

Final Report

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Project aims and summary:

The goal of this project was to understand whether hypnotic suggestibility and germane constructs were associated with atypical time perception and metacognition. Across seven studies, we have shown that hypnotic suggestibility is associated with a specific metacognitive deficit whereas dissociative tendencies are associated with a specific timing deficit. We also show how distorted timing varies across different altered states of consciousness. We further expanded upon these results by strengthening understanding of the neurophysiology of hypnotic suggestibility, the developmental factors underlying the relationship between dissociation and suggestibility, and the evidence for elevated suggestibility in a clinical population characterized by pronounced dissociation.

Study I: Neurophysiology of atypical metacognition in high hypnotic suggestibility

Our first study aimed to expand upon our previous result that hypnotic suggestibility is associated with a selective deficit in metacognition pertaining to the sense of agency (Terhune & Hedman, 2017). In particular, 14 highly suggestible participants and 17 medium suggestible control participants completed the Metacognition of Agency Task (MAT; (Terhune & Hedman, 2017) whilst the electrical signals of their brain were recorded using magnetoencephalography (MEG).

Unfortunately, we were unable to replicate our previous result – highly suggestible and control participants did not differ on any features of the task including metacognitive awareness of their sense of agency. For this reason, we did not contrast the two groups on the neurophysiological correlates of metacognitive judgments during this task. Insofar as multiple changes to the task were implemented to accommodate the completion of the task in the MEG scanner relative to our previous study (Terhune & Hedman, 2017), including a change of posture, experimental conditions, trial length, response format, number of trials, and other features, it remains challenging to account for this replication failure. Due to our inability to determine the source of the replication failure, we plan to wait until further research is completed with this task before we submit this work for publication. We are hoping to conduct a replication/extension of our original study soon.

Study II: Altered resting state network connectivity in high hypnotic suggestibility

Recent research suggests that highly suggestible individuals have atypical metacognition pertaining to the sense of agency at baseline (Terhune & Hedman, 2017). This implies that even in the absence of a hypnotic induction or specific suggestions, these individuals have aberrant cognitive functioning although the neural basis of these effects are largely unknown because the vast majority of neurophysiological studies of highly suggestible individuals' brain states have focused on the impact of an induction or specific suggestions (Oakley & Halligan, 2013; Terhune et al., 2017). Recent research suggests that atypical medial prefrontal cortex activation (McGeown et al., 2009) and frontal-parietal connectivity (Terhune et al., 2011) may be useful markers of high hypnotic suggestibility. However, these and other studies are limited in multiple ways, most notably by their reliance on an extreme-groups design in which highly suggestible participants are compared against low suggestible controls; this design is problematic because low suggestible participants are an atypical subgroup that is not representative of the general population (Lynn et al., 2007).

This study sought to circumvent the limitations of previous studies by comparing the resting state neurophysiological profiles of medium (n=17) and highly (n=14) suggestible participants using MEG. Participants were scanned in an eyes-open resting state condition without an induction or any specific suggestions. We used phase-amplitude coupling to derive canonical resting state networks, as previously done with MEG (Florin & Baillet, 2015), and estimated functional connectivity (Vinck et al., 2011) within a medial prefrontal network, the frontal-parietal network, and between the two networks in upper alpha (11-

13Hz) and lower beta (13-20Hz), two frequency bands of interest that have been previously implicated in hypnosis (Jamieson & Burgess, 2014; Terhune et al., 2011).

We were able to replicate 6 canonical resting state networks (Figure 1) as shown in a previous MEG study (Florin & Baillet, 2015). We also found that highly suggestible individuals reliably displayed lower phase-lag index values than medium suggestible individuals in the different networks of interest (Figure 2). These differences were present in both upper alpha and lower beta bands although they were more pronounced in the latter. Critically, control analyses revealed that these effects were not present in other frequency bands within these networks nor in any frequency bands in other networks.

