Can an Elderly Stereotype Prime Degrade Performance on a Simulated Surgical Task?

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Automaticity literature has clearly demonstrated that the mere activation of stereotypes can have a negative impact on a perceiver's own behavior. If this finding transfers to the context of minimally invasive surgery (MIS), it is important to be aware of these effects and fully understand the implications. The current study looks at the possibility that the behavioral effects of automatic stereotype activation could occur during MIS. Specifically, will an elderly prime result in slower performance? Participants that received the elderly prime were slower and had more errors when completing trials after the prime than participants that received the young prime. These results suggest that surgical performance may be affected by stereotypes and the increased error rates found in the elderly population may not be due solely to the complexity of their care.

It is now well-established that stereotypes can become automatically activated by the mere presence of physical features associated with a stereotyped group (Devine, 1989; Bargh, Chen, & Burrows, 1996). Not only can the presence of a stereotyped group activate a specific stereotype, but numerous studies have also shown that this activation can influence a person's behavior (see Wheeler and Petty, 2001, for summary). Specifically, stereotype activation can cause the perceiver to act in stereotype-consistent ways; for example, activation of the elderly stereotype can lead participants to show impaired memory performance (Levy, 1996).

The fact that stereotypes can affect behavior without a perceiver's awareness is important because of the wide range of negative consequences that can occur, such as decreased memory (Levy, 1996) and increased hostility (Bargh et al., 1996). These negative consequences highlight the need to determine the effect stereotypes have in situations where activation can have dire consequences.

The effects of stereotypes are especially important because even low-prejudiced people can experience negative effects when they are knowledgeable about specific stereotypes (Devine, 1989). The current study looks at the possibility that the behavioral effects of automatic stereotype activation could occur during minimally invasive surgery (MIS).

Minimally Invasive Surgery

During MIS, surgeons make several small incisions in which cameras and long thin instruments are inserted. By viewing the camera image on a monitor, surgeons are able to complete the entire surgical procedure. MIS results in many benefits for the patient, such as faster recovery times, less damage to healthy tissues and shorter hospitalization stays (Tendick, Jennings, Tharp, Stark, 1993).

MIS and Stereotypes

While the benefits of MIS may outweigh the costs, a considerable amount of errors still occur. Studies looking at specific MIS procedures have found complication rates of 1.6% (Cuschieri et al., 1991) to 5.47% (Wherry, Marohn, & Rich, 1994). Data such as this have initiated the redesign of the healthcare system to make it safer (Berwick & Leape, 1999). However, not all causes of errors have been examined. Stereotype activation and the application of stereotypes could contribute to the high error rates found in the medical domain.

Age stereotypes. Demographic information has shown that older patients have a higher incidence of preventable adverse events during their treatment compared to younger patients (Thomas & Brennan, 2000). These increased error rates have been attributed to frailty and greater likelihood of comorbid illness (Weingart, Wilson, Gibberd & Harrision, 2000). While it is thought that the number of adverse events with elderly patients is a result of the clinical complexity of their care and not age based discrimination (Thomas & Brennan, 2000), automatic stereotype activation may also contribute.

Bargh, Chen and Burrows (1996) showed that participants walked slower after being primed with the elderly stereotype, even though they did not realize they were doing so. It is possible that when surgeons are working on elderly patients, the same stereotype application could happen to them. If their performance is significantly slowed, this could lead to adverse consequences for the patient because of the increased operation time. Cuschieri (1995) described a "surgical fatigue syndrome" that occurs after performing MIS for about four hours. This surgical fatigue syndrome could result in an increase in errors.

