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Clinical delusions are difficult to investigate in the laboratory because they co-occur with other symptoms and with intellectual impairment. Partly for these reasons, researchers have recently begun to use hypnosis with neurologically intact people in order to model clinical delusions. In this paper we describe striking analogies between the behavior of patients with a clinical delusion of mirrored self misidentification, and the behavior of highly hypnotizable subjects who receive a hypnotic suggestion to see a stranger when they look in the mirror. Based on these analogies, we argue that the use of hypnosis is a reliable method to investigate the surface features of clinical delusions. But to what extent can hypnosis successfully recreate delusions? Can it also contribute to a better understanding of delusion formation? Although clinical delusions and hypnotically induced beliefs are different in etiology, some analogies can be identified in the underlying processes that characterise them, based on the two-factor theory of delusion formation.

Keywords: Beliefs; Delusions; Hypnosis; Mirrored Self Misidentification

1. Delusions

According to the *Diagnostic and statistical manual of mental disorders* (American Psychiatric Association, 2000), delusions are false beliefs based on incorrect inferences about external reality that persist despite evidence to the contrary. A key feature of delusions is that they are not normally shared, and are rejected by other members of the subject's cultural group. Although all parts of the definition can be challenged with counterexamples, the literature seems to converge on the view that people with delusions report belief-like states that are unusually resistant to

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counterevidence, given their often bizarre content, or their implausibility. Many have argued that delusions can never be coherently described as belief states (Berrios, 1991); that they constitute a propositional attitude significantly distinct from that of ordinary beliefs (Stephens & Graham, 2006); that they demand a metacognitive explanation (Currie, 2000; Currie & Ravenscroft, 2002); or that they are altered modes of experience or alternative realities (Gallagher, 2009; Sass, 1994, 2004). Others have defended the belief-status of delusions (Bayne & Pacherie, 2005; Bortolotti, 2009; Broome, 2004; Coltheart, 2005). For the purposes of this paper, we shall assume that delusions are belief-like in that they are states that can be defended with reasons and may lead to action.

Whether delusions actually lead to action has been widely debated in the philosophical literature, where it has been argued that people with schizophrenic delusions experience the phenomenon of ''double bookkeeping'' (Gallagher, 2009; Sass, 2004). The delusion is reported with conviction but not consistently acted upon. A balanced view, supported by the available empirical and anecdotal evidence, is that most delusions are action-guiding most of the time, but that in some circumstances people with delusions can be charged with attitude-behavior inconsistency: their actions cannot always be explained by and predicted on the basis of their delusional reports. This is not a surprising finding since it has long been observed that, in normal cognition, conscious attitudes (which include preferences and beliefs) may not be causally efficacious on behavior. Further, on most accounts of the generation of action, it is accepted that beliefs alone are not sufficient to motivate one to act, and there is evidence suggesting that in schizophrenia, motivation can be undermined by emotional disturbances, avolition, and poverty of action (Bortolotti, 2010).

Cognitive neuropsychological accounts tell us that delusions are the result of one or more neuropsychological deficits. Delusions are caused either by abnormal experience (Maher, 1974), by the combination of abnormal experience and reasoning biases (Garety, Kuipers, Fowler, Freeman, & Bebbington, 2001), or by a breakdown of certain aspects of perception and cognition (Langdon & Coltheart, 2000). For example, Langdon and Coltheart (2000) have proposed a two-factor theory of delusions. By their view, factor 1 is a neuropsychological anomaly responsible for the content of the delusion, and factor 2 is a hypothesis evaluation deficit responsible for the acceptance of a delusional hypothesis as true.

According to this account, a woman with Capgras, who thinks that her father has been replaced by an impostor, would form this belief because her normal autonomic response to her father's face has been impaired (factor 1). This leads her to question the identity of her father, even if she can judge that the face she sees is identical to that of her father. However, this abnormal event (reduction of autonomic response) is not the only cognitive deficit responsible for the formation of the delusion. The theory also postulates a deficit at the level of hypothesis evaluation to explain why the thought that one's father has been replaced by an impostor is adopted as a plausible explanation of the abnormal event (factor 2). This second factor is necessary because individuals can experience factor 1 deficits without forming a delusion. For instance,

Tranel's (Tranel, Damasio, & Damasio, 1995) patients experience reduced autonomic responses to a loved one's face, yet are not delusional (see also Young, 2008).

The two factor theory is a general cognitive theory by which any disruption in cognitive processing akin to factors 1 and 2 should result in delusional beliefs that are similar to clinical cases. One way of disrupting cognition in factor 1- and factor 2-like ways is with hypnosis. Hypnotic suggestions can generate anomalous experiences and false hypotheses about the world (similar to factor 1) as well as disrupt their normal evaluation (similar to factor 2). Delusions and hypnotic beliefs are believed with conviction and maintained regardless of evidence to the contrary, and both delusions and hypnotic experiences feel compellingly real. Indeed, Sutcliffe (1961) argued that hypnotized individuals are essentially deluded about the real state of the world. Thus, hypnosis should be able to produce beliefs with features similar to those of clinical delusions.

For the purposes of this paper, we embrace the cognitive neuropsychological approach to the scientific investigation of delusions, and assume that the two-factor theory of delusion formation is broadly correct. We focus on a monothematic delusion (a delusion concerning one specific fact or experience) known as ''mirrored self misidentification.'' This delusion can ensue after a stroke or in the early stages of dementia, and is characterised by the patient thinking that the person they see when they look in the mirror is not themselves but a stranger. Here, we shall present some striking analogies between the behavior of people with the clinical delusion and the behavior of subjects given a hypnotic suggestion to see a stranger in the mirror, and discuss general methodological benefits and limitations of using hypnosis to study delusions.

