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Stereotype strength and attentional bias: Preference for confirming versus disconfirming information depends on processing capacity

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ABSTRACT

In two experiments, we investigated the relationships among stereotype strength, processing capacity, and the allocation of attention to stereotype-consistent versus stereotype-inconsistent information describing a target person. The results of both experiments showed that, with full capacity, greater stereotype strength was associated with increased attention toward stereotype-consistent versus stereotype-inconsistent information. However, when capacity was diminished, greater stereotype strength was associated with increased attention toward inconsistent versus consistent information. Thus, strong stereotypes may act as self-confirming filters when processing capacity is plentiful, but as efficient information gathering devices that maximize the acquisition of novel (disconfirming) information when capacity is depleted. Implications for models of stereotyping and stereotype change are discussed.

Introduction

Although there has been a plethora of studies on the ways that stereotypes bias attention, judgment, memory, and behavior (Hamilton & Sherman, 1994), much less research has examined how differing levels of stereotype strength might moderate these effects. Most stereotyping research either explicitly or implicitly assumes that individuals within a particular culture possess similar group stereotypes and therefore presuppose that individuals within that culture will be similarly affected by stereotype activation. However, recent research has documented clear individual differences in the extent to which stereotypic attributes are associated with social categories (e.g., Payne, 2001; Wittenbrink, Judd, & Park, 1997). The strength of these associations has been shown to be an important moderator of stereotyping effects (for a review, see Greenwald, Poehlman, Uhlmann, & Banaji, in press).

Stereotype strength and attention

The present experiments add to this nascent area of research by examining the influence of stereotype strength on the allocation of attention to stereotype-relevant behavioral information. There is scant direct research on this question, and different predictions can be derived from different theoretical frameworks. Perhaps the predominant accounts of how stereotypes guide attention are schematic filter models. These models propose that stereotypes (and other expectancies) act as filters that increase the ease with which expectancy-consistent information can be processed (for reviews, see Sherman, Lee, Bessenoff, & Frost, 1998; Sherman, Macrae, & Bodenhausen, 2000; Stangor & McMillan, 1992). They further argue that, because people tend to be cognitive misers who are motivated to minimize the use of cognitive resources, most attention will be devoted toward information that is easiest to comprehend – expectancy-consistent information. As stereotype strength increases, the relative ease of processing stereotype-consistent versus -inconsistent information should presumably also increase. Thus, filter models predict that attention will shift toward stereotype-consistent information and away from stereotype-inconsistent information as stereotype strength increases.

An alternative account derived from the person memory literature makes the opposite prediction: that, as stereotype strength increases, attention shifts away from stereotype-consistent and toward -inconsistent information. This account is based on the argument that unexpected information is processed more extensively because it is difficult to comprehend (e.g., Hastie, 1980; Srull, 1981; see also Brewer & Nakamura, 1984). The stronger the expectancy, the greater is the difference in comprehension of expected and unexpected information, and the greater is the tendency to carefully process (and, therefore, attend to) unexpected information (Srull, Lichtenstein, & Rothbart, 1985). Thus, schema-filter models and the person memory model make opposing predictions based on the same principle—that expectancy-consistent information is easier to understand than expectancy-inconsistent information.

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Finally, the script pointer + tag model (Schank & Abelson, 1977) proposes that expectancy-inconsistent information receives more attention than expectancy-consistent information because consistent information can be coded as merely a generic example of the expectancy (with a "script pointer"), whereas inconsistent information must be uniquely coded ("tagged") as novel information that violates the expectancy. This model also predicts that stronger expectancies will shift attention toward unexpected information because, as expectancy strength increases, consistent information is more likely to be encoded with a script pointer, whereas inconsistent information is more likely to violate the expectancy and require a special tag (a process that requires attention).

To date, there is little direct evidence bearing on the question of stereotype strength and attention. There is, however, some indirect evidence offered in a comprehensive meta-analysis of the literature on expectancies and memory by Stangor and McMillan (1992). These authors operationalized expectancy strength in two ways. First, they argued that expectancies held by participants on their own outside of the lab (e.g., existing stereotypes) are likely to be stronger than expectancies provided in the context of an experiment (e.g., novel target trait expectancies). Second, they argued that social expectancies grow stronger as children age. Their meta-analysis showed that both of these indices of expectancy strength were associated with greater recall of expectancy-consistent information, consistent with schematic filter models of stereotyping and attention.

