Chapter 16

Executive control without conscious awareness: the cold control theory of hypnosis

Zoltán Dienes and Josef Perner

16.1 Introduction

Control and awareness seem intimately related (e.g. Norman and Shallice 1986; Jacoby 1991). Of course, some forms of control occur quite unconsciously (plausibly, for example, the detailed configuring of motor movements; Milner and Goodale 1995). However, there are some forms of control, such as planning or overcoming strong response tendencies (the 'executive tasks' of Norman and Shallice) that are so commonly associated with conscious awareness that it would seem bizarre if they occurred without it. In fact, unconscious executive control is not possible in the theories of Norman and Shallice and Jacoby. In this chapter, we argue for the theoretical possibility of unconscious executive control, based on the higher order thought (HOT) theory of Rosenthal (1986, 2002, 2005), and then argue that hypnosis provides an example of executive control without conscious awareness (cf. Hilgard 1977; Spanos 1986; Oakley 1999).

A fundamental explanatory problem in hypnosis is how activities that are normally performed voluntarily out of the hypnotic setting can be performed with the experience of involuntariness after hypnotic suggestion (see Lynn and Rhue 1991; Fromm and Nash, 1992 for reviews). Of course, hypnotic phenomena present the researcher with many interesting problems to be explored, but a central if not defining issue is the experience of involuntariness, singled out as the 'classical suggestion effect' by Weizenhoffer (1974). It is this experience of involuntariness under hypnotic suggestion which makes the experience of carrying out otherwise mundane actions, such as slowly raising one's arm, holding one's arm out straight and rigidly, acting like a child, and so on, hypnotic rather than mundane. Other counterintuitive hypnotic phenomena, such as alterations in perception (positive and negative hallucinations), may also be examples of this process of creating the experience of involuntariness (cf. Bentall 1990; Frith 1992). Hypnotic behaviour involves planning, and yet can be performed without conscious awareness of the contents of the plans, and without conscious awareness of intentions to perform the behaviours (Hilgard 1977; Sheehan and McConkey 1982; Spanos 1986; Oakley 1999).

In this chapter, we first review different types of control, and then we consider the distinction between control and awareness of control in the light of Rosenthal's (2002)

HOT theory. The framework we develop provides a number of ways of accounting for hypnotic phenomena, in particular the experience of involuntariness.

16.2 Two types of control

Hilgard (1977) suggested a model of cognitive control in which action schemata (which he called cognitive control structures) compete amongst themselves such that the strongest at any given moment comes to control behaviour. An executive ego can override the strongest so that some other control structure actually controls behaviour. Hilgard presented this model as part of his neo-dissociation theory of hypnosis. Later, Norman and Shallice (1986) provided a very similar and influential theory of cognitive control, motivated independently and without reference to hypnosis. They suggested that action schemata compete to control behaviour. The schema with the most activation is the one that wins. The level of activation of a schema is determined by the match of the schema's trigger conditions with the conditions that actually obtain, and by the lateral excitation and inhibition between schemata (mutually incompatible schemata inhibit each other; cooperating schemata excite each other). This process by which a schema comes to be sufficiently active that it is the one that controls behaviour is called contention scheduling. In addition, there is a supervisory attentional system (SAS) that can send additional excitation or inhibition to a chosen schema, biasing its chances of winning. The SAS is attention demanding and is involved in conscious control, according to Norman and Shallice. The SAS achieves its function by forming intentions: a particular type of imperative representation with the function of bringing about its content.

Norman and Shallice (1986) suggested particular executive function tasks that the SAS was needed for, for example learning new actions or overcoming a strong pre-existing response. If contention scheduling were just left to itself, we would be entirely creatures of habit. If we always drive a certain route from home to work, that route is likely to be taken every time if contention scheduling were the only control process at work. However, sometimes we can decide to do something new; for example, to make a detour at the traffic lights by turning left rather than right in order to buy milk at the supermarket. This new action requires the SAS. Typically the new action would only be accomplished if we were consciously aware of wanting to do it at the appropriate juncture. Hence, Norman and Shallice regarded the SAS as being intimately related to conscious awareness of what one is doing. Jack and Shallice (2001) indicated that they regarded that relationship, between intentional action (SAS) and conscious awareness, as a contingent one that has to be demonstrated (unlike Jacoby 1991, who takes intentional control to be constitutive of conscious awareness). We will argue that the contingent relationship can systematically break down.

16.3 Conscious awareness

We now explore the relationship between control and conscious awareness by use of Rosenthal's (1986, 2002) HOT theory. Rosenthal provided an account of when a mental state is conscious, e.g. when is seeing a case of conscious seeing and when is it unconscious?

Blindsight patients can indicate highly accurately whether an object is moving up or down, even while they claim to have no visual experience whatsoever (Weiskrantz 1986, 1997). Their accurate responses indicate they do see that, for example, an object is moving up. However, their verbal reports indicate that they do not consciously see that an object is moving up. The data indicate that we need a distinction between seeing and consciously seeing, or more generally between being simply *conscious* or *aware of something* and being *consciously aware of something* (Carruthers 2000).

A mental state (e.g. of seeing) makes us conscious of some state of affairs, in the minimal sense of 'conscious of' that applies to the seeing that occurs in a blindsight patient's blind field. What the blindsight patient fails to have is awareness of being in the mental state of seeing that state of affairs. Indeed, Rosenthal argues that a mental state, like seeing, is a conscious mental state only when we are conscious of being in that mental state. Consistently, it sounds bizarre to say the blindsight patients could consciously see but were not conscious of seeing. When we are conscious of seeing, we consciously see.