2. Methodological Challenges in the Study of Delusions

We propose that hypnosis is a useful and appropriate way to model beliefs with delusion-like features in the laboratory. Previous research suggests that ''hypnosis may serve as a laboratory model for the study of a wide variety of psychopathological conditions, including delusional states'' (Kihlstrom & Hoyt, 1988, p. 68). Indeed, hypnotic techniques and suggestions have effectively modeled a range of clinical phenomena (for reviews, see Barnier & Oakley, 2010; Oakley, 2006), including repression and impulse inhibition (Burns & Reyher, 1976; Perkins & Reyher, 1971; Reyher, 1961, 1962, 1969; Reyher & Basch, 1970), conversion hysteria (Halligan, Athwal, Oakley, & Frackowiak, 2000a; Halligan, Bass, & Wade, 2000b), auditory hallucinations (Szechtman, Woody, Bowers, & Nahmias, 1998), functional amnesia (Barnier, 2002; Barnier & McConkey, 1999; Barnier, McConkey, & Wright, 2004; Cox & Barnier, 2003), functional blindness (Blum, 1975; Bryant & McConkey, 1989a, 1989b), abnormal control, and disorders of passivity (Blakemore, Oakley, & Frith, 2003; Haggard, Cartledge, Dafydd, & Oakley, 2004).

More specifically, hypnosis has already been used to model delusion-like experiences. First, in 1961, Sutcliffe explored whether hypnosis could be used to

create a sex-change delusion (a form of identity delusion) in some highly hypnotizable individuals. Building on his work, McConkey and colleagues found that in response to a hypnotic suggestion for a sex-change delusion, highly hypnotizable individuals changed their name, described themselves differently, and selectively processed information that was consistent with their suggested sex (Burn, Barnier, & McConkey, 2001; McConkey, Szeps, & Barnier, 2001; Noble & McConkey, 1995). Hypnosis has also been used to model identity delusions by giving subjects a hypnotic suggestion to become a same-sex sibling or a close friend (Cox & Barnier, 2009a, 2009b). In response to the suggestion, highly hypnotizable participants changed their name, described themselves differently, generated autobiographical information from the perspective of their suggested identity, and maintained the belief in the face of challenges.

It would seem that hypnotically induced beliefs share some of the features of clinical delusions. But why should they be used as models of delusions? Cannot we not simply study delusions ''in the wild''? Delusions often occur with other clinical symptoms and intellectual impairment, and this makes them very challenging to investigate. In particular, it is difficult to examine the ways in which patients defend the content of their beliefs, construct complex confabulatory explanations, and resist apparent counterevidence. In the majority of cases, people with delusions come to the attention of the therapist, and of the cognitive psychologist, well after the delusion is firmly established, and has manifested in a range of behaviors that have attracted the attention of others. If a person with mirrored self misidentification is asked by a therapist why she believes that the person in the mirror is not herself, she may offer an explanation that she developed and effectively rehearsed in her previous exchanges with other people who have asked similar questions. But if the belief that there is a stranger in the mirror is created via hypnosis, and the hypnotic subject is asked questions about it immediately afterwards, her responses can give us some insight into the early experience of a delusion. Thus, with hypnosis we can examine the subject's behavior in the instant in which the belief is first reported.

In clinical settings it is not always possible to investigate a delusion in isolation. People may have more than one delusion, be in a state of anxiety or depression that affects their behavior, or experience rapidly declining cognitive function due to degenerative diseases such as dementia. Comorbidity makes it harder to detect which behaviors are due to the delusion under investigation, and which are present in that individual for independent reasons. But in the laboratory it is possible to observe the behavioral effects of a belief that shares the key features of a delusion in isolation from other potentially interfering factors.

Further, ethical considerations significantly constrain the type of questioning that is appropriate with clinical patients. The types of challenges that can be safely explored with people having clinical delusions might be limited. It is important to avoid causing them distress, and to preserve their trust and continued cooperation, which are beneficial for treatment. In some circumstances, extensive questioning can be detrimental to therapy, and lead to an unintended increase, rather than reduction, in the rigidity of a delusion. For example, a man with Capgras who believes that his

wife has been replaced by an impostor may be encouraged to ask the claimed impostor questions that only his wife would be able to answer. However, if his wife fails to answer correctly (not because she is an impostor, but because she simply cannot remember the answers) the intended challenge to the delusion may have the counterproductive effect of reinforcing the delusional belief (Coltheart, 2007). In contrast, with subjects whose beliefs are due to hypnotic suggestion, more extensive questioning can be attempted, because the created belief state is transient and has no long-term harmful effects on the subject. The hypnotic suggestion allows us to explore the conditions under which a delusion may be successfully challenged, maintained or abandoned. Finally, for delusions that are rare, such as the delusion of mirrored self misidentification, it can be difficult to find a sufficient number of clinical cases for a scientific study of their features. Finding alternative ways of studying these delusions is especially important.

If hypnotically induced beliefs prove to be a good analogue for clinical delusions, some of the methodological problems listed above could be avoided, or solved. Evidence from the formation and manifestation of hypnotically induced delusions has the potential to inform therapy for clinical delusions, and advance current cognitive neuropsychological theories of delusion formation.

3. Hypnosis and Mirrored Self Misidentification

We wish to compare the behavior of patients in clinical cases of mirrored self misidentification (Breen, Caine, & Coltheart, 2000a, 2001; Breen, Caine, Coltheart, Hendy, & Roberts, 2000b; Davies, Coltheart, Langdon, & Breen, 2002) with that of subjects who received a hypnotic suggestion that they would see a stranger in the mirror (Barnier et al., 2008). We outline how the experience of seeing a stranger in the mirror is described; whether an explanation for that experience is articulated, and what form it takes; whether secondary confabulations are generated to justify the experience; whether the characterization or explanation of the experience is resistant to challenges and apparent counterevidence; and whether the characterization or explanation of the experience is consistent throughout the experience or whether there are elements of confusion and uncertainty in the subjects' reports.

The clinical cases we consider come from the study by Breen and colleagues (Breen et al., 2001). In case 1, patient FE believed his reflection was another person, not himself, who was following him everywhere. In case 2, patient TH also believed that his reflection was another person, not himself. Both FE and TH attempted to converse with their reflected image and were perplexed when the person in the mirror did not reply. When the examiner, Nora Breen, appeared in the mirror beside them in an attempt to challenge their beliefs, both FE and TH acknowledged that they could see her reflection in the mirror. However, whereas FE believed that the examiner's reflection was Nora, TH did not. TH believed Nora's reflection to be "the woman who had come with her" (Breen et al., 2000b, p. 90).

