Is hypnotic responding the strategic relinquishment of metacognition?

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Abstract

According to the 'cold control theory' of Dienes and Perner (2007) hypnotic responding is intimately linked to metacognition. Specifically, we proposed that what makes a hypnotic response hypnotic is the intentional performance of a (physical or mental) action while having inaccurate higher order thoughts to the effect that one was not intending the action. That is, the essence of hypnosis is a strategic lack of metacognition. In this chapter, I explore this idea in three ways. First, I argue that individual differences in first-order abilities, e.g. ability to attend to the world or inhibit information, are unrelated to hypnotisability; however, the tendency to be aware of one's mental states while performing a simple task is related to hypnotisability. Second, I argue that impairing the brain region involved in metacognition (specifically the brain region involved in maintaining accurate higher order thoughts) enhances hypnotisability. Third, I argue that hypnotised subjects have no abilities they don't have any way; the essence of hypnosis is not the existence of any first-order abilities but the fact one's actions feel involuntary. Overcoming pain seems a counter-example, but debatably, the only quality that hypnosis adds to one's ability to overcome pain is the feeling that the pain goes away by itself.

In this chapter the importance of understanding metacognition at the level of self-ascription of mental states (to use the terminology of Proust, 2012) will be highlighted. I argue that hypnosis might provide a sort of show case for metacognition researchers, because a mere change in ascriptive metacognition results in behaviour so bizarre that many people believe that response to hypnotic suggestion involves either faking or else an extraordinary change in first order states (attention or other abilities). Hypnosis illustrates the dramatic effect a small change in metacognition can have, even on such an everyday activity as raising one's arm. Consider the hypnotic suggestion that the arm will rise by itself, and the person looks in amazement at their rising arm. Is the person faking their claims of involuntariness? Or can they selectively attend in such a remarkable way they inhibit all information that contradicts the hypnotic suggestion, allowing the suggested response to happen? I argue that neither faking nor first order attentional abilities are typically involved, but rather metacognition.

The cold control theory of Dienes and Perner (2007; see also Barnier et al 2008) takes a common component from previous theories in hypnosis (e.g. the sociocognitive tradition represented by Spanos 1986, and the normally contrasting neo-dissociation theory of Hilgard 1977) and identifies it as the essence of hypnosis: Namely, hypnotic response is constituted by intending to perform some motor or cognitive action, while remaining unaware of the intention – in fact, the hypnotised subject actively thinks she is not intending to perform the action. Construed in this way, hypnosis is a purely metacognitive phenomenon. It involves no changes in first order abilities, i.e. abilities that rely on mental states that are only about the world. If one intends to lift one's arm it will rise; but if one is resolutely unaware of the intention, the arm will appear to lift by itself, producing the phenomenology of hypnosis.

Cold control theory claims that there is nothing more to hypnotic responding than the metacognitive change. The ability to raise one's arm is unexceptionable; what is strange in hypnotic response is only the metacognition that goes with it. (Cold control is "cold" because it is executive control without an accurate higher order thought (HOT): Control without the HOT). On this theory, incidentally, it follows that no animal could be hypnotised unless it had mental state concepts, at least of intentions, so that it could intentionally do something while believing it wasn't intentional!

This chapter will explore evidence and predictions of this metacognitive approach to understanding hypnosis. Initially, I will indicate what I take the phenomena of hypnosis to be that I want to explain. Then, the term metacognition will be defined as it is used in this chapter. Next, the chapter will consider the relation between hypnosis and metacogntion. First it overviews the correlates of hypnotisability and suggests metacognitive correlates may be more promising than those measuring first order cognitive abilities. Then, data are described investigating the effect on hypnotic response of impairing prefrontal regions previously shown to be involved in establishing accurate higher order thoughts. Finally the prediction of the theory that no first order abilities are acquired by virtue of responding hypnotically (the only change is metacognitive), and relevant empirical evidence considered for the absence of hypnotically-induced first order abilities.

A What is hypnosis?

