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RUNNING HEAD: Anomalous experiences and hypnotic suggestibility

**Anomalous experiences are more prevalent among highly suggestible individuals  
who are also highly dissociative**

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The data that support the findings of this study are openly available in Open Science Framework at [osf.io/cfa3r](https://osf.io/cfa3r).

## **Abstract**

**Introduction:** Predictive coding models propose that high hypnotic suggestibility confers a predisposition to hallucinate due to an elevated propensity to weight perceptual beliefs (priors) over sensory evidence. Multiple lines of research corroborate this prediction and demonstrate a link between hypnotic suggestibility and proneness to anomalous perceptual states. However, such effects might be moderated by dissociative tendencies, which seem to account for heterogeneity in high hypnotic suggestibility. We tested the prediction that the prevalence of anomalous experiences would be greater among highly suggestible individuals who are also highly dissociative.

**Methods:** We compared high and low dissociative highly suggestible participants and low suggestible controls on multiple psychometric measures of anomalous experiences.

**Results:** High dissociative highly suggestible participants reliably reported greater anomalous experiences than low dissociative highly suggestible participants and low suggestible controls, who did not significantly differ from each other.

**Conclusions:** These results suggest a greater predisposition to experience anomalous perceptual states among high dissociative highly suggestible individuals.

**Keywords:** dissociation; hallucination; hypnosis; hypnotizability; perception; sleep

## **1. Introduction**

Anomalous experiences encompass a wide array of unusual (but not necessarily pathological) subjective states including mystical experiences such as a deep sense of connectedness with the universe, ostensibly paranormal experiences such as a sense of presence, unusual sleep experiences such as sleep paralysis and lucid dreaming, and hallucinations (Cardeña, Lynn, & Krippner, 2014). Such experiences have the potential to inform our understanding of the boundaries of conscious states and how they may differ from psychopathology.

Although the factors that predispose individuals to anomalous experiences are diverse, multiple studies indicate a role for suggestibility, an individual's responsiveness to suggestions. Suggestions are communications for involuntary changes in behavior or perception (Kirsch, 1999), such as "you will hear a voice say your name" (suggestion for an auditory hallucination). Responsiveness to suggestion can be measured following a hypnotic induction (hypnotic suggestibility) or when no induction is administered (non-hypnotic suggestibility), although the two tend to correlate moderately (Braffman & Kirsch, 1999; Wieder & Terhune, 2019). Both hypnotic and non-hypnotic suggestibility appear to covary with hallucination-proneness (Alganami, Varese, Wagstaff, & Bentall, 2017), unusual sleep experiences (Fassler, Knox, & Lynn, 2006), and other spontaneous anomalous experiences (Pekala, Kumar, & Cummings, 1992), as well as germane traits such as self-transcendence (e.g., proneness to experience a loss of boundaries between the self and others, or the rest of the world; Cardeña & Terhune, 2014). Similarly, experimental research has consistently demonstrated that specific (hypnotic) suggestions can be used to trigger hallucinations in non-clinical highly suggestible individuals (e.g., Barber & Calverley, 1963; McGeown et al., 2012) and non-clinical hallucination-prone individuals (Alganami et al., 2017; van de Ven & Merckelbach, 2003; Young, Bentall, Slade, & Dewey, 1987).

The relation between hypnotic suggestibility and hallucination-proneness aligns well with contemporary theories of hypnosis that have sought to understand response to suggestion within the context of predictive coding models (Jamieson, 2016; Martin & Pacherie, 2019). Similar to recent accounts of hallucinations (Corlett et al., 2019; Sterzer et al., 2018; Tulver, Aru, Rutiku, & Bachmann, 2019) – according to which perception is modeled as an active process integrating beliefs

about the world (priors) and sensory evidence – these theories propose that response to suggestion is facilitated by a propensity to form highly precise priors that exert a top-down influence over motor control and perception, giving rise to compelling changes in behavior and experience. These models predict that individuals displaying high hypnotic suggestibility, who comprise around 10-15% of the general population (Woody & Barnier, 2008), should display increased hallucination-proneness due to a tendency to weight perceptual priors more strongly, resulting in a concomitant down-weighting of sensory evidence (Martin & Pacherie, 2019).

