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PRIMING ABILITY-RELEVANT SOCIAL CATEGORIES IMPROVES INTELLECTUAL TEST PERFORMANCE

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ABSTRACT

Research shows that priming affects behavioral tasks; fewer studies, however, have been conducted on how social category primes affect cognitive tasks. The present study aimed to examine the effects of social category primes on math performance and word recall. It was hypothesized that Asian prime words would improve math performance and word recall whereas elderly prime words would improve math performance, but not memory. Asian primes (a math ability-relevant prime) led to an increase in math performance, as compared to a baseline measurement whereas the presentation of elderly primes did not affect math performance. In addition, elderly prime words had a lower recall rate than did Asian prime words. The current research is interpreted as showing how social category stereotypes can have potentially positive and/or negative influences on performance in testing situations.

INTRODUCTION

Thinking of competent and intelligent individuals should have a beneficial outcome. For instance, Dijksterhuis and van Knippenberg (1998) found that thinking of professors increased performance on a subsequent cognitive ability task. Similarly, Lockwood and Kunda (1997) found that role models increase motivation to be successful. Based on the previous research then, thinking of high ability individuals, such as Asians (stereotyped to be intelligent) and the elderly (thought of as

wise) should inspire individuals to strive for success and possibly improve performance on a cognitive ability task.

Research has demonstrated a concept accessibility and behavior linkage (Banfield, Pendry, Mewse, & Edwards, 2003; Bargh, Chen, & Burrows, 1996; Dijksterhuis & van Knippenberg, 1998; Follenfant, Légal, Marie Dit Dinard, & Meyer, 2005; Wheeler & Petty, 2001). The activation of a social category leads to greater accessibility of category related content (Higgins, 1996), thus influencing subsequent judgments and behavior. Greater accessibility means that this information is more available to be used to guide future evaluations and behaviors (Higgins, 1996).

Previous studies inducing participants to contemplate successful social categories have found that increased social concept accessibility can have performance benefits for intellectual tasks (Levy, 1996; McIntyre, Paulson, & Lord, 2003; McIntyre, Lord, Gresky, Ten Eyck, Frye, & Bond, 2005). The present research aimed to increase the accessibility of social categories associated with improved intellectual performance and wisdom in some settings, but also associated with decrements in performance in other settings.

Social category priming and behavioral outcomes

Previous investigations have indicated that thinking about a social category can influence individuals to behave in ways consistent with the target group and affect behavioral outcomes. Dijksterhuis and van Knippenberg (1998) showed that participants primed with professors (thought to be intelligent) performed better on a knowledge task than did participants primed with soccer hooligans (thought to be unintelligent) and participants who were not primed with any social category. Additionally, participants primed with soccer hooligans performed worse than did participants in the control condition. Thus, the present research examined the effects of two social category primes, Asians and the elderly, on two cognitive ability tasks, math performance and memory.

Wheeler, Jarvis, and Petty (2001) demonstrated that stereotype consistent behavior can be elicited from a member of a non-stereotyped group if that perceiver endorses stereotypes of the non-stigmatized group. Similar results were also found by Bargh and colleagues (1996), who showed that the activation of the African American stereotype resulted in participants behaving more aggressively (consistent with African American stereotypes). Bargh and colleagues also demonstrated that participants interrupted the experimenter more frequently and quickly after activating the concept of rude (via priming) compared to participants who were primed with polite-related words. Additionally, they showed that priming the elderly social category caused participants to walk more slowly (Bargh et al., 1996). Consistent with these findings, Banfield and colleagues (2003) showed that elderly-primed participants took longer pauses between consecutive movements than did participants who were neutrally primed. These studies indicate that social category primes have a robust influence across domains, thus, researchers need to examine the benefits of also priming other relevant outcomes.