Hypnosis is a situation in which a person creates altered experiences of volition or reality in accord with the requirements of the situation (see Nash & Barnier 2008 for recent reviews of the field). The requirements can be provided by the suggestions of another person, for example a hypnotist, but they can also be produced by the goals of the person themselves.

An example of an altered experience of volition is ‘magnetic hands’, which 90% of people can experience: Hold your hands out in front of you palms facing each other and imagine your hands are magnets, creating a force pulling your hands together. You have responded successfully if you feel a force pulling your hands together, as if by themselves. If you just tried this now, the goal was set by yourself without the need for a hypnotist to be present. An example of an altered experience of reality is hallucination. Look at a pale object in front of you and make it look red. If you can experience the redness as genuinely external and in the object, that is if it seems like you are seeing it as red, you have responded successfully. Only about 10% of people can reliably respond to such cognitive suggestions. Alterations in the experience of reality can also have delusional components, for example, it can be suggested that people have changed gender (McConkey et al 2001). There is a normal distribution of response to hypnotic suggestion with the top 10% of responders called ‘highs’ and the bottom 10% ‘lows’; those in between are ‘mediums’. Why some people are more hypnotisable than others remains unresolved (Heap et al 2004).

The English word ‘hypnosis’ suggests a state – in everyday speak we can say a person can enter hypnosis, hypnosis can be induced, and a person may be hypnotised. In the definition above I have deliberately avoided having a special state be constitutional of hypnotic responding: I take the role of a special state to be a theoretical and empirical issue that could go in several directions, with the fundamental phenomenon we trying to explain (the ability of some people to alter the experience of volition and reality) remaining the same (cf Kirsch et al 2011). But some facts are worth bearing in mind. There is a relatively standard procedure that serves as a ‘hypnotic induction’ consisting of suggestions for relaxation and sleepiness. Often a condition is operationally defined as hypnotic in experimental research if it was preceded by this induction. Yet the induction causes only a small increase in the rate of responding to suggestions. For example, if seven standard

suggestions are given without a hypnotic induction and on average 2 are passed, an induction will increase the response rate to 2.5 (Braffman & Kirsch 1999). Further, this increase in response can be accounted for by an increase in expectancy of responding. Correspondingly, almost any procedure can serve as an induction, including: stationary cycling with suggestions of becoming more alert; a sugar pill labelled 'hypnotic'; inert medically scented gas; stroking the head; staring in the eyes; pressure on the thumbs; drinking magnetised water; a blow on a gong; or the simple "now you are hypnotised" (Lynn et al 2008). There may or may not be a special state that slightly facilitates hypnotic response (see Oakley 2008 for a recent review), but the aim of this chapter is not to focus on explaining any such state. Cold control might be facilitated in a special state, or the special state could just be another suggestion implemented by cold control.

One theory of hypnotic response that has to be considered first, even if just to dismiss, is that hypnotic response is faked. However, at least in academic research settings, highs, unlike people asked to fake being high, carry on responding to suggestions even when they think they are alone unobserved (Kirsch et al 1989); highs, unlike people asked to fake being highs, pass lie detector tests of honesty (Kinnunen et al 1994); and highs responding to suggestion rather than faking response have different brain regions involved, with the brain regions being consistent with those expected if the responses were veridical (Oakley 2008; Ward et al 2003).

Two broad approaches have historically been used to explain hypnosis. One explains the responses as purely responses to demand characteristics according to well established everyday psychological principles (e.g. Spanos 1986). Social pressure has a powerful effect on people's actions. If the two people either side of you on stage are acting like chickens, you can either act like a chicken or ruin the show. Before you know it, you are acting like a chicken. Such an explanation can be combined with a metacognitive approach like cold

control to argue that demand characteristics lead people to be unaware of their intentions. But it need not. Demand characteristics might create expectations, and the expectations might directly cause the hypnotic experiences, just as expectations directly cause placebo effects (Kirsch 1985). In this case no further metacognitive explanation is necessary. If a person believes they did not intend the mental or physical action, they are just being accurate.