However, the relation between anomalous experiences and suggestibility may be moderated by *dissociation* (i.e., "An experienced loss of information or control over mental processes that, under normal circumstances, are available to conscious awareness, self-attribution, or control, in relation to the individual's age and cognitive development"; Cardeña & Carlson, 2011, p. 251). Accumulating evidence suggests that dissociation accounts for some of the heterogeneity in high hypnotic suggestibility (Dell, 2009; Terhune & Cardeña, 2015). Indeed, high dissociative highly suggestible (HDHS) individuals are more responsive to hypnotic suggestions for hallucinations than low dissociative highly suggestible (LDHS) individuals and are also characterized by an elevated propensity for dissociative states and previous exposure to stressful life events (Terhune, Cardeña, & Lindgren, 2011), both of which reliably covary with hallucination-proneness in clinical and non-clinical samples (Bailey et al., 2018; Fassler et al., 2006; Irwin, Schofield, & Baker, 2014; Luhrmann et al., 2019; Pilton, Varese, Berry, & Bucci, 2015). Previous research has found an interaction between hypnotic suggestibility and dissociation in the reporting of anomalous experiences, with both variables related to anomalous experiences, including hallucinations, particularly when in conjunction (Pekala, Kumar, & Marcano, 1995). These results suggest that proneness to spontaneous anomalous experiences may be greater in highly suggestible individuals who are also highly dissociative.

This study sought to clarify the relation between hypnotic suggestibility and proneness to anomalous experiences. Participants were rigorously screened for hypnotic suggestibility by masked experimenters (Terhune et al., 2011) and independently completed a battery of psychometric measures that tapped different types of anomalous experiences (Bell, Halligan, & Ellis, 2006; Gallagher, Kumar, & Pekala, 1994; Watson, 2001). For completeness, participants also completed

germane measures of absorption and somatoform dissociation (Jamieson, 2005; Nijenhuis, Spinhoven, Van Dyck, Van Der Hart, & Vanderlinden, 1996). Absorption can be understood as a normative propensity for episodes of pronounced attentional and emotional engagement in different activities (Eisen & Carlson, 1998; Tellegen & Atkinson, 1974), and has been linked to proneness to anomalous experiences (Glicksohn & Barrett, 2003). Somatoform dissociation includes dissociative experiences related to sensory perception and bodily sensations (e.g., functional paralysis), and has been associated with anomalous experiences such as out-of-body experiences (Gow, Lang, & Chant, 2004). We contrasted the predictions that high hypnotic suggestibility would be characterized by an elevated predisposition to anomalous experiences and that such a predisposition specific to highly suggestible individuals who are also highly dissociative.

## 2. Method

### 2.1. Participants

Twenty-one low suggestible (LS;  $M_{\text{Age}}=22.86$ ,  $SD=2.33$ , 16 females), 19 low dissociative highly suggestible (LDHS;  $M_{\text{Age}}=23.68$ ,  $SD=3.11$ , 13 females), and 11 high dissociative highly suggestible (HDHS;  $M_{\text{Age}}=23.82$ ,  $SD=3.60$ , 9 females) individuals provided informed written consent to participate in this study in exchange for monetary compensation. The groups did not significantly differ in age,  $F(2,48)=0.56$ ,  $p=.58$ , or gender distributions,  $\chi^2(2)=0.71$ ,  $p=.70$ . Participants were first screened in groups using the *Waterloo-Stanford Group Scale of Hypnotic Susceptibility, Form C* ( $HS \geq 8$ ,  $LS \leq 4$  Bowers, 1993) followed by two complementary individual measures of hypnotic suggestibility, the *Revised Stanford Profile Scales of Hypnotic Susceptibility, Forms I and II* ( $HS \geq 10$ ; Weitzenhoffer & Hilgard, 1967), which are tailored for the upper range of hypnotic suggestibility. Psychometric data were missing for one HDHS participant. Dissociative status was determined on the basis of scores on the Swedish *Dissociative Experiences Scale-II* ( $HDHS \geq 20$  [75<sup>th</sup> percentile]; Körlin, Edman, & Nybäck, 2007). Stratifying LS participants by dissociation was not possible because dissociation and hypnotic suggestibility were correlated in this sample, resulting in only two high dissociative LS participants (for further sample details, see Terhune et al., 2011).