Cognitive factors. The cognitive demands associated with MIS, such as mental concentration (Berguer, Smith, Chung, 2001), also have implications for stereotypes. Gilbert & Hixon (1991) found cognitively busy participants were less likely to activate a particular stereotype, but more likely to use it once activated. In the MIS environment, surgeons become exposed to their patients' group membership before surgery and cognitive busyness begins. The lack of cognitive busyness during initial exposure should increase the likelihood the relevant stereotype becomes active. During the surgical procedure, cognitive busyness occurs because of the demands associated with MIS and the attention required for various sources of information (Tollner, Riley, Matthews & Shockley, 2005). This should make surgeons more likely to use stereotypes that have been activated.

Current Study

While the notion that stereotype activation might have effects on surgical performance is a sensitive subject because of the implications, there is reason to believe these effects may occur. Automaticity literature has clearly demonstrated that the mere activation of stereotypes can have a negative impact on a perceiver's own behavior. If this finding transfers to the context of MIS, it is important to be aware of these effects and fully understand the implications.

The purpose of the current experiment is to determine if the age stereotype (young versus elderly) affects performance on a peg-transfer task with a laparoscopic simulator while under cognitive load. Specifically, will an elderly prime result in slower performance?

EXPERIMENT

Method

Participants. Thirty-six undergraduate introductory psychology students (18 male and 18 female) from Texas Tech University participated for course credit.

Apparatus & Displays. A perceptual-motor task relevant to laparoscopic surgery was simulated with a laparoscopic simulator that consists of a wooden box, miniature cameras, and surgical graspers (DeLucia, Hoskins & Griswold, 2004). Refer to Figure 1.

Figure 1. Laparoscopic simulator.

A block of wood that contains nine holes was located inside the box (refer to Figure 2). Three wooden pegs were located in three holes. A color CCD bullet camera was mounted on the top of the box. The camera image was displayed in real time on a monitor located directly in front of the participant. Finally, the top of the box opened with a hinge to provide participants with a direct view of the interior.

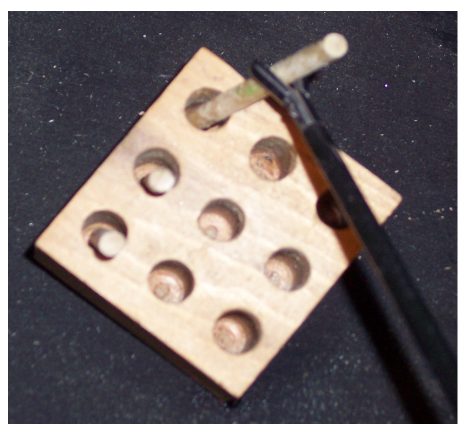

Figure 2. Block and wooden pegs used for peg transfer task.

Participants were primed with the stereotype by reading an information card. The card contained information such as name, age, race, picture, and a short paragraph about the person's experience; all paragraphs were identical. See Figure 3 for an example. Participants received one of three different cards; a young or elderly card, or control card that contained only the paragraph.

To induce cognitive load, half the participants underwent a simple short-term memory task. They rehearsed strings of random digits one less than their short term memory (STM) capacity. STM capacity was measured using the Digit Memory Test (Turner & Ridsdale, 2004). The test operationally defines STM as digit span, the length of a digit string that participants can remember. The rehearsing of digits was chosen to increase cognitive load because MIS surgeons often need to remember multiple pieces of information during the surgery.

Figure 3. Example of information card used to prime elderly stereotype.

Procedure. Participants were told the experiment was a pilot study to measure novice laparoscopic performance. First, participants' short term memory (STM) capacity was measured. Forward digit span was obtained by presenting random digit strings to participants, at the rate of one digit per second, and asking them to repeat the digits. There were two trials of each digit length. Digit length began with two and increased by one until participants failed to recall the correct number sequence for both digit strings in a pair of trials. Backward digit span was found through the same procedure, except digits were repeated backwards. Digit span was measured by averaging the number of digits correctly repeated forwards and backwards.

Participants were then instructed on how to complete the peg transfer task. A peg was picked up with the left grasper, transferred to the right grasper and placed in the right side of the block. This process was completed with all three pegs and then all pegs were moved back to their starting position. Both accuracy and speed were emphasized during every trial.

