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Using suggestion to model different types of automatic writing

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ABSTRACT

Our sense of self includes awareness of our thoughts and movements, and our control over them. This feeling can be altered or lost in neuropsychiatric disorders as well as in phenomena such as "automatic writing" whereby writing is attributed to an external source. Here, we employed suggestion in highly hypnotically suggestible participants to model various experiences of automatic writing during a sentence completion task. Results showed that the induction of hypnosis, without additional suggestion, was associated with a small but significant reduction of control, ownership, and awareness for writing. Targeted suggestions produced a double dissociation between thought and movement components of writing, for both feelings of control and ownership, and additionally, reduced awareness of writing. Overall, suggestion produced selective alterations in the control, ownership, and awareness of thought and motor components of writing, thus enabling key aspects of automatic writing, observed across different clinical and cultural settings, to be modelled.

1. Introduction

Our sense of self includes the everyday experience that we are aware of our thoughts and movements, that we exercise control over them, and that they belong to us. However, the feelings of control, ownership, and awareness of thoughts and movements can be altered or lost, as is evident across a range of common neuropsychiatric disorders. For example, experiences of alien control are psychiatric symptoms occurring in schizophrenia and other forms of psychosis where patients describe components of experience and behaviour as being under the control of some force or entity outside the self – such as alien control of movement ('they inserted a computer in my brain. It makes me turn to the left or right'), and thought insertion ('I look out of the window and ... the thoughts of Eamonn Andrews [TV presenter] come into my mind') (Mellor, 1970). Narrowing or loss of awareness of thought and movement are exemplified in the case of psychogenic non-epileptic seizures, defined as "episodes of altered movement, sensation, or experiences resembling epileptic seizures ... not associated with ictal epileptiform discharges but which instead have a psychological origin" (Brown, Syed, Benbadis, LaFrance, & Reuber, 2011; Lesser, 1996). Awareness is partially or fully lost in up to 50% of these patients (Brown et al., 2011).

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Alien control of thought or movement associated with narrowing or loss of awareness is also described in culturally-influenced dissociative phenomena linked to spirit possession, mediumship, and shamanism, which have been widely reported across different cultures and periods of history (Rouget, 1985; Seligman & Kirmayer, 2008; Taves, 2006; Vitebsky, 2001). These phenomena are associated with culturally sanctioned attributions of alien control of thought, speech, or movement by supernatural agents (such as spirits or deities), in which a human intermediary is often viewed as a vehicle through which a supernatural agent communicates or reveals information to a human audience. One cross-culturally prominent form of revelation is "automatic writing", experienced or interpreted as the involuntary or automatic production of writing, typically attributed to an agent other than the usual conscious self, such as deity, spirit, or subconscious self, occurring with or without conscious awareness (Ellenberger, 1970).

More than one hundred years ago, James (1890) described how subjective experience could be altered in different ways during automatic writing. He proposed that the mind's "organised paths" can be "thrown out of gear" thereby giving rise to a range of different experiences. The present study evaluated James's proposals, by showing how targeted suggestions for automatic writing can dissociate aspects of thought and movement that are usually experienced as unitary. Automatic writing allows the investigation of different experiences of alien control involving both thought and movement within a single experimental paradigm because: (i) the normal experience of handwriting integrates both thought (thinking what to write) and movement (the motor act of writing); and (ii) phenomenological reports suggest that automatic writing can involve a range of dissociations of the control, ownership, and awareness of thought and movement when writing. For example, when analysing reports based on the widespread practice of automatic writing in Europe and North America in the late 1800s and early 1900s, the American physician Morton Prince described two different types of automatic writing (Janet & Prince, 1907). Some automatic writers reported that thoughts corresponding to the written words just "*surged apparently from nowhere without logical associative relation into the mind*". Other writers stated that they felt little or no control over their hand movements and what the hand was writing – "*my arm was lifted into the air*" (Koutstaal, 1992). Furthermore, practitioners of automatic writing have reported full awareness during the communication period, or alternatively were not aware of any messages communicated (Taves, 2006). Phenomenological accounts therefore suggest that automatic writing may involve a loss or reduction of the control and ownership of thoughts, or hand movement, either with or without a narrowing of awareness.

Following Prince's (Janet & Prince, 1907) classification, we employed suggestion as an experimental technique in an attempt to closely model the various types of automatic writing experience during a sentence completion task in highly hypnotically suggestible participants. Hypnosis involves controlled modulation of components of cognition, such as awareness, volition, perception, and belief, by an external agent (the hypnotist) employing techniques of attentional focusing and suggestion (Oakley & Halligan, 2009a,b; Oakley, 2008). As such, suggestions can create experimental models of different ways in which psychological functions and associated experiences can dissociate (Kihlstrom, 2013; Oakley & Halligan, 2009a,b). We chose to use hypnotic procedures for this study to maximise the effectiveness of the suggestions employed (Derbyshire, Whalley, & Oakley, 2009; Mazzoni, Venneri, McGeown, & Kirsch, 2013; McGeown et al., 2012). We have argued elsewhere that experimental hypnosis procedures should be considered as having two distinct and separate components (see for example (Oakley & Halligan, 2013)). Briefly, the first component is the use of a standardised induction script intended to create a focused attentional state, historically referred to as a hypnotic 'trance' or 'state' of hypnosis (Kirsch & Lynn, 1995; Mazzoni et al., 2013), but which we label here simply as 'hypnosis'. The second is the use of suggestion. Traditionally, some suggestions, particularly for relaxation have been introduced during the induction procedure, though it is important to note that relaxation is not an essential feature of hypnosis (Banyai & Hilgard, 1976; Miller, Barabasz, & Barabasz, 1991; Mitchell & Lundy, 1986). More relevant here are 'targeted' suggestions, which are introduced after the induction procedure has been completed and are intended to manipulate an aspect of behaviour or experience of particular experimental interest. In the present study we are interested primarily in the influence of specific targeted suggestions on writing. We also explore whether the hypnosis induction procedure itself, without targeted suggestions (sometimes called 'neutral' hypnosis), affects writing behaviour.

The main aim of the current study was to determine whether suggestions administered to highly hypnotically suggestible subjects could reproduce forms of automatic writing described by individuals in different historical and cultural settings (Deeley, 2013; Spitz, 1997). This would provide evidence that suggestive processes can produce dissociations in a complex behaviour (i.e. writing) which normally integrates thought, movement, and awareness. A key outcome of establishing such dissociations was to create a replicable experimental model of thought insertion and alien control of movement in psychosis as well as culturally influenced alterations of consciousness, such as inspired writing attributed to supernatural causation. Experimental conditions and their contrasts were therefore chosen to test the hypothesis that targeted suggestions could produce selective alterations in the control, ownership, and/or awareness of the thought and motor components of writing.

2. Method

2.1. Participants

Twenty healthy, English speaking, highly hypnotically suggestible volunteers were recruited from a pool of approximately 350 volunteers who had been screened for suggestibility using Form A of the Harvard Group Scale of Hypnotic

Susceptibility, (HGSHS:A) (Shor & Orne, 1963). All participants were right-handed for writing, 13 were female and the mean age was 24.2 (standard deviation = 6.1) years. All scored 8 or more on the HGSHS:A (scale range 0–12) with a mean score of 9.5 (SD = 1.3). The study was approved by King's College London Research Ethics Committee and all volunteers provided written informed consent. Volunteers received £30 (GBP) in compensation for their time.