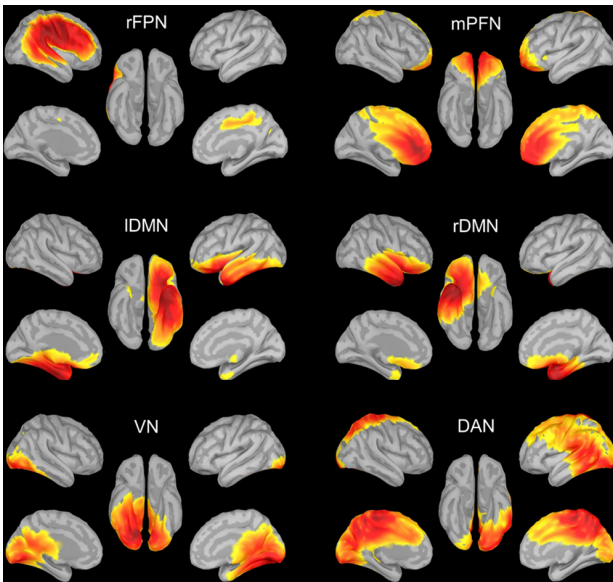


Figure 1. PAC-derived RSNs in the entire sample (collapsed across groups). RSNs are thresholded at 40% of their maximum value. rFPN = right Frontal Parietal Network; mPFN = medial Prefrontal Network; IDMN = left Default Mode Network; rDMN = right Default Mode Network; VN = Visual Network; DAN = Dorsal Attention Network.

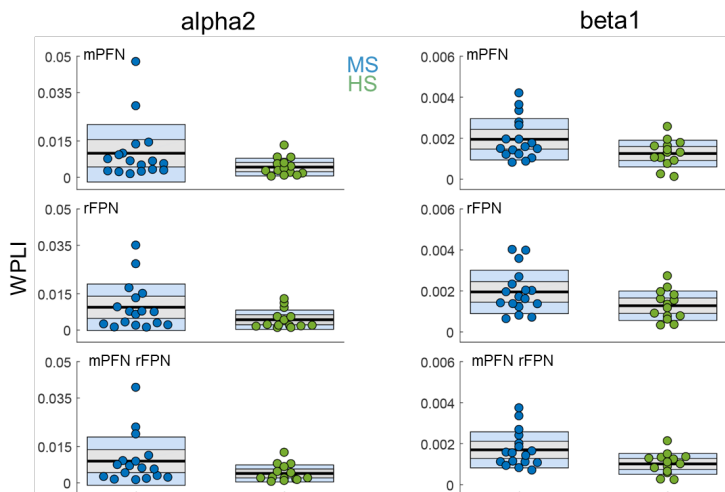


Figure 2. dWPLI (functional connectivity) in PAC-derived RSNs in medium suggestible (MS; blue) and highly suggestible (HS; green) participants in alpha2 and beta1 bands in medial prefrontal network (mPFN), right frontal parietal network (rFPN), and between mPFN and rFPN. * $p < .05$, ** $p < .01$, *** $p < .001$

These results corroborate and expand upon previous research (Jamieson & Burgess, 2014; McGeown et al., 2009; Terhune et al., 2011) using more sophisticated methods and analyses. In particular, our results demonstrate that highly suggestible individuals exhibit reduced functional connectivity within and between medial prefrontal and lateral prefrontal resting state networks. These effects are not artefactual of a design flaws in previous research and may provide a neurophysiological marker of high hypnotic suggestibility. A paper describing this study (Barone, Polito, Florin, Sowman, Barnier, Moore, & Terhune, in prep) is nearing completion (currently with co-authors).

