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Déjà Vu in the Laboratory:
A Behavioral and Experiential Comparison of
Posthypnotic Amnesia and Posthypnotic Familiarity

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Abstract

This experiment aimed to create a laboratory analogue of déjà vu. During hypnosis, one group of high hypnotizables completed a puzzle game and then received a posthypnotic amnesia suggestion to forget the game (PHA condition). Another group of highs were not given the game, but received a posthypnotic familiarity suggestion that it would feel familiar (PHF condition). After hypnosis, all participants were given the game and described their reactions to it. Whereas 83% of participants in both condition passed their respective suggestions, more in the PHF condition felt a sense of déjà vu. An EAT inquiry revealed that they experienced sensory fascination and confusion about the source of familiarity, akin to everyday déjà vu. These findings highlight the value of using hypnosis as a laboratory analogue of déjà vu and provide a framework for investigating clinical manifestations of this phenomenon.

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Déjà vu is the mysterious, fleeting sensation of having seen or lived unfamiliar situations before. Déjà vu has been defined as “a clash between two simultaneous and opposing mental evaluations: an objective assessment of unfamiliarity juxtaposed with a subjective evaluation of familiarity” (Brown, 2004, p. 2). Thus, it involves an erroneous or inappropriate feeling of familiarity for present information and/or events, combined with awareness that this feeling of familiarity is incorrect. Although déjà vu is a fairly common experience (Brown, 2004; Richardson & Winokur, 1967), it is highly unpredictable and usually brief, making it difficult to investigate experimentally. To address this difficulty, in this experiment we used hypnotic suggestions to create déjà vu in the laboratory. We approached this research from a cognitive neuropsychological perspective (similar to the approach taken by Moulin, Conway, Thompson, James, & Jones, 2005 and Moulin et al., 2006) by adopting a case-study approach and focusing on a small number of carefully selected high hypnotizable participants. This approach is also consistent with neuroimaging work involving hypnosis (e.g., Barabasz & Barabasz, in press; Derbyshire, Whalley, Stenger, & Oakley, 2004; Halligan, Athwal, Oakley, & Frackowiak, 2000; Oakley, in press; Rainville, Duncan, Price, Carrier, & Bushnell, 1997; Raz, Fan, & Posner, 2005). Specifically, we compared déjà vu like experiences following either a posthypnotic amnesia suggestion or a posthypnotic familiarity suggestion.

Approximately 97% of the population have experienced déjà vu at least once and 67% experience it regularly. Déjà vu is more common in younger people and is more likely to occur when the person is fatigued or travelling (Richardson & Winokur, 1967). Experiences of déjà vu can last from two to thirty seconds before dissipating with no untoward effects

(Neppe, 1983). Déjà vu is characterised by both perceptual salience and confusion. The following description captures the essence of the sensation: “hearing, touch and smell often seem to intermingle in the déjà vu experiences. It is almost like photographic memory....as if I was encountering a mini-recording in my head but trying to think ‘where have I come across that before?’” (O'Connor & Moulin, 2006, p. 247).

Déjà vu was originally explained in terms of “optical pathway delay” (e.g. Osborn, 1884). According to this theory, one optical pathway lags behind the other, disrupting the usual simultaneous visual input received by the brain. This results in two separate signals reaching the brain, where the second signal is interpreted as “familiar”. This inappropriate feeling of familiarity gives rise to the sensation of déjà vu. However, the optical pathway delay account is inconsistent with findings that individuals who lack input from the optic nerve (in particular forms of blindness) also experience déjà vu (O'Connor & Moulin, 2006) and that déjà vu is experienced across multiple sensory modalities, not just vision. Instead, recent research has indicated that the conscious experience of familiarity is associated with activation of the medial temporal lobe (Aggleton & Brown, 1999; Vignal, Maillard, McGonigal, & Chauvel, 2007). When a familiar stimulus is encountered, the medial temporal lobe is activated appropriately, and a normal sensation of familiarity arises with accompanying memories of previously experienced events. However, if the medial temporal lobe is activated inappropriately in response to an unfamiliar stimulus, an individual may experience familiarity without accompanying memories – producing the sensation of déjà vu (Vignal et al., 2007). In other words, déjà vu is the consequence of a dissociation between two normally congruent aspects of remembering – memory and familiarity.

Déjà vu can also take a more disruptive and debilitating clinical form, known as déjà vecu. Déjà vecu was traditionally used as a term to describe events that felt as though they had been “already lived through” (for information on a range of déjà vu experiences including

déjà vecu, see Funkhouser, 1995). However, more recently it has been conceptualized as a pathological form of déjà vu (Moulin et al., 2005). Déjà vecu is characterised by a persistent and overwhelming sense of déjà vu for many experiences in daily life, which should not be familiar to the sufferer. It has been primarily reported in individuals with dementia (Moulin et al., 2005; Moulin et al., 2006) but it is also thought to occur in individuals with temporal lobe epilepsy (Adachi et al., 1999), migraine (Sacks, 1970), and psychosis (Murai & Fukao, 2003). Unlike déjà vu, déjà vecu has behavioral consequences. Patients believe that they have previously experienced the situations and events that feel (falsely) familiar, so they withdraw from any activity that feels familiar to them. Patients confabulate to explain such behavior, justifying their sensations of familiarity with beliefs bordering on delusion. The case of patient AKP illustrates these features well (Moulin et al., 2006). Following significant memory problems, AKP was diagnosed with dementia. As his memory declined, AKP's carer noticed that he stopped reading the newspaper, an activity he'd always enjoyed as one of his last links to the outside world. When questioned, AKP said that he didn't want to read the paper because he'd already read it. Whenever each day's paper arrived, he said he'd read and remembered every story it contained. But he hadn't read the paper – he was experiencing déjà vu. Ironically, although AKP's dementia meant that he had difficulty remembering events he had experienced, events that he had not experienced felt familiar. AKP not only went to great lengths to justify these feelings – he claimed he had woken up early, walked to the newsagent and read the paper there, before returning to bed – AKP changed his behavior in a way that reduced the quality of his life.