In Rosenthal's account, we are conscious of mental states by having thoughts about those states. A thought about being in a mental state is a second-order thought (SOT), because it is a mental state about a mental state. For example, the first-order state could be seeing that 'the object in front of me is black'. By virtue of this first-order state, we are conscious of the object in front of me being black. By virtue of the SOT that 'I see that the object in front of me is black', we are conscious of the first-order state of seeing. The seeing is then a conscious mental state, we consciously see that the object in front is black. In summary, according to HOT theory, a mental state is a conscious mental state when the person has a HOT to the effect that they are in that mental state (for elaboration, see Rosenthal 2002; for review, criticism and discussion of higher order theories of consciousness, see chapters in Gennaro 2004).

A SOT (e.g. 'I see that the cat is black') constitutes awareness of the first-order thought ('the cat is black') resulting in the first-order thought being a conscious thought. The SOT itself is not a conscious thought until one becomes conscious of it—by a third-order thought (TOT; 'I am aware that I am seeing that the cat is black'). It is by virtue of the TOY that one is consciously aware or introspectively aware that it is *me* who is *seeing*. TOTs rather than SOTs constitute introspection because being consciously aware of the world is not introspection; introspection is being consciously aware of one's mental states.

We will make use of the distinction between SOTs and TOTs later when discussing hypnosis. Consider the intention to 'lift the left arm!' This is not a conscious intention unless there is the SOT that 'I am intending to lift my left arm'. Due to this SOT, one is conscious of the intention, but not consciously aware of having the intention. To be consciously aware (or introspectively aware) of intending, there needs to be a TOT that 'I am aware that I am intending to lift my left arm'.

HOT theory in principle allows intentions (including those used in executive control) without HOTs of intending. The theory allows unconscious intentions; thus, on the theory, unconscious intentions should sometimes happen. This prediction is counterintuitive and directly contradicts the theories of Norman and Shallice (1986) and Jacoby (1991).

If executive functioning were always performed consciously, HOT theory would prima facie be in trouble. By the same token, the counterintuitive finding of unconscious performance of executive tasks would corroborate HOT theory. We call executive control without a HOT (without conscious intentions) 'cold control'.

The every day use of the term 'intention' does not clearly distinguish the first-order imperative representation that controls the action schema ('Do A!', 'If C do A!') from the HOTs about that representation (e.g. 'I am intending to do A', 'I am intending to do A if C'). For clarity, we use the term 'intending' (or 'intention') to refer to the first-order imperative representation (just as 'seeing' refers to the first-order visual representation and not to the HOT that one is seeing). Thus, intending is genuinely causal. The SOT about intending has the function of tracking this causal process. The SOT, as a representation, can misrepresent, and hence occasionally gets things wrong (cf. Wegner, 2002)[1], and this allows an explanation of hypnotic phenomena: the cold control theory of hypnosis, or executive control without accurate HOTs.

16.4 Cold control: executive control without a HOT

16.4.1 The theory

The cold control theory of hypnosis states that a successful response to hypnotic suggestions can be achieved by forming an intention (imperative representation in the SAS) to perform the action or cognitive activity required, without forming the HOTs about intending that action that would normally accompany the reflective performance of the action. The first part of the theory claims that hypnosis typically involves the SAS (i.e. executive control). We first consider the evidence for this, and then consider the consequence of not forming suitable HOTs about intending. Claims amounting to cold control theory have been made before (e.g. Spanos, 1986; Kihlstrom, 1992). In this sense, cold control theory is not novel; however, we pursue the claim in a single-minded way (Spanos and Kihlstrom also made other claims we do not make) and drawing on HOT theory (Rosenthal 2002) to look at data in a new way (making claims that Spanos and Kihlstrom did not make). The relationship of cold control theory to previous theories is considered below.

Hypnotic suggestions can involve the subject engaging in executive function tasks. For example, a standard suggestion used in stage hypnosis, and that can be reproduced in the laboratory (Evans 1980), is the suggestion to forget, for example, the number '4'. The subject will count, e.g. '1, 2, 3, 5, 6' fingers on a hand. This must involve executive control (overcoming a strong pre-existing habit), but the person denies awareness of why they count unusual numbers of fingers on their hands. [According to the logic of Jacoby (1991), the ability of the subject to exclude '4' from its habitual production implies conscious awareness of 4; this is just what the subjects themselves deny having.]

[1] However, that does not mean that conscious will is an illusion (contrast Wegner, 2002). Most of the time the HOTs accurately track and make us aware of the underlying causal intentions (executive control) and/or the consistency of actions made by contention scheduling (interacting with the environment) with executive control (compare Wegner and Wheatley, 1999).

Sackheim *et al.* (1979) found that with strong motivation instructions for blindness, a highly hypnotizable subject performed significantly *below* chance in reporting the emotion shown in photographed faces. Bertrand and Spanos (1985) gave subjects a list of three words in three different categories, and highly hypnotizable subjects ('highs'), when suggested, could selectively forget one word from each category. Subjects recalled on a category-by-category basis, and must have inhibited the to-be-forgotten word when recalling each category. Spanos *et al.* (1982) found that under suggestion to forget certain words in any type of task given to them, 'highs' produced those words at a *below* baseline level in a word association test. This requires executive control, because the existing associations that would be produced by contention scheduling must be suppressed. Strikingly, Raz *et al.* (2002) found that 'highs' could eliminate or dramatically reduce the Stroop effect when given the suggestion that they could not read the words. Remarkably, the habit of reading was apparently suppressed. Challenge suggestions also require executive control. In a challenge suggestion, the subject is asked to try to perform some action, such as bending the arm, while being told the arm is rigid and unbendable. People often respond to this suggestion by trying to contract both triceps and biceps simultaneously (Comey and Kirsch 1999). However, contention scheduling ensures the smooth performance of actions by inhibiting contradictory actions, and so does not lead to a muscular stalemate.

In general, virtually any arbitrary behaviour can be hypnotically suggested despite the fact that such behaviour might be novel to the person, at least novel in context, and many hypnotic suggestions require the person to ignore some salient aspect of the situation (e.g. analgesia or amnesia suggestions). At least many hypnotic responses are under executive control.