Study III: Atypical metacognition in high hypnotic suggestibility

Since the emergence of cognitive science it has been believed that responsiveness to hypnotic suggestion is facilitated in part by an impairment or reduction in higher-order awareness regarding one's mental states (Miller et al., 1960). In the wake of this early hypothesis, Hilgard proposed that response to suggestion is facilitated by normal executive control without awareness that one is exercising control (i.e., a reduction in executive monitoring) (Hilgard, 1986). More recently, Dienes and colleagues have more specifically hypothesized that high suggestibility is enabled through a reduction of awareness of one's intentions (Dienes & Perner, 2007) and recently found evidence for this prediction (Lush et al., 2017). An outstanding question is whether individuals displaying high hypnotic suggestibility have atypical intention awareness at baseline (i.e. outside of the hypnotic context). Previous research has shown that schizotypy, a correlate of suggestibility (Gruzelier et al., 2004), is associated with increased variability in temporal estimation errors of motor intentions but not of motor movements (Moore & Bravin, 2015).

The present study tested the prediction derived from Dienes's and Perner's cold control theory (Dienes & Perner, 2007), namely that highly suggestible individuals would display impaired awareness of intentions. 66 healthy participants were screened on a modified version of the Harvard Group Scale, a standardized measure of hypnotic suggestibility (Shor & Orne, 1962), and completed a Libet temporal estimation task (Libet et al., 1983). In the latter task, participants used a clock to estimate when they made a voluntary motor response, when they heard a tone, when they consciously experienced the intention to make a voluntary motor response. It was expected that hypnotic suggestibility would be associated with later awareness of intentions (mean estimation error) or aberrant awareness of intentions (variability [SD] of estimation error), as shown with schizotypy (Moore & Bravin, 2015), but would not differ in temporal estimates in the simple motor response or auditory tone conditions, which functioned as controls. As predicted, hypnotic suggestibility was positively associated with variability of estimation errors only in the motor intention condition (Figure 3). By contrast, hypnotic suggestibility did not correlate with mean estimation errors of intentions nor estimation errors for either of the control conditions.

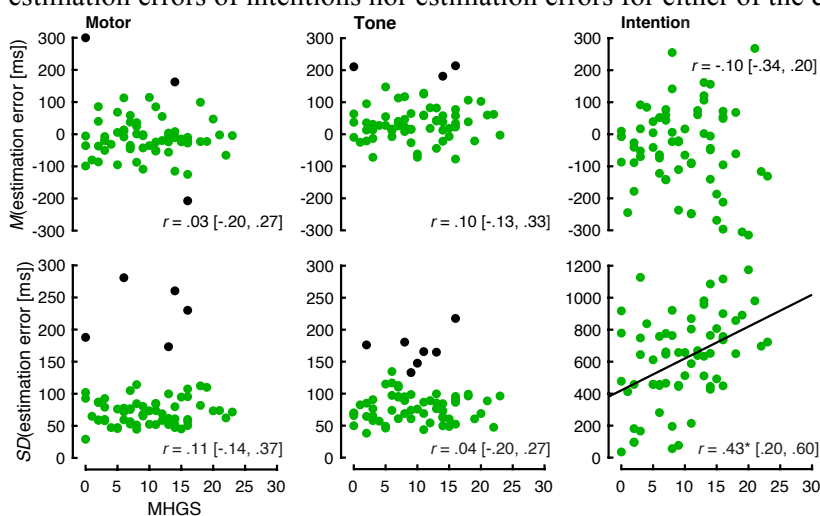


Figure 3. Associations between temporal estimation errors (M [top] and SD [bottom]) in the three conditions of the Libet temporal estimation task and hypnotic suggestibility. Black markers reflect outliers. MHGS=Modified Harvard Group Scale. Bracketed values reflect 95% Cis. * $p < .001$

These results demonstrate that hypnotic suggestibility is associated with aberrant awareness of motor intentions. This effect is specific – hypnotic suggestibility was unrelated to temporal estimates of motor responses or auditory tones. This suggests that highly suggestible individuals have a select deficit in consciously accessing their intentions but have relatively intact awareness of their motor responses as well auditory stimuli in their environment. These results are consistent with the prediction of cold control theory, that highly suggestible individuals have impaired intention awareness (Dienes & Perner, 2007). Insofar as the results replicate those observed in schizotypy (Moore & Bravin, 2015), they are also consistent with previous research linking schizotypy and hypnotic suggestibility (Gruzelier et al., 2004). A paper describing this study (Kongway, Ivanof, Moore, & Terhune, *in prep*) is nearing completion (currently with co-authors).