Notably, neuropsychological testing revealed that, for FE, brain damage had disrupted his processing of familiar faces, which led to his inability to recognise his own face (Breen et al., 2000b). However, his recognition of Nora's face was still intact. In contrast, for TH, brain damage had disrupted his normal interaction with mirrors (mirror agnosia), so that he thought a mirror functioned like a window. This contributed to his belief that the person in the mirror could not have been him, but a stranger who looked just like him. His mirror agnosia also explained why he did not recognise Nora (as it would not have been possible for her to be on both sides of the window). Thus, these two cases of mirrored self misidentification involved similar delusional beliefs which stemmed from two different neuropsychological deficits.

The suggestions used fall into a category of hypnotic suggestion known as "cognitive-delusory." These are the most difficult type of hypnotic suggestion and can only be experienced by the most highly hypnotizable individuals (i.e., those who are most susceptible to hypnosis; Cox & Barnier, 2010). To select suitable subjects, two standardised measures of hypnotizability were used—the Harvard Group Scale of Hypnotic Susceptibility, Form A (Shor & Orne, 1962) and the Stanford Hypnotic Susceptibility Scale, Form C (Weitzenhoffer & Hilgard, 1962)—which have been in use worldwide for over 50 years. Only those subjects who received high scores by responding to the majority of suggestions on both of these measures were selected for hypnotic mirrored self misidentification experiments.

To create hypnotic mirrored self misidentification, these highly hypnotizable individuals (also known as "highs") receive a hypnotic induction that instructs them to close their eyes, relax and focus on the hypnotist's voice. The hypnotic induction typically encourages subjects to focus their attention and to become absorbed in the communications of the hypnotist, engendering in them a "motivated cognitive commitment" to respond (Sheehan, 1991, p. 526). Thus, for highly hypnotizable subjects, the hypnotic induction alters their monitoring and evaluation of reality, which may disrupt the process of belief formation in a similar way to factor 2. Following the hypnotic induction, participants receive a suggestion to create mirrored self misidentification. For example, they are told:

> In a moment, I am going to ask you to open your eyes, and when you do, I would like you to lean forward and to look to your left. When you look to your left, you will see a mirror. The mirror you will see will have properties of a normal mirror, with one major difference. The person you see in the mirror will not be you, it will be a stranger. When you open your eyes and turn your head to your left, whilst remaining as deeply relaxed and comfortably hypnotized as you feel now, you will see a stranger reflected in the mirror. I would now like you to slowly open your eyes, turn your head to the left and look into the mirror. (Barnier et al., 2008, p. 414)

To index their response to the suggestion, participants are asked to open their eyes, look in the mirror and describe what they can see. If subjects report seeing a stranger, they are asked to describe the stranger, to describe the ways in which the stranger looks similar to them, and to describe the ways in which the stranger looks different

from them. After indexing response to the suggestion, their experience is challenged using a series of clinically inspired appearance challenges, behavior challenges, and contradictions. *Appearance challenges* involve questions such as "how is it possible that you and the stranger look so similar?" Another appearance challenge involves the hypnotist appearing in the mirror alongside subjects and asking "who else do you see now?" *Behavioral challenges* involve tasks such as asking participants to touch their nose while looking in the mirror and asking "what did the stranger do when you touched your nose?" and "why do they always do the same things as you do?" The purpose of these challenges is to explore the conditions under which subjects might abandon their hypnotically induced delusions. *Contradictions* involve asking participants what a third person would say about their experiences.

Finally, the mirrored self misidentification suggestion is cancelled and a hypnotic de-induction is administered (based on Weitzenhoffer & Hilgard, 1962). The de-induction terminates hypnosis and reorients subjects to external reality. It involves counting backwards from 20 to one and instructing subjects to open their eyes and feel wide awake by the end of the countdown. After the experiment, a post-experimental inquiry is conducted, where subjects are asked about their hypnotic experiences. The Experiential Analysis Technique (Sheehan & McConkey, 1982) involves videotaping the hypnosis session and, after the session, having a second, independent experimenter watch the videotape with the subject. The cues afforded by the videotape remind subjects of their private, subjective experiences during the hypnosis session. While watching the video they are asked whether they genuinely believed the suggested effects, and they are invited to comment on their hypnotic experiences.

4. Surface Features of Clinical and Hypnotically Induced Delusions

There are some observed similarities between clinical and hypnotically induced delusions.

4.1. "What Do You See in the Mirror?"

When people with clinical delusions are interviewed about their experience in front of the mirror, the presence of a stranger in the mirror is no longer a novelty, as they have seen "the stranger" in the mirror many times before. Thus, in their answers, they make explicit reference to previous experiences of "the stranger in the mirror" and may even call that person by name. Hypnotic subjects are asked to describe their experience in front of the mirror just after receiving the hypnotic suggestion, and, predictably, they show considerable surprise at seeing someone whom they do not recognise in the mirror—for instance, they search for another person in the room to whom that reflection may belong.

But when clinical patients and hypnotic subjects are asked *what* they see in the mirror, their responses are very similar. They report that the person looks like them, but also describe some differences. In the scripts of such exchanges, clinical patient

Table 1 What do you see in the mirror?

