( $M = 0.59$ ,  $SD = 0.32$ ),  $p = .045$ ,  $d = 1.03$ . LDHS participants ( $M = 0.45$ ,  $SD = 0.41$ ) didn't differ from either group,  $ps > .3$ .

There were main effects of Group for both the AVLT and CSPAN (see Table 2). HDHS participants exhibited lower scores on both tasks than LDHS, AVLT:  $p = .079$ ,  $d = 0.64$ ; CSPAN:  $p = .042$ ,  $d = 0.72$ , and LS participants, AVLT:  $p = .011$ ,  $d = 0.94$ ; CSPAN:  $p = .015$ ,  $d = 1.04$ . LDHS and LS participants did not differ on either measure,  $ps > .5$ . The three groups exhibited comparable response accuracy on the *Degraded Films Task*, but differed in response latency. As predicted, LDHS participants displayed faster response times (indicating superior performance) than HDHS,  $p = .004$ ,  $d = 1.15$ , and LS participants,  $p = .012$ ,  $d = 0.88$ , whereas the latter two groups did not differ,  $p = .65$ . These results indicate that HDHS participants exhibit deficits in working memory capacity and free recall, whereas LDHS participants have superior object visual imagery.

### *Fantasy-proneness, Psychopathology, and Trauma*

Data were unavailable for one of the HDHS participants for all self-report measures except the S-DES (see Table 3 for descriptive statistics). The three groups differed on ICMI component 1 (pathological fantasy); contrary to the central prediction of some dissociative typological models, the HDHS participants exhibited higher scores than LDHS and LS participants,  $ps < .001$ ,  $ds = 1.68$  to  $2.05$ ; the latter two didn't differ,  $p > .5$ . The three groups didn't differ on ICMI component 2 (imaginative involvement), or the BSI, but did differ in dissociative psychopathology (DES-T).

HDHS participants exhibited higher scores than LDHS,  $U = 6.50$ ,  $Z = 4.23$ ,  $p < .001$ ,  $d = 2.11$ , and LS,  $U = 15$ ,  $Z = 4.01$ ,  $p < .001$ ,  $d = 1.99$ , participants, who did not differ,  $Z < 1.25$ . Five of the 11 HDHS participants (45%) were classified as members of the dissociative taxon, whereas none of the 19 LDHS and 21 LS participants were,  $\chi^2(2, N = 51) = 20.16$ ,  $p < .001$ ,  $phi = .63$ . We also found a main effect of Group for LSC-R scores, with HDHS participants reporting a greater incidence of stressful life events than LDHS,  $U = 44$ ,  $Z = 2.37$ ,  $p = .018$ ,  $d = 1.19$ , and LS,  $U = 42$ ,  $Z = 2.69$ ,  $p = .007$ ,  $d = 1.57$ , participants. In addition, among those who had experienced at least one stressful event ( $n$ s: LS = 19, LDHS = 17, HDHS = 9), HDHS participants reported greater emotional distress at the time of the event than LDHS,  $U = 35$ ,  $Z = 2.25$ ,  $p = .025$ ,  $d = 0.90$ , and LS,  $U = 30$ ,  $Z = 2.74$ ,  $p = .006$ ,  $d = 1.27$ , participants. LS and LDHS participants didn't differ on either measure,  $Z$ s  $< 1.5$ , and the three groups didn't differ on any of the other LSC-R event features. Cumulatively, these findings counter the claim that fantasy-proneness is unique to LDHS participants and point to elevated pathological symptomatology and a greater history of stressful life events among HDHS participants.

#### *Dissociative Tendencies and Low Hypnotic Suggestibility*

Exploratory analyses examined whether dissociative tendencies covaried with individual differences among LS participants. S-DES scores correlated with responsiveness to the RSPS dreams and regressions profile, posthypnotic recall organization, and the feeling of helplessness during stressful events in the LS sample,  $r_s(21) > .45$ ,  $p$ s  $< .04$ , but not with any other measure,  $r$ s  $< .4$ ,  $p$ s  $> .05$ . These results suggest that dissociative tendencies do not modulate individual differences in the same variables among LS participants as among HS participants.

## Discussion

This study helps to clarify the relationship between hypnosis and dissociation by demonstrating that dissociative tendencies modulate individual differences among HS participants. HDHS participants were more responsive to hallucination suggestions, experienced greater involuntariness during hypnotic responding, and exhibited impaired working memory capacity. They also reported greater pathological (dissociative taxon and fantasy-prone) symptomatology, and a greater history of, and emotional response to, stressful life events. LDHS participants, in contrast, were found to display superior object visual imagery, but otherwise comparable functioning to LS participants. These findings add to a growing literature indicating that high hypnotic suggestibility is not a uniform condition. In particular, this study provides further evidence for a bifurcated HS typology comprised of a dissociative subtype and an imagery subtype (Barber, 1999; Kunzendorf & Boisvert, 1996; Terhune & Cardena, in press).