Volunteers were made aware that participation in the present study was subsequent to their earlier testing on the HGSHS:A and that it would involve similar hypnotic procedures. The researcher conducting all parts of the experiment was one of the authors (EW). Immediately prior to the start of the experiment, participants were informed that it would involve different types of writing and, irrespective of how strongly they experienced any suggested effects, these would occur only during the session. They were also told that, whatever other experiences they might have, their right hand would hold the marker pen throughout.

2.2. Materials and apparatus

We conducted the experiment in a 'mock training scanner' (Fig. 1) to determine whether individual participants identified as highly suggestible during group screening (see above) could in fact experience the suggested effects as a basis for subsequent inclusion in a functional magnetic resonance imaging study to measure concomitant brain activity. The mock scanner simulated the look and feel of the real MRI scanner, allowing our research volunteers to experience writing (eyes closed, lying down) in a safe, simulated MRI scanning environment, while also providing a standardised setup for the experiment. A custom-built writing frame was mounted above the supine participants (Fig. 1). Participants were given a felt-tipped pen and kept their eyes closed throughout the experimental conditions. Special care was taken to support the participant's right arm and head.

2.3. Design and procedure

The study comprised 7 conditions, with 10 trials (i.e. 10 sentences) in each condition. First, participants completed a practice block of 3 trials. A schematic of the basic trial structure is given in Fig. 2. Each trial lasted for 22 s and consisted of a 'thought interval' (10 s) followed by a 'movement' interval (12 s). Thus, each trial consisted of a cognitive (thought) and a motor (movement) component. At the start of each trial, participants were presented with a sentence stem via headphones, e.g. 'The dog__'. The sentence stem was repeated once. Stimulus words used for the stems were based on common nouns from the British National Corpus and were matched across conditions for frequency in written and spoken English (Leech, Rayson, & Wilson, 2001). Depending on the condition, participants were instructed to think of a short simple suitable ending to the sentence stem, or it was suggested to them that "you will have the experience that an engineer is inserting a sentence ending into your mind" ('thought insertion'). A short tone was used to cue the start of the movement interval, whereupon participants were instructed to write down the sentence ending from the thought interval. Alternatively, during the 'alien

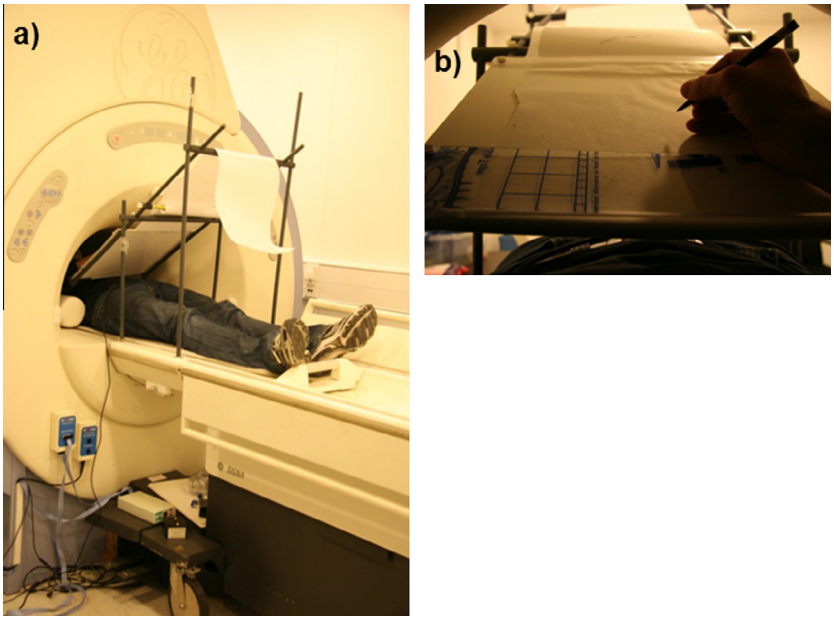

Fig. 1. (a) Experimental set-up showing a participant lying in the 'mock' training scanner. A paper roll, mounted on a specially-constructed writing frame, was advanced manually by the experimenter after each trial. (b) Participant's perspective image taken from inside the bore of the training scanner. The participant's eyes were closed throughout the experiment.

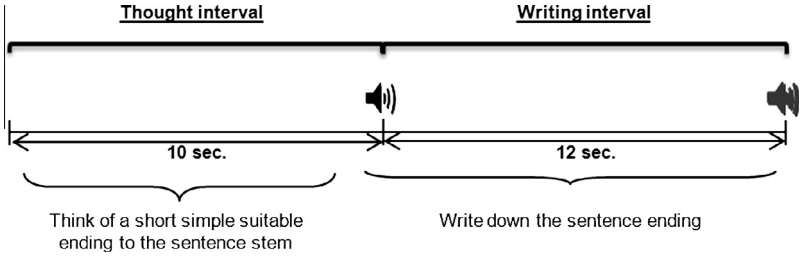

Fig. 2. Basic trial design for all conditions. Each trial consisted of a thought interval and a writing interval. In the thought interval, participants were instructed to listen to a sentence stem presented through headphones and think of a "short simple suitable ending" and hold it in mind. After the tone in the writing interval, participants wrote down the sentence ending they had thought of. In different experimental conditions, targeted hypnotic suggestion was used to systematically manipulate subjective experience for the thought (thought interval) and movement (writing interval) components of writing.

control of movement' condition it was suggested to participants that "you will have the experience that an engineer is controlling your hand movements as you write". A second tone at the end of the trial instructed participants to stop writing immediately. Each trial was separated by an 8 s rest interval.

Prior to each experimental block (10 trials), the participant was given a set of instructions/suggestions. The first block involved self-controlled writing while non-hypnotised (Table 1, condition 1). All subsequent blocks were presented in random order (Table 1) after a hypnotic induction procedure that consisted of a combination of visual fixation and progressive relaxation suggestions (Deeley et al., 2012; Oakley, Deeley, & Halligan, 2007a). Microsoft Excel (RAND function) was used to generate randomised sequences of natural numbers between 2 and 7. For each participant, a new sequence was used to present the experimental conditions (Table 1; Nrs. 2–7). In condition numbers 3–6 (see Table 1), targeted hypnotic suggestion was used to modulate the subjective experience of control over thought and movement components of writing. The aim of the suggestions was to produce alterations in the experience of cognitive (thought) and motor (movement) subcomponents of writing separately in order to model different types of automatic writing (Janet & Prince, 1907), and analogous dissociative and passivity phenomena. Additional suggestions were used to reduce feelings of awareness in condition 6 (TI + ACM + rA) to model mediumistic writing associated with loss of awareness. In a control condition (Nr. 7; SIM), also performed during hypnosis, participants were instructed to simulate alien control of movement (cf. condition Nr. 4). It should be noted, however, that the simulation condition we used did not involve the classical simulation design (Orne, 1959), which explicitly controls for social demands by the inclusion of an independent control group of low hypnotisable participants exposed to the same hypnotic procedures but instructed to 'fake hypnosis' in order to deceive the experimenters. Hypnosis was terminated at the end of the experiment for all participants.