A curious relationship between HOTs of intending and task performance in some situations may be illustrated by Wegner's (1994) task of asking people to not think of white bears for a specified time. People find this extraordinarily difficult. In this task, an intention is formed by the SAS 'Do not produce representations of white bears'[2]. This representation can be used to guide the lower system, and also monitor its success. However, if a SOT is automatically formed 'I am intending not to produce representations of white bears', the HOT about intending makes the content of the intention, which includes the concept white bear, the content of a conscious mental state. That is, if engaging in the task to not think of white bears itself leads to a HOT of intending, that makes one consciously think of the concept of white bears[3].

[2] Alternatively, the intention could be phrased: 'do not think of white bears!' Although this intention is a mental state about a mental state (an intention about thinking), it is not the right sort of HOT to produce awareness of being in a mental state (it does not assert that one is in a certain mental state). Thus, in the following, we will still refer to this intention as a first-order state.

[3] Wegner (1994) postulates a monitoring process that constantly looks for mental contents indicative of failure of control, and it is the action of the monitor that leads to the dramatic failures of thought suppression. We are not arguing against this account, just pointing out that successfully not consciously thinking of the concept of white bears entails not having any HOTs about the intention to not think of white bears.

Highly hypnotizable subjects may be especially good at avoiding accurate HOTs about intending. Bowers and Woody (1996; also King and Council 1998) found that after hypnosis, 'highs' could *not* think of their favourite car for 2 min more effectively than 'lows'[4]. Prima facie, the 'highs' could engage in executive control without corresponding HOTs. Consistently, the fact that 'highs' can pass the forget-4 task implies that 'highs' need not become consciously aware of the labels for concepts that figure in their intentions, i.e. their intentions can indeed remain unconscious.

It can be difficult to dissociate HOTs from certain first-order states. Consider HOTs of perception. It is very difficult now to form the HOT that 'I am seeing a pink elephant' when in fact you are not (not to be confused with forming the HOT that 'I am imagining seeing a pink elephant'). Conversely, try performing the 'I am not seeing a white bear' task while looking at a white bear for 2 min. The link between intention and HOTs about intending may be weaker than the link between perception and HOTs about perceiving, allowing HOTs of intending to be more loosely triggered by relevant actions (Wegner and Wheatley 1999; Wegner 2002). The SAS can delegate control to contention scheduling, so it is not always easy to check whether an action was intentional by checking the SAS's description of the act. The specific action selected by contention scheduling will be but one way of implementing the SAS's more general intention in relation to the environmental flux of stimulation, e.g. switching gears in traffic. In any case, for simplicity we will presume that all that is required in hypnotic response is dissociating HOTs about intending from actual intentions.

16.4.2 How can HOTs about intending be prevented?

According to HOT theory, HOTs are just thoughts and so their occurrence will be sensitive to the same influences as other thoughts, i.e. consistent with socio-cognitive approaches to hypnosis (e.g. Spanos 1986, 1991), formation of a HOT about intentions might be prevented by activation of beliefs and expectations inconsistent with it.

Kirsch and Lynn (1999) have especially emphasized the importance of expectation in hypnotic responding. However, there is a powerful argument against hypnotic responsiveness being directly caused by expectations. Kallio and Revonsuo (2003) point out that in everyday life we can fully expect to, for example, see our keys where we left them on the table, but in clear viewing conditions this does not cause us to see our keys on the table if they are not there. Alternatively, consider expecting not to see something. With hypnotic suggestion, 'highs' can fail to see, for example, words (e.g. Bryant and McConkey 1989). Wagstaff *et al.* (2002) found that when non-hypnotized subjects were 100% confident they would not see something on a sheet of paper (all the previous pieces of paper had been blank), they all did still see the '8' that was on it. Surely evolution has led us to see or not see what the data rather than our expectations indicate, when the data are

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4 The difference between 'highs' and 'lows' occurred only after hypnotic induction. However, Woody *et al.* (1992) point out that in general 'highs} can respond in the same way with or without hypnotic induction so long as they notice the contextual appropriateness to do so.

clear. In everyday life, expecting to see our keys does not in itself make us see them when they are not there.

Cold control theory offers a solution to the problem of why we can have illusions in a hypnotic context but not normally in non-hypnotic contexts, with good viewing conditions. Expectations need only affect the formation or otherwise of HOTs of intending. In order to hallucinate keys, we would need to intend to imagine keys being there. Expectation can lead us to not have HOTs about intending the imagery but, in order to hallucinate hypnotically, the intention to imagine has to be there for some reason, i.e. that it fits in with other intentions, plans and strategies. Cold control theory does not need to postulate that expectations affect first-order perceptual or other first-order states in clear viewing conditions; expectations need only affect HOTs about intending. Thus, hallucinations and the other phenomena of hypnosis will only occur when they are strategically appropriate (White 1941; Barber 1969; Sarbin and Coe 1972; Spanos 1986), because relevant intentions will only be formed when strategically and contextually appropriate. In the absence of intentions to visualize, seeing can be strongly guided by the actual state of affairs in clear viewing conditions.

While expectations seem the most natural candidate for preventing the formation of HOTs about intending, they may not be the only effective means for preventing formation of HOTs about intending. Cold control theory would allow for any other mechanism by which HOTs are avoided, or even a special state in which HOTs can be readily avoided [we are not personally partial to a state explanation of hypnosis; see Kirsch and Lynn (1995) for the arguments against state theory; Kallio and Revonsuo (2003) for arguments sympathetic with state theory].

We will now consider whether cold control theory sheds any light on differences in difficulty in different hypnotic suggestions and also any light on individual differences in hypnotizability.