Patient with delusion (FE)	Male subject given hypnotic suggestion (MW)
I: Now look in the mirror. Straighten yourself up a little.	*I: Tell me, what do you see?*
FE: (FE gasps and shakes his head) That's not me.	*MW: (looks behind him) Who's that?*
I: Who is that?	*I: Tell me about what you see.*
FE: That's not me.	*MW: Another person.*
I: Who is it?	*I: Tell me about the person.*
FE: It hits me straight away . . . I mean, I thought first of all I didn't like his face at all. But I got used to his face as I, I even smiled at him when we go the bathroom or something for a wash, but it's not me.	*MW: They're wearing a purple shirt (same colour as his shirt), got a big nose, got a mole on their neck.*
I: Ok, what does that person look like?	*I: Is the person you see a male or a female?*
FE: Well he looks like me.	*MW: Male (looks behind him).*
I: He does look like you.	*I: Tell me more about what they look like.*
FE: Yes, oh yes, he's not a bad looking fellow.	*MW: They've got short, curly hair, brown eyes, brown hair.*
I: Not a bad looking fellow. So what does he look like can you describe him?	*I: Have you ever seen this person before?*
FE: I can do better than that.	*MW: No (looks behind him).*
I: Hmm. Does he wear glasses?	*I: Does this person remind you of anyone?*
FE: . . . . I think he does, I think he does.	*MW: I think I've seen him before at school.*
I: Yeah?	*I: Do you mean at uni or earlier?*
FE: Ah yes, he does wear glasses.	*MW: Oh, yeah, earlier.*
I: He does wear glasses and what colour is his hair?	*I: Tell me about that. . .where you might have seen him?*
FE: Ah, I think he's ah, as white as I am.	*MW: I think he was in the year below me. Yeah, I knew there was something.*
I: He's not as white as you are?	*I: What did you think his name is?*
FE: No.	*MW: Anthony (not his name).*
I: Uh-uh. Is he going a bit bald? Or does he have a full head of hair?	*I: In what ways does this person look like you?*
FE: No, I think he's about the same, same as mine as far as hair coverage. About the same as mine.	*MW: Same coloured hair. I've got hazel eyes.*
I: About the same as yours. Ok. Alright. So this is the person that you see in your house?	*I: And what colour eyes does he have?*
FE: Hmm (FE nods).	*MW: Brown.*
	I: In what ways does the person you can see look different to you?
	MW: Different coloured eyes. I think my nose is smaller, got bigger lips.
	I: He has or you have?
	MW: I have. And I've got more freckles.

FE thinks the person in the mirror is as bald as he is, but is uncertain about whether the color of the stranger's hair is the same as his. Hypnotic subject MW says that the person in the mirror has hair the same colour as his, but different coloured eyes. He also thinks that the person in the mirror has a bigger nose, smaller lips and fewer freckles. The behavior of hypnotic subject MW highlights the subjectively real and compelling nature of his experience. He displays initial surprise at seeing the person in the mirror and appears so convinced that it is a stranger that he frequently looks behind him in an attempt to find the person in the room. (His interview is reproduced in table 1—the ''I'' stands for ''interviewer'' and the initials for the clinical patient or hypnotised participant.)

Table 2 Does the stranger look like you?

Patient with delusion (TH)	Female subject given hypnotic suggestion (PK)
I: Ok. Now what do you see there?	I: Okay, tell me, what do you see?
TH: I see my, my (gestures towards reflection of face), my face in there.	PK (looks around)
I: Right.	I: What is it you see in the mirror?
TH: Yep.	PK: I think it's myself but I don't know. There is no one there (looks behind).
I: Uh-uh, so . . .	I: Tell me more about the person that you see in the mirror.
TH: A reflection of it.	
I: A reflection. Right.	PK: It looks a lot like myself.
TH: Yeah.	I: Are they male or female?
I: Right. Ok. And can you describe what that reflection looks like?	PK: Female. It looks just like me but I don't think it's me.
TH: Yeah. Just like that bloke there. (TE indicates towards the reflection in the mirror). [. . .]	I: Okay, have you seen this person before?
	PK: Yes, it looks just like me.
I: How would you describe him?	I: Who do you think the person is?
TH: Well the only way I could describe him is that he looks like me.	PK: I don't know. I don't have a twin or anything. I don't . . . maybe it's me. It could be . . . I don't . . .
I: He looks like you?	I: Does the person you see look different to you?
TH: Yeah.	PK: No, it looks just like me.
I: Uh-uh, does he look a lot like you?	I: How is it possible that the person in the mirror looks just like you?
TH: A lot like me!	
I: Does he?	PK: Well, it's not possible because there is no one there (looks behind, gestures to space).
TH: Yeah.	I: What would a friend or family member say if they saw the reflection in the mirror?
I: Yeah ok, so is he bald?	
TH: Ah . . . is he bald? (TH is looking directly at his reflection) He'd have to be wouldn't he or I wouldn't . . . yeah he'd have to be.	PK: I think they would say it was me.

In the exchanges reported in table 2, both clinical patients and hypnotic subjects indicate some uncertainty about whether they are truly distinct from the person in the mirror. Clinical patient TH talks about a reflection, a *non-entity*, rather than a person in the mirror, and hypnotic subject PK initially thinks that the person in the mirror is herself, then later thinks it is not, and finally reconsiders the possibility that it may be her. Both PK and TH seem to engage in explicit inferential reasoning, by using expressions such as ''it looks like me but I don't think it is me'' or ''he would have to be bald, wouldn't he?''

4.2. ''Does He Talk?''

In both clinical and hypnotically induced delusions of mirrored self misidentification, people have difficulty rationally explaining the fact that the strangers in the mirror look like they are talking, but their voice cannot be heard (or can be heard only occasionally). In clinical patient TH's interview, TH states that the person cannot talk, but shortly after this he claims that the person in the mirror has

Table 3 Does he talk?

Patient with delusion (TH)	Male subject given hypnotic suggestion (MW)
TH: I haven't been able to get him to talk since I've known him. *I: Right. Why do you think?* *TH: I don't know. See, he, you, he just answered for me (gestures at reflection), he said he doesn't know.* *I: Oh right.* *TH: I don't know either.* *I: So when you ask him questions he doesn't answer you?* *TH: No. So I assume that he can't talk.* *I: Yeah.* *TH: So he's the only one who could answer that question.*	*I: What's he doing at the moment?* *MW: Looking into the mirror. I don't know where he is though (looks behind him and around room).* *I: What does he seem like as a kind of person?* *MW: Yeah, all right. He keeps on looking at me.* *I: Is he doing anything in particular or saying anything in particular?* *MW: Just looking at me. He's saying something but I can't understand.* *I: Why can't you understand?* *MW: Because I can't lip read.* *I: Can you hear him?* *MW: No.* *I: How come?* *MW: Because I can only see him.*

answered one of the interviewer's questions. Hypnotic subject MW finds it obvious that the person in the mirror can be seen but not heard, as if he were behind a closed window (see table 3 for details).