Table 3  
*Descriptive [Mean and (Standard Deviation)] and Inferential Statistics for the Self-report Measures as a Function of Group*

Variable	Group			$F_{[2,47]}$	$p$	$\eta^2$
	LS	LDHS	HDHS			
ICMI 1: Pathological fantasy	2.19 (1.91) <sub>a</sub>	2.68 (2.08) <sub>a</sub>	5.90 (1.79) <sub>b</sub>	12.91	< .001	.36
ICMI 2: Imaginative involvement	3.52 (1.81)	4.10 (1.10)	4.90 (1.52)	2.84	.07	.11
S-DES	10.36 (7.90) <sub>a</sub>	11.62 (5.24) <sub>a</sub>	35.29 (14.58) <sub>b</sub>	$H_{[2]}$ 23.76	< .001	.48
DES-T	5.71(6.57) <sub>a</sub>	5.86 (3.80) <sub>a</sub>	26.13 (15.82) <sub>b</sub>	21.38	< .001	.43
BSI	0.47 (0.30)	0.51(0.46)	0.74 (0.59)	1.01	.60	.02
LSC-R	0.11 (0.07) <sub>a</sub>	0.13 (0.11) <sub>a</sub>	0.29 (0.18) <sub>b</sub>	7.88	.019	.16
Age at onset	15.14 (4.77)	14.15 (2.70)	15.95 (1.98)	2.98	.23	.07
Age at end	17.69 (5.15)	17.38 (3.18)	19.14 (1.78)	2.05	.36	.05
Fear of serious harm	0.24 (0.32)	0.25 (0.27)	0.38 (0.25)	3.10	.21	.07
Feeling of helplessness	0.63 (0.37)	0.63 (0.37)	0.74 (0.23)	4.80	.09	.11
Emotional distress	3.47 (0.81) <sub>a</sub>	3.77 (0.74) <sub>a</sub>	4.31 (0.29) <sub>b</sub>	8.94	.011	.20
Effect on current life	2.23 (0.91)	2.42 (0.99)	3.09 (0.98)	4.10	.13	.09

*Note.* LS = low suggestible; LDHS = low dissociative highly suggestible; HDHS = high dissociative highly suggestible; ICMI = *Inventory of Childhood Memories and Imaginings*; S-DES = *Swedish Dissociative Experiences Scale*; BSI = *Brief Symptom Inventory*; LSC-R = *Life Stressors Checklist - Revised*; different superscripted letters indicate cell means significantly differ (see text for inferential statistics).

Our findings are consistent with a number of previous studies as well as predictions derived from different dissociative typological models. The features of the HDHS participants in this study closely correspond to other analyses with this sample, in which the dissociative HS subtype experienced greater involuntariness, increased negative affect, and pronounced distortions in awareness during hypnosis, but no alterations in memory (Terhune & Cardeña, in press). Elevated involuntariness in the HDHS subtype has important consequences because it is commonly regarded as the core phenomenological feature of hypnotic responses (Weitzenhoffer, 1974). The finding of superior object visual imagery in the LDHS participants is consistent with the proposal of an imagery subtype (Barber, 1999; Carlson & Putnam, 1989; Kunzendorf & Boisvert, 1996). Finally, elevated fantasy-prone and dissociative psychopathology and greater exposure to stressful life events among the HDHS participants supports the hypothesis that this subtype displays greater psychopathology (Lynn et al., 1999). However, insofar as the reliability and validity of the DES-T is inconsistent (Cardeña, 2008; Merritt & You, 2008; Waller, Ohanian, Meyer, Everill, & Rouse, 2001; Watson, 2003), this finding should be interpreted with caution.

Despite the support for bifurcated dissociative typological models, our results are inconsistent with multiple predictions from certain versions of these models. First, HDHS participants did not display pronounced spontaneous posthypnotic amnesia. Although this finding is at odds with Barber's (1999) prediction, it is consistent with the results of our previous study (Terhune & Cardeña, in press) and the extant literature (Kihlstrom & Schachter, 1995). Spontaneous posthypnotic amnesia may be either extremely rare and/or artifactual of demand characteristics (Wagstaff, 1999), at least among non-clinical groups. In either case, it should not be interpreted as a signature of the HDHS subtype. Second, in contrast with predictions derived from Barber's (1999) typological model, the two HS subtypes differed in only two of the five suggestion profiles. However, the finding of superior responsiveness to hallucination suggestions in the HDHS subtype is arguably consistent with Kunzendorf and Boisvert's (1996) model, which maintains that this subtype experiences deficient monitoring during hypnosis. Finally, counter to a number of the typological models (Barber, 1999; Barrett, 1996), LDHS participants did not exhibit greater fantasy-proneness than HDHS participants. The three groups didn't differ in normal fantasizing, but HDHS participants displayed greater pathological fantasy-proneness. This finding is consistent with the repeatedly observed correlation between dissociation and fantasy-proneness (Giesbrecht, Lynn, Lilienfeld, & Merckelbach, 2008), but only with regard to a pathological form of fantasy-proneness, and casts doubt on the position that the LDHS subtype is fantasy-prone (Barber, 1999; Barrett, 1996).