Study IV: Atypical interval timing and metacognition in highly dissociative individuals

Dissociation is often hypothesized to represent a central feature of hypnosis and high hypnotic suggestibility (Terhune & Cardeña, 2015; Woody & Sadler, 2008). It is often stated that distortions in the perception of

time are a common feature of dissociation (Simeon et al., 2007; Spiegel et al., 2013). Despite the prevalence of this idea, there exists relatively little evidence for distorted time perception in dissociative individuals. A previous study in depersonalization-derealization disorder reported that these patients exhibited pronounced temporal disintegration symptoms on a self-report measure (Simeon et al., 2007) but did not investigate actual time perception, as assessed on standardized behavioural tasks. Simeon and colleagues also hypothesized that self-reported distorted timing among highly dissociative individuals might reflect atypical attention rather than timing per se. Moreover, there is evidence that highly dissociative individuals have impaired metacognition (Perona-Garcelán et al., 2012). If this generalizes to interval timing, it is possible that self-reported timing distortions among highly dissociative individuals arise from a deficit in their meta-awareness of their own interval timing abilities. Our next study sought to address these questions by examining the relationship between time perception and dissociative tendencies.

In this study, 60 healthy controls completed measures of dissociative tendencies (*Dissociative Symptoms Scale* [DSS]; (Carlson et al., 2016), a temporal bisection task in which participants had to estimate the duration of short visual intervals (300-700ms), and colour bisection task, which was matched to the temporal bisection task but involved colour judgments. This task was included as a control task to account for the role of individual differences in sustained attention and working memory during interval timing (Coull et al., 2012; Coull et al., 2004). This allowed us to determine whether any observed association between dissociation and timing is independent of attention and working memory in order to formally assess Simeon and colleagues hypothesis that distorted timing in highly dissociative individuals is attentional in origin (Simeon et al., 2007). On each trial of both tasks, participants reported their confidence in their preceding judgment, in order to assess metacognitive awareness pertaining to time bisection and colour bisection performance.

In the first block of the hierarchical regression, age, gender, years of education and colour bisection precision (a control task indexing attention and working memory), did not yield a significant model, $F(4,54)=0.67, p=.62, R^2=.05$ (see **Table 1**). As seen in **Figure 4**, colour bisection precision was not a significant predictor of dissociative tendencies. However, including temporal bisection precision in the second block significantly improved the model, $\Delta F(1,53)=5.64, p=.021, \Delta R^2=.09$, although the overall model remained non-significant, $F(5,53)=1.71, p=.15$. This suggests that dissociative tendencies are associated with impaired temporal precision.

Table 1. Inferential statistics for a two-block hierarchical regression on dissociative tendencies (Dissociative Symptoms Scale) ($N=60$).

Model	Variable	Beta	<i>t</i>	<i>p</i>	<i>sr</i>
1	Age	.14	.93	.36	.12
	Gender	-.03	-.20	.84	-.03
	Education	-.12	-.79	.43	-.11
	Colour precision	.14	1.09	.28	.14
2	Age	.20	1.33	.19	.17
	Gender	-.09	-.62	.54	-.08
	Education	-.10	-.69	.49	-.09
	Colour precision	-.02	-.13	.90	-.02
	Temporal precision	.36	2.38	.021	.30

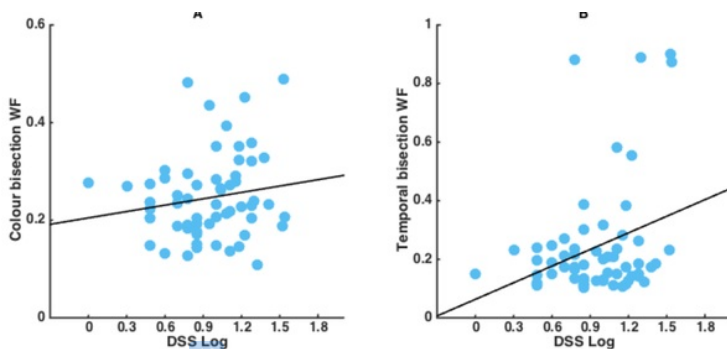


Figure 4. Colour bisection precision (measuring attention and working memory) was not significantly related to dissociative tendencies (DSS Log) (left) whereas temporal bisection precision was significantly related to dissociative tendencies (right). See Table 1 for inferential statistics.