4.3. Behavioral Challenges

How do clinical patients and hypnotic subjects react when the interviewer asks them to perform some behavioral tasks in front of the mirror (touch their own nose, or grab a tennis ball that is held over their shoulder)? These tasks challenge the delusion, because subjects need to account for the fact that the person in the mirror is performing the same tasks as they are. For clinical patient FE, who has had this experience of the stranger imitating him before, there is no element of surprise. As with TH, there is a recurrent theme of past attempts to communicate with the stranger in the mirror, which is missing in the hypnotic subjects' reports, since they have just "met" the stranger (see table 4 for details).

Hypnotic subject MW is genuinely surprised when he notices that the person in the mirror is "copying" him, and spontaneously bursts out laughing. Hypnotic subject PK seems very perplexed. As in the previous script, she uses the language of inferential reasoning to come to grips with her experience. This is particularly obvious when she says: "if it was me, I'd have the feeling it was me." It is interesting that, notwithstanding these individual differences, in all three cases behavioral challenges do not seem to give subjects a sufficient reason to seriously doubt or revise their belief that the person in the mirror is a stranger and not themselves. Rather,

Table 4 Behavioral challenges.

Clinical Patient FE	Hypnotic Subject MW	Hypnotic Subject PK
I: Ok, I'll get you to touch your nose with your hand, ok? (FE touches his nose) I: Have a look in the mirror, open your eyes. Ok. Put your hand down, and touch your nose with your hand again (FE touches nose). Right and put your hand down. So, he's doing what you're doing? FE: Yes that's right. I: And does he always do that? FE: Oh, only when I speak to him. And I, I if he's in the other room (FE gestures at reflection) and he goes past the mirror or something like that and ah, I always speak to him, you know, silently, but ah …	I: I'd like you to touch your nose with your finger. MW: He's copying me (laughs). I: What did he do? MW: He touched his nose (laughs and looks behind him). I: Why do you think he did that? MW: I don't know (laughs). I: Why do you think he would do that? MW: Maybe he's trying to make me seem like I'm crazy or something.	I: I would like you now to touch your nose while look-ing in the mirror. What did they do? PK: They touched their nose. I: Why did they do that? PK: I don't know. They're copying me. I: (holds tennis ball up) I would like you now to touch that for me. What did the person in the mirror do? PK: But how can it be me if it's … if I don't know that it's me. Because the reflec-tion is touching the ball as well. I: Why do they always do what you do? PK: I don't know. But if it was me, I'd have the feeling that it was me.

some additional explanation is sought (''he's trying to make me seem like I'm crazy'' or ''they're copying me'').

4.4. The Interviewer in the Mirror

At some stage in the course of the interview, interviewers place themselves at such an angle that they are also reflected in the mirror. Then the interviewer asks the clinical patient or hypnotic subject who the interviewer's reflection belongs to. As a challenge, this causes quite noticeable reactions (see table 5 for details). Clinical patient FE recognises the reflection of the interviewer, and claims that the stranger is next to her reflection. Clinical patient TH also recognises the interviewer's reflection in the mirror, but at this point he identifies his own reflection not as the stranger but as the ''reflection'' of the stranger, which can be interpreted as an attempt to maintain coherence without giving up the delusion. It is also interesting that TH makes another attempt to talk to the stranger, and that he calls him with his own first name (T). Hypnotic subject PK is increasingly uncomfortable with the idea that the person in the mirror is not herself, and cannot explain the absence of a stranger in the room.

Table 5 The interviewer in the mirror.

Clinical Patient FE	Clinical Patient TH	Hypnotic Subject PK
I: Can you see that, can you see the reflection of the person in the mirror? Yeah? *FE: Yes I can see that, yes.* *I: Who's this? Next to the person.* *FE: I don't know.* *I: Yeah. Who does it look like? Have you seen this person in here before?* *FE: It's you.* *I: It's me.* *FE: Yes.* *I: Me here.* *FE: Yes.* *I: Can you, what's my name?* *FE: I don't, oh yeah, Nora is it?* *I: Nora. That's right. So that's me in the mirror.* *FE: Yes.* *I: That's my reflection.* *FE: Yes.* *I: Hmm, ok. And who's that?* *FE: That's the ha ha, I don't know what to call him.*	*I: When you look in here, tell me again what you see. Who are these...two things. What are these two things that you see?* *TH: I can see a reflection (waves hand generally)...Oh are you talking to (points at reflection)...that gentleman or me? (gestures towards himself).* *I: I'm talking to you.* *TH: To me?* *I: Yep.* *TH: I can see your reflection (points at mirror).* *I: Hmm.* *TH: And ah, I can see T's reflection (points at mirror).* *I: T who?* *TH: Well I don't know his second name.* *I: Ok. Alright. That's fine.*	*I: Okay...Who else do you see in the mirror now?* *PK: I see you.* *I: How is that possible?* *PK: I don't know.* *I: And where are you in relation to me?* *PK: I'm next to you. Next to this person.* *I: So who must the two people in the mirror be?* *PK: Well...well, you think it would have to be me because they are the only people there.* *I: And how many people are there in the room?* *PK: Two, cause there isn't a stranger in the room.* *I: How come the stranger is not in the room?* *PK: [There's] nobody else.*

5. Analogies and Disanalogies

Let's consider some analogies and disanalogies in the observed surface features of the reports of mirrored self misidentification in order to establish whether beliefs induced by hypnotic suggestion can serve as a good model for clinical delusions.

In response to a specific suggestion, hypnotic subjects do not recognize their reflection in the mirror, often describe the person in the mirror as having different physical characteristics from themselves, and refer to their own reflection in the third person. When their suggested delusion is challenged, those who experience the delusion continue to maintain that there is someone else in the mirror. Finally, after the hypnotist cancels the suggestion, they express relief at no longer seeing a stranger, and they may even engage in personal grooming behaviors in front of the mirror (which were noticeably absent while they reported seeing a stranger in the mirror). These findings suggest many parallels between the features of clinical and hypnotically induced mirrored self misidentification. Both are characterised by *strong conviction* that the person they see in the mirror is not them. During an inquiry conducted according to the Experiential Analysis Technique, a number of hypnotic subjects commented on the compelling nature of their experience and insisted that they really saw a stranger in the mirror.