There is clear value in investigating the nature of the mysterious, yet rather common, experience of déjà vu and its relationship to the debilitating clinical condition of déjà vecu. But, as noted above, déjà vu is not an easy phenomenon to investigate. Because déjà vu is unpredictable, fleeting, and cannot be produced on demand, research has tended to rely on

retrospective reports. While such reports yield important data, it is difficult to disentangle the specific factors that trigger déjà vu. For instance, Linn (1953) noted that during World War II, soldiers marching across Europe frequently experienced déjà vu. These sensations may have been due to any number of factors – novel terrain, fatigue, stress – and the retrospective reports themselves may have been unreliable. Additionally, the only current way to investigate déjà vu involves neuropsychological case-studies. A better solution would be to develop the means to systematically investigate déjà vu in the laboratory.

In our view, hypnosis has the potential to provide a reliable laboratory analogue of déjà vu. Hypnosis has been used instrumentally (Reyher, 1961) to successfully model a range of clinical conditions, including dissociative disorders, conversion and somatoform disorders and clinical delusions (Barnier, 2002; Barnier, McConkey, & Wright, 2004; Blum, 1975; Bryant & McConkey, 1989a, 1989b; Burn, Barnier, & McConkey, 2001; Cox & Barnier, 2003; Halligan, Bass, & Wade, 2000; Noble & McConkey, 1995; Woody & Szechtman, 2000; Zimbardo, Andersen & Kabat, 1981; for review, see Barnier & McConkey, 1999; Cox & Bryant, in press; Kihlstrom, 1979; Kihlstrom & Hoyt, 1988; Oakley, 2006). Also, hypnotic suggestions have been used to create anomalous experiences (i.e., experiences that are statistically uncommon, experiences that may not be uncommon but that deviate from normal experience, and experiences that challenge standard explanations of reality; Cardena, Lynn, & Krippner, 2000) that are conceptually similar to déjà vu (e.g., a positive visual hallucination suggestion to see an object that is not present is conceptually similar to experiencing a sense of familiarity for an event that has not been experienced), as well as to create disjunctions between perception and awareness. For instance, Zimbardo et al. (1981) gave participants a posthypnotic suggestion for deafness with or without accompanying amnesia for the suggestion. Following hypnosis, participants who experienced deafness but were amnesic for the suggestion (and the source of their deafness) scored higher on a measure

of paranoia when confronted with two confederates apparently whispering, than did participants who experienced deafness but remembered the suggestion (and were aware of the source of their deafness). Thus, if hypnosis can produce a dissociation between perception and awareness, it is just as likely to produce a dissociation between memory and familiarity, similar to déjà vu (see also Sheehan, McConkey, & Cross, 1978).

Banister and Zangwill (1941) pioneered the use of hypnosis to experimentally create déjà vu. Before a hypnotic induction, participants were shown a set of pictures. Following the induction, they were administered a posthypnotic amnesia suggestion for these pictures. After a deinduction, they were shown the pictures again. Approximately 30% of participants reported a déjà vu-like experience for the pictures. However, Banister and Zangwill's (1941) use of posthypnotic amnesia is inconsistent with our current knowledge and understanding of déjà vu. In this study, when participants were shown the pictures again after hypnosis, they experienced an appropriate feeling of familiarity because they had encountered the pictures previously (during hypnosis). However, the posthypnotic amnesia suggestion led to an erroneous belief that the pictures were new. Whereas these participants experienced *true* familiarity for previously encountered stimuli, déjà vu involves *false* familiarity for stimuli that has not been previously encountered.

The aim of the present study was to develop a laboratory analogue of déjà vu consistent with our current understanding of déjà vu, involving false familiarity for an unfamiliar stimulus. We compared déjà vu experiences following a posthypnotic amnesia suggestion with déjà vu experiences following a posthypnotic familiarity suggestion. The posthypnotic amnesia suggestion was based on Banister and Zangwill's (1941) work. The posthypnotic familiarity suggestion was based on work by O'Connor, Moulin, and Conway (2007), which involved suggested familiarity for certain words. In their study, before a hypnotic induction participants were shown a list of words. Following the induction, they

were administered a posthypnotic suggestion that after hypnosis: (a) any words that were surrounded by a green box would be accompanied by a vivid recollection of having seen and read the word before, and (b) any words surrounded by a red box would simply feel familiar, “You may not be able to say why, but words presented in a red frame will simply appear familiar to you”. After a deinduction, participants were shown old and new words surrounded by either a green, red, or blue box. Approximately 30% of participants reported a déjà vu-like experience for the words. For instance, one said: “some words seemed a lot more familiar than others, even though I wasn't sure they had appeared in the main word list”.

To extend O'Connor et al.'s (2007) promising posthypnotic familiarity method to more complex experiences, as well as to compare it with Banister and Zangwill's (1941) posthypnotic amnesia method, in this experiment we tested 12 carefully screened, very talented high hypnotizable participants. This small, select group was based on the case-study approach typically seen in cognitive neuropsychological research. Following an hypnotic induction, we gave half of the participants a behavioral task, a puzzle game, followed by a posthypnotic amnesia suggestion: we suggested that after hypnosis they would not remember having attempted the puzzle game during hypnosis (*posthypnotic amnesia condition*). The other half of the participants did not attempt the puzzle game, but we gave them a posthypnotic familiarity suggestion: we suggested that after hypnosis they would experience the puzzle game as overwhelmingly familiar (*posthypnotic familiarity condition*). Following a deinduction, we gave all participants the puzzle game – half again and half for the first time – and asked for their reactions to the game.

Since déjà vu is a compelling private experience, we used multiple methods to index participants' reactions to these suggestions and to the puzzle game. We measured pass rates for the suggestions, we noted whether participants completed the puzzle game and the time they took to do it, and we asked for subjective ratings about the game. We also implemented

Sheehan and McConkey's (1982) Experiential Analysis Technique (EAT), which involves videotaping the hypnosis session and the participant and an independent experimenter watching it together in order to gain a deeper understanding of the individual's behavioral and subjective responding (for review, see McConkey, in press; Sheehan, 1991). In our experiment, the EAT focused on the quality of participants' experiences of familiarity or déjà vu for the puzzle task, and how this compared to normal, everyday déjà vu.