16.4.3 Why are some hypnotic suggestions easier than others?

Hypnotic suggestions can be roughly divided into simple motor suggestions ('Your arm is becoming so heavy it is falling'), challenge suggestions ('Try to bend your arm' in a rigid arm suggestion) and cognitive suggestions (amnesia, hallucination, the 'forget 4' suggestion, etc.). In general, more people can reliably pass motor suggestions (about 80 per cent of people for, for example, hand lowering and hands moving apart) than challenge suggestions, and more people pass challenge suggestions than cognitive suggestions (from 50 to 10 per cent of people, depending on the suggestion) (e.g. Hilgard, 1965; Perry *et al.* 1992; Kallio and Ihamuotila 1999). Cold control theory provides two ways of accounting for different degrees of item difficulty: first, different orders of HOTs to be avoided; and secondly, different degrees of effort involved in implementing first-order intentions. We consider each in turn.

16.4.3.1 The order of the thought: SOTs versus TOTs

Rosenthal (2005) suggested that most of the time when we have HOTs we simply have SOTS. Only occasionally, when we introspect, do we have TOTs. Given that TOTs are less

automatically created than SOTs, it is plausible to assume that accurate TOTS (that: 'I am aware I am intending to do X') would be easier to prevent than SOTs (that: 'I am intending to do X'). Given this plausible assumption, the individuals most skilled at preventing accurate HOTs, i.e. highly hypnotizable subjects, would be able to avoid both accurate TOTs and SOTs about intending. Less skilled individuals ('mediums' and 'lows') may only be able to avoid accurate TOTs about intending (and only form inaccurate TOTs but not inaccurate SOTs).

Assume that 'lows' can only prevent accurate TOTs of intending but not SOTs. For instance, the SOT that 'I am intending to not say four' is still there, making them consciously think of the content of the relevant intention ('do not say four'), hence making them have a conscious thought about 'four'. Even if they then had an inaccurate TOT ('I think I am not intending to not say four'), they may not be introspectively aware of intending to not say four, but they would still be thinking of four in a conscious mental state. So they could not do the 'forget 4' task. However, 'lows' could do other tasks such as arm heaviness. They would have an unavoidable SOT (with the content 'I am intending to lower my arm'), making them consciously think of lowering their arms, but, by virtue of preventing accurate TOTs ('I am aware I am intending to lower my arm'), they would not be introspectively aware of *intending* the arm to fall, so the action would appear involuntary.

If highly hypnotizable subjects can even avoid accurate SOTs of intending, then they can do the 'forget 4' task, because the SOT about intention can be avoided. Further, when performing motor suggestions, they can avoid SOTs about the motor suggestion and not be consciously thinking about the action in any way. Zamansky and Clark (1986) asked subjects with high and low hypnotizability to engage in imagery inconsistent with the hypnotic suggestions given (e.g. for a rigid arm suggestion, to imagine bending the arm). '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. In contrast, the performance of 'lows' was severely degraded by contradictory imagery, strongly supporting the notion that 'highs' but not 'lows' can avoid SOTs of intention. In order to implement the required executive control, 'lows' need to be consciously thinking about the action to be performed. 'Highs' do not need to be consciously thinking of the action to be performed. Similarly, Hargadon *et al.* (1995) found that 'highs' were just as responsive to an analgesia suggestion when involved in counter-pain imagery as in an image-less condition where imagery and even suggestion-related thoughts were proscribed. 'Highs' do not need accurate SOTs to respond effectively to suggestions. These results directly falsify theories of hypnosis that postulate that hypnotic response is based simply on absorption in response-consistent thoughts and imagery (Arnold 1946; Barber *et al.* 1974; Baars 1988, 1997), but corroborate cold control theory. Cold control theory also predicts that 'highs' should be able to produce analgesia just as effectively in or out of the hypnotic context (in both contexts, the same pain control strategies can be used, the only difference being that in the hypnotic context the pain reduction would feel more like a 'happening' than a 'doing'); this prediction is indeed supported (see Milling *et al.* 2002, 2005 for recent data and review).

The ability to avoid accurate SOTs would facilitate the performance of any hypnotic task that needs to be performed with intentions whose contents remain unconscious. Consider, for example, the task used by Spanos *et al.* (1982) in which subjects were to forget the use of a specific set of words in any context. One way to perform this task is to form an intention, the content of which involves reference to the specific words that are to be forgotten. However, the content would have to remain unconscious or else the words would be part of a conscious mental state and hence not forgotten. It is not obvious how else the task could be performed. It is an executive task so an intention must be formed; yet the intention should remain unconscious. Thus, similar cognitive tasks that involve not being consciously aware of some specific stimulus should be especially difficult, and more difficult than, for example, motor tasks where there is not a problem in being consciously aware of any concepts or stimuli in order to respond successfully.

16.4.3.2 First-order effort

The second way cold control theory can account for different degrees of difficulty for following hypnotic suggestions consists of the amount of effort required to implement first-order intentions.

Positive hallucination can be one of the more difficult hypnotic suggestions, depending on what needs to be hallucinated. According to Hilgard (1965), about 50 per cent of people pass the taste hallucination (experiencing a sweet or sour taste in the mouth) and about 50 per cent pass the mosquito hallucination (hearing or feeling a mosquito), but only about 10 per cent of people hallucinate a voice. How can cold control theory account for hallucinations and their degrees of difficulty? Positive hallucinations could be produced by the executive-controlled production of relevant imagery; the lack of accurate HOTs about intending the imagery might lead the person to experience the image as a perception because the image is not experienced as intended (cf. Bentall 1990; Frith 1992). However, why is this difficult?

First, to experience the image as a perception requires not only the avoidance of a TOT about intending but also the creation of an inaccurate HOT representing oneself as *perceiving* (rather than imagining) the target of the image (it is the triggering of this HOT that corresponds to experiencing the hallucination as 'real'). Such a HOT of perception may be facilitated by preventing any HOTs of imagining from occurring. Thus, hallucinations may involve preventing accurate SOTs and not just TOTs of intending.