The dissociation approach explains hypnotic response as a result of a change in cognitive control structures, with one structure splitting (dissociating) either within itself or from the other structures (Hilgard 1977). Such a change could involve changes in awareness of intentions, for example if the central executive split in two and what one half intended the other half was not aware of, as required by cold control. But dissociation theory does not require this. Dissociation might split off a control structure from the central executive, so its action were no longer triggered by intentions but by hypnotic suggestions (Bowers & Woody 1996). In this case also no further metacognitive explanation is necessary. If a person believes they did not intend the mental or physical action, they are just being accurate.

In sum, cold control theory is not an alternative theory to the main theories, it is a way of thinking about each. But it can be proved wrong, as we will see.

B. What is metacognition?

Metacognition is most broadly construed cognition about cognition. Cognition can be conceptual or non-conceptual; thus cognition about cognition can occur conceptually or non-conceptually. For example, Shea (2011) argues that the error signal in connectionist networks has representational content that is about the accuracy of the connectionist representation: Buried deep at the level of small numbers of neurons, any physiological error-signal is non-conceptually about non-conceptual representation, yet in the end about the accuracy of

mental states a person may be in. At the other end, Rosenthal (2005) discusses conceptual thoughts about whether one is in a certain mental state. Proust (2012) calls the latter metacognition "ascriptive", a general process of conceptually representing one's mental states, a process which could be applied to other people's mental states as much as one's own. She urges the term 'metacognition' be reserved for the non-conceptual abilities dedicated to evaluating one's own mental dispositions, as shown for example by the ability of some animals to evaluate their own cognitive accuracy without being able to pass theory of mind tasks about other individuals. The reader should bear in mind I am using metacognition to talk about the higher order thoughts of Rosenthal; the term can be substituted in the reader's mind with another if they have another preferred term for ascriptive metacognition.

Now I will consider the evidence for a link between metacognition and hypnosis.

C. Correlates of hypnotisability

According to one line of thinking, highly hypnotisable people are skilled in sustaining attention (Crawford et al 1993) perhaps especially in inhibiting distracting or contradictory information in the world (e.g. David & Brown 2002). This is a first order skill in so far as it involves ability to attend to the world or ignore distractions in the world. The relation between inhibitory ability without a hypnotic induction and hypnotic suggestibility has been studied most directly using the Stroop effect and negative priming. Studies using the Stroop test have produced conflicting findings, with either no difference between highs and lows or with differences in either direction[1]. A further way of assessing cognitive inhibition is with a

[1] Without hypnotic induction or suggestions being used, most studies have found no significant difference between highs and lows on Stroop interference (Aikens & Ray 2001; Egner et al 2005; Kaiseret al 1997; Kallio et al 2001). Dixon et al (1990) and Dixon and Laurence (1992) found significantly more Stroop interference in highs than lows; however, Rubichiet al (2005) found significantly less Stroop interference in highs rather than lows. On

negative priming task, in which participants are instructed to attend to some stimuli and ignore others. Dienes et al (2009) found with 180 participants the correlations between hypnotisability and negative priming or between hypnotisability and latent inhibition were close to zero, with upper limits of about 0.20. Similarly, Varga et al (2011) with 116 subjects found no significant correlations between hypnotisability and reaction time measures of sustained, selective, divided or executive attention.

In sum, there is no clear relation between hypnotisability and ability to inhibit information. If hypnotisability is related purely to those individual differences that exist between adult humans in metacognitive processes, these null results are to be expected. However, there is a striking exception to this overall conclusion, based on the work of Raz and his group. When highs are given the suggestion that words will appear to them as meaningless, the Stroop effect can be substantially reduced (e.g. Raz et al 2002; Raz et al 2003; see also Ianni et al 2006). The suggestion is just as effective whether or not a hypnotic induction is given (Raz et al 2006), so appears not to depend on being in a special state, but on having a certain ability. The effect appears non-existent to weak in lows (Raz & Campbell 2007). In as yet unpublished studies Ben Parris and I have also found the effect of this suggestion significantly less in lows than highs, even when the context is not defined to subjects as hypnotic i.e. the suggestion is given as an exercise in imagination and no induction is used: In this context, lows should not be motivated to perform badly. Note however the response was still hypnotic for highs in the sense that they produced altered experiences of reality. In sum, there appears to be an individual difference ability in reducing