We expected that our high hypnotizable participants would easily pass the amnesia and familiarity suggestions, but that their experiences of the behavioral task would be quite different. Whereas we expected that participants in the posthypnotic amnesia condition would report little or no explicit memory for attempting the puzzle game, their responding and comments might reflect implicit awareness of attempting the game during hypnosis. Importantly, we did not expect these individuals to experience déjà vu as they attempted the puzzle game after hypnosis. In contrast, we expected that participants in the posthypnotic familiarity condition would report compelling experiences of familiarity, and perhaps déjà vu, as they attempted the puzzle game for the first time after hypnosis.

Method

Participants and Design

We tested 12 (6 male, 6 female) very high hypnotizable individuals who were undergraduate psychology students at the University of New South Wales, Sydney, Australia. They participated in our experiment in return for either research credit of 2 hours or AUS\$25 (if credit was not required). We carefully selected these participants on the basis of their extremely high scores on a 10-item modified version of the Harvard Group Scale of Hypnotic Susceptibility, Form A (HGSHS:A; Shor & Orne, 1962) and a 10-item tailored version of the Stanford Hypnotic Susceptibility Scale, Form C (SHSS:C; Weitzenhoffer & Hilgard, 1962).¹ All participants scored in the range 8-10 on the HGSHS:A ($M = 9.42$, $SD = 0.79$) and 9-10 on

the SHSS:C ($M = 9.67$, $SD = 0.49$). We randomly allocated 6 (3 male, 3 female) participants into the *posthypnotic amnesia condition* (hereafter “PHA condition”) and six (3 male, 3 female) participants into the *posthypnotic familiarity condition* (hereafter “PHF condition”); there was no significant difference in the hypnotizability scores of participants across these conditions (all t s < 1.16 , all p s $> .260$).

Materials

We used a video camera, focused on the participant throughout, and DVD recorder to record both the hypnosis and EAT inquiry sessions onto DVD. We used a DVD player and color monitor to play the recording of the hypnosis session to participants during the EAT inquiry session and later to transcribe hypnosis and inquiry sessions for analysis.

We used two identical sets of a puzzle game, “Railroad Rush Hour”, set up on junior level 5 as the behavioral task. We used one set during hypnosis (in the PHA condition) and the second set after hypnosis (in the PHA and PHF conditions). The aim of the game is to rearrange a number of pieces on a board so that one particular piece, the ‘little red engine’, has a clear passage to the exit.

Procedure

We tested participants individually in two hour sessions, which involved a hypnosis procedure, a posthypnotic interview, and an EAT inquiry. The hypnosis procedure and posthypnotic interview were conducted by the first experimenter (the hypnotist) and the EAT inquiry was conducted by a second, independent experimenter (the inquirer). Table 1 sets out the experimental design.

Hypnosis procedure, including hypnotic puzzle game. Following informed consent, the hypnotist told participants to make themselves comfortable and asked them about their favorite suggestion from their previous (SHSS:C) hypnosis session. She then administered a standard induction procedure (from the tailored SHSS:C; Hilgard, Crawford, Bowers, &

Kihlstrom, 1979), followed by a number of suggestions to deepen hypnosis and build rapport, which included a hand lowering suggestion, a favorite food hallucination, an identity delusion, and the previously determined favorite suggestion.

After these suggestions, the hypnotist gave participants in the PHA condition the puzzle game, which had previously been hidden from view. She explained the rules and goal of the game. She drew participants' attention to a number of details of the puzzle game, and tested their understanding of the puzzle by pointing to two points on the puzzle-board. The hypnotist's verbatim instructions were:

In a moment, I will ask you to open your eyes slowly and to lean forward to look at the puzzle board. When you open your eyes and look at the puzzle, you will notice the colored train engines and train carriages on the grey board. When you open your eyes, you will notice in particular, the little red engine and, to the right of the green engine, the exit gate, sticking out from the side of the board. Now open your eyes slowly, lean forward and look at the board. Do you see the board?

Now, close your eyes, lean back and as you listen to my voice, relax, think about the grey board and the colorful train engines and train carriages. Your task will eventually be to solve this puzzle, by moving the pieces around the board so that you can move your piece, the little red engine, out of the exit gate and place it on the table to the right of the exit gate. But when you next open your eyes, I want you just to lean forward and put a finger from your left hand on the little red engine, and a finger from your right hand on the exit gate. Now open your eyes slowly.

[Wait for participant to put fingers on engine and exit]

That's great, now let your arms return to their original positions, lean back, close your eyes and relax, still deeply hypnotized. Before you attempt the puzzle, I will tell you a rule which you must obey when you are moving the engines and carriages around the

board. You may only move the pieces one at a time, forwards, in the direction they are facing, or backwards. Remember, you solve the puzzle by moving the little red engine out of the exit gate. In a moment, I will ask you to solve the puzzle. This may take a while, but as long as you obey the rule, you may move each piece as many times as you need. As you move each piece on the board, you will continue to feel as deeply relaxed and comfortably hypnotized as you feel now. I would now like you to open your eyes slowly, lean forward, and solve the puzzle.

Participants then worked to solve the puzzle game. Task latency was recorded from the moment they started to work on the puzzle until they moved the little red engine out of the exit gate. If they did not complete the behavioral task within 3 minutes they were instructed to stop trying (and task latency was recorded as 180 sec). Following this, the hypnotist hid the puzzle game from view and administered a deepening suggestion. She then gave all participants a mosquito hallucination suggestion before administering either the posthypnotic amnesia suggestion or the posthypnotic familiarity suggestion.

For participants in the PHA condition, the hypnotist administered a specific posthypnotic amnesia suggestion that targeted participants' memory for the puzzle game (which they attempted during hypnosis). The verbatim suggestion was as follows:

After you wake up, I will give you the puzzle task to do again. You will not recall having done the task during hypnosis. As you lean forward to look at the task, you will have no memory of having done this exact action before. When you notice the little red engine and the exit gate, you will have no recollection of having looked at them before, and you will feel as though you are noticing them for the first time. As you look at the puzzle board, you will not remember having done the same thing before during hypnosis. You will not be able to bring to mind that I had earlier explained the aim of the puzzle task to you. Nor will you recall having previously placed your

fingers on the little red engine and the exit gate. All of your thoughts and actions to do with the task will be forgotten without difficulty. When you hear me explaining the rule, you will have no memory of having listened to me tell you this exact rule before. Even as I tell you to start the task and as you move the colored pieces, you will have no recollection of having moved the engines and carriages before, in the exact same way. As you hear the sounds of the pieces on the board and feel your changing emotions as you solve the puzzle task, the sounds and emotions you experienced previously during hypnosis will all be forgotten. It will be easy to forget all aspects of having done the puzzle task before, until you hear me say “Now you can remember everything”. Until then, you will not remember having done the task before.