There is some noteworthy variation in the conviction expressed by hypnotic subjects. Hypnotic subject MW manifests very obvious shifts in his behavior from the period during the suggested delusion to the period after the suggestion is cancelled. During the suggested delusion, he never treats the image in the mirror as his own reflection, and often looks behind him to search for the person to whom the reflection belongs. He appears to be genuinely committed to the hypnotic delusion. After cancellation, he resumes his normal behavior in front of mirrors. For example, he immediately fixes his hair. But hypnotic subject PK is more tentative with respect to her acceptance of the hypnotic delusion, and seems to engage in explicit reasoning, when she argues with herself that the image cannot be her own reflection because otherwise she would feel that it is. She neither consistently identifies the reflection as her own in the course of the interview, nor does she mention alleged differences between herself and the person in the mirror.

One important similarity is that hypnotized subjects, like clinical patients, maintain their mirrored self misidentification delusion in the face of challenges. When asked to imagine what their family and friends would say about the person in the mirror, hypnotic subjects maintain their belief that they are seeing a stranger. On some occasions, they claim that their family and friends would have no trouble distinguishing them from the stranger. In behavioral challenges, hypnotic subjects argue that the stranger is simply copying their actions, they generate quite sophisticated explanations for the situation, and they give reasons to justify their (temporary) delusions. For instance, when asked to touch her nose and to explain what the person in the mirror was doing, one participant said "she's outside and wants to come in—she's imitating me so I'll feel closer to her."

In general, hypnosis seems to be effective in generating temporary delusion-like beliefs that are held with conviction, and thus it allows us to explore the way in which clinical delusions persist in the face of increasingly confronting challenges. This knowledge base may serve to inform clinicians who aim to challenge and resolve the delusional beliefs of their patients.

However, the striking analogies in the behavior of clinical patients and hypnotic subjects should not blind us to some interesting individual differences that cut across both clinical and experimental samples. Although most clinical patients and hypnotic subjects express strong conviction that it is not them in the mirror, others show *implicit awareness* of a link between themselves and the stranger. This awareness has been called "covert recognition" (Breen et al., 2000b, pp. 85, 90). For example, when clinical patient FE is asked what color hair the person in the mirror had, he tilts his head forward to examine his hair in the mirror before replying that the person is not as white as he is. Similarly, when clinical patient TH is asked if the person he can see in the mirror is bald he replies, "yes, *he'd have to* be" (Breen et al., 2000b, p. 88). This indicates that FE and TH may have some (implicit) awareness that the person in the mirror is actually their own reflection.

Likewise, some hypnotic subjects display covert recognition. For example, subject BE initially reports seeing herself in the mirror, but then describes herself in third-person terms and seems to suggest that there are visible differences between herself

Table 6 What's the stranger's name?

Clinical Patient TH	Hypnotic Subject BE
I: Yeah right, ok. Do you know what his name is?	I: I want you to tell me more about the person you can see.
TH: T. (same as participant's name).	P: Blonde hair, pink jumper, brown eyes.
I: Right. So he…	I: What else does she look like?
TH: That's what he told me his name was, T. My name's T. and…	P: Me.
I: Yeah. So that's a coincidence.	I: Have you seen this person before?
TH: He asked me what my name was when I met him and he said "T.", and I said "Oh well that's good, I'm T. too".	P: Yes.
I: Right.	I: Who is she?
	P: B. (same as participant's name)
	I: What is it about this person that makes you think they are B?
	P: She looks like her.

and the person whose image is reflected. Just like clinical patient TH, she reports that the image she sees in the mirror has the same name as she does (see table 6 for details).

Hypnotized individuals, like their clinical counterparts, often express discomfort at seeing the stranger in the mirror staring back. Clinical patient TH used curtains to cover all of the mirrors in his house, and he said that whenever he lifted up the corner of a curtain he could see the stranger peering out at him. Similarly, one hypnotised participant commented, "I was poking my head around as if I was sort of looking at someone secretly."

Clinical patient FE mentioned that the stranger made him feel a bit sick because he moves about so freely with him. Similarly, a number of hypnotic subjects made comments such as "I felt kind of weird seeing someone just stare at me that close," and "I didn't trust the other person." The level of suspicion displayed by some hypnotically deluded participants in this study is reminiscent of the suspicion displayed by Capgras patients who often believe the impostors may have murdered their relatives.

Probably the most salient observation concerns the frequency of secondary confabulations in both clinical cases and experimental sessions. The term 'secondary confabulation' refers to the production of false or distorted representations of oneself or the world (Fotopoulou, Conway, Birchall, Griffiths, & Tyrer, 2007) that occurs when clinically deluded patients attempt to justify or explain their deluded beliefs. Secondary confabulations are common among people with clinical delusions of misidentification. In Capgras delusion, individuals will point out subtle physical differences between the "impostors" and their relatives. For example, a woman suffering from Capgras syndrome in relation to her son said that the impostor differed from her son in that her son "had different colored eyes, was not as big and brawny, and her son would not kiss her" (Frazer & Roberts, 1994, p. 557). This Capgras patient offered post hoc reasons for her belief that the impostor was not her son by reference to physical and behavioral differences between her son and the impostor.

Similar behavior can be observed in somatoparaphrenia (the belief that one's limb, usually an arm, belongs to someone else). Clinical subjects not only claim that the arm is not theirs, but go on to describe it in such a way that suggests that it cannot be theirs (Feinberg, Deluca, Giacino, Roane, & Solms, 2005). Bisiach and colleagues (Bisiach, Rusconi, & Vallar, 1991) describe an 84-year-old woman who developed somatoparaphrenia after a right hemisphere stroke. In the experimental session, this woman claimed that her left arm belonged to her mother. When asked what her mother's arm was doing there, she replied "I don't know. I found it in my bed." Additionally, Halligan and colleagues (Halligan, Marshall, & Wade, 1995) describe a 41-year-old man, patient GH, who also developed somatoparaphrenia after a right hemisphere stroke. GH believed that his left hand, arm, leg and foot did not belong to him. GH explained (after he no longer had the delusion): "I came to the conclusion that it was a cow's foot. And in fact I decided that they sewed it on. It looked and felt like a cow's foot, it was so heavy."