Wheeler and Petty (2001) reviewed the possible mechanisms behind behavioral outcomes of stereotype activation and concluded that judgment can also be affected. For instance, one may

behave in ways consistent with a stereotype that is primed (i.e., higher test performance when thinking of professors). The link between stereotype priming and behavior can be used as an intervention in an applied setting and be beneficial to a given population. Hausdorff, Levy, and Wei (1999) subliminally primed older adults with either positive or negative elderly primes and found that walking speed increased for positively-primed elderly participants. Additionally, researchers have noted that people with an accessible stereotype might evaluate situations differently. The premise that stereotype activation and behavior are mediated by some cognitive process has been incorporated in many models (see Wheeler and Petty, 2001). Herr's (1986) previous finding also suggests that during an interaction, previous priming may lead to behavioral evaluations by way of self-fulfilling prophecy, whereby the perceptual expectations of an event alter behavior.

These studies demonstrate that when primed with a particular stereotype, people behave in ways consistent with that stereotype (Dijksterhuis & van Knippenberg, 1998). This change in behavior is likely due to increased accessibility (Higgins, 1996). One useful extension, then, is to show that social category priming should affect the intellectual performance for individuals in classroom type settings.

Stereotypes associated with social categories and cognitive performance

Studies have indicated that various social categories are associated with specific intellectual and cognitive abilities. Social groups thought to have high intellectual capabilities include professors (Dijksterhuis & van Knippenberg, 1998), males (Hyde, Fennema, & Lamon, 1990), and Asian-Americans (Aronson, Lustina, Good, Keough, Steele, and Brown, 1999; Shih et al., 1999) whereas those thought to have low intellectual capabilities include soccer hooligans (Dijksterhuis & van Knippenberg, 1998), African-Americans (Aronson, Fried, & Good, 2002), individuals of low socioeconomic status (Croizet and Claire, 1998), and the elderly (Hummert, 1990; Hummert, Garstka, Shaner, & Strahm, 1994; Hummert, Garstka, Shaner, & Strahm, 1995).

The association between Asian-Americans and intellectual abilities related to mathematics is of particular interest. Shih, Pittinsky, and Ambady (1999) found in two separate studies that in comparison to a no-prime control group, Asian-American women performed better on a quantitative task when their ethnic identity was made salient, but worse on the math task when their gender identity was made salient. An important inference can be made from these studies: increasing accessibility (via priming) leads to a category-consistent change in behavior, as was proposed by Higgins (1996).

The elderly are also associated with intellectual performance. In some settings, the prevailing perception is that the elderly are wise and to be valued for their wisdom and intellect (Levy, 1996). In other situations, however, they are associated with negative perceptions of intellect, such as being absent-minded, slow, and incompetent (Hummert, 1990; Hummert, Garstka, Shaner, & Strahm, 1994; Hummert, Garstka, Shaner, & Strahm, 1995). In a study using older adults, Levy (1996) demonstrated that self-judgments and performance on cognitive tasks can both be affected by priming. In that research, the activation of a positive aging stereotype (wise) in the elderly improved memory performance whereas the activation of negative aging stereotype (senile) resulted in a decline in memory performance.

According to Croizet, Désert, Dutrévis and Leyens (2003) these effects occur because of the link between stereotype activation and cognitive performance. Follenfant and colleagues (2005), who examined automatic behavior, state that once a stereotype is activated, it can affect both a person's cognitive and physiological performance. Légal (2005) suggests that this may be because cognitive structures responsible for behavioral representation overlap with those responsible for behavioral execution. It is important to note that all of these studies have shown that performance is malleable and affected by stereotype activation, which is often experimentally manipulated by priming positive or negative social categories (Shih et al., 1999).

Elderly and Asian stereotypes

The activation of either of these groups should lead to evaluations and behaviors that are consistent with that group's stereotype (Higgins, 1996). Asians are typically stereotyped as having superior mathematical abilities (Cheryan, & Bodenhausen, 2000). In a recent study, 29% of the Asian-American participants reported being perceived as having abilities in mathematics and science in comparison to only 5% of the Caucasian participants (Cheryan & Monin, 2005). A study by Aronson and Disko (1998, as cited in Aronson et al., 1999) found that 86% of participants endorsed Asians as being higher in intelligence. This finding has been consistent since Katz and Braly's (1933) study. Furthermore, non-Asians tended to envy Asian-American students based on their perceived high academic and intellectual competence (Lin, Kwan, Cheung, & Fiske, 2005).