After instruction, participants completed one trial with a direct view. This was meant to familiarize participants with the graspers and the task. Subsequently, participants were told to complete the task at least four times (trials were continued if participants were unable to complete one trial with less than two errors) while indirectly viewing the block on the monitor. These trials were meant to eliminate practice effects.

After sufficient practice, participants completed 3 more trials. The camera image was recorded for later analysis of errors and speed. During this phase, the STM task was also performed by half the participants. At the beginning of each trial, these participants were verbally presented with a random string of numbers one less than their maximum digit span. They were instructed to rehearse the numbers while performing the task, giving precedence to the STM task. Precedence was given to the STM task to prevent participants from not trying to remember the digits. After each trial, the digits were recited and accuracy was recorded. New numbers were given for each trial. These trials were meant obtain baseline performance levels.

After completion, participants were given a cover story for being presented the information card that primed the appropriate stereotype. Specifically, they were told it was to prepare them for a video they would watch later. Participants then completed three more trials. After completion, the participant was debriefed.

Surgical performance was operationalized in terms of movement time and accuracy. Movement time was recorded from the time the participant contacted the first wooden peg to the time the last wooden peg was released. Accuracy was found by recording the number of errors. Errors were defined as the number of wooden pegs dropped.

Results

Movement time. To determine if the elderly stereotype resulted in slower movement time, a 2 (cognitive load) x 2 (gender) x 3 (stereotype) between subjects ANOVA was conducted. The dependent variable, difference in average movement time between the first three trials (pre-prime) and last three trials (post-prime), was computed by first subtracting the amount of time a peg was dropped from each trial. Then the average duration of the post-prime trials was subtracted from the average of the pre-prime trials. This was done to eliminate individual differences and situations in which the peg was dropped in an area that was difficult to pick up.

A main effect of stereotype was found, $F(2, 24) = 4.29$, $p < .026$. See Figure 4. The main effect was followed up with Tukey's HSD. Participants that received the elderly prime were slower at completing the trials after the prime than participants that received the young prime. There was no difference between the control condition and either stereotype condition.

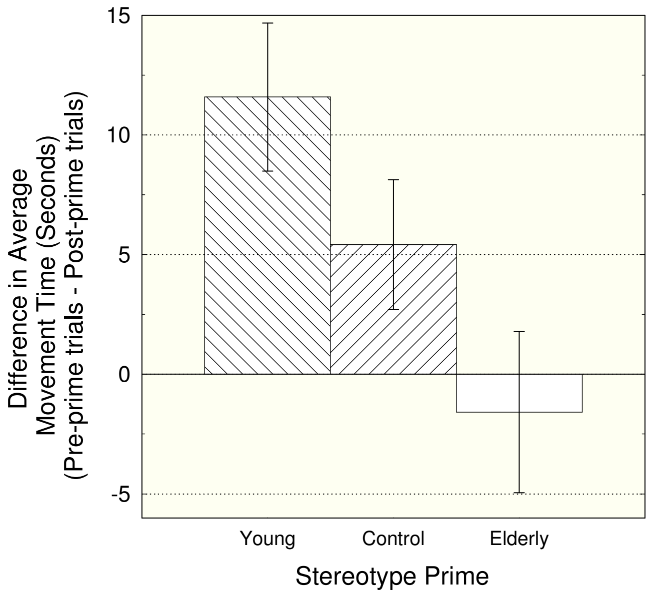

Figure 4. Difference in average movement time (pre-post). Positive numbers indicate participants were faster in the post trials. Negative indicate they were slower.

Errors. To evaluate if the elderly stereotype resulted in more errors a 2 (cognitive load) x 2 (gender) x 3 (stereotype) between subjects ANOVA was conducted. The dependent variable was the difference in the number of pegs dropped. This was computed by subtracting the number of drops made during the post-prime trials from the number of drops made during the pre-prime trials.