These results confirm our central prediction that time perception is distorted in highly dissociative individuals, thereby corroborating the idea that distorted timing is a feature of dissociation more generally (Simeon et al., 2007; Spiegel et al., 2013). By showing that this association is independent of precision on a colour bisection task, which is matched to temporal bisection performance for attention and working memory (Coull et al., 2012; Coull et al., 2004), our results indicate that distorted timing in highly dissociative individuals is independent of a potential broader set of deficits in attention and working memory in this population. In addition, our results further showed that highly dissociative individuals do not exhibit a deficit in metacognitive awareness pertaining to time perception. This suggests that these individuals have a specific impairment in time perception rather than a higher-order deficit in their awareness of their own timing abilities. Cumulatively, these results suggest that high dissociation is characterized by a selective deficit in time perception at the perceptual rather than metacognitive level that is independent of broader attentional and working memory deficits. A paper describing this study (Woodham, Hunter, David, & Terhune, in prep) is currently in preparation.

Study V: Distorted timing in altered states of consciousness

The experience of time is widely accepted to represent a fundamental feature of consciousness and is closely aligned with our experience of selfhood (Wittmann, 2015; Yin et al., 2016). Despite these associations, how time perception varies across different states of consciousness remains poorly understood. In particular, data regarding the extent to which time is distorted in different altered states of consciousness (ASCs) has not yet been systematically integrated. In particular, it remains unknown whether there is a consistent patterning of timing distortions across different ASCs. Advancing understanding of these patterns may facilitate the development of a more robust taxonomy of ASCs and help us to further understand the relationship between time perception and consciousness.

The original aim of this study was to conduct a meta-analysis of time perception in ASCs. Upon reviewing the literature in a systematic manner, it became apparent that this would not be possible as the relevant studies of time perception in different ASCs vary dramatically in the methods used. For example, studies of time perception during hypnosis have almost solely relied on simple verbal estimates of duration (Naish, 2014). Due to these methodological differences, which prevent comparisons across ASCs, we have instead undertaken a systematic review of the literature. In particular, we have performed extensive searches and we believe we have identified all studies that measured time perception in the context of hypnosis, meditation, state dissociation, and psychedelic drugs in addition to miscellaneous studies, such as on relaxation.

The cumulative set of results have yielded a number of important findings. First, whereas hypnosis, particularly among highly suggestible individuals, tends to be associated with a tendency to underestimate time, the opposite appears to be the case for meditation. Similar results to hypnosis tend to be observed in state dissociation and psychedelic states, which is consistent with research showing links between both and hypnosis (Lemerrier & Terhune, 2018; Terhune & Cardeña, 2015). Multiple studies have highlighted the links between time perception and interoception although further research is required in this regard. In addition, the results point to discrepancies between subjective and behavioural measures of time perception, which need to be considered to a greater extent in future research.

This study represents the first attempt to systematically integrate existing knowledge on time perception during ASCs. The results point to a number of important similarities but also discrepancies between different ASCs. They also highlight a number of outstanding questions and suggestion multiple lines of research. A paper describing this study (McClay, Yanakieva, Polychroni, & Terhune, in prep) is currently being in preparation.