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a related task, Iani et al (2006) found that highs and lows without an induction were not detectably different in terms of the effect of irrelevant flanking items on the classification of a central letter. Farvolden and Woody (2004) tested pro-active interference in highs and lows. Participants were trained on one set of paired associates (AB) then on three study-test trials of a second set (AC). On the first test trial of the second set, highs made more errors in recalling C to the cue A than lows did. Thus, highs may have found it harder to inhibit the effect of the first set of words, which is not consistent with highs being good at inhibition.

the effect of conflicting information, where highs can overcome conflict by use of imagination but lows cannot. It is intriguing how this can be reconciled with the equivalent uninstructed performance of highs and lows on the Stroop. Could highs be able to generate especially vivid images, overwriting the contents of perception? Yet on standard paper and pencil ratings of vividness of imagery, there is little to no relationship with hypnotisability (see Jamieson & Sheehan, 2002). The relation between hypnosis and a reported tendency to imaginative absorption has long been noted (e.g. Nadon et al 1991; Roche & McConkey 1990) though what abilities this entails is less clear (Jamieson & Sheehan, 2002). I will discuss the Raz effect further below; for the time being, just note that the ability to overcome Stroop in a certain context is a phenomenon for future research to attack the metacognitive approach to hypnosis at its weakest, because it appears to be a case where hypnotic response involves having a special ability not available non-hypnotically.

It will be useful to dismiss a theory some people may have about hypnosis that motivates the plausibility of a link between attention/inhibitory ability and hypnotisability. The theory that goes back to James Braid in 1847 and was revived by Baars (1988) is that successful hypnotic response occurs because highs maintain a persistent uncontradicted image of the required result. To test the theory, Zamansky and Clark (1986) asked subjects to engage in imagery inconsistent with the hypnotic suggestions given (e.g. for a rigid arm suggestion, to imagine a different world in which their arm is bending). Highs were just as responsive to suggestions (e.g. that the arm is unbendable) when engaged in imagery inconsistent with the suggestion as when having consistent imagery, even as they concurrently reported the imagery. That is, their arm remain unbent, even as the subjects described an image of the arm bending. Thus, the theory that highs attend to one idea and inhibit all else in order to achieve hypnotic response is false.

Given first order abilities are similar for high and low hypnotisable subjects, cold control theory indicates that what is important is to assess individual differences in tendency to produce accurate higher order thoughts. Designing a task to measure second order (metacognitive) processes without first order confounds is difficult, as the chapters in this volume on exploring metacognition in animals illustrates (see e.g. those by Perner or Beran) . Fortunately, the evidence for no difference in first order abilities between highs and lows allows second order differences to be explored more easily. We have begun exploring a test of second order thoughts. For example, in unpublished work, Karin Berg at Sussex asked subjects to keep looking at a candle while trying to either a) remain at all times aware of seeing the candle for 10 minutes (meditation task) or b) not consciously see the candle for 10 minutes (ignore task; compare Wegner's, 1994, 'white bear' ironic control task, where people are asked to not think of a white bear). People were asked at random intervals (roughly once a minute) whether they were just that instant before aware of seeing the candle. Because people remained physically looking at the candle there was a persistent first order visual representation of the candle; but to what extent did people have accurate higher order thoughts about seeing the candle? The difference between a) and b) in reports of seeing the candle was taken as measuring control in having accurate higher order thoughts, and the total number of reports of seeing the candle in both a) and b) as measuring coupling of higher order thoughts to first order states, i.e. the tendency to have an appropriate higher order thought given that a first order state exists. Higher order thought control did not correlate with hypnotisability ($r = -.23$, ns), but higher order thought coupling did ($r = -.54$). That is, highly hypnotisable people appeared generally prone to inaccurate higher order thoughts (regardless of their intentions): It is not that they have good metacognitive control over higher order thoughts but that higher order thought coupling is weak. The relation between HOT coupling and hypnotisability held for each task separately: For the meditation task there was a