For automatic writing with thought insertion (TI), we predicted reductions in feelings of control and ownership for the thought but *not* for the movement component of writing. For automatic writing with alien control of movement (ACM), we predicted the reverse, i.e. reductions in feelings of control and ownership for the movement but *not* for the thought component of writing. For the automatic writing with thought insertion and alien control of movement (TI + ACM) condition, we predicted reductions in feelings of control for both thought and movement components of writing. We additionally predicted a reduction in feelings of awareness for the loss of awareness condition (TI + ACM + rA). All these predictions are summarised in Table 1.

We also undertook further tests to assess the characteristics of automatic compared to voluntary writing. For conditions involving thought insertion we examined participants' writing *content* for differences in imageability, i.e. the ease with which a mental image of the word can be formed (James, 1985; Whaley, 1978), to examine whether words experienced as "inserted" had different sensory qualities or referents than voluntarily produced words, as measured by lexical statistics including written word frequency (CELEX-W) and imageability (Baayen, Piepenbrock, & Van Rijn, 1995; Davis, 2005). For conditions involving alien control of movement, we also tested whether the *form* of the writing, as measured by self-reports of visual appearance of writing, was affected. All automatic writing conditions were examined for evidence of hypergraphia (Britton, 1997) i.e. increased writing output, by measuring and comparing the number of words and characters written across experimental conditions. From an experimental perspective, measurement of content and form of writing is important when contrasting experimental conditions to determine whether alterations in the experience of automatic writing are linked to measurable differences in writing output. Finally, in order to explore any effects of hypnosis on writing, we compared voluntary writing before and after induction of hypnosis (see Table 1).

Given the nature of the study, the focus of interest was participants' reported experiences of their awareness, control and ownership for both the thought and writing intervals (Fig. 2) of the writing task. Therefore, we asked participants at the end of each block, to verbally rate ('0'–'10') their subjective experience, in relation to the sentence ending, for the thought content and movement of their right hand during writing, with respect to: (i) control ('0' means 'you had no part in initiating or controlling your thoughts in relation to the sentence endings/your hand movement during writing', and '10' means 'you and you alone initiated and controlled your thoughts in relation to the sentence endings/your hand movement during writing'); (ii) ownership ('0' means 'you do not experience that the thoughts in relation to the sentence endings were your thoughts/the hand movement during writing were your hand movements'; '10' means you felt that the thoughts/hand movements were

Table 1
Summary of the seven experimental conditions. In the hypnosis conditions (Nrs. 2–6), targeted hypnotic suggestion was used to modulate subjective experience of control over thought and movement components of writing. The predicted effect of the instructions or suggestion on subjective awareness of control and ownership for the cognitive (thought) and motor (movement) components of writing is provided on the right side of the table (✓ = *normal* feeling, and × = *reduced* feeling as a result of targeted suggestion). The Voluntary writing (VOL-NON-HYP) condition is the only non-hypnosis condition.

	Condition	Précis of instruction or suggestion	Cognitive component			Motor component		
			Control	Ownership	Awareness	Control	Ownership	Awareness
Non-hypnosis	1. Voluntary writing (VOL-NON-HYP)	Think of a short simple suitable ending to the sentence stem and write it down *Hypnotic induction procedure*	✓	✓	✓	✓	✓	✓
Hypnosis conditions (Nrs. 2–7)	2. Voluntary writing (VOL)	Think of a short simple suitable ending to the sentence stem and write it down	✓	✓	✓	✓	✓	✓
	3. Thought insertion (TI)	You will have the experience that an engineer is inserting the sentence ending into your mind. You have normal control over your hand as you write it down	×	×	✓	✓	✓	✓
	4. Alien control of movement (ACM)	Think of a short simple suitable ending. You will have the experience that an engineer controlling your hand movements during writing	✓	✓	✓	×	×	✓
	5. Thought insertion plus alien control of movement TI + ACM	You will have the experience that an engineer is inserting the sentence ending into your mind and that the engineer is controlling your hand movements during writing	×	×	✓	×	×	✓
	6. Thought insertion plus alien control of movement, no awareness (TI + ACM + rA)	You will have the experience that an engineer is inserting the sentence ending into your mind and that the engineer is controlling your hand movements during writing. You will not be aware of anything	×	×	×	×	×	×
	7. Simulation of alien control of movement (SIM)	Think of a short simple suitable ending to the sentence stem. Then, just pretend an engineer is controlling your hand movements during writing *Hypnotic reversal procedure*	✓	✓	✓	✓	✓	✓

yours'), and (iii) awareness (from '0' to '10', where '0' means 'you had no awareness of your thoughts in relation to the sentence endings/your hand movement during writing'; '10' means 'you had full normal awareness of your thoughts in relation to the sentence endings/your hand movement during writing'). The ratings were based largely on a previous study (Deeley et al., 2013b). Additionally ratings were taken for subjective 'depth of hypnosis', also rated from '0' (''not at all hypnotized'') – '10' (''as hypnotized as I've ever been''), absorption (''not at all absorbed'' – ''very absorbed indeed'') and relaxation (''not at all relaxed'' – ''very relaxed indeed''). In completing the depth scale, the participants all had at least one prior experience of hypnosis (i.e. the HGSHS:A used during screening) on which to base their response. Participants also completed ratings for the 3 practice trials. After completing the experimental blocks, hypnosis was terminated using a procedure that consisted of suggestions for a progressive return to normal, alert wide-awake feelings and bodily tension (Deeley et al., 2012; Oakley et al., 2007a). Outside of the bore of the mock scanner and post-experiment, participants completed ratings sheets and a semi-structured interview asking them about their experiences during the experiment. The session lasted approximately 2.5 h in total.

3. Results

3.1. Self-ratings: depth of hypnosis

The mean subjective hypnotic depth score increased from 2.0 (SD = 2.2) prior to the hypnosis induction procedure to 7.5 (SD = 1.3) in the hypnosis conditions; [$F(6, 114) = 49.70$; $p < 0.001$] (Table 2). There was no significant difference in depth of hypnosis across the 6 hypnosis conditions (Table 1; Nrs. 2–7); $F(5, 95) = 2.38$; $p = 0.068$, providing evidence that hypnosis was induced and maintained throughout the experiment. This result is consistent with previous research on subjective depth of the experience of hypnosis across experimental conditions involving hypnosis and targeted suggestions in an fMRI environment (Deeley et al., 2013a,b; Oakley et al., 2007a).

Table 2
Mean subjective depth of hypnosis (standard deviation in brackets) for the 7 experimental conditions ('0' = "not at all hypnotised"; '10' = "as hypnotised as I've ever been"). See Table 1 for key to abbreviations.

