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Can suggestion obviate reading? Supplementing primary Stroop evidence with exploratory negative priming analyses

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ABSTRACT

Using the Stroop paradigm, we have previously shown that a specific suggestion can remove or reduce involuntary conflict and alter information processing in highly suggestible individuals (HSIs). In the present study, we carefully matched less suggestible individuals (LSIs) to HSIs on a number of factors. We hypothesized that suggestion would influence HSIs more than LSIs and reduce the Stroop effect in the former group. As well, we conducted secondary post hoc analyses to examine negative priming (NP) – the apparent disruption of the response to a previously-ignored item. Our present findings indicate that suggestion reduces Stroop effects in HSIs. Secondary analyses show that LSIs had an NP effect at baseline (i.e., without suggestion) and that suggestion influenced the NP condition. Thus, at least in this experimental context, suggestion seems to dampen a deeply-engrained and largely automatic process – reading – by wielding a larger influence on HSIs relative to comparable LSIs.

1. Introduction

Most proficient readers cannot withhold accessing word meaning despite precise instructions to attend only to the ink color. The Stroop task provides evidence for the automaticity of reading (Stroop, 1935). Modern versions of this task show that when the ink color and the color word are incongruent (e.g., the word RED displayed in green ink), participants are slower and less accurate to respond "green" to the ink color compared to control items (e.g., the word LOT or the string XXX printed in green). Extensively studied in attention research, Stroop tasks and Stroop-like paradigms abound (MacLeod, 1991; MacLeod & MacDonald, 2000) and comprise the "gold standard" of automated performance (MacLeod, 1992). However, several studies – including a few using the influence of suggestion (Raz, Fan, & Posner, 2005; Raz, Shapiro, Fan, & Posner, 2002) – have challenged the automaticity claim by proposing that the assumed automatic processes underlying reading may be more malleable than heretofore acknowledged.

Using standard psychological tools (Shor & Orne, 1962; Weitzenhoffer & Hilgard, 1962), researchers can characterize individuals as either highly suggestible individuals (HSIs) or less suggestible individuals (LSIs). Following anecdotal reports from select individuals (MacLeod & Sheehan, 2003; Schatzman, 1980) and personal communications (e.g., Thalia Wheatley, Harvard University, 2002; Stanley Fisher, Albert Einstein College of Medicine, 2000), multiple Stroop studies have examined cognitive processing differences between highly suggestible individuals (HSIs) and less suggestible individuals (LSIs) as a function of a post-hypnotic suggestion (Raz, Kirsch, Pollard, & Nitkin-Kaner, 2006; Raz, Moreno-Iniguez, Martin, & Zhu, 2007; Raz et al., 2002, 2003, 2005). The crux of these reports proposed that a specific post-hypnotic suggestion degraded

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the Stroop effect in HSIs. A few researchers were able to replicate these findings at the individual – but not group – level (e.g., personal communication from Amanda Barnier, University of New South Wales, Australia, 2005); however, other researchers have been able to replicate the wholesale effect based on the suggestibility of participants even without ritualistic inductions such as those common in hypnosis (Raz et al., 2006). Although other researchers have challenged the automaticity of the Stroop effect without resorting to suggestion (Besner, 2001; Besner & Stolz, 1999a, 1999b, 1999c; Besner, Stolz, & Boutilier, 1997; Dishon-Berkovits & Algom, 2000; Kuhl & Kazén, 1999; Long & Prat, 2002; Melara & Algom, 2003; Pansky & Algom, 2002), most scholars continue to regard Stroop tasks as the apotheosis of automatic performance (Brown, Gore, & Carr, 2002; Brown, Joneleit, Robinson, & Brown, 2002).