However, Stangor and McMillan's meta-analysis also showed that expectancy strength was associated with better memory for inconsistent information on measures that control for response biases (e.g., recognition memory). This suggests that the recall advantage for consistent information is not due to enhanced encoding of that information. Instead, heightened recall of expectancy-consistent information might reflect reliance on expectancy-based retrieval cues (Sherman & Frost, 2000; Sherman et al., 1998). Furthermore, although it seems reasonable to assume that pre-existing expectancies (e.g., stereotypes) are stronger than experimentally provided expectancies and that older children possess stronger expectancies than younger children, neither of these assumptions has been directly tested. In studies that directly manipulated the strength of individual trait expectancies, Srull and his colleagues (Srull et al., 1985) found that memory for inconsistent information increased as expectancy strength increased, providing support for the person memory model. This possible discrepancy in the effects due to group (i.e., stereotypes) versus individual expectancy strength may be due to differences in the ways the two types of expectancies were presented (Heider et al., 2007).

To our knowledge, no study on stereotyping and attention has directly manipulated or measured stereotype strength. Moreover, no studies of stereotype strength have directly measured the amount of attention directed at consistent and inconsistent information, but rather have inferred attention from measures of memory. Though attention and memory may be related, it is not necessarily the case (e.g., Sherman et al., 1998). Given all of these considerations, it is difficult to draw clear conclusions about the effects of stereotype strength on attention. The aim of the present research is to provide more direct evidence on the matter.

Cognitive load and attention

This research also examines the role of cognitive capacity as a potential moderator of the relationship between stereotype strength and attention. Schematic filter models argue that preservation of cognitive resources is the key determinant driving preferential attention toward stereotype-consistent information. Specifically, stereotype-consistent information receives greater attention because it is easier to process, minimizing cognitive effort and/or preserving cognitive capacity for other tasks. Accordingly, filter models propose that, whatever happens under full capacity conditions, the depletion of cognitive resources will shift attention away from inconsistent and toward consistent information (e.g., Bodenhausen & Lichtenstein, 1987; Stangor & Duan, 1991). That is, when capacity is constrained, attention shifts toward the information that is easiest to process and imposes the least demands.

In contrast, the Encoding Flexibility Model (EFM; Sherman et al., 1998) predicts that, whatever happens under full capacity conditions, attention shifts away from stereotype-consistent and toward -inconsistent information when cognitive resources are depleted. The EFM concurs with filter models that stereotype-consistent information is easier to comprehend and process than inconsistent information. However, according to the EFM, because consistent information confirms prior knowledge, it provides minimal novel information and, as a result, receives less attention than inconsistent information (which does provide novel information; see also, Johnston & Hawley, 1994; von Hippel, Jonides, Hilton, & Narayan, 1993). This attention shift should be particularly evident when attentional capacity is limited. Under such conditions, the need for efficient processing is enhanced, and perceivers must be more selective in directing their attention toward novel information. A number of experiments have provided support for this prediction (Sherman, Conrey, & Groom, 2004; Sherman & Frost, 2000; Sherman et al., 1998).

Stereotype strength, cognitive load, and attention

Though there is now extensive evidence that attention shifts away from stereotype-consistent and toward stereotype-inconsistent information when resources are depleted, this relationship may be moderated by stereotype strength. Filter models predict that increases in stereotype strength and decreases in processing capacity will both shift attention toward consistent information. This suggests that the greatest attentional shifts toward consistent information would occur when the perceiver holds a strong stereotype and resources are depleted. Indeed, it may be the case that the predicted shift in attention toward consistent information when capacity is low only occurs when the perceiver has a strong stereotype.

The EFM also suggests that the effects of cognitive load on attention may be moderated by stereotype strength. According to the EFM, when resources are depleted, attention shifts away from consistent and toward inconsistent information because consistent information is redundant with existing knowledge and is easily encoded. Hence, any factor that increases the inferential power provided by a stereotype should increase one's ability to shift attention from consistent to inconsistent information. One such factor would be the strength with which a perceiver holds the stereotype. To the extent that a person holds a strong stereotype, consistent information should be particularly redundant and easy to process, whereas inconsistent information should be particularly novel and especially likely to attract attention. As a result, as stereotype strength increases, so too should perceivers' ability to shift resources from consistent to inconsistent information. This should be particularly true when capacity is low and the stereotype is more likely to be applied as an interpretational tool. Thus, the EFM predicts that the effects of cognitive load on shifting attention toward inconsistent information should be magnified by stereotype strength.