	Non-hypnosis	Hypnosis conditions					
Nr.	1	2	3	4	5	6	7
Condition	VOL-NON-HYP	VOL	TI	ACM	TI + ACM	TI + ACM + rA	SIM
Rating	2.0 (2.2)	7.0 (1.5)	7.3 (1.5)	7.4 (1.0)	8.0 (1.0)	7.9 (1.1)	7.5 (1.4)

Table 3
Mean self-ratings (standard deviations of the mean) of control, (b) ownership, and (c) awareness for the cognitive and motor components of writing following targeted suggestions ($N = 20$). See Table 1 for key to abbreviations. The four *a priori* questions and the condition contrasts: Q1 = condition Nrs. 1 vs. 2; Q2 = condition Nrs. 3 vs. 4; Q3 = condition Nrs. 5 vs. 6; Q4 = condition Nrs. 4 vs. 7.

	Non-hypnosis	Hypnosis conditions					
Nr.	1	2	3	4	5	6	7
Condition	VOL-NON-HYP	VOL	TI	ACM	TI + ACM	TI + ACM + rA	SIM
Control							
Thought	8.1 (1.9)	6.7 (2.9)	5.0 (2.4)	6.9 (2.7)	4.8 (2.5)	4.6 (2.6)	6.6 (2.6)
Movement	7.8 (1.7)	6.1 (3.0)	6.8 (2.6)	4.6 (2.7)	4.4 (2.6)	4.1 (2.4)	6.9 (2.3)
Awareness							
Thought	8.2 (2.0)	6.7 (2.7)	6.6 (2.3)	7.7 (1.9)	6.7 (2.8)	5.1 (2.3)	7.3 (2.2)
Movement	7.8 (1.7)	6.3 (2.8)	6.8 (2.1)	5.3 (2.5)	5.8 (2.7)	4.6 (1.5)	6.0 (2.2)
Ownership							
Thought	8.0 (1.9)	6.6 (3.1)	5.0 (2.5)	7.0 (2.4)	4.3 (2.9)	4.4 (2.8)	6.8 (3.0)
Movement	7.6 (2.0)	6.1 (2.8)	7.0 (2.7)	4.2 (2.8)	4.5 (2.6)	3.9 (2.5)	6.4 (2.9)

3.2. Self-ratings for control, ownership and awareness for the thought and movement components of writing

In order to determine if the various suggestions were successful in altering subjective experience, a repeated measures ANOVA was performed with the factors of cognitive and motor components of writing (thought vs. movement) and experimental condition (7 conditions), with self-ratings (awareness, control, ownership) as dependent variables. The overall difference in self-ratings, reported by participants across the various experimental conditions, just failed to reach significance $F(2, 38) = 3.91$; $p = 0.056$. All other main effects and interactions were significant (all $p < 0.05$). Similarly, a repeated measures ANOVA, 2 (cognitive and motor components) × 6 (condition) for the 6 hypnosis (i.e. post-hypnotic induction procedure) conditions with the self-ratings (awareness, control, ownership) as dependent variables, showed significant main effects and interactions (all $p < 0.048$), confirming that targeted suggestion produced powerful effects on subjective experience as measured by self-ratings.

To further explore these effects, ANOVAs were performed for each of the control, ownership and awareness self-ratings. For the 'control' and 'ownership' ratings, 2 (cognitive and motor components: 'thought' vs. 'movement') × 7 (experimental conditions) repeated measures ANOVAs revealed significant main effects of condition [all $F > 11.01$], no significant main effects of cognitive and motor components [all $F < 3.69$] and significant interactions [all $F > 6.58$]. For the 'awareness' ratings, there was a significant main effect of cognitive and motor components ($F(1, 19) = 16.98$; $p = 0.001$) and a significant interaction ($F(6, 114) = 4.99$; $p < 0.001$), as for control and ownership ratings. In addition, the main effect of condition was also significant ($F(6, 114) = 7.60$; $p < 0.001$). First-order correlations were also performed between the self-ratings (awareness, control and ownership), across the 7 experimental conditions to test the strength of relations between the self-ratings. This analysis yielded a mixture of low, moderate and high correlation values. Given the presence of high and moderate correlations between the three dependent variables (self-ratings), we conducted a MANOVA with the within subject factors of 'cognitive and motor components' (thought vs. movement), condition (7 levels) and Measures (3 levels; awareness, control and ownership). The multivariate results gave Pillai's Trace values of $p = 0.010$, $p < 0.0001$ and $p < 0.0001$ for cognitive and motor components, condition, and cognitive and motor components × condition interaction, respectively. MANOVA results were very similar to the Repeated Measures ANOVA reported above. Overall, results show that the targeted suggestions were effective in altering subjective experience in condition-specific ways.

A series of follow-up 2 × 2 repeated-measures ANOVAs and 2-tailed *t*-tests were performed to investigate the effects of specific experimental conditions on the cognitive and motor aspects of writing in relation to four *a priori* questions (see Section 3.3). All ANOVA significance (p) values are Greenhouse–Geisser corrected (Table 4).

3.3. Analysis strategy

In line with our generic hypotheses, the study had four *a priori* questions:

Table 4
Results from *a priori* 2 (cognitive and motor components) × 2 (experimental condition) repeated measures ANOVAs for control, ownership and awareness self-ratings for the 4 condition contrasts of interest (see Section 3.1; Results strategy). Follow-up *t*-tests for significant interactions are described in the text. Significance (p) values less than 0.05 are shown in **bold**.

	Cognitive and motor component		Condition		Interaction	
	$F(1, 19)$	p	$F(1, 19)$	p	$F(1, 19)$	p
Q1. Does hypnosis without targeted suggestions affect writing?: VOL-NON-HYP (Nr. 1) vs. VOL (Nr. 2)						
Control	2.677	0.118	11.104	**0.004**	0.351	0.561
Ownership	4.327	0.051	7.946	**0.011**	0.093	0.764
Awareness	2.156	0.158	7.881	**0.011**	0.002	0.967
Q2. Can the thought and movement sub-components of writing be experientially dissociated using targeted suggestions?: TI (Nr. 3) vs. ACM (Nr. 4)						
Control	0.273	0.607	0.089	0.769	14.808	**0.001**
Ownership	1.308	0.267	1.013	0.327	23.160	**0.000**
Awareness	15.430	**0.001**	0.378	0.546	13.900	**0.001**
Q3. Can targeted suggestion block reported subjective awareness?: TI + ACM (Nr. 5) vs. TI + ACM + rA (Nr. 6)						
Control	2.316	0.145	0.431	0.520	0.151	0.702
Ownership	0.199	0.661	0.477	0.498	2.034	0.170
Awareness	5.044	**0.037**	8.551	**0.009**	1.081	0.312
Q4. Are participants simulating?: ACM (Nr. 4) vs. SIM (Nr. 7)						
Control	6.047	**0.024**	6.667	**0.018**	15.323	**0.001**
Ownership	15.424	**0.001**	3.976	0.061	17.651	**0.000**
Awareness	55.225	**0.000**	0.130	0.722	3.489	0.077

Question 1: Can hypnosis without targeted suggestions affect writing?