In the present study, we wanted to conduct a typical Stroop task – drawing on a large and carefully matched sample – that would examine the differences in the influence of suggestion between HSIs and LSIs. As our primary hypothesis and in line with our previous reports, we expected that HSIs, compared to LSIs, would manifest a compelling reduction of the Stroop effect as a function of suggestion. In addition, as a surrogate exploration across the relatively large sample size, we extracted and analyzed post hoc the negative priming (NP) conditions for each participant. NP is a robust measure consisting of a pair of trials wherein the word ignored in Stimulus1 is identical to the ink color of the immediately following Stimulus2. In such cases, response time (RT) to Stimulus2 is typically longer than if Stimulus1 contained a word that did not become the ink color in Stimulus2 (Neill, 1977; see Mayr & Buchner, 2007 for a review). Our secondary hypothesis, therefore, was that, with suggestion, HSIs would show reduced NP compared to LSIs. NP is an advantageous supplementary index to Stroop performance because it is relatively immune to ulterior strategies that participants may adopt and because influencing a stepwise procedure is extremely difficult to manage consciously (Tipper, 2001). Thus, if suggestion reduced the Stroop effect in a large cohort, we would expect it to reduce NP as well.

2. Method

2.1. Participants

To measure the quantifiable rating of participants' response to suggestions under standard conditions, we screened volunteers for hypnotic suggestibility using both the Harvard Group Scale of Hypnotic Susceptibility Form A (HGSHS-A) (Shor & Orne, 1962) and the Stanford Hypnotic Susceptibility Scale, Form C (SHSS-C) without the ammonia challenge for anosmia (Weitzenhoffer & Hilgard, 1962). Participants were 83 proficient readers of English (38 female) aged 20–41 (mean = 29) years, all of whom had normal or corrected-to-normal vision. Having screened about 500 individuals on these two scales, we identified 49 participants scoring in the highly suggestible range (10–11 of a possible 11 on the SHSS-C; top 5% of HGSHS-A). We matched the remaining 34 participants – scoring in the less-suggestible range (0–1 of a possible 11 on the SHSS-C; bottom 5% of HGSHS-A) – to the HSIs using age, sex, handedness, education, and gross socio-economic status (SES) and cultural determinants. Most participants were medical and graduate students.

2.2. Materials

Each stimulus consisted of a single word written in one of four ink colors (i.e., red, blue, green, or yellow), which appeared in the center of the monitor where a black fixation cross was visible. All characters were in upper-case font against a white background, and the stimuli subtended visual angles of 0.5° vertically and 1.3–1.9° horizontally depending on the word length.

We used two classes of words in our classic Stroop paradigm: color words (RED, BLUE, GREEN, and YELLOW) and neutral words (LOT, SHIP, KNIFE, and FLOWER) and matched both classes for length as well as lexical frequency. Using Excel code, we extracted NP conditions by comparing every incongruent trial to the preceding trial (i.e., Stimulus1) for each participant. If Stimulus1 was incongruent, and the word of Stimulus1 matched the ink color of Stimulus2, the pair comprised an NP condition. Control conditions (CTRLs) for the NP condition consisted of an incongruent trial pair wherein the word ignored in the first trial was different from the ink color of the immediately following trial. As such, both trials of a pair had to be incongruent for the trial to potentially constitute an NP or CTRL condition. This operationalization of NP is common in cognitive psychology (Neill, 1977). Fig. 1 depicts NP and CTRL pairs within our Stroop task.

For the Stroop task, three experimental conditions were applied: a congruent condition, in which each color word was presented in its own color; a neutral condition, in which each neutral word was presented in any of the four colors; and an incongruent condition, in which each color word was presented in any of the three colors other than the one to which it referred (e.g., the color word RED presented in green). During each trial, participants were asked to indicate the ink color in which a word was presented in by pressing one of four keys on a keyboard. The color-labeled response keys were "V", "B", "N" and "M" for colors red, blue, green, and yellow, respectively. Two fingers of each hand were used to press the response keys (i.e., left middle finger for "V", right index finger for "N", etc.). Speed and accuracy were emphasized equally.

2.3. Design and procedure

Participants sat at a viewing distance of approximately 67 cm in front of a color computer monitor. They were instructed to focus their eyes on a fixation cross in the center of the monitor. A stimulus would follow, replacing the crosshair. The stim-