Fiske, Cuddy, Glich and Xu (2002) developed the Stereotype Content Model (SCM) in order to better classify stereotyped groups. Their model uses warmth and competence as two dimensions on which groups can vary (high or low), thus leading to four categories of classification: low warmth and high competence (e.g., Asians); high warmth and low competence (e.g., elderly); high warmth and high competence (e.g., ingroup); low warmth and low competence (e.g., welfare recipients). The elderly stereotype of warm and incompetent (SCM) is also stable and pervasive (Cuddy, Norton, & Fiske, 2005). In a study by Levy (1996), participants took longer to identify the location of the positive elderly-stereotypical primes (compared to the primes that were related to the negative stereotype), leading to the conclusion that the positive stereotype does not fit as well with the typical elderly stereotype. Thus, the negative elderly stereotype appears to be stronger or more prevalent in the general population. Isaacs and Bearison (1986) also studied the stereotype of the elderly for children and found that the negative stereotypes associated with aging have been shown to occur in individuals as young as six years old. Furthermore, both younger and older adults demonstrated strong stereotype activation for stereotypes about the elderly compared to relatively weak activation stereotypes about the young (Chasteen, Schwartz, & Park, 2002). Finally, Ryan (1992) found that the elderly are thought of as having more difficulties with memory tasks.

The dual nature of social category primes consciousness of the prime

Previous studies used priming paradigms to activate stereotypes, where in some cases the participant is unaware that he or she is being primed, but in other instances there is conscious awareness of the prime. The question remains, however, as to the importance of participants'

awareness of the priming. The subtlety of the activation of the stereotype is an important variable for determining the effect of that priming on behavior (Shih, Richeson, Ambadi & Fujita, 2002). Also, in a study examining self-fulfilling prophecies, participants who were subliminally primed (unaware that the priming was to have any influence on their behavior) acted in a more hostile manner during an exchange, which led to more hostility being demonstrated by their conversational partner in line with the notion of self-fulfilling prophecy (Chen & Bargh, 1997). These studies show that both supraliminal and subliminal priming lead to behavioral effects provided that the participant is not aware of the link between the prime and subsequent behavioral expectations. That is, it is not necessary to perceive the stimulus in order to show effects (e.g., priming).

In a related study, Shih and colleagues (2002) used Asian-American and non-Asian-American participants to examine the effect of Asian priming on math performance. In the supraliminal priming condition, words appeared for 1000 milliseconds (ms) (participants could read and consciously register the words); in the subliminal condition, words appeared for 80 ms (participants could not identify the word). Non-Asian participants showed a performance boost when supraliminally primed to Asian-related words, but no boost when subliminally exposed, while Asian-American participants showed enhanced performance in the subliminal prime condition, but showed performance deficits in the supraliminally exposed condition (Shih et al., 2002). These results appear to suggest that supraliminal priming will produce a stronger effect than subliminal priming, at least for the non Asian-American group. Bornstein and D'Agostino (1992), however, examined the mere exposure effect through two experiments and, in both cases, found larger exposure effects when stimuli were subliminally presented (5 ms) compared to when presentation was within the participants' awareness (500 ms). These results were consistent among the three types of stimuli used. Taken together, these results suggest that the conflict is not yet resolved; however, priming literature appears to prefer using supraliminal primes (e.g., Bargh et al., 1996; Shih et al., 2002).

Dijksterhuis and Bargh's (2001) model of social perception argues that perception of a stimulus automatically activates behaviors consistent with the stimulus. According to the model then, priming "Asian-American" would make the stereotype of superior quantitative ability more accessible, leading to a behavioral tendency relevant to mathematics performance. This process is thought to be automatic, thus leading to a change in behavior rather than experiencing anxiety. Priming an individual with "Asian-American" should thus lead to behavior striving toward math achievement rather than anxiety associated with stereotype threat.

Thus, the exact characteristics of the priming paradigm used is important in determining the effects of that prime on the perceiver. Furthermore, the relevance of the primes (in terms of the self) is an important factor to consider.