A second (compatible) explanation is that there exist individual differences in ability to prevent accurate HOTs of intention depending on the amount of cognitive effort required in executing the first-order intention. Performing a simple motor action may be less cognitively demanding than forming an image. Thus, it may be more difficult to suppress HOTs about forming images than performing motor actions. Images of tastes and simple noises (such as the sound of a mosquito) might be easier to form than images of voices. Similarly, ignoring intensely painful stimuli, or not perceiving a stimulus that has been primed by instructions (as in a negative hallucination), may be especially demanding. These are all proposals that are open to be being tested. Lifting an arm is harder than letting it drop; consistently, arm lowering is more easily experienced as involuntary than

arm raising (Kirsch and Lynn 1995, in their sample found a response rate of 51 per cent for hand lowering compared with 23 per cent for hand raising).

The greater skills of 'highs' in avoiding accurate HOTs may allow them to avoid HOTs even when large amounts of cognitive effort are required in implementing the first-order intention. This could be tested by acquiring effort ratings, or measuring interference of each task with, say, random number generation, for different types of tasks outside of the hypnotic setting and determining the correlation with assessed effort and difficulty of the corresponding hypnotic suggestion.

The idea that more difficult tasks make it harder to suppress HOTs of intention can also explain why challenge suggestions are more difficult than simple motor suggestions. A simple motor suggestion that one's arm is so light it is rising requires the effort needed to lift one's arm. However, the challenge to lift one's arm—while being told the arm is so heavy that it cannot be lifted—in principle involves both an attempt to lift the arm and an attempt to stop the lifting from happening. For some people, this will involve some considerable muscular effort using antagonistic muscles to prevent the lift (Comey and Kirsch 1999) and cognitive effort in intending to try to lift the arm while remembering to make it heavy. The greater effort involved in successful responding to the challenge suggestion rather than the simple motor suggestion may be one reason why it is harder to suppress HOTs of intending with challenge rather than simple motor suggestions. We will consider another way of successfully responding to challenge suggestions later, one that involves no muscular effort at all.

In summary, cold control theory enables us to get a handle on the order of difficulty of different hypnotic suggestions in a principled way. Suggestions that require avoiding accurate SOTs of intending will be more difficult than suggestions that require only the avoidance of accurate TOTs of intending; and the more effort involved in performing the task, the harder it may be to avoid accurate HOTs, so the more difficult the task will be as a hypnotic suggestion.

We cannot claim to have explained the rank order of difficulty of all hypnotic responses (e.g. why do only about a fifth of people pass post-hypnotic suggestion compared with a third of people passing amnesia suggestions?), but cold control theory does provide a means for thinking about why some suggestions are harder than others within the context of a single theory, a single mechanism for producing hypnotic responses.

16.4.4 Difference between subjects with high and low hypnotizability on non-hypnotic tasks

Cold control theory can generate predictions about how 'highs' and 'lows' may differ in various tasks outside the hypnotic context. The fundamental skill postulated by cold control theory is unlinking HOTs about intending from intentions. So the ability to produce actions in any context that feel like they happen by themselves should be the main correlate of susceptibility. Indeed, the best correlate of hypnotizability is suggestibility without a hypnotic induction; the correlation goes from about 0.65 (Hilgard and Tart 1966) to 0.85 (Barber and Glass 1962).

Hypnotizability should also correlate with other sorts of tasks. Being good at executive control is a likely correlate of hypnotizability, because if one is good at executive control

without HOTs, then plausibly (but not inevitably) one is simply good at executive control. Correlates for hypnotizability are notoriously difficult to find. Any non-hypnotic measures that do correlate with hypnotizability do so only moderately, if not sporadically. Nonetheless, despite the chequered pattern, findings can be usefully summarized in a broad-brush way in terms of executive function ability (Crawford *et al.* 1993). For example, maintaining attention is an example of an executive function task, because it involves successfully overcoming distraction. One of the most frequently replicated correlates of hypnotizability (with r ~0.30) is self-reported absorption in imaginative activities (e.g. Van Nuys 1973; Hilgard 1974; Tellegen and Atkinson 1974; Karlin 1979; Wilson and Barber 1981; Roche and McConkey 1990; Lyons and Crawford 1997; Barnier and McConkey 1999; contrast Jamieson and Sheehan 2002). Note that the relationship between executive control and hypnotizability is not strong (and is even less when context is controlled; Kirsch and Council 1992). Any theory that actually required 'highs' to be strong on executive control would have difficulty explaining the weak relationships found. 'Highs' are not 'highs' *because* they can, for example, concentrate well. Cold control theory does not need to make such assumptions: 'highs' are 'highs' because they can avoid HOTs of intending when actually intending, and this does not demand being especially good at executive control. Being good at executive control is just a likely correlate of hypnotizability, because one can allow oneself to prevent relevant HOTs if one is good at executive control without HOTs.

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16.4.5 Motivation for further research

Cold control theory opens new alleys to explore. For example, we have already noted the need to measure difficulty with independent ratings or secondary tasks when considering the order of difficulty of different hypnotic suggestions. Cold control theory predicts that if the performance of the executive system is compromised, hypnotic response is likely to be affected as well (see Kirsch *et al.* 1999). For example, repetitive transcranial magnetic stimulation (rTMS) applied to the frontal areas should lower hypnotic response particularly to suggestions demanding special executive control, such as selective amnesias. In contrast, the dissociated control theory of Woody and Bowers (1994) predicts an increase in hypnotizability with a disruption of frontal lobe activity. Similarly, cold control theory, unlike dissociated control theory, predicts that frontal lobe patients should have low hypnotizability scores. The commitment to HOTs also motivates research contrasting cold control with 'empty heat', which is discussed below.

