

## Response to Terhune: Testing Cold Control Theory

Response to the Commentary: Metacognition and Cold Control in Hypnosis

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July 2012

First off, we would like to thank Terhune for his careful (and kind) consideration of cold control theory. In his comment on our paper, Terhune queries some of the evidence for cold control theory and asks what specific predictions could be made to distinguish cold control from dissociated control theory. We agree with the thought that while cold control predicts the effects of rTMS and alcohol on hypnotic response that we observed, so does dissociated control theory—therefore finding the prediction true does not specifically support cold control theory (on either a Popperian or Bayesian perspective, Dienes, 2008; there is no need for the specific notion of ‘reverse inference’ Terhune mentions, above and beyond these general philosophies of science). However, these data do support both theories together against theories that link hypnotic response to superior executive function: Hence, these data do support a contrast between hypnotic response and meditation (as also noted by Terhune.)

So how could cold control and dissociated control theory be distinguished? According to cold control theory, hypnotic response is produced by intending and carrying out the response using the executive system, while creating inaccurate higher order thoughts. Thus, if the frontal system is mildly impaired such that it can still intend and carry out the response, the impairment will not harm hypnotic response. If the impairment affects the area responsible for accurate HOTs, then hypnotic response will be facilitated. Conversely, if the frontal lobes are impaired to the extent that the subject sometimes fails to intentionally perform the

action, then by cold control theory the action will fail hypnotically just as often<sup>‡</sup>. By contrast, according to the dissociated control theory of Woody and Bowers (1994), hypnotic suggestions are not created by intentions at all, therefore a failure to be able to intentionally produce a cognitive or motor action is perfectly consistent with performing the action hypnotically. Indeed, it is precisely because the intentional (or executive) system has been compromised that hypnotic response occurs at all, according to (this version) of dissociated control theory. Dienes and Perner (2007) argued that many hypnotic responses appeared to involve executive functions, specifically overcoming habit and pre-potent responses (e.g. producing habitual responses at below baseline levels, Spanos, Radtke, & Dubreuil, 1982; overcoming the Stroop effect, Raz et al, 2006). On the face of it, such responses are problematic for dissociated control theory and consistent with cold control. Dissociated control theory could remedy the problem by postulating that the executive system was not actually involved at all in such responses; instead, for example, low level perception was changed (in a special hypnotic way, still to be specified), perceptions that triggered only automatic responses. (If subjects do not see a word after being given an alexia suggestion, they do not need to inhibit the word.) For example, if people became sufficiently drunk that they could not inhibit a pre-potent response intentionally, then by cold control theory, the response could not be inhibited hypnotically; by dissociated control theory, hypnotic response could still be successful.

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*‡ These opposing predictions hold under specifiable circumstances—so the falsifiability of the theory is not compromised*

With Ben Parris, we are currently collecting data on the key prediction of cold control theory that the intentional performance of an action can achieve anything that the hypnotic performance can\*. Specifically, in a “volitional” condition, we tell subjects that they can imagine words have no meaning, and experience their imagination as completely under their volitional control, and experience it as imagination and not perception. So far we have found that subjects achieve the requisite phenomenology—and also expect that they will experience the words as meaningless just as strongly in the volitional as in the normal post-hypnotic alexia condition. If the Stroop effect is reduced less in the volitional than the post-hypnotic suggestion condition, cold control theory is in trouble. Theories that postulate that hypnosis can change perception in a peculiar way would in contrast be supported. There would be more to hypnotic responding than self deception—more than cold control theory postulates.

One correction is needed. Terhune claims that it is striking that in Semmens-Wheeler and Dienes (submitted), alcohol intoxication impaired performance on executive functioning tasks but did not influence behavioral hypnotic responding. However, the only measure of response in that study was the subject’s rating of how strongly they experienced the suggestion, which alcohol strongly affected. Further, such subjective ratings are generally highly correlated with “objective” measurements (such as whether the arm moved more than a certain amount for an arm heaviness suggestion) (e.g. McConkey, Wende and Barnier, 1999). As yet there is no direct evidence either way as to whether disrupting frontal function fails to influence objective measures of responding. We anticipate that sensitive measurements will show

disrupting frontal function will affect objective measures, as subjective experiences and behavioral responses tend to go together in cooperative subjects.

Terhune asks the interesting question of how the formation of inaccurate HOTS about intentions actually improves the likelihood of those intentions giving rise to a particular hypnotic response. Why would the person have relevant intentions to lift an arm or imagine a counterfactual world in the first place? Consistent with White’s (1942) seminal notion of hypnosis as “goal directed striving”, a person will attempt to respond hypnotically when it fits their goals. To respond to arm levitation, a person may intend to lift the arm a small amount to see if it feels light. But they may only continue to lift their arm to a levitation suggestion if it feels like it is happening by itself, so the subjective experience likely feeds the motivation for the behavioral response and vice versa. (That is why the subjective and objective measurements of hypnotic response are so correlated.) McConkey et al (1999) asked subjects to continuously turn a dial indicating the strength of their hypnotic experience as they responded to suggestions. In general they found the dial was turned progressively higher as the suggestion progressed. One could imagine subjects first tentatively trying the suggestion voluntarily, then successful subjects finding they can experience some involuntariness (as they generate inaccurate higher order thoughts), motivating the first order intention even more. With practice, a high may be able to launch into a fully involuntary response from the beginning. However, much of this is speculation; the dial method should be useful in exploring cold control processes in more detail in future research.

\* This is a separate question to whether an induction alters performance. Assuming subjects do not need an induction to respond hypnotically—in the sense of experiencing alterations in perception in volition to suit task demands (as we define hypnosis in the main article), then finding an induction not relevant to e.g. responding to the alexia suggestion (Raz et al 2006) still leaves open the question of whether the intentional performance of an action can achieve anything that the hypnotic performance can.

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