For participants in the PHF condition, the hypnotist administered a specific posthypnotic familiarity suggestion that targeted participants’ feelings of familiarity for the puzzle game (which they would attempt after hypnosis). The verbatim suggestion was as follows:

After you wake up, I will give you a puzzle task to do. You will feel as though you have done the task before but you will not understand why you are having this feeling. As you lean forward to look at the task, you will have an overwhelming and surprising sense of familiarity – of having done this exact action before. When you notice the little red engine and the exit gate, you will believe that you have seen them before. As you look at the puzzle board, you will be overcome by an overwhelming sensation of having done exactly the same thing before. You will have an overwhelming sensation that I had earlier explained the aim of the puzzle task to you. You will even feel as though you had previously placed your fingers on the little red engine and the exit gate in the exact same way. All of your thoughts and actions to do with the task will be surprisingly familiar. However, you will not remember that, during hypnosis, I

suggested that you would feel this sensation of familiarity. When you hear me explaining the rule, you will have an overwhelming feeling that you have listened to me tell you this exact rule before. Even as I tell you to start the task and as you move the colored pieces, you will experience a surprising feeling of having moved the engines and carriages before in the exact same way. As you hear the sounds of the pieces on the board and feel your changing emotions as you solve the puzzle task, you will have an overwhelming feeling of having experienced these sounds and emotions previously. These sensations of familiarity will feel both overwhelming and surprising although you will not know why you are having these feelings until you hear me say “Now everything feels normal”. Until then, you will feel as though you have done the task before.

Finally, the hypnotist administered a standard hypnotic deinduction procedure (based on Weitzenhoffer & Hilgard, 1962) to all participants.

Posthypnotic interview, including posthypnotic puzzle game. Immediately following the deinduction procedure the hypnotist asked participants about their experiences of hypnosis from the induction to the mosquito hallucination. After at least two minutes of such conversation, the hypnotist presented participants with the second set of the puzzle game and explained the rules and goal of the game. These instructions were identical to the instructions given during hypnosis to those in the PHA condition.

Participants then worked to solve the puzzle game. As during hypnosis, task latency was recorded from the moment they started to work on the puzzle until they moved the little red engine out of the exit gate. If they did not complete the game within 3 minutes they were instructed to stop trying (and task latency was recorded as 180 sec). Following this, the hypnotist questioned participants about their experience of the puzzle game, focusing

especially on either memories or feelings of familiarity for the puzzle task. These questions were deliberately ordered from general to specific:

- 1) Tell me, what were you thinking and feeling as you were doing the puzzle task?
- 2) Do you have any memory of having seen or done this puzzle task before?
- 3) Did you feel at all familiar with any aspects of the puzzle task?
- 4) Did you notice anything unusual about how you felt when you were carrying out the puzzle task?
- 5) Could you relate any feelings you experienced during the task to sensations you may have felt in everyday life?
- 6) Did you experience the sensation of déjà vu at all during the task?
- 7) Did you ever have the feeling that you could predict what would happen next?

Finally, the hypnotist cancelled the posthypnotic suggestions. For participants in the PHA condition, the hypnotist said “Now you can remember everything”. For participants in the PHF condition, the hypnotist said “Now everything feels normal”.

EAT inquiry. The hypnotist invited the independent inquirer into the room and left. The inquirer told participants that together they would watch a DVD recording of the hypnosis session that he or she had just experienced. The inquirer left the decision to stop the videotape to participants. However, the inquirer stopped the recording and asked participants to comment on their experiences if they did not comment spontaneously on: the hypnotic puzzle game (for those in the PHA condition), the posthypnotic suggestion (both PHA and PHF versions), and the posthypnotic puzzle game (for all).

For participants in the PHA condition, during playback of the hypnotic puzzle game the inquirer asked questions such as: “What thoughts and feelings did you have while you were doing the task the first time?” The inquirer also asked participants to rate how easy or difficulty they found completing the task (1 = *very easy*, 7 = *very difficult*). During playback

of the posthypnotic amnesia suggestion, the inquirer asked questions such as: “What went through your mind as you listened to the suggestion?” and “What did you expect to happen after hypnosis?” During playback of the posthypnotic puzzle game the inquirer asked questions such as: “What thoughts did you have while you were doing the task this time?” and “Did you notice anything unusual about how you felt when you were doing the task?” The inquirer also asked participants to rate again how easy or difficulty they found completing the task.

For participants in the PHF condition, during playback of the posthypnotic familiarity suggestion, the inquirer asked questions such as “What went through your mind as you listened to the suggestion?” and “What did you expect to happen after hypnosis?” During playback of the posthypnotic puzzle game the inquirer asked questions such as: “What thoughts did you have while you were doing the task?” and “Did you notice anything unusual about how you felt when you were doing the task?” The inquirer also asked participants to rate how easy or difficulty they found completing the task (1 = *very easy*, 7 = *very difficult*). Finally, the inquirer answered participants’ questions and debriefed them.

Results

Response to Suggestion

We scored participants in the PHA condition as passing the suggestion if during the posthypnotic interview they reported no memory of completing the puzzle game (for the first time) during hypnosis. We scored participants in the PHF condition as passing the suggestion if during the posthypnotic interview they reported that the puzzle game (which they completed for the first time after hypnosis) felt familiar.²

In both the PHA and PHF conditions, five (83.3%) participants passed the suggestion and one did not. When the hypnotist asked participants in the PHA condition “Do you have any memory of having seen or done this puzzle task before?” they made comments such as

“...only when I was a child. My brother had one so we used to play with that on long car trips” and “I’ve done it before when I was a kid. I don’t know if it was that exact one but it was the same kind of thing.” When the hypnotist asked participants in the PHF condition “Did you feel at all familiar with any aspects of the puzzle task?” they made comments such as “I felt like I’d done that exact same thing before” and “like the engine ... how it feels and how it slides on the board. It just seems familiar.”