## 2.2. Measures

Participants completed five standardized psychometric scales, three of which measure a propensity for anomalous experiences:

The *Anomalous/Paranormal Experience* subscale of the *Anomalous Experiences Inventory* (AEI; Gallagher et al., 1994) is a 29-item scale indexing prior experience of a range of unusual experiences including interactions with aliens or the dead, out-of-body and mystical experiences, and putative psychic experiences. Each item is rated on a true-false binary scale with total scores ranging from 0 to 29.

The *Cardiff Anomalous Perceptions Scale* (CAPS; Bell et al., 2006) is a 32-item scale measuring a variety of aberrant perceptual states in various sensory modalities, ranging from pure hallucinations to variations in the quality of or sensitivity of perception. Participants report whether each item applies to them by responding “yes” or “no,” with total scores ranging from 0 to 32.

The *Iowa Sleep Experiences Survey* (ISES; Watson, 2001) is an 18-item scale that assesses frequency of a variety of unusual sleep experiences using two subscales: *General Sleep Experiences* (GSE, 15 items) that include sleep paralysis, somnambulism, and hypnagogic/hypnopompic hallucinations, and *Lucid Dreaming* (LD, 3 items). Each item is rated using a 7-point Likert scale ranging from “never” to “several times a week.” Scores range from 18 to 126 on the overall ISES scale, 15-105 on the GSE subscale, and 3-21 on the LD subscale.

These scales primarily measure the proneness of the participant to experience anomalous experiences, and not the question of belief in their objective reality. However, some items, in particular in the AEI, imply this belief to a degree (e.g., “I have communicated with the dead”). Anomalous experiences (as measured by the *Anomalous/Paranormal Experiences* subscale of the AEI) strongly correlate with paranormal belief (as measured by the *Anomalous/Paranormal Belief* subscale of the AEI; Gallagher et al., 1994) (not included in the present study).

Two additional measures index potentially complementary domains of absorption and somatoform dissociation:

The *Modified Tellegen Absorption Scale* (MODTAS; Jamieson, 2005) is a 34-item modified scale of the original TAS (Tellegen & Atkinson, 1974) that includes a 5-point Likert scale (“never” to “very

often”). The MODTAS was developed to measure one’s propensity for all encompassing attentional and emotional states, by rating the frequency of the different experiences. Total scores range from 0 to 136.

The *Somatoform Dissociation Questionnaire* (SDQ; Nijenhuis et al., 1996) is a 20-item scale indexing different forms of dissociation pertaining to the body including paralysis, body numbness, loss of sight, hearing, and changes in sensory perception. Each item is rated on a 5-point Likert scale regarding the extent to which each statement applies to the respondent (from ‘not at all’ to ‘extremely’), with total scores ranging from 20 to 100.

All five measures (and subscales) had strong internal consistency (Cronbach’s  $\alpha$  range: .80-.94).

### 2.3. Procedure

Experimenters were masked to participants’ hypnotic suggestibility, dissociation status, and psychometric profile when hypnotic suggestibility assessments were administered (for further details, see Terhune, Cardeña, & Lindgren, 2011). Participants completed the battery of psychometric measures in a context separate from the hypnotic suggestibility assessments but the experimenter was the same and thus it is possible that participants could infer a relation between the two assessments.

### 2.4. Statistical analyses

The full raw data are available here: [osf.io/cfa3r](https://osf.io/cfa3r). The data violated the assumptions of distribution normality and/or homogeneity of variance and thus were analyzed using Welch ANOVAs for three-group contrasts and permutation tests (10,000 permutations) for planned comparisons. Effect sizes (and Bootstrap 95% confidence intervals [CIs] using 10,000 samples) were computed with  $\eta^2$ s for one-way effects and Hedge’s  $g$ s for comparisons (Hedges, 1981; Marfo & Okyere, 2019). The evidence in favor of the null hypothesis that LDHS do not differ from LS controls in the reporting of anomalous and dissociative experiences was assessed by computing Bayes factors (BFs) using half-normal distributions (Dienes, 2014) with the difference between HDHS and LS participants on each measure used as a prior. BFs below 0.33 and above 3 were interpreted as moderate evidence for the