A main effect of stereotype was found, $F(2, 24) = 4.32$, $p < .025$. See Figure 5. The main effect was followed up with Tukey's HSD. Participants that received the elderly prime dropped more pegs after the prime than participants that received the young prime. There was no difference between the control condition and either stereotype condition.

Discussion

The objective was to determine whether being primed with the elderly stereotype would affect performance. Results indicated that participants who received the elderly prime completed the trials after the prime slower and made more errors than participants that received the young prime.

An unexpected finding was participants under cognitive load did not perform worse than those not under cognitive load. It is hypothesized that the procedure inadvertently placed all participants under cognitive load. Gilbert, Pelham & Krull (1988) found participants had fewer cognitive resources to devote to a task when preoccupied with thoughts about a speech they expected to give later. In the current experiment it is possible that participants not in the cognitive load condition used available resources to think about what would happen during the remainder of the experiment and this preoccupation increased their cognitive load. This is supported by the post test questionnaire. In this questionnaire, 14 of 18 participants not in the cognitive load condition indicated they thought about the video or the person they would view in the video, while only 7 of 18 participants in the cognitive load condition indicated the same.

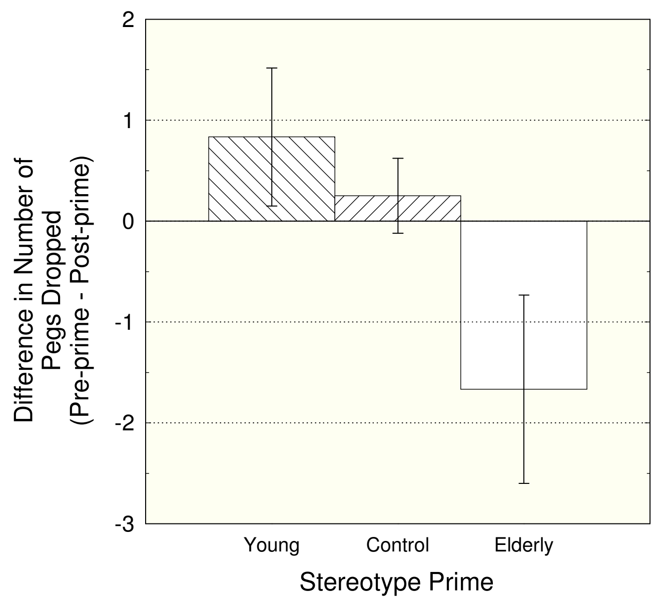

Figure 5. Difference in the number of times the wooden pegs were dropped (pre-post). Positive numbers indicate participants had fewer errors in the post trials. Negative indicate they had more.

Overall, the results suggest that surgical performance may be affected by stereotypes and the increased error rates found in the elderly population may not be due solely to the complexity of their care. While this may seem like a disheartening finding, it is important to be aware of its occurrence. Even if non-prejudiced surgeons automatically categorize people by age as Devine (1989) argues, their awareness of this automatic process will make them more likely to try to correct its effects (Wilson & Brekke, 1994). So, simply being aware of this finding may prevent its occurrence.

While the current study demonstrates the plausibility of stereotypes affecting surgical performance, qualification of the results is still needed. The current findings were obtained using carefully controlled conditions in which participants were only exposed to one stereotype. In a real surgical environment surgeons would be exposed to many different people and thus many different stereotypes. The current study does not attempt to address the possible interaction or dominance of different stereotypes. Future studies are needed to determine what effect stereotypes have in more realistic environments where participants are exposed to multiple stereotypes.

Future studies are also needed to determine ways to exploit the application of stereotypes to improve surgical performance. While the difference between the stereotype prime conditions and control condition was not significant in this study, the means indicate that the elderly prime degraded performance while the young prime improved performance compared to the control condition. Therefore, purposely exposing surgeons to positive stereotypes, such as the young prime here, may improve performance (See also Wheeler & Petty, 2001).

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