Completing the Puzzle Task

We scored participants as completing the puzzle game if they moved the ‘little red engine’ through the exit gate within 3 minutes. We also recorded latency to complete the puzzle; failure to complete was recorded as 180 sec.

Table 2 presents the number (and percentage) of participants who completed the puzzle game and their average latency to complete. Time 1 refers to participants’ first attempt at the puzzle. For participants in the PHA condition, Time 1 was during hypnosis and Time 2 was after hypnosis. For participants in the PHF condition, Time 1 was after hypnosis. In the PHA condition, all participants completed the puzzle within 3 minutes by their second attempt (after hypnosis). In the PHF condition, all but one participant completed the task within 3 minutes on their first and only attempt (after hypnosis). Participants in the PHA condition tended to complete the puzzle more quickly at Time 2 compared to Time 1, $t(5) = 2.39$, $p = .06$. Not surprisingly, they were quicker on their second attempt. However, participants in the PHF condition completed the puzzle task in about the same time as participants in the PHA condition (Time 1 or Time 2; all $t_s(10) < .89$, all $p_s > .40$). This remains the case even if participants who did not complete the puzzle task are excluded from analyses (all $t_s(7) < 1.0$, all $p_s > .40$). Table 2 also presents participants’ ratings of task difficulty. A paired samples t test indicated no significant difference in ratings of task difficulty in the PHA condition between Time 1 and Time 2, $t(5) = 2.00$, $p = .10$. Separate independent samples t tests also

indicated no significant difference between PHA and PHF conditions at Time 1, and no significant difference between PHA at Time 2 and PHF at Time 1 (all $t_s(10) < .83$, all $p_s > .43$). Thus, participants in both the PHA and PHF conditions reported a similar level of difficulty in completing the puzzle.

These data indicate that the (false) familiarity for the puzzle task reported by participants in the PHF condition did not lead to faster completion times compared to those in the PHA condition. However, this sense of (false) familiarity led to ratings of task difficulty closest to ratings made by those in the PHA condition at Time 2 (rather than Time 1). In other words, the sense of (false) familiarity did not translate to a behavioral advantage, but it did make the task feel slightly easier.

Experiences of Familiarity and Déjà vu

We categorized participants' reported experiences of familiarity as "strong", "weak", or "none" based on either their spontaneous comments or responses to questions during the posthypnotic interview. We coded familiarity as "strong" if participants' comments indicated a strong, noticeable sense of familiarity for the puzzle game. Such comments included "I feel like I've done it years and years ago" and "I've seen it before, I've done it before." We coded familiarity as "weak" if participants' comments indicated a weak and not especially compelling sense of familiarity for the puzzle task. Such comments included "maybe vaguely, maybe not this exact one, maybe something similar" and "I think I might have seen it before." We coded familiarity as "none" if participants denied any sense of familiarity or made no comments about the puzzle game being familiar.

In the PHA condition, 3 (50.0%) participants experienced a strong sense of familiarity, 2 (33.3%) experienced a weak sense of familiarity, and 1 (16.7%) experienced no sense of familiarity. In the PHF condition, 4 (66.7%) experienced a strong sense of familiarity, 1 (16.7%) experienced a weak sense of familiarity, and 1 (16.7%) experienced no sense of

familiarity. There was no difference between the PHA and PHF conditions in their pattern of experienced familiarity, $\chi^2(2, N = 12) = .48, p = .79$. Irrespective of the particular posthypnotic suggestion, more than half of the participants described a strong sense of familiarity. For instance, one participant commented “I’m trying to work out where I’ve done that before...it just looks really familiar.”

We categorized participants’ reported experiences of déjà vu in the same way – as “strong”, “weak”, or “none” based on either their spontaneous comments or responses to questions during the posthypnotic interview. We coded déjà vu as “strong” if participants’ comments indicated a strong, noticeable, specific sense of déjà vu for the puzzle game. Such comments included “It was pretty déjà vu...I think I’ve done something similar to it before” and “I felt like I had done that puzzle before...that exact one.” We coded déjà vu as “weak” if participants’ comments indicated a weak, non-specific, and not especially compelling sense of déjà vu for the puzzle game. Such comments included “For some reason I feel like I may have seen it before or spoken to someone about something similar before.” We coded déjà vu as “none” if participants denied any sense of déjà vu or made no comments about experiencing déjà vu for the puzzle game.

In the PHA condition, no participants experienced a strong sense of déjà vu, 3 (50.0%) experienced a weak sense of déjà vu, and 3 (50.0%) experienced no sense of déjà vu. In the PHF condition, 5 (83.3%) experienced a strong sense of déjà vu and 1 (16.7%) experienced no sense of déjà vu. This pattern of experienced déjà vu differed significantly across the PHA and PHF conditions, $\chi^2(2, N = 12) = 9.00, p = .01$. That is, the PHF suggestion was more likely to lead to a strong sense of déjà vu. For instance, one participant in this condition said “it just feels like I’ve done it before...the feeling of how it slides”; another said “I remember the different colors and the different parts of the puzzle and the aim of the puzzle, the exit and the red engine.”

In analyzing participants' comments during the posthypnotic inquiry, we coded: (1) whether their comments about the familiarity of the puzzle game were spontaneous and unsuggested or made only in response to direct questions from the hypnotist; (2) whether they explained the experience of familiarity as a consequence of a specific past event ("past event based"), as a consequence of completing the task during hypnosis ("recent event based"), or were unsure of the source of familiarity ("unsure"); and (3) whether participants' sense of familiarity was free-floating and confused ("confused") or was readily explained ("confident").

Participants in the PHA condition tended not to make spontaneous comments about the familiarity of the behavioral task (16.7%), and were more likely to explain their experience of familiarity as a consequence of a specific past event (66.7%); for instance, one participant said "I just remember it from the next-door neighbours... they've got the same little set"; another said "I had a smaller version of that when I was a kid." Participants in this condition also tended to be very confident about the source of their sense of familiarity for the puzzle game, giving ready explanations such as "because I used to play with it as a kid that's why I knew how to do it." In contrast, the majority of participants in the PHF condition made spontaneous comments (66.7%) about their sense of familiarity for the puzzle game, yet were unsure how to explain this familiarity (66.7%). They said things like "I'm trying to work out where I've done that before...it just looks really familiar." Relatedly, participants in this condition were much less confident (33.3%) about the source of their sense of familiarity; they had more difficulty in explaining it. One said "Did we do it in an experiment? I don't know...I've done that before, I just don't remember when."