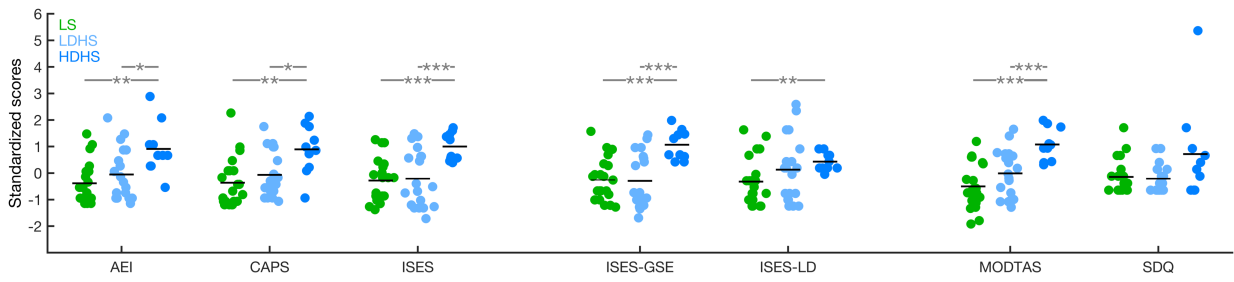


null and alternative hypotheses respectively, whereas BFs between these values were interpreted as inconclusive evidence (Dienes, 2011; Jeffreys, 1961).

### 3. Results

Total sample scores for each scale had the following characteristics ( $M \pm SD$ ): AEI:  $5.70 \pm 4.98$ , range: 0-20; CAPS:  $9.32 \pm 7.81$ , range: 0-27; ISES:  $55.05 \pm 17.49$ , range: 25-85; ISES-GSE:  $46.84 \pm 14.71$ , range: 22-76; ISES-LD:  $8.20 \pm 4.17$ , range: 3-19; MODTAS:  $53.68 \pm 23.81$ , range: 8-101; SDQ:  $22.46 \pm 3.83$ , range: 20-43 (20-29 after omitting an outlier; see Fig. 1). These data indicate that except for perhaps the SDQ, the sample covered a wide range of scores for all scales.

As can be seen in **Fig. 1**, there were group effects,  $F_s > 6.10$   $p_s < .008$ , for all three measures of anomalous perceptual states including the AEI (anomalous experiences:  $\eta^2 = .23$  [.08, .46]), CAPS (anomalous experiences:  $\eta^2 = .22$  [.06, .50]), and ISES (anomalous sleep experiences:  $\eta^2 = .26$  [.14, .45]) as well as the MODTAS (absorption:  $\eta^2 = .34$  [.21, .54]). HDHS participants scored higher on all four measures than LDHS participants,  $t_s > 2.52$ ,  $p_s < .019$ , with reliably large effect sizes nearing or exceeding  $1SD$ ,  $g_s$ : AEI: 0.96 [0.30, 1.92], CAPS: 1.05 [0.28, 2.20], ISES: 1.27 [0.69, 2.18], MODTAS: 1.31 [0.69, 2.19]. A similar pattern was observed when comparing HDHS against LS participants,  $t_s > 3.53$ ,  $p_s < .004$ ,  $g_s$ : AEI: 1.48 [0.76, 2.65], CAPS: 1.33 [0.54, 2.73], ISES: 1.70 [1.04, 2.83], MODTAS: 1.96 [1.33, 3.04]. By contrast, LDHS and LS participants did not significantly differ on any of these measures,  $t_s < 1.79$ ,  $p_s > .08$ ,  $g_s$ : AEI: 0.36 [-0.25, 1.02],  $BF_{0,1.29} = 0.73$ , CAPS: 0.33 [-0.27, 1.02],  $BF_{0,1.26} = 0.63$ , ISES: 0.07 [-0.55, 0.71],  $BF_{0,1.28} = 0.28$ , MODTAS: 0.55 [-0.05, 1.25],  $BF_{0,1.58} = 1.48$ . The three groups did not significantly differ on the SDQ,  $F(2,20.09) = 0.95$ ,  $p = .41$ ,  $\eta^2 = .06$  [.00, .30], LDHS vs. HDHS: 0.64 [-0.18, 1.68]; LS vs. HDHS: 0.48 [-0.31, 1.57], LS vs. LDHS: 0.12 [-0.54, 0.70],  $BF_{0,0.34} = 0.37$ . These results indicate that HDHS are more prone to anomalous experiences than LDHS participants. HDHS participants reported greater levels of trait absorption but not somatoform dissociation, which would be more likely to be more present in some clinical groups (Nijenhuis, 1999). In addition, there was evidence for the null hypothesis that LDHS do not differ from LS controls in the reporting of anomalous sleep experiences whereas the data were ambiguous with regard to whether the latter two groups differ or not on the other measures.



