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IMPAIRMENT OF EXECUTIVE ABILITIES FOLLOWING A SOCIAL CATEGORY PRIME

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ABSTRACT

Previous research has found evidence for a behavioural assimilation effect (Bargh, Chen, & Burrows, 1996) where the priming of a social category leads participants to behave in line with the stereotypes or associated traits of that social category. The current study investigated the effect of priming psychology students with the category "neuropsychological patient" on their subsequent executive function abilities. Fifty-nine participants were randomly assigned to one of three conditions; participants received a neuropsychological patient prime, a beach scene prime or no prime. Following the prime, participants completed the Tower of Hanoi task, which is frequently used to assess executive function among those with neuropsychological disorders. As predicted, participants in the neuropsychological patient prime condition showed behavioural assimilation, performing significantly worse on the Tower of Hanoi task than participants in either control condition. We discuss the implications of observing behavioral assimilation effects in this new domain.

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INTRODUCTION

Social psychological research has revealed that people are influenced, often in an unintentional and automatic fashion, by stimuli in our social environment (see Bargh, 1994). It is thought, for example, that attitudes are automatically activated in the presence of an attitude object (Bargh, 1989) and that stereotypes are automatically activated in the presence of features associated with a stereotyped group (Brewer, 1988; Devine, 1989). More recently, researchers have found evidence for a behavioural assimilation effect (Bargh, Chen, & Burrows, 1996); that is, the automatic activation of a social category can lead participants to behave in line with the stereotype or associated traits of that social category. The current study investigated whether assimilation effects may also be observed in a new context, with respect to so-called "executive functions," stereotypically associated with neuropsychological patients. If such an effect can be demonstrated, it may have significant implications for our understanding of behavioral assimilation and self-categorization in normal and clinical populations. Below, we outline the origins of this line of research, summarize evidence for the behavioural assimilation effect, outline the link between neuropsychological impairment and executive functioning, and explain our current hypothesis.

The Effect of Priming on Impression Formation and Behaviour

Social psychologists have spent many years studying the effects of priming on an individual's subsequent impressions of others. Priming is the incidental activation of knowledge structures, such as trait concepts and stereotypes, by the current situational context. The activation of these concepts can carry over for a time to exert an unintended passive influence on the interpretation of the behaviour of others. If, for example, a group membership category is activated by seeing someone from that social category, the category will remain activated (or primed) for some time after the stimuli person is no longer present. Because any categorization carries with it a unique set of social stereotypes, attitudes and stereotypic traits, these also remain accessible and are likely to be used in the interpretation of other people's behaviour. This incidental activated knowledge can influence people's judgements without any awareness that such influence is occurring (Bargh & Chartrand, 1999; Bargh & Ferguson, 2000).

Although it is now accepted that judgments of others can be automatically and unintentially activated, until recently it has been widely assumed that behavioural responses to the social environment are under conscious control (Bargh, 1989). Devine (1989), for example, argued that the activation of stereotypes is automatic, but that whether prejudiced behaviour is instigated as a result is a matter of conscious choice. Research conducted over the past decade has, however, discovered that priming can have a profound influence on social behaviour.

The Behavioural Assimilation Effect

Priming participants with traits, or even group categories that are associated with certain traits, can increase the extent to which participants behave in line with those traits, a phenomenon known as *behavioural assimilation* (Bargh et al., 1996; Dijksterhuis & van Knippenberg, 1998). Activating perceptual information may influence behaviour as well as impression formation because behavioural responses are mentally represented in a similar way to other social

information like trait concepts, stereotypes and attitudes (Chartrand & Bargh, 1999; Dijksterhuis & van Knippenberg, 1998). Indeed, there is neuropsychological evidence for this link; the same area of the premotor cortex is active when humans perceive an action and when they perform that action themselves (Buccino et al., 2001).

Bargh and colleagues (1996) conducted several studies that established the behavioural assimilation effect. They first primed participants with the trait of rudeness during a scrambled sentence task (Srull & Wyer, 1979). Compared to participants who were primed with politeness or who were given no prime, those in the rudeness prime condition were subsequently quicker to interrupt an experimenter's conversation with a confederate. In a second study, Bargh et al. (1996) demonstrated that priming stereotypes of elderly people made participants subsequently walk more slowly; in other words, it made them more likely to behave in accordance with an elderly stereotype. Finally, participants were judged to have behaved in a more hostile manner when a computer error occurred during a study after they had been subliminally priming with photographs of African Americans (for whom there is an associated stereotype of "hostile") than if they had been subliminally primed with photographs of Caucasian faces. In none of these studies did participants express any knowledge of the prime embedded in the scrambled sentence task or its influence on their subsequent behaviour, demonstrating the automatic and unintentional nature of the primed behaviour.