This type of behavior can be observed in hypnotic subjects as well. In an attempt to recreate somatoparaphrenia in the laboratory, one of our subjects, a young woman, was given a hypnotic suggestion that one of her arms did not belong to her, and was then asked to describe the arm. She said that it was not her arm, but rather the arm of an old man. She scrunched up her face in apparent disgust and said her arm was "old" with "old knuckles." This secondary confabulation supported her belief that the arm belonged to someone else.

Secondary confabulations are also frequently produced by clinical patients with the mirrored self misidentification delusion. To justify their belief that the person in the mirror is not them, they claim that it is a stranger who looks very much like them and lives in or near their house, follows them around and watches them in the bedroom and in the bathroom (Breen et al., 2001, p. 240). As seen in the transcripts above, confabulations of this kind are common in hypnotic subjects who have received a suggestion to see a stranger in the mirror. In response to questions about whether, and in what ways the person they could see in the mirror looked different to them, the majority of hypnotic subjects confabulated physical differences between themselves and the image in the mirror, and often attempted to provide explanations as to whom the person was, or why they tried to copy their behavior.

To sum up, we observed that hypnotic and clinical delusions are analogous, in that subjects report the belief that there is a stranger in the mirror with conviction, they may display covert recognition, they manifest discomfort at the thought of there being a stranger in the mirror, and they resist challenges to their delusional beliefs via secondary confabulations. But there are also some important disanalogies. If we confine our attention to surface features, one obvious difference between clinical and hypnotically induced delusions is that clinical mirrored self misidentification is much more persistent than hypnotic mirrored self misidentification. For the most part, hypnotic effects are confined to the hypnotic setting. In contrast, clinical delusions last for a significant period of time, and often resist relentless challenges, such as constant probing from family and friends. In addition to this, clinical delusions are more intense and have more extensive behavioral consequences (Kopelman, 2007)

than their hypnotic counterparts. For instance, in mirrored self misidentification, the belief that one's reflection is that of a stranger might be so overwhelming that the person avoids looking in the mirror and covers up all the mirrors in the house (as in the case of clinical patient TH).

Before we can establish satisfactorily whether hypnosis can recreate delusions in the laboratory, we should delve beneath the surface and discuss analogies and disanalogies in *underlying processes*.

6. Beneath the Surface

What do we mean when we talk about ''hypnotically induced delusions''? The evidence presented and our discussion of analogies and disanalogies might suggest one of two positions: (1) with hypnosis we can create *beliefs with delusion-like features* that are a methodologically valuable analogue of delusions; or (2) with hypnosis we can recreate *delusions* proper. In the DSM definition, clinical delusions are characterised primarily in terms of the epistemic character of their surface features. For instance, the definition refers to how people with delusions behave with respect to their beliefs (e.g., they resist counterevidence) and to the type of beliefs they report (e.g., implausible in content). This might suggest that, if we can argue that hypnotically induced beliefs share the same features as clinical delusions and present the same epistemic faults, then there is nothing to prevent us from drawing the strongest conclusion—that we can recreate delusions in the laboratory.

However, the DSM definition of delusion fails to provide necessary and sufficient conditions for delusional beliefs, and fails to demarcate delusions from other irrational beliefs (Bortolotti, 2009). In order to improve our understanding of clinical delusions, the cognitive neuropsychological approach not only investigates the surface features of delusional beliefs, but also invites us to think about the mechanisms that are responsible for the formation of delusions. Can hypnosis also mimic the underlying mechanisms responsible for the formation of delusions?

Whether hypnosis merely mimics the surface features of clinical delusions or whether it can also model some of the relevant underlying processes echoes a long-standing debate about how hypnosis actually works. While some researchers argue that hypnosis mostly influences one's experiences (Hilgard, 1991; Kihlstrom, 1985), others claim that in doing so, it also influences processing ''all the way down to the brain'' (Oakley & Halligan, 2009; Woody & Bowers, 1994). For instance, Oakley and Halligan (2009) propose that hypnosis can model many of the clinical features, related physiological processes, and underlying neural mechanisms thought to be involved in clinical conditions. In support of their view, they have found that a subject with hypnotically suggested ''conversion disorder paralysis'' (i.e., paralysis that does not have an organic basis) not only produced the clinical features of conversion disorder paralysis but also showed remarkably similar patterns of neural activation as an actual patient with this condition (Halligan et al., 2000a; Marshall, Halligan, Fink, Wade, & Frackowiak, 1997). If hypnotic analogues can recreate not

only the phenomenological features of clinical conditions (i.e., what patients say and do) but also the associated physiological and neural processes, researchers would have an invaluable tool for testing hypotheses that inform both theory and treatment for clinical conditions.

There are two broad theoretical views about how hypnosis works. According to the first view, purported by theorists such as Hilgard (1991) and Kihlstrom (1985), hypnosis changes experiences more than underlying control of behavior. By their view, hypnotized subjects lack the ability to monitor their own behavior. They control their experiences in the same way as non-hypnotised subjects but are unaware of their role in producing the hypnotically suggested effects. They may therefore experience hypnotic effects as involuntary and compellingly real but are unaware of their role in generating these effects. In terms of hypnotically induced delusions, this theory suggests that a hypnotic analogue will only mimic the surface features of clinical delusions—subjects will report delusion-like experiences and behave as if they are deluded, but they will show no underlying physiological or neural changes.

According to the second view, purported by theorists such as Woody and Bowers (1994), hypnosis produces genuine changes in the underlying control of behavior. By their view, during hypnosis, specific suggestions bypass the executive control that we normally exert over our behavior. Consequently, the experience of involuntariness that is often associated with hypnotic responding is an accurate reflection of an underlying alteration in control. In terms of hypnotically induced delusions, this theory suggests that a hypnotic analogue will not only mimic the surface features of clinical delusions, but will also reproduce the relevant underlying physiological and neural changes.