16.4.6 Summary

Cold control theory postulates that hypnotic responding is based on executive control without HOTs about intending. It thus explains why many hypnotic responses can be executive tasks. It also gives us a handle on the order of difficulty of hypnotic suggestions (e.g. whether the suggestion requires SOT or just TOT avoidance), on individual differences in hypnotizability (e.g. the weak relationship between executive ability and hypnotizability), and on why expectations seem to have much larger effects in a hypnotic rather than a non-hypnotic context. It also allows subjects different routes to achieving a given hypnotic response.

16.5 Other accounts suggested by HOT theory

Cold control theory postulates that hypnotic experiences of lack of voluntariness arise due to the unusual separation of intendings from the usually accompanying HOTs about intendings. However, HOT theory itself can produce two other explanations of hypnosis. First, HOT theory proposes a distinction between HOTs and first-order states, and the converse of first-order states without HOTs (cold control theory) is HOTs without first-order states (*empty heat theory*). Secondly, in HOT theory, mental states seem to belong to a person because the HOT represents that person—the 'I'—as being in the state. However, if somehow there could be multiple selves, one of those 'I's may not be aware of the experiences of the other Is (Kihlstrom 1997): the *multiple-selves theory of hypnosis.*

16.5.1 Empty heat: HOTs without first-order states

According to Rosenthal (2000), one can have a SOT that one is in a certain first-order state, without actually being in that state. Mistaken HOTs could produce many of the experiences brought about by hypnotic suggestion, in particular hallucinations, by representing one as being in a state one is not actually in.

If hypnotic suggestions operate directly on HOTs, then hypnotic hallucinations would not involve actual first-order perceptual states. So hypnotic hallucinations would not, for example, facilitate implicit perceptual tasks, or involve the use of visual pathways in the brain, or at least they would involve only areas concerned with HOTs about perception.

On the other hand, if, as cold control theory postulates, hypnotic hallucinations operate via preventing HOTs about intentions to imagine, hypnotic hallucinations would activate brain pathways involved in perception to the extent that those pathways are used by the imagination. Kosslyn and Thompson (2003) provided a meta-analysis of positron emission tomography (PET), functional magnetic resonance imaging (fMRI) and single photon emission computed tomography (SPECT) studies of visual imagery, showing that imagery can activate early visual cortex, as early as V1 or V2. Conversely, Rees *et al.* (2002) argued that visual awareness depends on prefrontal and parietal cortex rather than just specifically visual cortical areas, and Rees (2001) also speculates that conscious awareness depends on dorsal frontoparietal cortex. If we accept both these claims, finding a context in which hypnotic hallucinations causes activity in primary visual cortex would support cold control theory but falsify empty heat theory in that context. This is the sort of logic we now pursue in one example.

Kosslyn *et al.* (2000) asked highly hypnotizable subjects either to 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. To be consistent with empty heat theory, the fusiform area would need to be responsible for the formation of HOTs of seeing. However, Dehaene *et al.* (2001) found that both conscious and unconscious (masked) words produced activity in the fusiform area, so activity in this area is not sufficient for HOTs of perception. Similarly, Driver *et al.* (2001) reported activation in the fusiform

area for extinguished (i.e. not consciously seen) visual stimuli, i.e. empty heat theory is falsified as an account of the colour hallucinations reported in Kosslyn *et al*.

On the other hand, for cold control theory to account for the results, imagination would need to be sufficient to induce activity in the fusiform areas. Indeed, when subjects were instructed without hypnosis to 'remember and visualize' the colour pattern, the same degree of activation of the right fusiform region was found as when subjects were hallucinating. However, the 'remember and visualize' instructions led to less activation in the left fusiform region than when hallucinating, challenging cold control theory. 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 'remember and visualize' condition. The wording was chosen to 'lead the subjects to attend to the visible stimulus and alter it rather than to substitute a complete hallucination', i.e. the demand characteristics entailed forming a less convincing image in the 'remember and visualize' condition rather than the hallucinate condition. It is thus not surprising that this was reflected in less relevant activity in the fusiform area for the 'remember and visualize' condition than the hallucination condition. Cold control theory predicts that if subjects capable of producing activation in the left fusiform gyrus when hypnotically hallucinating colour are tested out of hypnosis, activation will be produced in the left fusiform gyrus when subjects are asked intentionally to produce the same vivid experience as when hallucinating—but these results are not yet in.

Future research might identify separate populations of cold control and empty heat hallucinators. Brain imaging may find some people who reliably show no activation in V1–V5 while hallucinating and some people who reliably do. Cold control and empty heat would be then both supported as individual strategies in responding to hallucination suggestions.

Empty heat theory could in principle apply to challenge suggestions, such as being asked to try to bend one's arm, while being told one's arm is as rigid as an iron bar. In this case, to pass the suggestion, the subject must fail to move. On cold control theory, the subject might intend to 'go through the motions of trying to move but do not move', while being unaware of intending this. Empty heat theory offers an alternative strategy. The subject does not intend to move at all, but forms the 'empty' (with no actual first-order intention) SOT that 'I am intending to move' and/or the TOT that 'I am aware I am intending to move'. However, without the intention to move, the subject will not move (even while the subject believes that he or she is trying), so the suggestion is passed. With the cold control strategy, muscular effort is exerted in both trying to move and resisting that attempt. With the empty heat strategy, no muscular effort would be exerted at all. Comey and Kirsch (1999) found that about 70 per cent of people passing a challenge suggestion reported that they did try to respond to the challenge.

16.5.2 Multiple selves

Kihlstrom (1997) suggested that hypnotic subjects could create an additional 'hypnotic I' which is the cause of hypnotic responding. Because the hypnotic I's intentions (causes of hypnotic responding) are not linked to the normal I, the person does not experience

himself as intending to make the actions occur. This theory corresponds to Hilgard's (1977) neo-dissociation theory in that Hilgard postulated that in hypnosis the executive ego was split in two so that there are two conscious streams, one controlling the hypnotic responses and the other unaware of this control.