Study VI: Dissociation and suggestibility: A model-comparison approach

Although dissociation is widely seen as a core mechanism in hypnosis (Woody & Sadler, 2008), the relationship between dissociative tendencies and hypnotic suggestibility remains poorly understood. In particular, although there is robust evidence for elevated hypnotic suggestibility in dissociative disorder patients (Terhune & Cardeña, 2015), the evidence for an association between hypnotic suggestibility and dissociative tendencies in the general population is mixed (Dienes et al., 2009). We reasoned that poor evidence for this association in the general population may be due to a failure to properly consider important moderating variables, including trauma and attachment. For example, a prominent model of dissociation (diathesis-stress [DS] model; (Butler et al., 1996) proposes that hypnotic suggestibility renders one prone to dissociation if one is exposed to trauma (**Figure 5**). By contrast, the dual pathway to suggestibility model (DPS) (Carlson & Putnam, 1989; Terhune & Cardeña, 2015) proposes that exposure to trauma coupled with

a propensity for dissociative tendencies will result in elevated suggestibility (**Figure 5**). Both models can be extended by incorporating insecure attachment, which known to influence the relationship between trauma and dissociation (Gušić et al., 2016), as an additional moderating influence.

This study sought to discriminate between these two models. 205 healthy participants completed a novel behavioural measure of non-hypnotic suggestibility and standardized psychometric measures of dissociation, trauma, and insecure attachment. The first set of analyses tested the simple moderation models (i.e., without incorporating the additional moderating influence of insecure attachment) (**Figure 5**). The results were consistent with both models: trauma moderated the association between suggestibility and dissociation (DS model) and Dissociation moderated the association between trauma and suggestibility (DPS model). However, a Bayesian model comparison indicated that the DS model exhibited superior fit to the data.

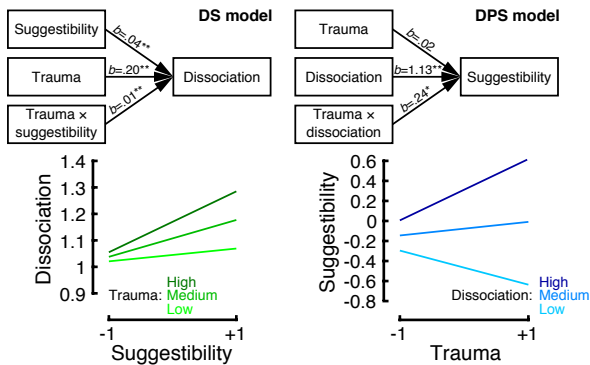


Figure 6. Simple moderation analyses evaluating the DS and DPS models. Values denote unstandardized beta coefficients. * $p < .05$ ** $p < .01$

These results provide clear-cut evidence for the diathesis-stress model of dissociation and help to elucidate the complicated relationship between dissociation and suggestibility in the general population. In particular, our results suggest that highly suggestible individuals who are exposed to trauma and display an insecure attachment style will develop a propensity for dissociative tendencies. A strength of the present study is that we used Bayesian model comparison methods to distinguish the diathesis-stress model from an alternative competing account of the relationship between dissociation and suggestibility. These results provide, to our knowledge, the first evidence for the diathesis-stress model in the general population and provide a conceptual pathway for further research on the association between dissociation and suggestibility. A paper describing this study (Wieder & Terhune, under review) is currently under review.

Study VII: A meta-analysis of suggestibility in functional neurological disorders

Since the nineteenth century, hypnosis has been associated with functional neurological disorder (FND), a condition previously known as hysteria and conversion disorder (Ellenberger, 1970; Gauld, 1992) that is characterized by a variety of seemingly neurological symptoms that appear to have a non-organic or psychogenic origin. Patients with an FND are highly dissociative and there is consistent evidence that patients with a dissociative disorder exhibit elevated suggestibility (Terhune & Cardena, 2015). Although FND and hypnosis have long been associated, recent reviews have suggested that the evidence for elevated suggestibility in patients with an FND is mixed (Bell et al., 2011). Nevertheless, these and other authors have not precisely quantified the evidence and evaluated whether atypical suggestibility in this population is attributable to methodological artifacts.