To address this question, the data from the VOL-NON-HYP (Condition Nr. 1; Table 1) and VOL (Nr. 2) conditions were compared. Instructions were identical for both conditions and there was no hypnotic suggestion for a change in experience. Participants were simply instructed to think of a short simple suitable ending to the sentence stem and to write it down once they heard the auditory cue. In this way the effects of hypnosis on writing could be measured without being confounded by hypnotic suggestion for a change in experience. All other task demands were kept constant, so that the only difference was the presence or absence of hypnosis. Table 4 (Q1) shows that hypnosis produced an attenuation of awareness, control and ownership for both thought and movement sub-components of writing (main effects of condition); participants still felt largely aware and in control of their writing, though relatively less so compared to their non-hypnotised state. The lack of significant interactions suggests that hypnosis affected the thought and movement sub-components of writing in equal measure.

Question 2: Can the thought and movement sub-components of writing be experientially dissociated using targeted suggestions?

While writing is typically experienced as a unitary task, here we tested whether targeted suggestion could be used to systematically separate the thought and movement sub-components of writing. Therefore in the TI condition (condition Nr. 3), normal voluntary control of thought but not movement during writing was targeted, compared to the reverse in the ACM condition (Nr. 4), i.e. control of movement, but not thought, was targeted. With the exception of those parts of the targeted suggestion intended to vary subjective experience of each sub-component of writing (thought or movement; see Table 1), the wording of the rest of the suggestion was kept identical. The data from the TI (Nr. 3) and ACM (Nr. 4) conditions were therefore compared to test whether the thought and movement components of writing can be manipulated independently.

The significant interactions (Table 4, Q2) and follow-up *t*-tests, confirmed (in line with the hypotheses) a double dissociation between the thought and movement components of writing, for participants' experience of control. Importantly feelings of control and ownership for the thought component in the Voluntary ('control' mean = 6.7; SD = 2.9; 'ownership' mean = 6.6; SD = 3.1) and the ACM ('control' mean = 6.9; SD = 2.7; 'ownership' mean = 7.0; SD = 2.4) conditions did not differ $t(19) = 0.258$; $p = 0.799$. Likewise feelings of control and ownership for movement in the TI ('control' mean = 6.8; SD = 2.6; 'ownership' mean = 7.0; SD = 2.7) condition did not differ from that in the Voluntary condition $t(19) = 0.840$; $p = 0.411$, demonstrating the specificity of the suggestion which affected the targeted cognitive (thought) component only, and not the non-targeted (movement) one (see Table 3). When it was suggested that an engineer was "inserting the sentence ending into your mind" (i.e. thought insertion), participants reported significantly lower feelings of control over their thought content (mean = 5.0; SD = 2.4) than their hand movement (mean = 6.8; SD = 2.6); $t(19) = 2.987$; $p = 0.008$ (Table 3). This pattern was reversed in the ACM condition when it was suggested that the engineer is controlling the participants' hand movements but not their thought content in relation to the sentence endings. Here participants reported normal control over their thought content (mean = 6.9; SD = 2.7) but significantly reduced control over their hand movements (mean = 4.6; SD = 2.7); $t(19) = 2.854$; $p = 0.010$. Thus participants' experience of control was shown to be doubly dissociated between the thought and movement (cognitive and motor) components of writing. Follow-up *t*-tests revealed that a double

dissociation between thought and movement was also present for ownership ratings (all $p < 0.004$). The ratings of ownership for cognitive and motor components for the ACM and TI conditions respectively did not differ from those in the Voluntary condition (all $p > 0.215$). Therefore, as predicted, targeted suggestion produced specific effects on control and ownership ratings for both thought and movement components of writing separately, thereby modelling key aspects of automatic writing phenomena.

Question 3: Can targeted suggestion reduce reported subjective awareness?

The data from the TI + ACM (Nr. 5) and TI + ACM + rA (Nr. 6) conditions were compared to investigate if targeted suggestion can reduce subjective feelings of awareness, in order to model the loss of awareness often reported during 'mediumistic' automatic writing (Janet & Prince, 1907; Koutstaal, 1992). The follow-up 2 × 2 ANOVA showed a significant main effect of cognitive and motor components ($p = 0.037$) and of condition ($p = 0.009$; see Table 4; Q3) for the awareness ratings only. Post-hoc analysis using *t*-tests revealed that awareness ratings for both the thought component [$t(19) = 3.47$; $p = 0.003$] and the movement component [$t(19) = 2.17$; $p = 0.043$] were greater in the TI + ACM condition than the TI + ACM + rA condition. Therefore the suggestion specifically targeted to reduce awareness in the TI + ACM + rA condition was successful in decreasing participants' self-reported feelings of awareness, effectively modelling keys aspects of mediumistic automatic writing.

Question 4: How can we control for the possibility of participants simulating?

To control for the possibility that participants might be simulating the various subjective experiences at the time of automatic writing, we compared results between the ACM (Nr. 4) and SIM (Nr. 7) conditions. In the ACM condition it was suggested to participants that "the engineer is controlling your hand movements while you write" whereas in the SIM condition, participants were instructed to merely "pretend" that this was the case. The two conditions were identical in all other aspects. Differing results for the movement component between the ACM and SIM conditions would support the view that participants were not pretending but genuinely experiencing alterations in subjective experience as a result of suggestion.

When we compared self-ratings for *suggested* ("An engineer is controlling your hand movement as you write" – ACM condition) and *simulated* ("Just pretend that an engineer is controlling your hand movement as you write" – SIM condition) alien control of movement, we found that self-ratings were significantly different for the movement component for both control [mean ACM = 4.6 (SD = 2.7); mean SIM = 6.9 (SD = 2.3)]; $t(19) = 3.514$; $p = 0.002$ and ownership ratings [mean ACM = 4.2 (SD = 2.8); mean SIM = 6.4 (SD = 2.9)]; $t(19) = 3.005$; $p = 0.007$. There was no difference however for the thought component for which there was no suggested change; control [mean ACM = 6.9 (SD = 2.7); mean SIM = 6.6 (SD = 2.6)]; $t(19) = 0.815$; $p = 0.425$ and ownership ratings [mean ACM = 7.0 (SD = 2.4); mean SIM = 6.8 (SD = 3.0)]; $t(19) = 0.667$; $p = 0.513$. As there was also no suggestion to reduce awareness for either of these conditions, unsurprisingly there were no significant differences in awareness ratings for the thought [mean ACM = 7.7 (SD = 1.9); mean SIM = 7.3 (SD = 2.2)]; $t(19) = 1.121$; $p = 0.276$ nor movement components [mean ACM = 5.3 (SD = 2.5); mean SIM = 6.0 (SD = 2.2)]; $t(19) = 1.116$; $p = 0.278$ for the suggested (ACM) and the simulated (SIM) conditions. Taken together, results show modulation of subjective experience for movements targeted by suggestion only, and not when participants were asked to simulate alien control of the same movements (see Table 3).