Rosenthal (2003) elaborates how apparently separate selves could arise in terms of HOT theory. We will not pursue the idea further, however, because this approach predicts a hidden observer, and the notion of a hidden observer has generated much controversy (see, for example, Kirsch and Lynn 1998, for an overview, and comments by Kihlstrom 1998, and Woody and Sadler 1998). For example, hidden observer responses can in principle arise by attending to the pain or away from the pain depending on the demands of the situation (Spanos 1986), and this is consistent with cold control theory. While it may be open how best to interpret the processes producing hidden observer responses, one fact about hidden observer responses is uncontroversial: people often pass all sorts of hypnotic suggestions without demonstrating a hidden observer on request. While the level of hidden observer responding can vary dramatically according to the overt demands for it and the type of suggestion (see Kirsch and Lynn 1998, for a review), in many studies about 50 per cent of 'highs' show hidden observer responding. That would be roughly 5 per cent of the population, whereas a majority of people are responsive to at least some hypnotic suggestions. Bowers (1992) and Kirsch and Lynn argue that one cannot use phenomena so rare as hypnotic amnesia or the hidden observer to support the notion of multiple selves (separated by amnesic barriers) as an explanation of hypnotic responding in general. We conclude that multiple selves is at least a rare route to hypnotic response compared with cold control.

16.6 Comparison with other theories

Cold control theory's emphasis on executive function brings it in line with the two most prominent theories of hypnosis in the 1970s and 1980s, namely Hilgard's neo-dissociation theory and the socio-cognitive approach, the latter argued for vigorously by Spanos, amongst others. The 1990s saw theories emerge in which hypnotic responding involved contention scheduling rather than executive control (e.g. Woody and Bowers 1996; Brown and Oakley 2004). We briefly compare cold control with these different theories.

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16.6.1 Dissociation theory

In Hilgard's neo-dissociation theory (1977, 1986, 1992), the 'executive ego' (SAS) was postulated as being the cause of any hypnotic response, consistent with cold control theory. The potential incompatibility between the theories is whether there is some part of the person that is aware of the first-order states the hypnotized person denies having. According to cold control theory, when a highly hypnotizable person produces, for example, hypnotic analgesia, there simply are no HOTs about the pain (nor HOTs about intending to engage in cognitive strategies to relieve the pain). According to Hilgard, the monitoring and executive functions of the executive ego (SAS) are split into two. 'The two parts differ only in that they are separated by an amnesic barrier' (Hilgard 1986, p. 234).

This might imply that the two parts are quite capable of their own HOTs, and this makes Hilgard's theory a multiple selves theory (Kihlstrom 1997), different from cold control. However, Hilgard (1986) also said that there are 'two experiences going on simultaneously; of one the subject is aware, of the other he is unaware' (p. 236). The streams are also referred to as subconscious versus conscious. There are two interpretations of these phrasings. In one, the stream about which one lacks awareness, the subconscious stream, is a stream of first-order states for which there are no accurate HOTs. This is the 'no HOTs' interpretation. In the other interpretation, the lack of awareness refers only to the lack of awareness of the stream by one of the selves; it is the hypnotized self that is unaware, though another self is aware of the first-order contents.

The 'no HOTs' interpretation makes neo-dissociation theory compatible with cold control. Many suggestions could be carried out by forming intentions, but failing to be aware of those intentions, i.e. by cold control (Kihlstrom 1992). Dissociative responses could also come about in negative hallucinations by having only first-order states of perceiving in the absence of accurate HOTs of perception, a perceptual analogue of cold control (i.e. cold perception). Kihlstrom (1998) prima facie accepted the 'no HOTs' interpretation of neo-dissociation theory in reviewing implicit–explicit distinctions generally (e.g. in blindsight) as supporting evidence for Hilgard's theory. Blindsight consists of first-order visual states without HOTs of seeing; there is no evidence that blindsight involves multiple selves (Kirsch and Lynn 1998).

The prime evidence for neo-dissociation theory is the hidden observer, and the hidden observer can express HOTs. This strongly implies that Hilgard did not intend the 'no-HOTs' interpretation of his theory. Cold control theory and neo-dissociation theory are then clearly different theories. However, they have in common the postulate that hypnotic responding involves executive functions.

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Bowers and Woody (1994) provided another take on dissociation theory. They described hypnosis as a weakening of frontal lobe function so that contention scheduling could control behaviour (hence the feeling of involuntariness). In dissociation terms, the dissociative split did not render the supervisory attention system in two (as in Hilgard's theory, or a version of it), it split one or more action schemata from the supervisory attentional system, so that the schemata could become directly triggered by hypnotic suggestion. Thus, they call their theory the dissociated control theory. However, uniquely associating actions experienced as involuntary with contention scheduling creates a problem. Hypnotic responding cannot be based simply upon contention scheduling, because hypnotic responses can involve performing executive function tasks, as reviewed above. Our primary criticism of dissociated control theory, and its primary difference from cold control theory, is that the theory fails to get to grips with the highly strategic and, when necessary, executive nature of hypnotic responding. In cold control theory, like dissociated control theory, control is split off from consciousness, but the supervisory attentional system is still involved.

Bowers and Woody (1996) used Wegner's white bear task to provide support for their theory. They argued that the absence of the ironic conscious awareness of bears (or cars, in their study) indicated that the highly hypnotizable subjects simply did not have the

intention to not think about bears. However, as indicated above, the success of 'highs' on the white bear task does not necessitate the conclusion that the task is performed non-intentionally (it could be performed intentionally and with avoiding relevant HOTs).

A further difference between cold control and dissociated control theories is that dissociated control theory is committed to a special state of hypnosis, specifically a state in which frontal lobe function is weakened. However, consistent with the idea that 'highs' in hypnosis actually have good executive abilities which can be used when expectations allow, when 'highs' were given hypnotic suggestions to eliminate the Stroop effect altogether, remarkably they could do this (Raz *et al.* 2002).

