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Abstract

Can unconscious knowledge be elicited by ideomotor action when the knowledge fails to be elicited by verbal reports? Using a Ouija board, Gauchou et al. (2012), found ideomotor action produced substantial accuracy for general knowledge questions previously rated as pure “guesses”, and for which later verbal reports produced accuracy close to chance. We replicated the procedure substituting Chevreul’s pendulum rather than a Ouija board. We found that questions whose answer was previously rated as a guess, were answered equally well and at about chance levels by ideomotor action and verbal responses. Thus, one cannot presume that ideomotor action rather than verbal report will allow greater knowledge to be expressed in any particular context, including therefore the hypnotherapy one. An ideomotor action may elicit only conscious knowledge. Further research is recommended to clarify this important issue.

The term ideomotor action was first used by Carpenter (1852) to refer to the causal effect of ideas on muscle contraction, independently of volition. It became a crucial idea in James Braid's theory of hypnosis, namely hypnosis as monoideism, where one dominant idea comes to control behavior by way of ideomotor action (Robertson, 2009)[1]. William James adopted the term ideomotor action, but went even further regarding all actions as ideomotor, that is as caused by the idea of them happening (James, 1890); the difference between apparently volitional and nonvolitional actions is only whether attentional effort was involved in sustaining the idea (or in consenting to it). According to James' theory, ideomotor action without effort is unlikely to indicate unconscious knowledge any more than volitional action is, because both are mediated by the same idea of moving. Ideomotor action is sufficiently compelling as an experience of acting without conscious involvement, however, that it has constantly intrigued people as possibly being guided by unconscious knowledge. Even James (1890, p 205) affirms that when a subject with suggested numbness claims not to feel touches, "that same skin will prove to have a perfectly normal sensibility if the appeal be made to that ..sub-consciousness, which expresses itself automatically by writing or by movements at the hand" (cf Weinberger, 2000). This special issue is about intelligence, the flexible use of knowledge; in this paper we focus on the expression of knowledge, an aspect of intelligence.

A key modern theory of voluntary action is predictive processing (e.g. Clark, 2019). Its account of action by "active inference" is remarkably similar to James': In order to move, one forms a model of the proprioceptive sensations that would be experienced if the movement were to happen. But a crucial extra step is needed for intentional movement: The actual proprioceptive

[1] The theory that subjects entertain one idea to the exclusion of others as an explanation of hypnotic response, though later adopted by Baars (1988), was falsified by Zamansky & Clark (1986), who showed highly hypnotizable people can describe contradictory states of affairs to those suggested while simultaneously successfully responding to the suggestion.

signal is dampened so that it does not override the model of what should be experienced (the dampening thereby producing a form of sensory attenuation). Ideomotor action could be defined to be that movement that arises simply from imagining the movement. The smallness of the movements (i.e., their need to be magnified by e.g. a pendulum in order to be observed) shows why something extra is needed for large movements: An intention, which may produce both the proprioceptive model and the dampening of the actual proprioceptive signal.

Hypnotic actions can be any behaviour in the repertoire of the subject under normal conditions. Thus, hypnotic motor action is not simply ideomotor. According to a range of theories (e.g. Hilgard, 1977; Spanos, 1986) hypnotic action occurs by intending the action to occur while being unaware of the intention, a process Dienes and Perner (2007) called "cold control" (cf. Lynn et al., 1990). But ideomotor action and a hypnotic motor response, such as a finger lifting as if involuntarily, have in common their guidance by imagined proprioceptive sensation (just as James declared), together with the feeling of the movement happening as if by itself.

Can unconscious knowledge be expressed using ideomotor or analogous hypnotic phenomena? This notion has been embraced in psychotherapy since the very beginning. In the 1880s, Janet used automatic writing to access knowledge otherwise thought to be inaccessible in the hope of finding the cause of the particular mental ailment of the patient (Ellenberger, 1970; and see Short, 2021, for recent uses). Similarly, Lecron (1954) recommended using suggested movements in hypnotic treatments to indicate 'yes', 'no', 'I don't know', or 'I don't want to answer' (cf. Erickson, 1959, Example 6). The movements are experienced as involuntary, and by asking yes/no questions in this way it is possible to gradually narrow down the possibilities and arrive at complex issues underlying psychological problems. This idea is still in use in therapy

(Ewin, Elmer, & Hammond, 2006). Erickson (1959, p 8) included in the preamble to the subject that the question to be answered by a suggested finger lift “This question…can be answered only by their unconscious mind, not by their conscious mind” (see also Erickson et al., 1976, p 44). The fact that the participant may view the response not as something they personally are asserting may allow sensitive topics to be addressed. However, that does not mean that the suggested action was controlled by unconscious knowledge more than a verbal response would be.