Rationale

The present research attempted to prime two separate social categories believed to be relevant to math and recall (Asian and elderly, respectively). It was expected that being primed with social categories associated with mathematics and wisdom would improve mathematics performance, relative to baseline performance. It was also hypothesized that priming individuals with the elderly

would have a positive effect on math scores, but a negative effect on memory scores, but that an Asian social category prime would positively affect both types of performance.

We hypothesized that participants would experience a performance boost due to the nature of the prime. Priming was induced in a subtle manner such that participants would not be explicitly told of the stereotype that Asian-Americans are skilled at mathematics since doing so may have lead to stereotype threat (Shih et al., 2002).

Method

Participants

Seventy-two undergraduate students (50 women, 22 men) completed the study in exchange for course credit.

Procedure

To measure the effect of social category (Asian—math) stereotype activation on math ability and recall while ensuring that stereotype threat was not triggered, the experiment was conducted under the premise of examining memory processes with no mention of test importance or diagnosticity. Participants were told that the aim of the experiment was to study memory after completion of a distracting task, referred to as a numbers task.

Participants were instructed to turn the page of the materials packet, write down the current time and begin the first numbers task. The numbers tasks consisted of 30 relatively easy math questions randomly selected from a GRE preparation booklet. These questions were then divided into three sets of ten questions, balancing for item difficulty. Participants were allowed 15 minutes to complete all ten items (or until all participants in that session had completed the task) and upon finishing, write down the time. Participants were told that the first numbers task was necessary in order to clear their minds and to make sure that all participants were in the same mindset when beginning the memory task. Participants were then asked to cross their arms to ensure that no words could be written down during the presentation of the word list. A word list containing the nine (elderly or Asian) primes and seven neutral words was presented for one minute. The word list was spontaneously generated and subjected to a word-frequency analysis (Kucera & Francis, 1967). After an independent-samples t-test, it was determined that the lists were not different in terms of memorability. The word list was then subjected to a Q-Sort (n=30) with an overall agreement of 82.9% for elderly and 83.7% for Asian.

Participants were then instructed to begin the second numbers task (math test) with the same time limit as before. After 15 minutes had passed (or all students had finished), participants were then allowed one minute to write down as many words as they could recall from the word list. All participants were assigned to each priming procedure counter-balancing for order. After the math tests were complete, all participants were debriefed and thanked for their participation. None of the participants were aware of the nature of the procedures or experimental hypotheses.

Results

Math performance

It was reasoned that participants would perform better after being primed with the Asian relevant or elderly relevant words compared to baseline levels of mathematics performance. The percentage of items correctly answered were compared in a mixed model ANOVA with test performance as the repeated factor (Asian, elderly, baseline) and order as a between subjects factor. That analysis found a significant main effect for math test, $F(2, 140) = 3.05$, $p < 0.05$, such that participants scored significantly higher after the Asian prime compared to baseline performance ($p < .05$), but no differences occurred from test performance after the elderly prime. That effect, however, was qualified by a marginally significant test type X order interaction, $F(2, 140) = 2.43$, $p = .09$. As shown in Table 1, participants scored significantly better directly after the Asian prime ($M = 73.06$) than after the baseline test ($M = 63.89$), by bonferroni contrasts $p < .05$, simple effects $F(2, 70) = 4.56$, $p < .05$, in the Asian-elderly prime order. The effect for the elderly-Asian order was not significant. Thus, improved performance was significant only for participants who first were primed with Asian related words and were then immediately tested.

Word recall

The number of Asian or elderly related words were also hypothesized to be affected by the stereotypes associated with the specific social categories. As the elderly are stereotyped as demonstrating memory loss, it was hypothesized that word recall would be lower after participants were primed with the elderly than when primed with Asians. The number of words correctly recalled from each prime category were thus compared in a mixed model ANOVA as for the math scores. That ANOVA found a only significant effect for word type, $F(1, 70) = 80.13$, $p < .001$, such that participants recalled significantly more Asian prime related words ($M = 63.14$), than elderly prime related words ($M = 40.42$). As can be seen in Table 2, the interaction was not significant, $F(1, 70) = .95$, ns, nor was the prime order, $F(1, 70) = .139$, ns.