16.6.2 Socio-cognitive approach

The other great strand of theorizing about hypnosis has been broadly called the social psychological (e.g. Sarbin and Coe 1972; Spanos 1986) or socio-cognitive (Spanos 1991; Kirsch and Lynn 1997) perspective. These approaches view hypnotic behaviour as fundamentally similar to other more mundane forms of social behaviour, behaviour to be explained by personal (rather than subpersonal) states such as expectations, beliefs, purposes and attributions. The body of empirical work showing that hypnotic responses are indeed contextually appropriate, flexible, planned and goal directed (e.g. Spanos 1986) inspired a central notion in cold control theory, namely that executive functions are involved (consistent also with Hilgard's neo-dissociation theory). Cold control can also be simply described at the personal level, i.e. as the use of intentions without awareness of having those intentions, a description entirely consistent with the social psychological approach (and also, on a certain reading, with neo-dissociation theory). Where cold control theory goes beyond social psychological approaches is in a specific commitment to HOT theory (Rosenthal 1986); and social psychological approaches go beyond cold control theory in having a specific commitment to there being no special state of hypnosis. The social psychological approach is also consistent with empty heat theory, but cold control is the opposite of empty heat. We have seen above how a commitment to HOT theory leads to predictions concerning, for example, the order of difficulty of hypnotic suggestions, and also to considering brain imaging to distinguish cold control and empty heat theories. Different approaches—such as the social psychological and cold control—need not be incompatible to inspire different research questions, different types of answers and different agendas.

16.6.3 Neurophysiological accounts

Crawford and Gruzelier (1992) and Guzelier (1998) proposed a neurophysiological account of hypnosis. They postulate that 'highs' have better executive skills than 'lows' (e.g. Crawford *et al.* 1993) and hence can deploy their attention in different ways. Gruzelier (1998) and Gruzelier and Warren (1993) argue that the better ability of 'highs' to focus attention allows them during an induction to exhaust their frontal abilities, and hence end up frontally impaired in a hypnotic state. In contrast, Crawford *et al.* (1998) see hypnotic responding to, for example, pain as dependent on the effective functioning of the supervisory attentional system in 'highs'. Crawford's idea is, of course, consistent

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with cold control theory, but, as noted above, cold control theory does not rely on any superior ability of 'highs' over 'lows' in frontal tasks, and the evidence for hypnotizability differences in frontal task performance indicates an effect probably too weak actually to form the basis of the capacity for hypnotic responding.

16.7 **Evolutionary context**

Why does hypnotic behaviour exist? At first blush, hypnotic experience and behaviour are an unlikely product of natural selection. Surely natural selection favours accurate perception without hallucinations, and awareness of one's own control over one's actions (or at least not a systematic misrepresentation of the intentional causes of actions)? One possibility is that hypnosis was not specifically selected for at all. For whatever reason HOTs evolved, only a certain amount of accuracy was required of them, and the residual amount of slack between intentions and HOTs about intending—the slack that allows hypnotic experience—was simply tolerated by selective processes. However, another answer is suggested by the observation that hypnotic-like experiences are extremely common cross-culturally and seem to serve definite functions (Lewis 1973, 2003). We take the intentional control of cognition and behaviour without awareness of intention as the essential nature of hypnotic experiences. These types of experiences occur largely associated with religious rituals and in the form of spirit possession (Lewis 2003). Presumably, for our ancestors tens of thousands of years ago, hypnotic experiences also occurred in divine and spiritual contexts. If our distant human ancestors performed actions, or saw images, etc. that it seemed to them they did not produce, the obvious conclusion might have been that a spirit or divine force caused them.

One speculative function of such possession experiences is to support religious beliefs. If there were selective pressure on people to have religious beliefs, as some have argued (e.g. Alper 1996), then the experience of being taken over by a spiritual force would help strengthen spiritual beliefs (Oesterreich 1930), and hence could be selected for as well. Cold control would be the perfect way of achieving this end. The strategic nature of cold control allows the experience to correspond to whatever is required by the religious beliefs held, and to make sure the experiences occur in appropriate contexts. The lack of accurate HOTs provides the necessary self-deception (so that the cognition or behaviour can be attributed to divine intervention). The claim that hypnotic-like possession experiences can bolster religious beliefs is supported by large number of possession instances in religions struggling to obtain power; once religion has power, there is less need for such experiences to give authority to the religion, and indeed the experiences occur less often (Lewis 2003).

Lewis (1971, 2003) reviews the various sociological functions of possession experiences. For example, a possessed person can perform behaviours for which they are not held responsible. A socially marginalized person (such as in many cultures, a woman in a struggling marriage) can demand (with the voice of a mighty spirit) from the husband the gifts necessary for the spirit to be exorcized. In general, a person who speaks with the voice of a spirit acquires the authority of the spirit. If this performance is convincing to

others, then the person (male or female) can climb the social ladder to achieve a status they could never have been accorded otherwise, including becoming the most senior political figure. Lewis (2003) documents just how culturally and globally widespread this phenomenon is. Again cold control provides the perfect mechanism. The behaviour and experience can be planned so as to be as contextually appropriate as possible, depending on the assumptions of the particular culture. The self-deception afforded by inaccurate HOTs enables the performance to be convincing to oneself, which in turn makes it more convincing to others.

In this respect, hypnosis is just one particular cultural expression of a more general phenomenon, and many of the particular characteristics of hypnotic behaviours are historical accidents frozen in time. The association of hypnosis with sleep (long discredited in the academic world), or the notion that the hypnotized person is passive, apparently lobotomized as it were, are simply particular cultural beliefs.

16.8 Concluding note

While we call cold control theory a 'theory', in truth we regard it more as a means of theoretically orienting in the right direction rather than as a final explanation of hypnosis. However, we hope our arguments convince psychologists, philosophers and cognitive scientists generally that hypnosis offers a rich domain for testing ideas of consciousness and control.

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