In order to clarify the evidence for atypical suggestibility in FND patients, we sought to perform a meta-analysis of all controlled studies of suggestibility in these patients. We systematically surveyed the literature and identified all studies ($k=13$) that administered standardized suggestibility scales to FND patients and controls. We next carefully coded each study for suggestibility in each group as well as methodological features, such as the presence of a hypnotic induction and whether the experimenter administering the suggestibility scale was blind to participant group.

Overall, the meta-analysis yielded robust evidence for elevated suggestibility in patients with an FND. The cumulative group difference was statistically significant, $Z=3.73$, $p < .001$, reflecting a group difference of approximately half of a standard deviation, $g=0.55$ [0.26, 0.84] (**Figure 6, bottom**). This supports the long-held hypothesis that FND patients display elevated suggestibility. Interestingly, FND patients and controls did not differ in nonhypnotic suggestibility, $Z=0.43$, $p=.67$, $g=0.25$ [-0.91, 1.42] (**Figure 6, top**), but did differ in hypnotic suggestibility, $Z=4.70$, $p < .001$, $g=0.63$ [0.37, 0.89] (**Figure 6, middle**), although the

difference between the two did not achieve significance, $p=.54$. We next contrasted studies where the experimenter was blind or not. Blind studies were associated with numerically larger effects, $Z=2.34$, $p=.02$, $g=0.74$ [0.12, 1.36], than unblind studies, $Z=2.69$, $p=.007$, $g=0.47$ [0.13, 0.81], although this difference was non-significant, $p=.46$.



Figure 9. A forest plot depicting standardized mean differences (and 95% confidence intervals) of the difference between functional neurological disorder (FND) patients and controls in nonhypnotic suggestibility (top) and hypnotic suggestibility (bottom) in a random-effects meta-analysis. Green squares depict group differences (patients – controls) in individual studies whereas black diamonds depict weighted mean differences in a set of studies. If a black diamond does not overlap with the vertical line (0 difference), then the effect is statistically non-significant.

This study represents the first systematic quantitative analysis of atypical suggestibility in FND. The results clearly indicate that patients with an FND are more suggestible than controls. Critically, further analyses revealed that this group difference in suggestibility does not appear to be driven by whether the experimenter administering the scale was blind to the group affiliation of each individual patient/participant. Finally, there was some evidence that the group difference was more pronounced with hypnotic suggestibility measures. Insofar as patients with an FND are highly dissociative (Lyssenko et al., 2018), this is arguably consistent with the proposal that highly dissociative individuals benefit more from a hypnotic induction than controls (Barber, 1999), although further research is clearly needed to evaluate this hypothesis more stringently. A paper describing this study (Wieder, Brown, Thompson, & Terhune, in prep) is currently being written and it is expected that the paper will be submitted during Spring-Summer 2019.

Summary and conclusions

The central aims of this project were to advance understanding of atypical metacognition and time perception in high hypnotic suggestibility and germane conditions. Across seven studies, we have shown that hypnotic suggestibility is associated with a specific metacognitive deficit whereas dissociative tendencies are associated with a specific timing deficit. We also show how distorted timing varies across different altered states of consciousness. We further expanded upon these results by strengthening understanding of the neurophysiology of hypnotic suggestibility, the developmental factors underlying the relationship between dissociation and suggestibility, and the evidence for elevated suggestibility in a clinical population characterized by pronounced dissociative symptomatology. Together, these results help to significantly advance our understanding of the neurocognitive mechanisms underlying hypnosis and germane altered states of consciousness.

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Output

Presentations

In addition to the progress achieved on this project, the support of the Bial Foundation was acknowledged in the following **academic presentations**:

- 1) "Metacognition and self-related processing in highly suggestible individuals", Science of Self Conference, Sydney, AU (November 2017) (Invited talk).
- 2) "Atypical metacognition in high hypnotic suggestibility", Society for Clinical and Experimental Hypnosis, Chicago, USA (November 2017) (Conference presentation).
- 3) "The role of the cerebellum in hypnosis", Society for Clinical and Experimental Hypnosis, Chicago, USA (November 2017) (Invited talk).
- 4) "Measuring individual differences in response to hypnotic suggestion: Modernization and the researcher-clinician gap", John Elliotson Memorial Lecture, Section of Hypnosis and Psychosomatic Medicine, Royal Society of Medicine, London, UK (May 2018) (Invited talk).
- 5) "Impaired intention awareness in high hypnotic suggestibility", Association for the Scientific Study of Consciousness, Krakow, Poland (June 2018) (Conference presentation).