Some recent research does indicate that hypnotic suggestions do change more than behavior and reported experience. For instance, Raz and colleagues (Raz, Shapiro, Fan, & Posner, 2002) used a Stroop task to demonstrate that hypnotic suggestions can "turn off" our automatic tendency to read printed words. In a classic Stroop task subjects are asked to name aloud the ink color of printed words. The colors might be incongruent with the word (e.g., the word *blue* printed in red ink) or congruent with the word (e.g., the word *green* printed in green ink). Individuals are typically slower at naming color incongruent words due to an automatic tendency to prioritize the reading of words rather than naming the ink color (Stroop interference). Raz and colleagues gave hypnotized subjects a suggestion that after hypnosis they would read words as a foreign language. Following hypnosis, they then gave subjects a Stroop task (i.e., instructed them to name the ink color of words) and found that highly hypnotizable subjects could eliminate Stroop interference. These findings generated great interest in the field because they provided the first evidence that hypnotic suggestions could influence automatic cognitive processes involved in word reading.

Notably, there is also some evidence that hypnosis can produce changes at a neural level. For instance, Kosslyn and colleagues (Kosslyn, Thompson, Costantini-Ferrando, Alpert, & Spiegel, 2000) used Positron Emission Tomography (PET) to examine neural activity when subjects were looking at color and greyscale patterns.

They found that in response to a hypnotic suggestion to see a grayscale pattern in color, the same color area in the brain was activated as when they were actually looking at color patterns. Other evidence supporting the idea that hypnosis can produce changes at a neural level comes from work on hypnotic auditory hallucinations (Szechtman et al., 1998). Subjects who received a hypnotic suggestion to hallucinate a recorded voice displayed the same neural activity as when they were actually listening to the recorded voice. Interestingly, patterns of neural activity were different when subjects were asked to imagine hearing the recorded voice. Similar findings have been reported by Derbyshire and colleagues (Derbyshire, Whalley, Stenger, & Oakley, 2004) when comparing neural activation during actual, imagined and hypnotic pain. Mendelsohn and colleagues (Mendelsohn, Chalamish, Solomonovich, & Dudai, 2008) have also provided evidence in support of hypnotically-induced neural changes in their use of hypnosis as a laboratory analogue of functional amnesia (amnesia that has no apparent organic basis). In their study, hypnotized subjects received a post-hypnotic suggestion to forget a movie they had watched a week earlier. Following hypnosis, their brains were imaged using functional magnetic resonance imaging (fMRI) during a recognition memory test of the movie. Findings indicated alterations in brain areas responsible for memory retrieval.

Most importantly, Halligan, Oakley and colleagues (Halligan et al., 2000a) found that a hypnotic analogue of conversion disorder paralysis recreated this condition at the neural level. In their first study (Marshall et al., 1997), they used PET to record brain activity in a woman diagnosed with conversion disorder paralysis of the left leg. When she was asked to move the paralyzed leg she failed to do so and there was no activation in her primary motor cortex. Critically, other neural areas were activated (right orbito-frontal and right anterior cingulate cortex) and these were interpreted as inhibiting intentional movements. Halligan, Oakley and colleagues (Halligan et al., 2000a) then compared these clinical patterns of neural activation to those produced by a case of hypnotically suggested conversion paralysis. They gave a male subject a hypnotic suggestion to experience left leg paralysis and recorded his brain activity using PET as he attempted to move his left leg. The behavior, experiences and notably, brain activation patterns of this hypnotized subject were identical to the clinical patient with conversion disorder paralysis. These authors subsequently followed up their findings with 12 hypnotized subjects who received a hypnotic suggestion for leg paralysis, and were also asked to fake hypnotic leg paralysis (in a counterbalanced order; Ward, Oakley, Frackowiak, & Halligan, 2003). They found that genuinely experienced hypnotic paralysis produced patterns of neural activations that were different than intentionally faked paralysis. Based on this work, there is evidence to suggest that hypnotic analogues may share similar neural underpinnings with their clinical counterparts.

There is an increasing body of evidence to suggest that hypnosis can change more than mere experiences, and can mimic underlying neural mechanisms. Although the analogies between clinical patients and hypnotic subjects presented in this paper may only support claims about similarity of surface features, there are reasons to suppose

that the similarities extend beyond this. Note that although the etiology of clinical and hypnotically induced delusions may be quite different, this does not rule out the possibility that they share underlying mechanisms. In clinical delusions the aetiology involves a neuropsychological impairment; there is no such impairment in the origin of hypnotically induced delusions. Whereas the neuropsychological impairment presumably produces a bottom-up disruption of cognitive processing (e.g., altered primary perception for faces), hypnotically induced delusions are created by strategic, top-down processes, which are influenced by hypnotic ability, social factors, and motivation (Barnier & Oakley, 2010). However, there are good reasons to speculate that this hypnotic top-down process may result in neural patterns that are similar to those found in clinical cases.

7. Conclusion

In this paper, we argued that using hypnosis to model delusions can improve our understanding of the surface features of clinical delusions and of the underlying mechanisms responsible for delusion formation. The behavior of clinical patients with delusions of mirrored self misidentification and that of hypnotic subjects who are given a suggestion to see a stranger in the mirror present striking analogies. Both clinical patients and hypnotic subjects report their beliefs with conviction and hold on to their beliefs when confronted with evidence that contradicts them. Further, both clinical patients and hypnotic subjects provide confabulatory explanations to account for their delusional beliefs.

Although hypnotically induced delusions are temporary and less intense than their clinical counterparts, and although individual differences can be observed across clinical and experimental samples, there are good reasons to regard hypnotically induced delusions as a reliable model for the study of the behavioral manifestations of clinical delusions.

Further research is required to explore whether there are also relevant analogies in the processes underlying the formation of clinical and hypnotically induced delusions. However, current evidence suggests that hypnosis may be able to model clinical delusions "all the way down to the brain." Indeed, the available evidence on the instrumental uses of hypnosis and the evidence we presented on mirrored self misidentification speak in favour of the view that the cognitive mechanisms involved in delusion formation are variations of those involved in the formation of beliefs in general.

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