Discussion

In the present study, the hypotheses were partially supported. When primed with Asian relevant words, participants performed better on a math task compared to when primed with elderly relevant or neutral words. When primed with elderly relevant words, participants did not perform significantly better than when primed with neutral words. When participants were primed with Asian relevant words, they had a higher recall rate than when primed with elderly relevant words. When primed with elderly relevant words, however, participants did not perform significantly worse than when primed with neutral words. The data indicate that being primed with Asian relevant words led to a benefit in cognitive performance and memory, while being primed with elderly relevant words did not result in significant differences in performance on the two tasks compared to when primed with neutral words.

The results have important implications for cognitive performance and academic outcomes.

Consistent with previous findings (McIntyre et al, 2003; McIntyre et al, 2005; Shih et al, 2002), being subtly primed with a group thought to have high intellectual capabilities can lead to boost in performance on a cognitive task. Perhaps this knowledge can be applied to further methodologies currently used to improve performance and combat test anxiety. If participants are induced to activate a stereotype consistent with positive performance, perhaps this will alleviate anxiety associated with performance and lead to a performance boost.

These methods, however, should not be confused with similar methods producing stereotype threat (Steele, 1997). In the present research, the test consisted of simple rather than difficult questions and was not presented as diagnostic of ability. Prior iterations of stereotype threat have indicated these to be important factors (Quinn & Spencer, 2001). Additionally, the current study did not highlight gender of participants, and used both men and women. By comparison, for mathematics stereotype threat, gender awareness is typically high, and typically applicable to women but not men. Finally, individuals are more likely to experience stereotype threat if they believe there is a possibility that they will be negatively stereotyped (Wout, Shih, Jackson, & Sellers, 2009). The possibility of participants being negatively stereotyped in the present research was minimal as no mention of diagnosing quantitative ability was presented.

Limitations

One weakness of the present study is that a within subjects design may have been problematic. Previous studies investigating priming and subsequent performance have generally utilized a between subjects design (e.g., Dijksterhuis & van Knippenberg, 1998). Additionally, the social category primes ought to be generalized in future investigations. Another weakness of the current experiment is that the findings that elderly relevant prime did not affect recall may have been due to null results rather than detrimental effects associated with this social category being activated.

Future directions

As previously mentioned, follow-up investigations should apply these findings in such a way to examine whether priming can lead to more positive academic outcomes by alleviating test anxiety. Additionally, future studies ought to investigate whether similar outcomes can be obtained in workplace settings. If employees experience performance boosts via priming, the effects may lead to higher levels of self-efficacy, job commitment, and job satisfaction.

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Table 1. Mean mathematics test performance by measurement time and order of prime.

Math Performance Setting

	Baseline	After Elderly Prime	After Asian Prime
Elderly-Asian	71.38	73.05	71.94
n = 36	(22.95)	(22.78)	(24.24)
Asian-Elderly	63.88	68.61	75.27
n = 36	(24.64)	(25.98)	(18.28)

Note: Standard deviations are in parentheses.

Table 2. Mean recall of Elderly related or Asian related words by order of prime.

Percentage of Words Recalled

	Elderly Words	Asian Words
Elderly-Asian	40.89	61.14
n = 36	(23.87)	(18.48)
Asian-Elderly	39.95	65.14
n = 36	(15.30)	(24.93)

Note: Standard deviations are in parentheses. Recall means are expressed as a percentage of total words that were correctly recalled.

Appendix A.
Correlation Matrix of all variables (n = 72).

	Order	Math Base line	Math After Asian prime	Math After Elderly Prime	Percent Asian Words recalled
Math Base Line	-.158				
Math After Asian Prime	.024	.670**			
Math After Elderly Prime	-.149	.661**	.731**		
Asian Words recalled	.092	.399**	.342**	.255*	
Elderly Words Recalled	-.024	-.301*	.270*	.244*	.473

Note: * indicates $p < .05$; ** $p < .001$

Appendix B

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