Subsequent research by Dijksterhuis and van Knippenberg (1998) demonstrated the behavioural assimilation effect on more complex social behaviours. They found that participants who imagined a typical professor (associated with the stereotype "intelligent") subsequently outperformed those who imagined a typical secretary, on a general knowledge task. In a further study, participants asked to imagine a typical soccer hooligan (associated with the stereotype "stupid") performed worse on the general knowledge task than those who had received no prime. In explaining how priming can influence complex behaviours, Dijksterhuis and van Knippenberg (1998) argued that although intelligence is an abstract concept rather than a concrete behaviour, behavioural representations are likely to be hierarchically structured, whereby the abstract concept "intelligence" is associated with a series of behavioural patterns, for example concentration, careful consideration of information and systematic thinking. Thus, although priming would not have changed participants' actual level of intelligent or knowledge, it may have temporarily induced participants to behave differently in their reaction to the multiple choice task. Priming participants with "intelligent" may have, for example, subconsciously induced concentration, led to the use of more varied strategies and additional cues, and increased confidence, all of which may have affected performance.

The Effect of Priming a Social Category on Executive Functioning

The current study tested the hypothesis that executive function may be impaired by priming the category "neuropsychological patient." Executive function (Mazaux et al.,1997) refers to a set of psychological processes, associated with the prefrontal cortex of the brain (Owen et al., 1991), that allow us to control and coordinate complex cognitive tasks (Miyake et al., 2000). In their model of executive functioning, Norman & Shallice (1986) proposed that most responses are under fairly automatic control, with automatic cues triggering specific schema that coordinate action. In situations where routine selection of operations is inappropriate, however, an

attentional coordinating system takes over to deal with the situation (Baddeley, 1986). Executive function therefore refers to the control processes needed to successfully perform tasks that are difficult or novel (Norman & Shallice, 1986). Two important aspects of executive function are the ability to keep task- or goal-related information active in working memory during controlled processing and the ability to inhibit prepotent, but inappropriate, responses (Miyake et al., 2000).

One form of assessment frequently used to capture executive function is the Tower of Hanoi task, in which participants are required to move a set of disks arranged in order of size on one peg to a different peg in the same order, while abiding by certain rules. To complete the Tower of Hanoi task with ease, an executive function is necessary; the inhibition of prepotent responses to deal with goal-subgoal conflicts (Goel & Grafman, 1995; Miyake et al., 2000). Put simply, to move from the start state to the goal state, participants are required to form subgoals which involve counterintuitive moves away from the goal state before they can ultimately move closer to the goal state. Individuals with executive function abilities can inhibit the natural tendency to make a more obvious, but actually incorrect move, in favour of a counterintuitive move to complete the Tower of Hanoi task. In contrast, however, neuropsychological patients with prefrontal cortex damage perform poorly on the Tower of Hanoi task because the damaged area of the brain is strongly implicated in executive function (Grigsby, Kaye & Robbins, 1995). Goel & Grafman (1995) identified the cause of the difficulty in completing the Tower of Hanoi task among those with prefrontal cortex damage as a failure to resolve goal-subgoal conflicts when they arose during the task.

The Current Research

The goal of the current research is to investigate the assimilation effect of priming the category "neuropsychological patient" on executive function, measured using the Tower of Hanoi task. This is the first study to look at the effect of priming on a measure of executive function, a complex behavioural outcome. An additional aim of this research is to bridge the gap between social and cognitive psychology. Priming models the implicit processes of social interaction. We are constantly influenced by social cues in everyday life. These include cues relating to group membership and social categories. Showing that social priming can have an affect on cognitive processes will provide an important link between these two domains. We also look at the negative effect of priming. Dijksterhuis & van Knippenberg (1998) argued that evidence for negative or undesirable effects may provide a strong case for the unintentional nature of priming on behaviour, because people are unlikely to engage in undesirable behaviour on purpose, running the risk of coming across as incompetent. We predict that with a sample of undergraduate psychology students, who, in the context we study, are knowledgable about neuropsychological disorders and their associated symptoms, priming with the category "neuropsychogical patient" will lead to impaired performance on a task that requires the executive function of prepotent response inhibition.