negative correlation between number of times they were aware of the candle and hypnotisability (r = -.47; contrast Van Nuys 1973); and so was there for the ignore task (r = -.46; cf Bowers & Woody 1996). (Note in the meditation task, the results show highs failing to follow instructions well and in the ignore task the results show highs following instructions well.) The relation between coupling and hypnotisability held even after partialing out expectation of responding to each suggestion, motivation to respond to each suggestion, and a paper and pencil measure of sensitivity to social desirability (i.e. tendency to say things to please people: Marlow Crowne test, an attribute which was not controlled in the Van Nuys study). The apparent weak coupling may allow highs to decide in appropriate contexts to *forgo* higher order thoughts of intending in order to respond hypnotically to suggestions. These results are preliminary (N = 20), and Rebecca Semmens-Wheeler is following them up at Sussex by using a succession of images rather than a candle to focus on; we can then test the extent to which people were taking in the images in later memory tests to verify reports of consciously thinking of the images or not. While the results are preliminary, at least cold control suggests a line of enquiry not pursued before in understanding the correlates of hypnotisability: Individual differences in ascriptive metacognition.

D. Manipulating the neural substrate of metacognition

Now we consider whether we can do something to change hypnotisability, specifically by affecting people's ability to engage in accurate metacognition. Lau and Passingham (2006) found two masking conditions where people could discriminate one of two shapes to an equal degree but the conditions differed in the extent to which people were aware of seeing the shapes rather than thinking they were just guessing. That is, first order abilities were equivalent, but metacognitive abilities differed. fMRI indicated that a single

cortical area distinguished the conditions, the mid dorsolateral prefrontal cortex (DLPFC). Further, when Rounis et al (2010) disrupted the area with theta burst TMS, subject's awareness of seeing, as revealed by their ascriptive reports of seeing, was disrupted even when first order perception was titrated to be the same with and without TMS. That is, the disruption Rounis et al found was purely metacognitive. If the area is responsible for accurate higher order thoughts in general, disrupting the region with rTMS or alcohol should make it harder to be aware of e.g. intending to perform an action. That is, it should be easier to subjectively respond to a hypnotic suggestion. Sam Hutton and I, in as yet unpublished work, tested this prediction of cold control theory with TMS. Twenty-four mediums were subject to rTMS to the dorsolateral prefrontal cortex (DLPFC) and to a control site, the vertex, in counterbalanced order. The hypnotist was blind to which site had been stimulated. Subjects gave ratings on a 0-5 scale of the extent to which they experienced the response, for four suggestions (magnetic hands, arm levitation, rigid arm and taste hallucination). Overall, rTMS to the DLPFC rather than vertex increased degree of subjective response by about a third of a rating point on average. Further, subjects did not differ in their expectancy that they would respond in the two conditions, so the rTMS had an effect on hypnotic experience above and beyond expectancies. A further study conceptually replicated the effect, but this time using alcohol. The dorsolateral prefrontal cortex is disrupted by alcohol and surprisingly previous research has not investigated the effect of getting drunk on hypnotisability. Rebecca Semmens-Wheeler, Dora Duka, and I recently explored the effect of alcohol on hypnotic response. Thirty-two mediums were assigned to either an alcohol or placebo alcohol condition; those in the alcohol condition drunk the equivalent of roughly five glasses of wine over a 30 minute period. Both groups were then tested on nine suggestions and various frontal tasks. Alcohol indeed disrupted frontal function. Crucially, alcohol increased subjective response by one scale unit compared to placebo, on the same scale as used in the

TMS study. While the prediction of cold control that disruption of the DLPFC would enhance hypnotic response was confirmed in both experiments, both TMS stimulation and alcohol would have affected a large area of prefrontal cortex subserving numerous functions, not just metacognition. Thus the results are also consistent with other theories, such as that of Woody and Sadler (2008) who postulate hypnosis is a state of diminished frontal function. However, the situation is not one of stalemate. Cold control in principle specifies which areas are the important areas for future work, as technology allows more specific areas of the cortex to be targeted.