To illustrate the important differences between the reactions of participants in the PHA and PHF conditions, following are excerpts from the posthypnotic interview with a male participant in the PHA condition and a male participant in the PHF condition.

Response to Posthypnotic Amnesia Suggestion

Hypnotist: What were you thinking and feeling as you were doing that task [puzzle game]?

Participant: Pretty much every piece would have to move. Every piece has to move and you have to go backwards before you go forwards.

Hypnotist: And do you have any memory of having seen or done this task before?

Participant: No.

Hypnotist: Did you feel at all familiar with any aspects of the task?

Participant: I've done it before when I was a kid. I don't know if it was that exact one but it was the same kind of thing.

Hypnotist: And did you notice anything unusual about how you felt when you were carrying out the task?

Participant: [Participant shakes head and pulls face]

Hypnotist: Could you relate any feelings you experienced during the task to sensations you may have felt in everyday life?

Participant: Not really, it was just a puzzle that I did.

Hypnotist: Did you experience the sensation of déjà vu at all during the task?

Participant: [Participant shakes head and pulls face] No.

Hypnotist: And did you ever have the feeling you could predict what would happen next?

Participant: Only after I looked at it and realised where the green one had to go.

Response to Posthypnotic Familiarity Suggestion

Hypnotist: Just tell me what you were thinking and feeling as you were doing the puzzle task.

- Participant: I think I've done something like this before. I dunno...I was just looking at what had to go where and how it could be manipulated. Actually, when I first looked at it I thought I wouldn't expect to finish it but once I started doing it, it made sense. It was just a bit odd.
- Hypnotist: So you told me that you felt as though you had done it before. Tell me a bit about that.
- Participant: It was pretty déjà vu. It seems like a real childhood toy kind of thing. I think I've done something similar to it before.
- Hypnotist: Can you tell me when you might have done that?
- Participant: I'm not sure. Probably when I was a kid or something.
- Hypnotist: Were there any particular aspects of the task that seemed familiar?
- Participant: Like the engine...how it feels and how it slides on the board. It just seems familiar.
- Hypnotist: And you mention that it feels like déjà vu...
- Participant: Yes.
- Hypnotist: Can you tell me a bit about that?
- Participant: It just feels like I've done it before. The feeling of how it slides over and stuff. It's like...it wasn't a surprise to me how they moved.
- Hypnotist: And do you think...
- Participant: I think I might have seen it before.
- Hypnotist: Was there anything else you were thinking or feeling whilst you were doing the task?
- Participant: I was hoping I would solve it because it would be embarrassing if I couldn't...saying it's like a kid's thing.

During the EAT inquiry a number of interesting themes emerged, which also illustrate differences between the PHA and PHF conditions. These themes surrounded: (1) participants' interpretations of the suggestion; (2) confusion about the familiarity experienced for the puzzle game; (3) fascination with the sensory aspects of the puzzle game; (4) breaching of the posthypnotic amnesia; (5) the relationship between déjà vu in the laboratory and naturally occurring déjà vu; and (6) task focus.

To explore participants' interpretation of the suggestion, we asked them to describe their thoughts and expectations as they listened to the suggestion. While listening to the suggestion, participants in the PHA condition focused on attempting to forget their initial completion of the puzzle task. They made comments such as "I was trying to think about how I would forget about remembering it...I just had to suppress it...think about other things", and "I focused on forgetting...I sort of just compiled it and packaged everything that I had done...then just sort of put it aside in my mind." Participants in the PHF condition described attempting to visualize the puzzle, but they were also quite confused about what to expect. Their comments included: "it was a little bit confusing because she was talking about the red engine and the exit gate and I had no idea about what the red engine and the exit gate were", and "I was imagining something...and it's hard to imagine something you've never seen before so I was just concentrating on what she said, the fact she'd mentioned the red fire engine and the fact she'd mentioned the gate."

During the EAT participants in the PHF condition commented in ways that indicated they felt confused about the familiarity they felt for the puzzle game. For instance, one said "A little bit confused because I felt like I knew exactly what I had to do, and I'd done it before, but it was frustrating that I couldn't do it"; another said "I remember thinking I've seen this before. Then I remember thinking 'why?' Why would I feel like I've done this before?", and a third said "when she started explaining the rules I was going yeah I know the rules...when?

When did I find this out? When did I? When did I do it?” In contrast, participants in the PHA condition commented in ways that indicated they were confident, rather than confused, in the source of the familiarity.

Participants’ EAT comments also suggested a strong sensory fascination. Participants in the PHF condition in particular appeared to be captured by the sensory features of the puzzle game, such as the colors of the pieces, the sounds the pieces made when sliding across the board, and how the pieces felt as they moved. For example, one said: “it just feels like I’ve done it before....the feeling of how it slides over and stuff”; another said “one of the main things that stuck out at me was how it felt and how they moved”, and a third said “I remembered very strongly it was a red engine and it had to go out of the exit and you had to slide things....and the little carriages in plastic”. In contrast, participants in the PHA condition tended to focus more on how they were going to complete the puzzle task.

We thought it was possible that re-presenting participants in the PHA condition with the same puzzle game following hypnosis would breach their posthypnotic amnesia. Indeed, although these participants did not report any memory of completing the task at Time 1, during the EAT they commented in ways that suggested some awareness of having done so. For example, one said: “maybe I did remember doing it and I was trying not to remember for the sake of the suggestion”; another said “I remembered that I did it before but I couldn’t remember how I did it.” Thus, the familiarity reported by 5 participants in this condition (3 strong, 2 weak) may reflect in part, breaching of the posthypnotic amnesia.