**Fig. 1.** Standardized scores on psychometric measures as a function of group. Horizontal lines denote mean scores within each group. LS=low suggestible; LDHS=low dissociative highly suggestible; HDHS=high dissociative highly suggestible; AEI=*Anomalous Experiences Inventory*; CAPS=*Cardiff Anomalous Perceptions Scale*; ISES=*Iowa Sleep Experiences Scale*; ISES subscales: GSE=*General Sleep Experiences*, LD=*Lucid Dreaming*; MODTAS=*Modified Tellegen Absorption Scale*; SDQ=*Somatiform Dissociation Questionnaire*.

\*  $p < .05$

\*\*  $p < .01$

\*\*\*  $p < .001$

In order to more clearly determine the specificity of group differences in anomalous sleep experiences, we compared the groups on the two subscales of the ISES: General sleep experiences (GSE) and Lucid dreaming (LD) (see **Fig. 1**). There were group effects for both,  $F_s > 5.5$ ,  $p_s < .005$ , GSE:  $\eta^2 = .29$  [0.16, 0.49], LD:  $\eta^2 = .09$  [0.02, 0.28], but the patterns differed across scales. HDHS scored higher than LS participants on both subscales,  $t_s > 2.50$ ,  $p_s < .020$ ;  $g_s$ : GSE: 1.73 [1.05, 2.90], LD: 0.94 [0.36, 2.00] whereas HDHS scored higher than LDHS participants on the GSE,  $t = 3.86$ ,  $p < .001$ ,  $g = 1.46$  [0.86, 2.45], but the two groups did not significantly differ on the LD,  $t = 0.76$ ,  $p = 0.47$ ,  $g = 0.29$  [-0.25, 1.06]). LDHS and LS participants did not significantly differ on either measure:  $t_s < 1.33$ ,  $p_s > .19$ ; GSE:  $g = -0.06$  [-0.71, 0.57],  $BF_{0,1.31} = 0.19$ , LD:  $g = 0.41$  [-0.20, 1.07],  $BF_{0,0.75} = 1.51$ . These results indicate that elevated proneness toward anomalous sleep experiences among HDHS relative to LDHS participants was specific to general sleep experiences with no clear evidence for or against a group difference in lucid dreaming.

#### 4. Discussion

HDHS participants displayed greater proneness to anomalous perceptual states and episodes of absorption than LDHS and LS participants, who did not significantly differ. These results are consistent with the proposal that high hypnotic suggestibility is characterized by a propensity for weighting perceptual priors over sensory evidence (Martin & Pacherie, 2019), but indicate that these

effects are more pronounced among those who are also highly dissociative. Moreover, using Bayesian statistics, we found evidence in favor of the null hypothesis that LDHS do not differ from LS controls in the reporting of anomalous sleep experiences (the data were insensitive in distinguishing between the alternative and null hypotheses for group differences on the other scales). These effects complement previous work showing that HDHS participants seem to exhibit a dissimilar neurocognitive profile from LDHS participants (Dell, 2009; Terhune & Cardeña, 2015) and may help to explain inconsistent results in the relation between suggestibility and hallucination-proneness (Alganami et al., 2017; Young et al., 1987).