The therapeutic use of ideomotor (or hypnotic) action is sometimes based on the assumption that people have an immense repository of knowledge in the unconscious part of the brain with a higher capacity than normal awareness (Ewin et al., 2006; Lecron, 1954). Consequently, if people could tap into this knowledge to even some extent, they could then arm themselves with solutions to their problems. There is good evidence that people have acquired a body of unconscious knowledge, as shown for example by artificial grammar learning paradigms (e.g. Ling et al., 2016; Reber, 1967; Rebuschat, 2015) and sequence learning (e.g. Destrebecqz, & Cleeremans, 2001; Fu, Dienes, & Fu, 2010; Janacsek, & Nemeth, 2015; Norman, Price, Duff, & Mentzoni, 2007). The knowledge acquired in implicit learning tasks (e.g. Dulany, Carlson & Dewey, 1984; Vadillo, Konstantinidis, & Shanks, 2016) or conditions like blindsight (Weiskrantz, 1986) can typically be elicited by forced choice tests (i.e., by objective measures), which are at least volitional, if not verbal. The unconscious nature of the knowledge is revealed by it subjectively seeming to the person they do not have the knowledge (i.e., the unconscious nature of implicit knowledge is revealed by subjective measures, e.g. Dienes, 2012). If unconscious knowledge already tends to be well elicited by forced choice verbal tests (i.e., by the person indicating verbally or with button presses the answers), it would be surprising and thus important if actions experienced as non-volitional could elicit even more knowledge.

Marcel (1993) reported that different response modalities (i.e., eye blink, finger lift, or verbal report) were associated with different abilities to discriminate a brightness contrast, with verbal report having the lowest disrcimination. Marcel argued this only occurred when each act constituted a report of an experience. However, when the act expressed a guess, there was little difference between modalities. Thus, there was a difference between response modalities when the response expressed conscious rather than unconscious knowledge. Further, Overgaard and Sørensen (2004), in a partial procedural replication of Marcel, argued there were individual differences in which modality was associated with greater discriminability; and verbal report may be best for most people.

The only way to know if ideomotor action can elicit unconscious knowledge is to test the claim directly. A recent study has strikingly found that participants could answer a greater number of general knowledge questions correctly by ideomotor movements than they could consciously answer. Gauchou et al. (2012) used the Ouija game to elicit responses to general knowledge questions. Participants filled in a questionnaire of 80 yes/no questions, and were instructed to rate their answers as either “guessed” or “known.” During the next phase, eight questions were selected according to each category defined by the modalities (guessed/known, correct/incorrect, yes/no) and answered using the Ouija board with a confederate who surreptitiously removed her hand during the answers, allowing the subjects to move the board on their own. To counterbalance the order of testing, another eight questions (the same for every participant) were also answered, first using the Ouija board, and then again verbally. There was no significant difference for known answers between the two modalities. But there was a significantly higher accuracy for guessed answers using the Ouija board versus verbal report 65% vs 50% (where 50% is chance), which suggests that it is possible to access more semantic memories using ideomotor movements than by answering the same questions in a way that was presumably experienced as volitional. Olson, Jeyanesan, and Raz (2017) did not find a significant difference between ideomotor (using a pendulum) and verbal answers for the detection of briefly flashed letters. However, the evidential value of this non-significant result was not assessed using a Bayes factor.