3.4. Effects of hypnosis with and without targeted suggestion on written output

3.4.1. Hypnosis effects on quantity of written output (word and character count)

Some automatic writing behaviour is associated with increased writing activity or hypergraphia (Britton, 1997; van Vugt, Paquier, Kees, & Cras, 1996). However, ANOVAs confirmed that there was no significant difference in the number of words [$F(6, 114) = 1.54$; $p = 0.21$] or characters [$F(6, 114) = 2.03$; $p = 0.07$] written for each sentence across the 7 experimental conditions (Table 5). Likewise there was no difference in the number of words $F(5, 95) = 0.15$; $p = 0.92$ or characters; $F(5, 95) = 1.362$; $p = 0.265$ when the 6 hypnosis conditions were compared directly. *A priori t*-tests revealed a higher word-count in the VOL-NON-HYP (mean = 3.1; SD = 0.9 words) relative to the VOL condition (mean = 2.8; SD = 0.8 words); $t(19) = 2.374$; $p = 0.028$.[2] All other *a priori* comparisons were non-significant (all $p > 0.549$). Similarly, *a priori t*-tests showed that the number of characters produced during the VOL-NON-HYP (mean = 12.3; SD = 3.7 characters) tended to be greater relative to the VOL condition (mean = 11.4; SD = 3.2 characters), but this did not reach significance: $t(19) = 2.007$; $p = 0.059$. The *t*-test comparing the TI and the ACM condition was also not significant; $t(19) = 1.94$; $p = 0.07$. The other *a priori* comparisons were non-significant (all $p > 0.29$).

3.4.2. Hypnosis effects on content of written output

Linguistic statistical analyses (N-Watch psycholinguistic statistics programme) (Davis, 2005) were performed on the *content* (written word frequency CELEX-W, derived from the CELEX English linguistic database) (Baayen et al., 1995) in order to

[2] Note that significance values are *a priori* and therefore have not been adjusted for multiple comparisons (Howell, 2011).

Table 5
Mean word and character count, written frequency (CELEX-W) scores and imageability scores for the 7 experimental conditions. Form of writing is shown in the final column. Participants were asked to rate (0–100) how similar their own writing samples from each condition were to a sample of their normal writing. Writing samples were presented in random order ($N = 20$). See Table 1 for key to conditions.

Nr.	Condition	Word count	Character Count	CELEX-W	Imageability	Form
1	VOL-NON-HYP	3.1 (0.9)	12.3 (3.7)	6602 (2304)	312 (28)	58 (27)
2	VOL	2.8 (0.8)	11.4 (3.2)	6033 (2645)	314 (22)	47 (26)
3	IT	2.7 (0.6)	10.6 (2.7)	5964 (1705)	316 (24)	39 (24)
4	ACM	2.7 (0.6)	11.6 (2.0)	6808 (2866)	313 (24)	45 (27)
5	IT + ACM	2.7 (0.8)	10.6 (2.3)	6879 (3241)	321 (25)	29 (16)
6	IT + ACM + rA	2.8 (0.6)	11.3 (2.5)	7510 (4209)	319 (17)	27 (20)
7	SIM	2.7 (0.6)	11.6 (2.2)	5795 (2359)	311 (19)	44 (29)

investigate the effects of hypnosis and targeted suggestion on writing (Table 5). Variations in factors such as *word frequency*, the ease with which words can be accessed in the semantic system and *imageability*, the ease with which a mental image of the word can be formed (James, 1985; Whaley, 1978), for example, in the content of inserted thought might differentiate automatic writing across conditions (Young, 2008). However, there was no difference in the written frequency (CELEX-W), ($F(6, 114) = 1.24$; $p = 0.30$) or word imageability ($F(6, 114) = 0.70$; $p = 0.61$) for the sentence endings produced between all 7 experimental conditions (Whaley, 1978). Similarly, no differences were observed when the analyses were confined to the 6 hypnosis conditions (Table 1) in written word frequency ($F(5, 95) = 1.412$; $p = 0.25$) or word imageability ($F(5, 95) = 0.74$; $p = 0.55$). Furthermore, all *a priori* *t*-test comparisons were non-significant for both written frequency (all $p > 0.12$) and imageability (all $p > 0.48$).

3.4.3. Hypnosis effects on form of written output

After completing the experimental conditions, participants were asked to rate (0–100) how similar randomly presented samples of their writing produced during the experiment were to a sample of their normal handwriting (i.e. produced with eyes open and using the same writing instrument as used during the experiment; Table 5). No formal graphological analysis was performed. An ANOVA for all 7 experimental conditions was significant ($F(6, 108) = 5.651$; $p < 0.0001$), as was the ANOVA for the 6 hypnosis conditions ($F(5, 95) = 3.961$; $p = 0.007$), indicating that participants rated that the form or appearance of their writing varied with experimental condition.

The follow-up *a priori* *t*-tests (Section 3.3) revealed an effect of hypnotic induction, i.e. participants judged their writing to be significantly less similar during hypnosis compared to before the induction of hypnosis ($t(19) = 2.384$; $p = 0.028$). Furthermore, participants also rated writing produced in both conditions combining thought insertion and alien control of movement (TI + ACM and TI + ACM + rA) to be different than that produced in the voluntary hypnosis (VOL) condition ($t(19) = 2.914$; $p = 0.009$ and $t(19) = 3.376$; $p = 0.003$ respectively). No other *a priori* comparisons were significant (all $p > 0.178$). During automatic writing, targeted suggestion produced self-reported alterations in the form of writing for the combined conditions (i.e. Nrs. 5 and 6) only.

In summary, the results show that there was a tendency for the hypnosis conditions (Table 1; Nr. 2–7) to produce fewer words and characters relative to the non-hypnosis condition (Table 1; Nr. 1). However, there was no difference in content of writing between the experimental conditions (Table 5). Self-ratings showed that the form or appearance of writing was considered to be less like participants' usual writing when it was produced during hypnosis. The form of writing was least similar in those conditions which combined thought insertion and alien control of movement (i.e. Nrs. 5 and 6; Table 5), which involved more extensive suggestions for changes in experience.

3.5. Phenomenology of alien control: who is the engineer?

We were interested in participants' phenomenological accounts of the "engineer" who featured in the targeted suggestion conditions (i.e. Nrs. 3–6) relating to automatic writing. Inspection of participant responses showed variations in post-experiment descriptions of subjective experience, with respect to visual/non-visual and technical/non-technical (i.e. reference to contemporary technology) accounts. Therefore we asked two independent raters to sort participants' description of the engineer into visual/non-visual and technical/non-technical categories. The raters judged that 6 participants' responses were visual (e.g. "I imagined blonde hair in a ponytail, but couldn't see a face. I imagined she was some sort of scientist. My feelings toward her were neutral."), while a further 13 participants were judged to use non-visual descriptions (e.g. "No physical presence as such. More like a presence as opposed to something that one can see. No thoughts as such. Just that the 'engineer' had a certain amount of power"). Inter-rater reliability for the visual/non-visual ratings among both raters was 0.78 (Pearson's *r* pairwise correlation). For the remaining participant, the raters could not categorise a response as either visual or non-visual. For the technical descriptions, the raters judged that 6 participants' responses referred to some form of contemporary technology to describe their experience of the alien control automatic writing conditions (e.g. "Kept thinking of a machine. Felt like I had no rapport with the image. Cold – lifeless. The machine was a yellow crane. A large one."), while the remaining 14 participants' responses were judged to be non-technical (e.g. "I did not imagine any room or machine, only the hand of the engineer moving my hand". Inter-rater reliability for the technical ratings was 0.55 (Pearson's *r*).