METHOD

Participants and Design

Fifty-nine undergraduate students, 49 female and ten male, were randomly assigned to one of three conditions, a neuropsychological patient prime, a beach scene (control) prime or a no-prime control. All participants received course credit for taking part.

Procedure

Participants were given an instruction sheet, informing them that the study involved two sub-tests, a short impression formation task and a simple cognitive task. Participants were then randomly assigned to either the priming condition or one of two control conditions. The prime was adapted from the procedure used by Dijksterhuis and van Knippenberg (1998). Participants were asked to imagine a neuropsychological patient and list what might be their typical behaviours, lifestyle and appearance for a period of five minutes. To rule out the alternative explanation that priming participants with any concept affects task performance, participants in the beach scene prime control condition were asked to imagine a beach scene and list what they might typically see going on around them for five minutes. Participants in the baseline control condition received no prime. Participants were then given the Tower of Hanoi task to solve. Following completion, they were asked what they thought the study examined and if they were at any point suspicious about the rationale given for the study. This allowed us to check participants' awareness of the priming procedure and thus to rule out its influence in their later performance. Finally, participants were fully debriefed and thanked for their participation.

Dependent Measure

The Tower of Hanoi task was presented on a computer. It consisted of three vertical pegs and five disks of varying size. Initially, participants were presented with a start state in which the disks were placed in descending size order on the first peg. Participants were then instructed that they should aim to reach a goal state in which the disks are stacked in descending size order on the third peg. Participants were informed that they would be limited by three constraints while completing this task. First, only one disk may be moved at a time. Second, any disk not being currently moved must remain on a peg. Third, a larger disk may not be placed on top of a smaller disk. Before the test session, participants were given the opportunity to familiarize themselves with the task in a brief practice session with the experimenter. The experimenter demonstrated how to use the mouse to move the counters in the task and demonstrated a move that was allowed (moving the first disk onto the next peg) and a move that was not allowed (putting the second bigger disk onto the smaller first disk). The program was then reset, and participants were then informed that they had up to ten minutes to complete the task. The number of moves taken was recorded by the computer.

RESULTS

We expected that priming participants would influence their performance on the Tower of Hanoi Task. Specifically, we expected participants in the neuropsychological patient prime condition to

take more moves to complete the task than those in either the beach scene prime control or the no-prime control conditions. The mean number of moves taken to complete the Tower of Hanoi task was therefore subjected to a three (prime: no prime vs. beach scene prime vs. neuropsychological patient prime) between-subjects analysis of variance (ANOVA). The predicted main effect was significant, F (2, 32) = 3.47, $p < .05$ (see Table 1).

Table 1: Moves Taken on the Tower of Hanoi Task as a Function of Prime

	No Prime (N = 10)	**Beach Scene Prime (N = 12)**	**Neuropsychological Patient Prime (N = 13)**
Mean Number of Moves	70.50 (28.88)	75.67 (26.51)	111.62 (58.20)

Note: Standard deviations are shown in parentheses

Planned constrast analysis (Judd & McClelland, 1989) was employed to test where the significant differences were. Contrast A (no prime: 1, beach scene prime: 0, neuropsychological patient prime: -1) tested whether, as predicted, the number of moves taken to complete the Tower of Hanoi task in the neuropsychological patient prime condition was significantly greater than in the no prime condition. Contrast B (no prime: 0, beach scene prime: 1, neuropsychological patient prime:-1) tested whether there was the number of moves taken to complete the Tower of Hanoi task in the neuropsychological patient prime condition was significantly greater than in the beach scene prime condition. Contrast C (no prime: 1, beach scene prime: -1, neuropsychological patient prime: 0) tested whether there was a significant difference in performance between the two prime conditions (we predicted no difference). As expected, participants in the neuropsychological patient prime condition took significantly more moves to complete the Tower of Hanoi task than participants in the no prime condition, Contrast A; t (32) = -2.34, p = .026, and they took more moves than participants in the beach scene prime condition, Contrast B; t (32) = -2.15, p = .039. There was no significant difference in number of moves taken to complete the Tower of Hanoi task in the no prime and beach scene prime control conditions, Contrast C; t (32) = -0.29, p = .78.