The aim of the current study was to replicate Gauchou et al.'s (2012) findings that unconscious general knowledge can be expressed via ideomotor action. A different form of ideomotor action—a pendulum—was used as the ideomotor response in our study. This method was chosen because pendulum movements require no confederate and can be easily taught to most people to elicit ideomotor answers. The pendulum, though only used a few times in an experimental setting (Easton & Shor, 1975; Montgomery & Kirsch, 1996; Olson et al, 2017; Wegner, Ansfield, & Pilloff, 1998), is a convenient way of using ideomotor movements to express 'yes' or 'no' answers in a way that feels non-volitional. It has also been used in therapy (Heap, 2017). Apart from using a pendulum to elicit ideomotor responses, the design followed that of Gauchou et al., with only minor modifications. In the current study, three confidence levels were used to get a more graded picture of the level of confidence experienced at the time of answering. In order to have a question in each modality, 12 questions were selected from the initial questionnaire (as opposed to Gauchou et al.'s eight selected questions) according to the participants' answers. The second set of questions were also expanded to have an equal number of 12 questions. Finally, contrary to Gauchou et al's study, participants were not blindfolded.

Method

Participants

Twenty-eight participants were recruited from the University of Sussex School of Psychology's subject pool of undergraduate students, and received 10 UK pounds compensation. One participant had to be excluded from the analysis as no ideomotor response could be elicited despite various attempts, leaving 15 females and 12 males in the final sample. Ethical approval was obtained from the University of Sussex School of Life Sciences Research Governance Committee. Informed consent was obtained before starting the experiment, and participants were aware that they could withdraw from the study at any point.

Materials

A set of 98 yes/no general knowledge questions was constructed, similar to those used by Gauchou et al. (2012). The questions included yes/no questions from different domains of general knowledge.For example, "Is Lima the capital of Equador?" or "Was the opera The Magic Flute composed by Mozart?" (see supplemental materials https://osf.io/rsy5p/ for the full questionnaire). Following Gauchou et al. (2012), the questions were divided into 2 groups. *Set A* contained 74 questions and *Set B* contained 24 questions.

Design

A repeated measures design was used, following Gauchou et al. (2012). Each participant completed the questionnaire, then used the pendulum to answer 12 questions selected to cover different confidence and difficulty levels. To counterbalance order of testing, participants answered 12 previously untested questions from another set (B) with the pendulum, which was followed by verbally answering the second 12 questions (plus the remaining 12 of set B). In this way, there were a total of 24 questions answered both verbally and with the pendulum. Half of them were answered first with verbal report, and half first with the pendulum.

Procedure

Upon their arrival, participants completed all 74 Set A questions on the computer by putting an X in either yes or no and rating their level of confidence after each question ("I am absolutely certain", "I had some confidence but not sure", "I could just as well flipped a coin"). Then, participants were instructed in how to use the pendulum, and were asked known questions (such as "Is it Friday today?" "Were you born in the UK?" etc.) to establish the direction of yes or no answers from the pendulum. Once a consistent response was obtained at least four consecutive times, a set of 12 questions was selected from *Set A*, subject to the constraint that each question should come from a different one of the 12 categories given by the possible outcomes: correct answer (answer should be 'yes' or 'no'), correctness of the answer (correct or incorrect), and the confidence level (absolutely certain, had some confidence but not sure, and could just as well flip a coin). The combination of these possible outcomes yields 12 categories (2x2x3). The experimenter read out the questions in a clearly audible way, and participants were told to focus on the question, expecting the answer from the pendulum. An answer was accepted when the pendulum started to move in an unequivocal yes or no direction, swinging at least 1.5 centimeters from the middle, as judged by the experimenter. When the first 12 questions were answered, another set of 12 questions (Set B) was asked, still using the pendulum. These questions were the same for everyone. When all 24 pendulum answers were obtained, participants answered a questionnaire on the computer consisting of 24 questions which contained the 12 questions previously asked using the pendulum (Set B).

Finally, participants were asked about their experience and beliefs about the pendulum exercise. Participants were debriefed about the purpose of the study and allowed to ask questions. The experiment took about 45 – 60 minutes for each subject.