We propose that the present findings can be explained by a disruption in executive functioning among HDHS participants. This hypothesis is broadly in keeping with other dissociation theories (Woody & Sadler, 2008), but diverges from such accounts by maintaining that this deficit is restricted to this subtype (Brown & Oakley, 2004; Kunzendorf & Boisvert, 1996). Impaired source monitoring in HDHS participants accounts for their greater responsiveness to hallucination suggestions (Bentall, 1990)

as well as their greater levels of pathological fantasy, which may reflect an impaired ability to discriminate fantasy from reality (Klinger et al., 2009). By systematically impairing participants' awareness of intentions, a monitoring deficit among HDHS participants can also account for their elevated involuntariness during hypnotic responding. The working memory deficit observed in HDHS participants provides further evidence for impaired executive functioning in this group and may also point to a deficit in the monitoring of inner speech, which is dependent upon the *phonological loop* in working memory (Shergill, Bullmore, Brammer, Williams, Murray, & McGuire, 2001). This deficit may contribute to the hypothesized reduction of inner speech following a hypnotic induction (Miller, Galanter, & Pribram, 1960) in this subtype, an effect that been argued to provide the basis for a weakening of executive functions during hypnosis and increased suggestibility (Hilgard, 1986; see also Brown & Oakley, 2004). Deficient executive functioning in this subtype may further contribute to elevated psychopathological symptomatology, in particular impaired emotion regulation (Terhune & Cardena, in press). Although this study provides little information on the mechanisms underlying hypnotic responding among LDHS participants, these respondents may achieve high hypnotic suggestibility through their superior imagery abilities, flexible use of attentional resources during hypnosis, high non-hypnotic suggestibility, and greater response expectancies (Brown & Oakley, 2004; King & Council, 1998; Kunzendorf & Boisvert, 1996; Terhune et al., 2009).

Our results have a number of implications for the study of psychopathology. In particular, this study suggests that rather than pursuing a linear relationship between hypnotic suggestibility and psychopathology, researchers should investigate whether distinct HS subtypes differ in these features. This study and others (King & Council, 1998; Terhune et al., 2009) point to dissociation as an important variable for deriving HS subtypes. Although we stratified individuals on the basis of a single dissociation measure, dissociation is unarguably a heterogeneous construct (Cardena, 1994; Holmes et al., 2005). Dell (2009), for instance, maintains that heterogeneity in both the construct of dissociation and among HS individuals contributes to the inconsistent relationship between dissociation and hypnotic suggestibility. There is evidence that dissociation encapsulates two distinct processes: *detachment* and *compartmentalization* (Brown, 2006; Cardena, 1994; Holmes et al., 2005). Detachment refers to alterations in consciousness characterized by reduced awareness of environmental or endogenous stimuli (e.g., depersonalization), whereas compartmentalization consists of a deficit in the ability to control or consciously access actions, information, or processes that are normally amenable to control (e.g., conversion blindness). It is apparent that HDHS individuals experience spontaneous detachment and compartmentalization more frequently in their daily lives (present study) and more vividly following a hypnotic induction (Terhune & Cardena, in press) than LDHS individuals. There is also considerable evidence that a mechanism paralleling compartmentalization underlies hypnotic responding and gives rise to the dissociations between explicit and implicit processing commonly observed therein (Holmes et al., 2005; Kihlstrom, 1998). It may be worthwhile to examine whether the magnitude of such dissociations

(e.g., during posthypnotic amnesia) differs across LDHS and HDHS subtypes.

There is accumulating evidence for two subtypes of post-traumatic stress disorder (Lanius et al., 2010): a non-dissociative subtype that experiences hyperarousal and vivid reliving of the traumatic event during exposure to threatening stimuli and a dissociative subtype that responds with experiential detachment. These two subtypes clearly parallel the LDHS and HDHS subtypes, respectively. Examining whether the dissociative subtype of post-traumatic stress disorder is characterized by similar features of hypnotic responding as the HDHS subtype is likely to improve our understanding of executive functioning and suggestibility in post-traumatic stress disorder as well as its treatment with hypnotherapy (Cardena, Maldonado, van der Hart, & Spiegel, 2009). A related question is whether a hypnotic induction has different effects on suggestibility in the two subtypes. The dissociative typological models maintain that the HDHS subtype requires a hypnotic induction to achieve high suggestibility (Barber, 1999; Barrett, 1996; Brown & Oakley, 2004) and thus will exhibit lower non-hypnotic suggestibility than the LDHS subtype. Similar effects may hold for dissociative patient populations; for instance, although such patients tend to exhibit higher hypnotic suggestibility than controls (Bryant et al., 2001; Spiegel et al., 1998), at least one study found that somatization disorder patients did not exhibit elevated non-hypnotic suggestibility (Brown, Schrag, Krishnamoorthy, & Trimble, 2008). Examining individual differences in non-hypnotic suggestibility in HS subtypes is likely to yield further insights into the modulatory influence of dissociation on hypnotic suggestibility in clinical and non-clinical populations.