E. Hypnotic versus non-hypnotic abilities

According to cold control theory, a person has no first order abilities in responding to a hypnotic suggestion that they did not have already. The difference is only that performing the action hypnotically makes it feel like it is happening by itself. That is, the only difference between responding hypnotically and non-hypnotically is a metacognitive one in the sense of forming higher order thoughts about first order states. This is a controversial claim. For example, Hilgard (1977) and others have claimed that there is a hypnotic mechanism of pain reduction not available non-hypnotically. On the other hand, those in the sociocognitive tradition (e.g. Spanos, 1986) claim people can reduce pain equivalently by hypnotic suggestion as by the use of cognitive strategies: Both techniques essentially involve eliminating “catastrophising” cognitions (i.e. thoughts that one is being badly harmed), generating positive thoughts, reinterpreting sensations, and controlling attention. Cold control aligns itself with the sociocognitive tradition in this respect. The difference between cognitive behavioural and hypnotic methods is only that in the former the person is aware of actively engaging in strategies while in the latter the pain seems to go away by itself. According to

Spanos, the problem with studies that have found a difference between hypnotic and non-hypnotic suggestions is that when subjects are aware that a hypnotic condition will be compared to a non-hypnotic one, they like to please the experimenter by "holding back" in the non-hypnotic condition in order that they can perform better in the hypnotic condition. Further, studies comparing hypnotic and non-hypnotic conditions have to control expectancy, as different expectancies could produce different degrees of placebo pain relief (cf Kirsch et al 1995). Studies directly comparing hypnotic with cognitive behavioural treatments for experimental pain often have not found differences between these conditions (Milling et al 2002) even when the authors argue for hypnotic techniques involving a different mechanism (e.g. Miller & Bowers 1986, 1992). On the other hand, Derbyshire et al (2009), for example, found the same suggestion given with an induction rather than without produced slightly greater degrees of pain relief as revealed in subjective ratings and in the "pain matrix" (the brain areas involved in pain as revealed in fMRI) - but here hold-back and expectation effects seem likely. So no conclusive answer can be given about whether hypnotic pain relief is more effective than non-hypnotic pain relief. But if there is a difference, it is small. Further, there is less awareness of using cognitive strategies in hypnotic rather non-hypnotic pain relief (Hargadonet al 1995; Miller & Bowers 1986), just as a metacognitive account predicts.

Pain relief might be regarded as a sort of negative hallucination; it is at least the removal of a perception one would otherwise have. Hallucinations generally might strike the reader as a case where people do something hypnotically they could not do otherwise: Hypnotically people can take themselves as perceiving something they would not perceive otherwise. For example, Kosslyn et al (2000) argued that people could "see" colours with hypnotic hallucination that they could not see with imagination. Kosslyn et al asked highly hypnotisable subjects to either see a colour pattern in colour, or to see a grey-scale pattern in colour. PET scanning indicated that the left and right fusiform areas were active in highs

either seeing genuine colour or hallucinating colour, but not when veridically seeing grey-scale. When asked to imagine the same colour changes, activation changes were not detected in the left fusiform. In interpreting the latter result, however, one should bear in mind Kosslyn et al's concern that the subjects did not "drift into hypnosis" and hallucinate in the imagination condition. The wording in the imagination condition was chosen to "lead the subjects to attend to the visible stimulus and alter it rather than to substitute a complete hallucination". That is, the demand characteristics entailed forming a less convincing image in the imagination rather than the hallucinate condition. It is thus not surprising that this was reflected in less relevant activity in the fusiform area for the imagination condition than the hallucination condition. Both hold-back and expectation effects are likely to operate. Cold control theory predicts that people will be able to intentionally produce the same vivid experience in imagination as when hallucinating, and to produce the same fusiform activities, with a hypnotic induction being irrelevant. The prediction about fusiform activities has not yet been tested. But the capacity for subjective experience of seeing colour has been. Kirsch et al (2009) gave subjects exactly the same suggestion with or without induction and subjects rated how much colour they saw on a 0-100% scale. Subjects could drain or add substantial amounts of colour when given a suggestion, and there was no evidence that hypnotic induction made a difference. Further, without induction, subjects did not rate themselves as hypnotised, so a 'drifting into hypnosis' hypothesis was ruled out. Recall similar results were obtained for the suggestion that words become meaningless: the effect of the suggestion was just as strong whether or not a hypnotic induction was given (Raz et al 2006).