These results are broadly consistent with the extant literature on predictors of hallucination-proneness including a reported greater history of stressful life events (Bailey et al., 2018), an insecure attachment style (Berry, Fleming, Wong, & Bucci, 2018; Pilton et al., 2016), an increased predisposition to dissociative states (Pilton et al., 2015), and a heightened responsiveness to suggestions for hallucinations (Alganami et al., 2017; van der Ven & Merckelbach, 2003; Young et al., 1987), all of which characterize high dissociative or HDHS individuals (Marcusson-Clavertz, Gušić, Bengtsson, Jacobsen, & Cardeña, 2017; Terhune et al., 2011; Wieder & Terhune, 2019). Hallucination-proneness among HDHS individuals may be further facilitated by the more general experience of having less control over mental content (Cardeña & Marcusson-Clavertz, 2016). Our results also corroborate the finding that anomalous experiences are more common in this group but expand upon this previous result through more rigorous screening of hypnotic suggestibility than previous studies and use of a more diverse array of measures, which suggest that the observed effect is not specific to a particular scale. Indeed, anomalous sleep experiences best discriminated the two highly suggestible subtypes even though they did not significantly differ in reports of lucid dreaming. These results are consistent with the repeatedly-observed link between dissociation and specific aberrant sleep characteristics, such as sleep paralysis and longer REM sleep (but not lucid dreaming), which may be mediated by a labile sleep-wake cycle that enables intrusions of sleep-like processes during waking states (Cardeña, Lynn, & Krippner, 2017; Fassler et al., 2006; Giesbrecht & Merckelbach, 2004, 2006; Van Der Kloet et al., 2013).

Despite convergences with the extant literature, limitations of this study warrant that our results be treated cautiously. Aside from the measures of hypnotic suggestibility, all scales were dependent upon self-report. The possibility that the effects are driven by demand characteristics seems however unlikely given that LDHS participants, who exhibit high hypnotic suggestibility, did not reliably differ from LS controls, the groups did not significantly differ in somatoform dissociative experiences, and hallucination-proneness measures reliably predict hallucinations in laboratory tasks (e.g., Alganami et al., 2017). Nevertheless, it will be important to determine whether these effects generalize to the experimental induction of anomalous perceptual states, including hallucinations, through commonly used procedures such as conditioning (Corlett & Powers, 2018) or exposure to ambiguous or noisy stimuli (Alganami et al., 2017; Terhune & Smith, 2006). Another limitation is the absence of a high dissociative LS subgroup, which occurred because hypnotic suggestibility and dissociative tendencies were correlated in this sample (Terhune et al., 2011). Accordingly, we cannot rule out the possibility that hallucination-proneness is merely a characteristic of high dissociative individuals irrespective of hypnotic suggestibility. However, our results indicate that we can discount the claim that proneness to anomalous experiences is a reliable marker of high hypnotic suggestibility independent of dissociative status. Finally, the relatively low population sample size may have reduced our ability to uncover some differences. Significant correlations between somatoform and psychoform dissociation were previously reported in large non-clinical populations (Farina et al., 2011). Our failure to observe significant group differences in somatoform dissociation is potentially due to our relatively small sample sizes, compounded by the fact that somatoform dissociation experiences are also less frequently reported than psychoform dissociative experiences in non-clinical samples. We nevertheless found a trend of moderate effect size for higher somatoform dissociation in HDHS compared to LDHS and LS participants, which is worth exploring further in future studies.

In summary, the present study sought to test the prediction that high dissociative highly suggestible individuals have a greater propensity for different types of anomalous experiences than low dissociative highly suggestible individuals and low suggestible controls. This prediction was largely borne out in the results. High dissociative highly suggestible individuals reliably exhibited a greater propensity for different anomalous experiences than the other two groups, with the strongest

effects observed with anomalous sleep experiences, such as sleep paralysis. By contrast, low dissociative highly suggestible individuals did not significantly differ from low suggestible controls with evidence for the null hypothesis that these two groups do not differ in sleep experiences. These results are broadly congruent with previous research (Alganami, Varese, Wagstaff, & Bentall, 2017; Fassler, Knox, & Lynn, 2006; Pekala, Kumar, & Cummings, 1992; Cardeña & Terhune, 2014), particularly on research linking dissociation to unusual sleep experiences. However, working with the hypothesis that hallucinations and other anomalous experiences are partly driven by a tendency to over-weight perceptual priors (Corlett et al., 2019; Sterzer et al., 2018; Tulver, Aru, Rutiku, & Bachmann, 2019), our results are at odds with the proposal that high hypnotic suggestibility is uniformly characterized by hallucination-proneness.

### **Declaration of interest**

The authors declare no conflicts of interest.

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