A final implication of this study and others pointing to different HS subtypes concerns the instrumental use of hypnosis in the production of experimental analogues of psychopathological conditions (for a review, see Oakley, 2006). Instrumentally-oriented studies using functional neuroimaging require relative uniformity of mechanisms underlying hypnotic responding among HS individuals (Barnier & McConkey, 2003; Woody & McConkey, 2003). Insofar as the presence of two HS subtypes with dissimilar cognitive and phenomenological profiles suggests that they are experiencing hypnotic suggestions through distinct mechanisms, this study warrants that instrumental studies more closely consider individual differences in this population.

Despite the strengths of this study, it possesses a number of limitations that are worth considering when evaluating its implications. One limitation is the near absence of high dissociative LS participants from our sample. The structure of this study opens the possibility that the observed differences between LDHS and HDHS participants are not unique to HS individuals and reflect broader covariates of dissociation. Importantly, this limitation does not apply to the effects observed with the indices of hypnotic responding, as LS participants displayed floor effects on these measures, or to superior imagery in the LDHS subtype because they still outperformed LS participants. Critically, correlational analyses in the LS participants revealed that dissociative tendencies did not covary with any of the variables that differed across the two HS subtypes. We have recently found that HD individuals who were not screened for hypnotic suggestibility displayed poorer working memory capacity

than LD individuals (Terhune, Cardeña, & Lindgren, 2010), whereas previous studies have reported superior working memory capacity in HD individuals (De Ruiter, Phaf, Elzinga, & Van Dyck, 2004; Veltman, de Ruiter, Rombouts, et al., 2005). Accordingly, it remains unclear whether the working memory deficit in the HDHS subtype is unique to this population. A second limitation of this study is the small sample size. The relatively small number of HDHS participants in the study clearly limits the generalizability of our findings. However, it is important to note that in addition to the cognitive and self-report batteries used in the current study, these individuals were extensively screened on three different measures of hypnotic suggestibility from a sample of 640 individuals. We find it especially salient that the prevalence of this subtype in our sample (2%) corresponds closely to its predicted prevalence in the general population (3%; Lynn et al., 1999) and that our results possess a number of striking convergences with the extant literature (King & Council, 1998; Kunzendorf & Boisvert, 1996; Wallace, 1990).

Two alternative interpretations of the present results are worth evaluating. First, it could be argued that the observed differences in hypnotic responding between HDHS and LDHS participants are caused by greater hypnotic suggestibility in the former group. However, the two subtypes did not differ on a general group measure of hypnotic suggestibility, the WSGC (Bowers, 1993), and only differed on two of the five suggestion profiles in the RSPSs (Weitzenhoffer & Hilgard, 1967). We maintain that these results indicate that HDHS participants possess a superior ability for responding to hallucination suggestions, but display otherwise similar levels of hypnotic suggestibility to LDHS participants (for a related discussion, see Woody, Barnier, & McConkey, 2005).

A second interpretation of the present results is provided by the componential model (Laurence et al., 2008; Woody et al., 2005). This account maintains that HS participants represent a uniform population but that individual differences therein result from variability in ancillary componential abilities (see also Lynn et al., 1999). According to this account, the findings of this study could be interpreted as reflecting the modulatory influence of dissociative tendencies on individual differences in an otherwise homogeneous group and not the existence of discrete HS subtypes. It needs to be acknowledged that the componential approach was developed to account for the factorial structure of standard hypnotic suggestibility scales and not to address heterogeneity among HS participants. Accordingly, further development of the model is needed to generate specific predictions regarding heterogeneity in this population. Discerning points at which the componential and dissociative typological models diverge in their predictions represents a task of paramount importance for future research. Irrespective of which approach possesses greater strength, our results clearly indicate that an examination of the modulatory influence of dissociative tendencies on individual differences in high hypnotic suggestibility will be more fruitful than the conventional approach of attempting to establish a linear association between these two variables. We also are intrigued by the possibilities that such an orientation may assist in reconciling seemingly incompatible hypotheses in the experimental

hypnosis literature (Barber, 1999; Brown & Oakley, 2004; King & Council, 1998) and strengthening our understanding of the relationship between hypnotic suggestibility and psychopathology.

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