Responses on the feedback sheet showed that no participant indicated suspicion about the rationale of the current study, the link between the prime and the subsequent Tower of Hanoi task, or the predicted effect of the prime on the task. Thus, the effect of the prime on subsequent behaviour appears to have been unintentional and nonconscious.

To summarize, priming the category "neuropsychological patient" led to an assimilation effect, whereby participants showed poorer executive function than those in either control condition. The lack of significant difference between performance in the two control conditions confirms that it was the content of the prime, not the presence of any prime, that led to impaired performance on the Tower of Hanoi task.

DISCUSSION

The aim of the current study was to ascertain whether priming psychology students with a familiar category, neuropsychological patients, would lead to behavioural assimilation (Bargh et al., 1996; Dijksterhuis & van Knippenberg, 1998). Supporting our predictions we found that, compared to participants in two control conditions, the neuropsychological patient prime led to poorer performance on the Tower of Hanoi, a task considered to be a good indicator of executive function (Goel & Grafman, 1995). Thus, following the prime, participants assimilated to the behaviour expected of neuropsychological patient, displaying poorer executive function.

Dijksterhuis and van Knippenberg (1998) argued that behavioural assimilation would occur not only for simple behaviours, like the effect of an elderly prime on walking speed, but also for complex behaviours, for example behaviours associated with abstract traits like "intelligent." Our findings support this argument; primed participants showed behaviour associated with the abstract trait "poor executive function." We argue that the category "neuropsychological patient" may have influenced performance on the Tower of Hanoi task through a hierarchically structured chain of events. The activation of this social category and its associated trait "poor executive function" may, in turn, have activated a number of behavioural characteristics of that trait, for example inability to inhibit inappropriate responses, poorer planning abilities and poorer goal management. Although the prime would not have genuinely impaired participants executive function skills, it may have temporarily triggered these types of behavioural responses, for example increasing the likelihood that participants try to solve the Tower of Hanoi task by focusing on the final goal rather than attending to counterintuitive sub-goals.

These findings extend previous research by finding evidence for behavioural assimilation in a domain not previously investigated and by identifying the effect of priming on a a complex and abstract trait, executive function. Moreover, while previous research has looked at the effect of priming social categories recognized by the majority (e.g., the elderly, African Americans), the current study looked at the effect of a social category and associated knowledge structure held by a specific population, psychology students. Our findings show that it is not just stereotypes widely held in a particular society that can unintentionally influence our behaviour, but also specialist knowledge that we may hold. Clearly, these findings cannot be generalized to other populations, for example those who do not have a knowledge of psychological disorders. They do, however, warrant further research on the effect of specific knowledge structures in producing behavioural assimilation.

We acknowledge that the current research would have been enhanced by the inclusion of alternative measures of executive function. Although the Tower of Hanoi task is widely used to assess the inhibition of prepotent responses and planning ability (Goel & Grafman, 1995), Miyake et al. (2000) noted two additional important aspects of executive function; the ability to shift between tasks or mental sets and the ability to update and monitor working memory representations. Further research should investigate the parameters of the effect of the prime used in the current study, whether its effect limited to the Tower of Hanoi task or if it also influences these additional aspects of executive function.

The findings from the current study have implications for those who belong to groups typically associated with poor executive function, for example the elderly and those with neuropsychological disorders (Owen et al., 1991; von Hippel, Silver, & Lynch, 2000). The fact that expectations about executive function in certain groups has a direct, unconscious effect on executive function may lead to a self-fulfilling prophecy (e.g., Snyder, Tanke, & Berscheid, 1977). People who expect to have poor executive function, for example the elderly, may actually show greater executive function impairment when their status as an elderly person, and therefore associated traits like poor executive function, is activated. Moreover, because of a lack of awareness that a behaviour has been influenced by the perception of a stimuli in the environment, that behaviour is likely to be misattributed to other causes of which the individual is aware (Bargh et al., 1996). Thus, in the case of an elderly person, poor performance on an executive function task as a result of an environmental prime will be attributed to old age and poor mental capacity, with obvious negative implications for that individual.

On a more positive note, the current findings imply that executive function is malleable. If executive function can be impaired among young, healthy participants by priming them with a category associated with impaired executive function, priming the elderly or those who are neuropsychologically impaired with a category or trait associated with good executive function may lead to improved executive performance. Finally, executive function is associated with the ability to inhibit stereotyped and prejudiced reactions (von Hippel et al., 2000). If executive function is malleable, as we have shown, priming categories associated with good executive function should also reduce stereotyping and prejudice.

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