Results

Raw data are available at https://osf.io/rsy5p/. Bayes factors (*B*) were used to assess strength of evidence for the alternative hypothesis, H1, over the null, H0 (Wagenmakers, Verhagen, Ly, Matzke, et al., 2017). A *B* of above roughly 3 indicates moderate evidence for H1 over H0 and below roughly 1/3 moderate evidence for the H0 over Hl, though these conventions should be regarded as rough (i.e., there are no sharp cut offs). All Bayes factors, *B*, reported here represent the evidence for H1 relative to H0; to find the evidence for H0 relative to H1, take $1/B$. *B*s between 3 and 1/3 indicate no evidence one way or the other for distinguishing H1 from H0 (see Dienes, 2014; cf Jeffreys, 1939). Here, $B_{H(0,\, x)}$ refers to a Bayes factor in which the predictions of H1 were modeled as a half-normal distribution with an SD of *x* (Dienes & McLatchie, 2018); the half-normal can be used when a theory makes a directional prediction where *x* scales the size of effect that could be expected. Gauchou et al (2012) found a difference of 15% between modalities when participants felt they were guessing; thus, we set the SD to be 15%. For simplicity we used the same model for all tests.

To indicate the robustness of Bayesian conclusions, for each *B*, a robustness region is reported, giving the range of scales that qualitatively support the same conclusion (i.e., evidence as insensitive, or as supporting H0, or as supporting H1), notated as: RR [x1, x2] where x1 is the smallest SD that gives the same conclusion and x2 is the largest (see Dienes, 2019).

The average number of “guess” responses out of 24 total responses was 6.7 (SD = 2.4), of “some confidence” responses was 7.3 (2.1) and of “certain” responses was 9.1 (2.7). Table 1 shows the percent accuracy for each level of confidence according to modality (pendulum vs verbal). The crucial test is the difference in accuracy between pendulum and verbal for guess responses, $t(26) = 0.39$, $p = .70$, $B_{NH(0,15)} = 0.36$, $RR_{1/3<B<3}$ [0, 16%], close to the convention for moderate evidence for H0. Accuracy for guessing, averaged over modality, 51% (12%), was not above chance, $t(26) = 0.39$, $p = .70$, $B_{NH(0,15)} = 0.27$, $RR_{B<1/3}$ [13%, >50%].

[insert Table 1 about here]

Table 1

Percent correct of general knowledge questions. Standard deviations in parentheses.

	Modality	
Confidence	Pendulum	Verbal
Guess	52 (11)	51 (19)
Some confidence	53 (15)	55 (16)
Certain	73 (15)	69 (19)

Gauchou et al. (2012) used two confidence categories: "known" vs "guessed", so the latter may include all cases where the subject did not believe that they actually knew. If we combine "guess" and "some confidence" to form a "low confidence" category, then there was evidence for no difference in accuracy between the pendulum (53%, SD = 11%) and the verbal report (54%, SD = 14%), $t(26) = 0.16$, $p = 0.87$, $B_{NH(0,15)} = 0.20$, $RR_{1/3<B<3}$ [9%, >50%]. There was little evidence one way or the other for whether accuracy for guessing, averaged over modality, 53% (12%), was above chance, $t(26) = 1.96$, $p = .06$, $B_{NH(0,15)} = 1.42$, $RR_{1/3>B>1/3}$ [0, 1%; 7%, >50%].

Taking low confidence as defined above, and high confidence as certain, a 2 X 2 modality (pendulum vs verbal) by confidence (low vs high) repeated measures ANOVA on percentage accuracy, showed decisive evidence for a main effect of confidence, $F(1, 26) = 37.16$, $p < .001$, $B_{NH(0,15)} = 2.34 \times 10^7$, $RR_{B>3}$ [0.6%, >50%], with high confidence response (71%) being more accurate than low confidence ones (53%). There was evidence for no main effect of modality, $F(1, 26) = 0.23$, $p = .64$, $B_{NH(0,15)} = 0.30$, $RR_{B<1/3}$ [14%, >50%], with pendulum response (63%) being similar in accuracy to verbal responses (61%). There was evidence for no interaction between modality and confidence, $F(1, 26) = 0.84$, $p = .37$, $B_{NH(0,15)} = 0.16$, $RR_{B<1/3}$ [7%, >50%], thereby failing to replicate the interaction that Gauchou et al. (2012) obtained.