During the EAT, we also asked participants whether they could relate any feelings they experienced during the puzzle game to sensations they experienced in everyday life. This question was intended to explore whether déjà vu in the laboratory was experientially similar to déjà vu in everyday life. Participants in the PHA condition either said that they did not experience déjà vu for the puzzle or said that their experience with the puzzle was much less

compelling than the déjà vu that they've experienced in their everyday lives. For instance, one said "with déjà vu (that occurs naturally) it usually hits me straight away...like ooh I know this. This (experiment) was more like have I or haven't I ... not as strong." In contrast, participants in the PHF condition commented in ways that suggested that the déjà vu they experienced for the puzzle was similar to the déjà vu they've experienced in their everyday lives. For instance, one said "It was like most of the déjà vus I have because I can really lose myself in déjà vu...it felt like I had done it before"; another said "I recognised the parts, I remembered how I saw it...it felt comforting and familiar." One participant in this condition claimed that her experience of déjà vu was so compelling that she felt she could predict what would happen next. She said "I felt as though I had power and knowledge and confidence...I thought I was on top of the problem."

Finally, based on participants' descriptions during the EAT of how they went about completing the puzzle game, two raters coded their focus as being either "sensory focus" where they focused on the sensory aspects of the game such as the colors of the pieces or the sound of the pieces sliding, "event focus" where they focused on a past event involving the puzzle game, or "strategic focus" where they focused on solving the puzzle. Participants could be coded as having more than one of these types of focus. In the PHA condition, 16.7% of participants were coded as having a sensory focus, 33.3% were coded as having an event focus and 66.7% were coded as having a strategic focus. In the PHF condition, 66.7% were coded as having a sensory focus, 16.7% were coded as having an event focus and 66.7% were coded as having a strategic focus. Thus, more participants in the PHF condition compared to the PHA condition focused on the sensory aspects of the puzzle game as illustrated by their comments indicating sensory fascination. In both the PHA and PHF condition, many participants were also focused on completing the puzzle game. This strategic focus is illustrated by comments including "when I was doing the puzzle task I was just trying to focus

on getting it done”, and “I thought why is it that this feels really familiar...but I was kind of more focusing on how I was going to solve the puzzle.”

Discussion

This experiment is one of only a handful to attempt to capture the mysterious, fleeting sensation of déjà vu in the laboratory (e.g., Banister & Zangwill, 1941; O'Connor, Moulin, & Conway, 2007). It is the first to compare two potential hypnotic analogues of déjà vu based on suggestions for posthypnotic amnesia and posthypnotic familiarity. Both suggestions were successful: participants who received the amnesia suggestion reported no memory of completing the puzzle game (for the first time) during hypnosis; participants who received the familiarity suggestion reported that the puzzle game (which they completed for the first time after hypnosis) felt familiar. However, these suggestions lead to quite different “déjà vu” experiences.

According to Brown (2004), déjà vu involves “an objective assessment of unfamiliarity juxtaposed with a subjective evaluation of familiarity” (p. 2). Whereas our posthypnotic familiarity suggestion created an analogue consistent with this understanding of déjà vu, our posthypnotic amnesia suggestion did not. Focusing first on the PHA condition, five of the six participants in this condition passed the suggestion, and five of the six reported (either strong or weak) feelings of familiarity for the puzzle game. However, only three of the six experienced a sense of déjà vu; these feelings were weak and only reported in response to questioning from the experimenter. These percentages and reported experiences are consistent with Banister and Zangwill’s (1941) findings. Like these earlier data, the results from our PHA condition are best interpreted in terms of source amnesia or breaching of the amnesia. Although during the posthypnotic inquiry participants in the PHA condition reported no complete, explicit memory of completing the task at Time 1, they did indicate familiarity for the task during the EAT inquiry. These participants experienced true familiarity for a recently

experienced, but (totally or partially) forgotten event. Some participants confidently attributed this familiarity to an earlier event in their lives, which is more akin to the phenomenon of *source amnesia* (where information learned during hypnosis is recalled following hypnosis but the source of that information, the hypnotic context, is forgotten; Evans, 1979; Evans & Thorne, 1966). Other participants attributed this familiarity to an increasing recognition (over the course of the inquiry) that they may have completed the puzzle game during hypnosis, which is more akin to the phenomenon of *breaching* (where posthypnotic amnesia is partially or completely reversed (“breached”) before the cancellation cue in response to cues to the forgotten material or social/motivational demands; Coe, 1996). Overall, the experiences of participants in the PHA condition seemed quite unlike déjà vu experiences in everyday life.

In contrast, the PHF condition, which we based on earlier work by O’Connor et al. (2007), was more successful in mapping everyday déjà vu. Five of the six participants in this condition passed the suggestion, and five of the six reported (either strong or weak) feelings of familiarity for the puzzle game. Most importantly, five of the six experienced a sense of déjà vu; these feelings were strong and often reported spontaneously. The comments of these participants, highlighted by our use of detailed posthypnotic and EAT inquires, suggested that their déjà vu experiences were characterised by perceptual salience and confusion, very similar to déjà vu “in the wild”. Specifically, participants given the posthypnotic familiarity suggestion talked often about the sensory features of the puzzle game – the feeling of the pieces sliding, the sound of them moving and the color of the engine. They also indicated that they were confused about why the game felt so familiar; they struggled to work out whether and when they might have experienced it before, much like in everyday déjà vu.

By adopting a cognitive neuropsychological approach and focusing on a select group of high hypnotisable individuals, our findings suggest that posthypnotic familiarity is a viable method for creating and investigating déjà vu in the laboratory. This approach has allowed us

to establish a hypnotic paradigm for investigating déjà vu and provides a framework for future research using a larger sample size. This success adds to other recent contributions of instrumental hypnosis including, for instance, investigations of functional amnesia, functional blindness, delusions, auditory hallucinations, pain, and disorders of motor control (Barnier, 2002; Barnier & McConkey, 1999; Blakemore, Oakley, & Frith, 2003; Cox & Bryant, in press; Bryant & McConkey, 1989a, 1989b; Cox & Barnier, 2003; Halligan et al., 2000; Rainville et al., 1997; Woody & Szechtman, 2000; Zimbardo et al., 1981). However, there are limitations to this laboratory analogue that we need to acknowledge and address in future research.