Table 6
Mean recall ratings (SD) for the 7 experimental blocks. Participants were asked post-experiment: ''How well do you feel you can recall this part of the experiment?'' where '0' = ''no recall'' whatsoever and '10' = ''full recall''. Participants reported significantly higher recall in condition 5 (IT + ACM) relative to the condition 6 involving reduced awareness (IT + ACM + rA).

	Non-hypnosis	Hypnosis conditions					
Nr.	1	2	3	4	5	6	7
Condition	VOL-NON-HYP	VOL	TI	ACM	TI + ACM	TI + ACM + rA	SIM
Mean (SD)	6.9 (2.5)	5.6 (2.5)	5.7 (2.5)	6.2 (2.5)	6.2 (2.5)	5.1 (2.5)	5.6 (2.5)

3.6. Post-experiment estimates of recall for the experimental conditions

Participants were asked immediately after the experiment how well they could recall each part of the experiment (Table 6). Recall ratings did not differ for all 7 conditions; $F(6, 114) = 2.16$; $p = 0.08$; nor for the 6 hypnosis conditions; $F(5, 95) = 1.08$; $p = 0.37$. Recall ratings were numerically lower during hypnosis, although the *a priori* comparison using a *t*-test was not significant; $t(19) = 1.94$; $p = 0.07$ (see 'Question 1', Section 3.3). For the combined conditions contrast ('Question 3', Section 3.3), participants reported significantly reduced recall in the TI + ACM + rA (reduced awareness) compared to the TI + ACM condition; $t(19) = 2.52$; $p = 0.021$. In other words, suggestion targeted to reduce awareness decreased participants' self-ratings of recall for the experimental block in question. The three remaining *a priori* comparisons were non-significant (all $p > 0.78$).

4. Discussion

The current study used targeted suggestion in a sentence completion task that modelled different types of automatic writing, involving 'thought insertion' and 'alien control of movement', separately and in combination. An additional suggestion specifically targeting awareness modelled the loss of awareness reported in some cases of automatic writing. The three main findings were: (i) targeted suggestions produced a double dissociation between the thought and movement components of writing for participants' feelings of control and ownership, indicating that each component can be selectively altered; (ii) induction of hypnosis without additional suggestions of loss of control of thought or movement was associated with a small but significant reduction of control, ownership, and awareness for both the thought and movement sub-components of writing; (iii) targeted suggestion can reduce awareness of automatic writing. Overall, hypnotic suggestion produced selective alterations in the thought and motor components of writing consistent with classical forms of automatic writing observed in different historical and cultural settings.

The small but significant reduction in control, ownership, and awareness for writing following induction of hypnosis, but with no additional suggestions targeting the experience of writing, is in keeping with previously described effects of hypnosis *per se*. Awareness of the hypnotic context and reference to 'hypnosis' itself creates a general expectation that control will attenuate (Carvalho et al., 2007; McConkey, 1986), consistent with the 'classic suggested effect', which specifies that to be authentic, hypnotic phenomena are experienced as involuntary and effortless (Spitz, 1997; Weitzenhoffer, 2000). Furthermore, the standard induction procedure employed in our study contains suggestions for relaxation and prior research has shown a small but significant increase in subjective reports of relaxation following this procedure compared to a pre-hypnosis resting baseline (Deeley et al., 2012). In addition to any effects increased relaxation might have, eye closure and suggestions that participants should disattend to distracting stimuli, coupled with requests to focus on the words of the suggestion, are likely to narrow awareness and influence participants' experience of writing. Nevertheless, overall the participants' reports of voluntary thought and movement immediately following hypnotic induction (Condition Nr. 2; Table 1) involved markedly higher levels of control, ownership, and awareness compared to the subsequent 'targeted suggestion' conditions (Condition Nrs. 3–6). Overall these findings illustrate the importance of having a 'hypnosis only' control condition following induction of hypnosis to contrast with experimental conditions employing targeted suggestions (Oakley et al., 2007a; Oakley & Halligan, 2009a,b).

Selective changes in control and awareness of thought and/or movement in response to targeted suggestion supports the view that specific suggestions can be effectively employed to model automatic writing along with the broader category of 'possession' and other altered states of consciousness attributed to supernatural causation (Deeley, 2013). Further, suggested variations in the control and awareness of thought and movement provide models of clinico-pathological symptoms of passivity phenomena (thought insertion and alien control of movement), as well as dissociative alterations in control and awareness of thought, such as dissociative identity disorder (Deeley, 2003) and/or movement, such as non-epileptic seizures (Brown et al., 2011). Variations in *ownership* produced by suggestions of loss of *control* support previous proposals that control and ownership are closely integrated experientially, suggesting that both may be subserved by a shared brain system (de Haan & de Bruin, 2010).

The effectiveness of targeted suggestions in reproducing the two types of automatic writing experience reported by Prince (Janet & Prince, 1907) raises the possibility that suggestive processes may not only represent an experimental way of modelling experiences of automatic writing, but may also contribute to their production. For example, it has been proposed that the broader category of culturally influenced possession states as well as dissociative phenomena including

dissociative identity disorder result from suggestions or autosuggestions of the type measured by hypnotic suggestibility scales (Deeley, 2003, 2013; Oakley, 1999). However, suggestive processes can take both verbal and non-verbal forms (Oakley, 2012). The beliefs, expectancies, and attributions through which suggestive processes exercise their effects on cognition, brain function, and experience are therefore likely to be accessible in different ways (Edwards, Adams, Brown, Pareés, & Friston, 2012). The experience of automatic writing may conform to expectancies derived from largely implicit cultural learning and social modelling (Deeley, 2003).

Historical accounts indicate that automatic writing is based on cultural familiarity with the practice, e.g. through media and written reports, as well as the descriptions and behaviour of peers (Ellenberger, 1970; Shaw, 2011). These forms of learning are likely to be less explicit about the expected content of altered experience than the precisely defined verbal suggestions we employed in the present study. Reliance on implicit learning may result in significant variation in the subjective experience of automatic writing within and between individuals depending on the individual's expectancies – for example, whether in any given instance automatic writing involves thought insertion, alien control of movement, loss of awareness, or is even guided by visual and auditory hallucinations (Ellenberger, 1970; James, 1985; Shaw, 2011). Even where explicit verbal suggestions are administered, individual variation in the experience of alien control may be present. For example, participants in the present study reported different experiences of the engineer. This indicates that participants' experiences, consciously or unconsciously, reflect their own associations when responding to complex suggestions, whilst experiencing the resultant change in the content of consciousness as involuntary and realistic. However, a broad distinction also emerged between those who formed vivid visual experiences of the engineer, and those who experienced the engineer as an unseen but strongly felt agentive presence. Visual experiences of the engineer were described with comments involving imagery, such as she had "blonde hair in a ponytail", while non-visual experiences with comments such as she was "like a presence as opposed to something that one can see" This finding was not predicted, and provides further evidence that experiences of alien control can take different forms. Future neuroimaging studies in larger samples will investigate whether visual and non-visual styles of responding to suggestions of alien control are associated with differences in brain activity. Similarly, further research on verbal and non-verbal mechanisms of suggestion and dissociation should contribute to improved understanding of both culturally influenced and clinico-pathological dissociative phenomena. For example, future research should investigate how social, cognitive, and neural processes involved in the acquisition and maintenance of beliefs influence responses to suggestive processes (Deeley, 2003, 2004).