We have not quite yet established what we need for these hallucination cases to show that people have the same abilities when responding hypnotically as non-hypnotically. One issue is whether hypnosis involves a special state that can be induced; the other is whether a person responds hypnotically. A person can respond to a suggestion, e.g. creating the feeling

of a magnetic force pulling their hands together, or even hallucinating an object change colour, without any special state having been induced (e.g. Braffman & Kirsch 1999). In this sense, hypnosis is a way of doing, not a way of being. Thus, showing that a hypnotic induction is not needed for subjects to experience hallucinations does not yet show that a person can do non-hypnotically whatever they can do hypnotically (cf Kirsch et al 2011). So the question is, does responding hypnotically - responding successfully to suggestions for altered perceptions and volition – consist in performing a (bodily or mental) action (no better or worse than one could do normally) (simply) while believing one is not intending it? Responses to cognitive suggestions involve performing mental rather than bodily actions (cf Proust 2012). What is the mental action involved in hallucinating colour? According to cold control it is imagining the colour. Following Frith (1992), if one imagined the colour but was unaware one intended to so imagine, the resulting visual representations are not taken to be self-generated, so therefore they are generated by the world: The subject experiences seeing. The prediction of cold control is that imagination will be just as vivid as hallucination – it is just the former will be taken to be internally generated while the latter appears external. Indeed, hypnotic hallucinations can be flimsy and transparent (McConkey et al 1991), though a detailed comparison with non-hypnotic imagination is still required (with hold-back and expectation controlled). More problematic is the Raz example, whereby subjects seem able to inhibit the reading of words under suggestion, even though they are not especially good at inhibiting words with no suggestion, under normal Stroop conditions (as discussed above). How can cold control explain this fact? It may be that there is a strategy that subjects could implement voluntarily to overcome Stroop: The suggestion implicitly provides it, but subjects do not realise they can use it quite generally (cf Sheehan et al 1988). Ben Parris, Lynne Somerville and I have just started testing subjects by first giving subjects the experience of the suggestion that they cannot read the word, then telling them that they can

use this strategy voluntarily at any time in order to overcome Stroop. We are taking ratings of volition, depth of hypnosis, and alterations in perception to determine if highs in no special state can voluntarily reduce the Stroop effect by intentional use of imagination, experienced as imagination. Cold control theory predicts that they can. But if people need to change their experience of specifically *perception* in order to overcome the Stroop effect, then the metacognitive account of hypnosis fails, at least for hallucinations.

F. Keeping it real

Hypnosis provides an interesting test case for pursuing the distinction Proust (2012) makes between metacognition involved in bodily versus mental actions. For example, bodily actions involve relatively known mechanisms of efferent copy and feedback signals in ways that contribute to the experience of volition. Monitoring one's actions is widely distributed amongst species, while monitoring cognition is restricted to a few. Thus, action and cognition monitoring may not share mechanisms at a detailed level. Yet Proust argues that mental actions are at a functional level equivalent; one can intend certain epistemic outcomes, and get feelings (e.g. of knowing) providing feedback on whether the outcome is being successfully approached. It is just such an analysis that cold control requires to be a general theory of hypnosis. If intending to act behaviourally is qualitatively different from intending to act mentally, there is challenge to cold control theory in uniting them in a single account of behavioural and cognitive suggestions. Metzinger (2009) similarly also distinguishes different types of agency - attentional, cognitive and bodily. Indeed, hypnotic suggestions are often broadly divided by hypnosis researchers into motor (e.g. the suggestion that an arm will rise) and cognitive (e.g. hallucinations, delusions, amnesia). Negative hallucinations likely involve altering attention (e.g. away from painful stimuli). Is there a single mechanism