Discussion

The current study followed Gauchou et al.'s (2012) procedure with some key exceptions, primarily the use of a pendulum rather than a Ouija board to elicit ideomotor action. Relatedly, we did not use a blindfold, although participants were allowed to close their eyes if this helped them elicit the ideomotor effect. Gauchou et al. used a confederate and we did not. Finally, in the present experiment, three rather than two confidence levels were used. We did not replicate Gauchou et al's interaction between confidence and modality, nor their higher and substantial accuracy for the ideomotor response rather than verbal response for low confidence answers. We provide no evidence that ideomotor action can elicit knowledge unavailable to verbal report.

Unconscious knowledge often expresses itself verbally when people believe they are guessing (or in implicit learning contexts, when people experience a feeling of intuition or familiarity) (Dienes, 2012; Cheesman & Merikle, 1986; Weiskrantz, 1997). By the same token, one could question why unconscious general knowledge would not be expressed in the same way. In this case, we should see performance beyond chance level for guessed verbal answers; in fact there was evidence that such answers were at chance ($B_{NH(0,15)} = 0.28$). Maybe in this case there was not unconscious knowledge to be expressed. (For intermediate confidence answers, there was no evidence one way or the other for whether performance was above chance; $B_{NH(0,15)} = 1.05$.) But why then did Gauchou et al. (2012) seem to find it expressed in ideomotor action with a very similar procedure?

A possible explanation for Gauchou et al.'s (2012) results is an experimenter effect. In both our and their study, questions were read out loud by the experimenter. But also, in their study, after a question was asked of the participant, the experimenter "placed the participant's forefingers on the planchette" (p 978). As the experimenter may have known the answers to the questions, there is some room for cues to be communicated. In any future replications using Ouija board, computer-read questions could be given via headphones so that the person who is placing the participants' fingers on the planchette would not know what question had been asked.

A further factor may be the time taken to elicit a Ouija response rather than a pendulum response: For almost the same procedure otherwise, our study took less than an hour for each participant, and Gauchou et al's took two hours. Indeed, the convenience of the pendulum was a key reason we chose it. Maybe the time taking savoring the question allows some knowledge to surface.

It may be important that Gauchou et al. (2012) used a confederate and participants believed that they were moving the Ouija board together with the confederate, which could further decrease their sense of being the agent of the action. It is not clear why this should be important for expressing non-personal semantic knowledge. But conversely, the fact that for known answers the results were the same when questions were answered volitionally and using the pendulum, suggests that the pendulum can give legitimate answers, without a sense of agency, which could be particularly useful in broaching sensitive issues. Further research could compare ideomotor responses to sensitive questions, such as to do with racism or sexuality, with direct questioning or implicit measures (e.g. Jiang et al., 2006).

In therapy, facilitating the expression of sensitive knowledge by the feeling one is not responsible for it, can be achieved by using suggestions for automatic behavior, mainly but not necessarily in a hypnotic context. Earlier we distinguished pure ideomotor action, small motions produced by imagining an action, from larger motor behaviors caused by cold control (e.g. hypnosis). The latter, for example a suggested finger movement, also involves the sense that one is not the agent of the action. Such actions are sometimes called ideomotor as well, but we suggest they involve a different mechanism: Cold control (e.g. hypnosis) vs the muscular spillover effects of purely imagining an action (ideomotor action). From Janet to Hilgard (1977), it has been evident that sometimes information can be available to one response (e.g. automatic writing, Short, 2021, or the hidden observer) that is unavailable to another (for example, only the hidden observer reports the painful nature of a noxious stimulus).

In general, cold control involves producing actions and experiences according to one's goals.   Ppeople skilled in cold control may when they have conflicting needs and goals, produce experiences they wish they did not have (amnesias, emotions, negative or positive perceptions, and so on), thereby presenting to a therapist with problems. Because such people are unaware of the intentions that produce the experiences, those experiences seem to happen by themselves. People may not realize they in fact have control over the sometimes unwanted experiences. But a problem caused by cold control may be solved by it. And it is in dealing with information hidden, by cold control, that a person may well use cold control to reveal it; for example, by finger lifts, head nods, or automatic writing. However, this study does suggest a word of caution: Do not take ideomotor responses as necessarily indicating any special knowledge.

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