First, in this experiment, the target of our suggestions – the object of déjà vu – was a puzzle game. A number of participants noted that their everyday experiences of déjà vu more commonly involve places and situations, rather than particular tasks (consistent with findings from retrospective reports; e.g., Brown, Porter, & Nix, 1994). Although focusing a posthypnotic familiarity suggestion on a more general place or situation, rather than a specific, time-limited task such as the puzzle game, may require a little ingenuity and pilot testing on the part of the experimenter, hypnosis research in related areas gives us reason to hope that suggestions for more complex events and stimuli would be equally successful. For instance, in a recent program of research, Barnier and her colleagues have extended posthypnotic amnesia for simple word lists to complex, emotional autobiographical memories (Barnier, 2002; Barnier & McConkey, 1999; Barnier, McConkey, & Wright, 2004; Cox & Barnier, 2003).

Second, one participant claimed that her laboratory experience of suggested déjà vu was different to everyday déjà vu because she was convinced that she *had* done the puzzle task before, whereas in everyday déjà vu she is sure that she *has not* previously experienced the situation. Although most participants denied ever seeing the puzzle before, we did not

control for whether they may have completed a similar task at some stage in their lives. However, it is more likely that in this case, the suggestion of familiarity (to a highly hypnotizable person) was almost too successful in that it diminished one vital component of déjà vu: the awareness that the familiarity was false. Thus, to accurately model déjà vu we need to balance the success of the suggestion for (false) familiarity with intact source monitoring (that the felt familiarity is indeed false).

Third, and more generally, a number of participants commented that the déjà vu they experienced in response to the posthypnotic familiarity suggestion was not as strong as déjà vu “in the wild”. This may have been due to the demands of the puzzle game. Two thirds of participants commented in ways that indicated they maintained a strong focus on completing the puzzle. Focusing on the task may have drawn attention away from the anomalous sensation of false familiarity. When people experience déjà vu in everyday life, the sensation typically captures their attention; they often pause to examine this internal state (comparing the feeling they are experiencing with their knowledge of the accuracy of the feeling). Participants’ focus on completing the puzzle game may have meant that relatively few attentional resources were available to focus on the sensation of déjà vu itself. Indeed, it is an interesting question whether déjà vu or déjà vecu might be “treated” by an attentional manipulation that directs the focus away from the internal, false familiarity state. For the purposes of this research, we may be able to generate an even closer analogue of everyday déjà vu by focusing posthypnotic familiarity on a task, situation or event that requires less attention and thus allows for greater introspection should déjà vu arise.

Although strong inferences from this experiment must await additional work with larger groups and appropriate controls (e.g., the real-simulating paradigm could be usefully implemented to explore the social and contextual demands of hypnotically elicited déjà vu; Orne, 1959, 1962), our findings suggest that hypnosis is a useful technique for creating and

studying déjà vu in the laboratory. Further development of this technique should compare its ability to model the “surface features” of déjà vu (as demonstrated in this experiment by reports of compelling familiarity, sensory fascination, and confusion about the source of the familiarity) with its ability to model the processes that drive déjà vu (e.g., dissociations between memory and familiarity and the involvement of the medial temporal lobe; Aggleton & Brown, 1999; Brown, 2004; Vignal et al., 2007; for a discussion of hypnotic models of surface features vs. processes, see Kihlstrom & Hoyt, 1988). Laying this issue aside, a hypnotic analogue of déjà vu offers a novel way to advance our understanding of its disruptive and debilitating clinical form -- déjà vecu. Currently, the only method for investigating déjà vecu is via neuropsychological case studies; there is no experimental analogue that reliably elicits feelings of false familiarity that have behavioral consequences. And there is very little understanding of the links between déjà vu and déjà vecu. In future work we plan to examine the role of belief formation and evaluation in déjà vu and match this to clinical cases of déjà vecu. We also hope to explore potential interventions for déjà vecu by challenging hypnotically suggested déjà vu and examining the impact of distraction techniques and/or self-monitoring training on reported déjà vu sensations.

Overall, this experiment offers more evidence of the instrumental value of hypnosis. In using hypnotic techniques to create déjà vu in the laboratory, we are developing the means by which researchers might finally be able to explore this common, yet elusive phenomenon in a systematic and reliable way.

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Footnotes

¹The 10-item modified HGSHS:A included: head falling, eye closure, hand lowering, finger lock, moving hands together, communication inhibition, experiencing of fly, eye catelepsy, posthypnotic suggestion, and posthypnotic amnesia; arm rigidity and arm immobilization items were removed to ensure that the procedure could be conducted within the time limits of a 1 hour class. The 10-item tailored SHSS:C included: hand lowering, moving hands apart, mosquito hallucination, taste hallucination, arm rigidity, dream, age regression, arm immobilization, negative visual hallucination, and posthypnotic amnesia; anosmia and auditory hallucination items were removed to ensure that the procedure could be conducted within the time limits of a 1 hour individual session.

²Two independent raters scored participants' transcripts. Interrater reliability was 80.3%. Disagreements, which tended to be of degree rather than of kind (especially since participants' comments during the posthypnotic inquiry and EAT inquiry sometimes were different) were resolved by discussion.

Table 1

Summary of Experimental Design

	Experimental Groups	
	Posthypnotic Amnesia	Posthypnotic Familiarity
Hypnosis Procedure	Induction	Induction
	Standard Suggestions	Standard Suggestions
	Hypnotic Puzzle Game (1)	
	Posthypnotic Amnesia Suggestion	Familiarity Suggestion
	Deinduction	Deinduction
Posthypnotic Interview	Posthypnotic Puzzle Game (2)	Posthypnotic Puzzle Game (1)
	Cancellation	Cancellation
EAT Inquiry	Discussion of Hypnotic Puzzle Game (1)	
	Discussion of Suggestion	Discussion of Suggestion
	Discussion of Posthypnotic Puzzle Game (2)	Discussion of Posthypnotic Puzzle Game (1)

Table 2

Performance and Ratings on Puzzle Game

	PHA		PHF
	Time 1 (Hypnotic Puzzle Game)	Time 2 (Posthypnotic Puzzle Game)	Time 1 (Posthypnotic Puzzle Game)
Completed	4 (66.7%)	6 (100.0%)	5 (83.3%)
Time	94.57 (69.89)	48.84 (28.43)	74.60 (65.18)
Task Difficulty	3.83 (1.83)	2.50 (1.38)	2.83 (2.32)

Note: Task Difficulty ratings were made on a scale of 1 to 7, where 1 means *extremely easy* and 7 means *extremely difficult*. For Time and Task Difficulty, standard deviations are in parentheses.