at a broad enough level of description to unite the different actions and agencies, as Proust suggests? Motor suggestions are on average easier than cognitive ones, with 90% of people able to pass one or other motor suggestion without being able to pass a cognitive one. So the divide is real at one level. On the one hand, the rTMS study reported above involved changes to both motor and cognitive suggestions. On the other hand, whether cold control can explain the sense of 'reality' of hallucinations and the conviction of delusions remains a possible weak point in the theory, with the theory fracturing precisely down the groove between different meta-entities that Proust and Metzinger identify. In the Kirsch et al (2009) study subjects were asked to "make the display coloured" or to "drain the colour": Responding to the suggestion involved intentionally doing something where the intention could be conscious. Further, in Derbyshire et al (2009) subjects rated more control over pain when given a suggestion after a hypnotic induction rather than without. So can hallucination really be based on being unaware of intentions? As Proust discusses, a mental action is an action because it partakes in a chain of mental events with a specified epistemic goal. The epistemic goal could be to have a certain perception. This can be achieved by a number of actions only some of which are intended but without awareness of so doing. For example, in the Derbyshire et al study, subjects imagined turning a dial in order to change the level of pain; conscious intentional control was exerted in changing the imagery of the dial – the link from the dial to pain relief need not occur by strategy of which the subject is conscious of intending. Thus, a subject may experience themselves as intentionally changing perception, even while cold control remains the mechanism by which imagination becomes mistaken as perception. The detailed phenomenology required by cold control will be interesting to test in future studies. Further, future research should investigate the non-conceptual underpinnings of the ascriptive metacognitive changes cold control postulates.

Proust's (2012) analysis of mental and bodily acts being functionally equivalent at a broad enough level of description also facilitates another metacognitive theory of hypnosis, different from cold control: The discrepancy-attribution theory of Barnier and Mitchell (see Barnier et al 2008). On this view, a hypnotic response involves evaluating the effort produced in a mental or bodily act – if the mental act is surprisingly easy, an explanation is sought in terms of an external cause, leading to attributions of involuntariness (in the case of motor suggestions) or perception (in the case of hallucinations). See Barnier et al (2008) for a comparison of the two theories.

The link between intention and hallucination used in cold control was first postulated by Frith (1992) and Bentall (1990) in order to explain schizophrenia (though later dropped by Frith). Yet in some ways schizophrenia and hypnotic response are opposites. In schizophrenia, hallucinations happen in ways detrimental to the person's overall goals. In hypnosis, response occurs to further the person's goals and hence is appropriate for the context. For example, a post-hypnotic suggestion to touch one's eyebrow when the word experiment is mentioned is not elicited in a different context from which it was given (Spanos et al 1987). Further, hypnosis appears to have no special compulsive power to make people perform anti-social acts against their principles (Coe et al 1973). Indeed, people with schizophrenia score below average on hypnotisability (see Pettinati 1982, for a critical review). That is, the relinquishment of metacognition in hypnosis is strategic and specific, unlike in schizophrenia.

Because cold control is used in the service of overall goals, it can be placed in an evolutionary context. Whatever selective forces resulted in people acquiring ascriptive metacognitive abilities (and they are surprisingly hard to specify: Rosenthal 2008), there may be a selective reason for people to strategically remain unaware of their intentions in certain contexts. Dienes and Perner (2007) argue that cold control has shown itself in every continent through all known history - in the form of spirit possession. Not only is spirit

possession widespread it comes with certain advantages when it is genuinely contextually appropriate and involves genuine self deception (i.e. when it involves cold control).

In sum, I argue hypnosis is quintessentially an alteration in metacognition, and both hypnosis and metacognition researchers would benefit from working together to understand its nature.

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