In the control condition (SIM; Table 1; Nr. 7), participants were asked to simulate alien control of movement to control for the possibility that participants might simply be pretending to experience the hypnotically suggested effects. Reports of reduced control and ownership for suggested, but not simulated, alien control of movement are consistent with the interpretation that participants experienced and veridically reported the intended effects of targeted suggestions. Nevertheless, the current behavioural findings cannot definitively rule out the possibility that differences between the suggested (ACM) and the corresponding simulated (SIM) condition in our within-subject design might be explained by demand characteristics. Our instruction to 'pretend', for example, could have been interpreted by participants as a demand for a reduced or degraded response to the suggestions, compared with the non-simulating conditions. The influence of demand characteristics on differences in the behavioural and neuroimaging correlates of suggested and simulated effects could be further investigated in future studies by adapting the classical simulation design (Orne, 1959). This design explicitly controls for social demands by the inclusion of an independent control group of low hypnotisable participants exposed to the same hypnotic procedures but instructed to 'fake hypnosis' in order to deceive the experimenters. However, a growing number of studies report that hypnotic suggestion results in subjective changes that correspond to underlying differences in activity in specific brain areas that can create alterations in 'automatic' cognitive phenomena, that are distinct from simulated behaviour and cannot easily be explained by compliance or imaginative processes (Oakley & Halligan, 2009a,b; Oakley & Halligan, 2013). For example, a PET study, using the same within-group simulation design, compared hypnotically suggested and intentionally simulated leg paralysis, and found that different brain areas were involved in the two conditions (Ward, Oakley, Frackowiak, & Halligan, 2003). We also report significant differences in brain activity associated with suggested compared to simulated alien control of movement in a neuroimaging study employing this experimental paradigm, providing additional support for the view that participants genuinely experienced the suggested effects (Walsh et al., in submission).

Participants reported reduced recollection of the experience of loss of awareness of automatic writing relative to other conditions. Loss of awareness provides a potential mechanism for the amnesia reported for some cases of automatic writing and other culturally influenced possession states (Crapanzano & Garrison, 1977). Narrowing of awareness could potentially contribute to amnesia through reduced encoding of information (Allen, Console, & Lewis, 1999). Alternatively, amnesia may result from inhibition of memory retrieval, as has been reported in cases of dissociative and post-hypnotic amnesia (Bell, Oakley, Halligan, & Deeley, 2011). Future studies of suggested amnesia could inform understanding of mechanisms of dissociative memory loss.

We did not make suggestions that the quantity, content or form of writing would be altered during hypnosis. However, participants wrote slightly fewer words when hypnotised (mean = 2.8; SD = 0.8) compared to pre-induction (mean = 3.1; SD = 0.9). While there was no difference in the *content* (written word frequency and imageability) of writing before compared to after induction, writing *form* (visual appearance and word and character counts) was affected. Participants reported that their writing while hypnotised was less similar to their normal writing produced before hypnotic induction, when both were carried out with eyes closed. In particular, for the condition combining thought insertion and alien control of movement with loss of awareness (TI + ACM + rA), participants rated their handwriting as less similar to their self-controlled

writing in hypnosis (VOL). A few participants even reported that they did not recognise their own handwriting for this condition when it was shown to them after the experiment. The altered form of writing in the hypnosis conditions may result from reduced feelings of control and awareness of hand movements compared to the non-hypnotised state. This explanation is supported by the fact that the greatest subjectively perceived change in form of writing was in the condition when awareness was most reduced (TI + ACM + rA) following suggestion (Table 5). Importantly the targeted suggestions had an impact over and above the main effect of hypnosis.

The present results extend previous instrumental research confirming hypnosis as an effective and informative tool for producing analogues of passivity and dissociative phenomena (Halligan & Oakley, 2013). In particular, the experimental paradigm extends an earlier study which investigated delusions of control using a simple repetitive movement (raising and lowering of left arm) (Blakemore, Oakley, & Frith, 2003). The more complex handwriting sentence completion task of the present study involves linguistic, cognitive, perceptual and motor components, allowing two possession phenomena (thought insertion and alien control of movement) to be modelled and compared in a single experiment. We are currently employing functional magnetic resonance imaging (Walsh et al., in preparation) to establish how closely the brain areas modulated in response to hypnotic suggestions for dissociation of movement and thought components during handwriting, correspond to brain areas already identified as being involved in the linguistic and motor components of writing from lesions producing central and peripheral agraphia (Beeson, 2004). For example, lesions to the left angular gyrus are associated with agraphia or Gerstmann's Syndrome (Gerstmann, 1942; Rusconi et al., 2009). Combining targeted suggestions for automatic writing with measurement of brain activity may therefore allow hypotheses about the function of regions and networks based on lesion-deficit studies to be tested in relation to models of 'functional' symptoms such as passivity or dissociative phenomena.

As with all research, the present study has a number of limitations. For example, while we obtained individual hypnotic suggestibility scores for our participants from the HGSHS:A screening session, we did not investigate a possible relationship between these scores and control, ownership and awareness during the writing task. The HGSHS:A (Shor & Orne, 1963) is a widely used, economic and effective instrument for screening large groups of individuals and assigning them to relatively broad sub-categories of hypnotic suggestibility for experimental purposes as we did here. However, it is generally regarded as necessary to determine more precise suggestibility scores using an individually administered scale where these are to be used as an experimental variable (see (Woody & Barnier, 2012)). Also, where hypnotic suggestibility is a focus of research, there is a strong case for including data from participants in high vs. low suggestibility groups or from the whole range of hypnotic suggestibility scores. However, our purpose was to use hypnotic suggestion as an experimental tool rather than to explore aspects of hypnotic suggestibility *per se*, so we used 'high-suggestibles' in a within-subject design and did not carry out an individual second screening for hypnotic suggestibility. Moreover, in addition to the intrinsic interest of the present data, an important secondary aim of the present study was to test participants individually using specifically targeted suggestions to see if they could experience the relevant writing-related effects with a view to their possible inclusion in a future neuroimaging study (Walsh et al., in submission).

In summary, the experimental paradigm presented here illustrates William James's proposal that automatic writing can cause the mind's "organised paths" to be "thrown out of gear". Specifically, targeted suggestions for automatic writing can dissociate aspects of the control, ownership, and awareness of thought and movement that are usually experienced as part of a unitary sense of self, so producing a replicable experimental model of thought insertion and alien control of movement in psychosis as well as culturally influenced alterations in consciousness.

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