- 6) “Impaired intention awareness in high hypnotic suggestibility”, International Society of Hypnosis, Montreal, Canada (August 2018) (Conference presentation).
- 7) “Improving credibility in hypnosis research”, International Society of Hypnosis, Montreal, Canada (August 2018) (Invited talk).
- 8) “Measuring hypnotic suggestibility”, International Society of Hypnosis, Montreal, Canada (August 2018) (Conference presentation).
- 9) “A meta-analysis of suggestibility in functional disorders”, British Society for Clinical and Academic Hypnosis, Edinburgh, UK (October 2018) (Invited talk).
- 10) “Atypical frontal connectivity as a neurophysiological marker of high hypnotic suggestibility”, Society for Psychophysiological Research (October 2018) (Invited talk).
- 11) “The cognitive neuroscience of suggestibility”, Department of Psychology, University of Essex, Essex, UK (February 2019) (Invited talk).

The role of the Bial Foundation in supporting my research was also acknowledged in the following **invited public talks**:

- 1) “Separating fact and fiction in hypnosis”, Brighton Skeptics in the Pub, Brighton, UK (April 2018).
- 2) “The science of hypnosis”, Shoreditch House, London, UK (July 2018).
- 3) “Separation fact and fiction in hypnosis”, Maidenhead Skeptics in the Pub, Maidenhead, UK (September 2018).
- 4) “Hypnosis: the state of the science”, Greenwich Skeptics in the Pub, London, UK (October 2018).
- 5) “Suggestion”, Salon London, London, UK (October, 2018).

List of publications

The following papers, directly generated by this project, are included below. In all papers, I have or will acknowledge the generous support of the Bial Foundation.

Published

1. **Terhune, D. B.**, & Oakley, D. A. (in press). Hypnosis and imagination. In A. Abraham (Ed.), *Cambridge handbook of imagination*. Cambridge, UK: Cambridge University Press.
2. Lemerrier, C. & **Terhune, D. B.** (2018). Psychedelics and hypnosis: Commonalities and therapeutic implications. *Journal of Psychopharmacology*, 32, 732-740.

Under review

3. Wieder, R., & **Terhune, D. B.** (under review). Dissociation and attachment influence the relationship between trauma and suggestibility: A moderated-moderation analysis.
4. Thompson, T., **Terhune, D. B.**, Oram, C., Sharangparni, J., Rouf, R., Solmi, M., Veronese, N., & Stubbs, B. (under review). The effectiveness of hypnosis for reducing pain: A meta-analysis of 85 controlled experimental pain trials.

Near to submission (Winter 2019)

5. Barone, J., Polito, V., Florin, E., Sowman, P., Barnier, A. J., Moore, J. W., & **Terhune, D. B.** (in prep). High hypnotic suggestibility is characterized by reduced functional connectivity in frontal networks.
6. Chong, K., Ivanof, B., Moore, J. W., & **Terhune, D. B.** (in prep). Aberrant intention awareness in high hypnotic suggestibility.

In preparation (Spring-Summer 2019)

7. Woodham, R., Hunter, E., David, A. S., & **Terhune, D. B.** (in prep). Dissociation is associated with distorted time perception: A psychophysical approach.
8. Wieder, R., Brown, R. J., Thompson, T., & **Terhune, D. B.** (in prep). Suggestibility in functional neurological disorders: A random-effects meta-analysis.
9. McClay, M., Yanakieva, S., Polychroni, N., & **Terhune, D. B.** (in prep). Distorted timing in altered states of consciousness.