Overview

The goal of the present research was to directly test the relationships among stereotype strength, processing capacity, and attention to stereotype-relevant information. These experiments advance past research in three important ways. First, these are the first studies on the topic that directly measure the strength with which participants hold a relevant stereotype. Second, these are the first studies on the topic that directly measure attention, rather than relying on measures of memory to infer attention. Finally, these are the first studies examining the interaction between stereotype strength and processing capacity.

Experiment 1 tested these effects with a negatively valenced stereotype: African-Americans and hostility. Experiment 2 examined these same effects with a positively valenced stereotype: women and warmth.

Experiment 1

Method

Participants

Twenty-nine Northwestern University undergraduates completed the experiment for partial course credit.

Materials and procedure

Attention measure. Participants were asked to form an impression of a person ostensibly selected at random from a pool of Chicago residents. For all participants, the computer "selected" a young adult Black male wearing a black headband and dark sunglasses. After viewing the target's photo for five seconds, participants were asked to read descriptions of his typical behavior. His behavior was described with 60 sentence fragments that had been pre-tested for their level of hostility. Of the 60 behaviors, 20 reflected hostile, anti-social behaviors (e.g., "Swore at the salesgirl"), 20 reflected friendly, pro-social behaviors (e.g., "Gave up his seat on the crowded subway to the elderly man"), and 20 were irrelevant to hostility (e.g., "Bought a new shirt"). Because hostility is a central component of the Black stereotype (Devine & Baker, 1991), the anti-social behaviors were stereotype-consistent and the pro-social behaviors were stereotype-inconsistent.

The behavioral descriptions were presented in pairs, with one item on the left side of the screen and one item on the right side. The particular items selected for each pair were generated randomly by the computer without replacement, with the constraint that, of the 30 pairs of behaviors, 10 contained stereotype-consistent and -inconsistent items, 10 contained -consistent and stereotype-irrelevant items, and 10 contained -inconsistent and -irrelevant items. Each pair was presented for 3 s. At one of four randomly generated times after the appearance of a pair of behaviors, an X appeared on either the left or right side of the computer screen. The X appeared after 1500 ms, 1750 ms, 2000 ms, or 2250 ms. Participants were instructed to press keys marked *left* or *right* as quickly as possible to indicate on which side of the screen the X had appeared, and the computer recorded the response times. These response times measure the extent to which participants were attending to the item on the left versus right side of the screen. To the extent that participants are attending to a particular item, they should respond more quickly to an X that appears in the location of that item (e.g., Bradley, Mogg, White, Groom, & de Bono, 1999; Sherman, Stroessner, Conrey, & Azam, 2005; Sherman et al., 2004). Prior to reading about the target person, participants were given practice performing the X-probe task with pairs of statements unrelated to personality characteristics or stereotypes (e.g., "Is Coke better than Pepsi?"). All stimuli were presented using Inquisit (2003).

Manipulation of processing capacity. During the impression formation task, approximately half of the participants were placed under cognitive load. These participants were informed that the experiment was concerned with people's ability to perform multiple tasks at the same time. Cognitive load was manipulated by asking these participants to hold an eight-digit number in memory as they performed the X-probe task. This manipulation has been used successfully in related research to deprive participants of processing resources (e.g., Sherman & Frost, 2000; Sherman et al., 1998, 2004, 2005). As a means of assessing compliance, these participants were asked to write down the eight-digit number on a slip of paper at the end of the X-probe task.[1]

Measure of stereotype strength. Upon completion of the X-probe task, participants engaged in a filler task, before completing a Go/No Go Association Task (GNAT; Nosek & Banaji, 2001) to measure the strength of their implicit associations between Black men and hostility. The GNAT was introduced as a word-search task aimed at studying the cognitive processes involved in distinguishing categorical stimuli from one another.

Participants completed a series of eight practice blocks before the final two blocks of interest. Each practice block consisted of 20 trials. On each trial, a single stimulus item was presented, and participants were told to press the space bar on their computers if the item belonged to a target category of interest and to do nothing if the item did not belong to that category. For all the practice blocks, participants were given a response deadline of 850 ms, by which time a response (if the item required one) needed to be given. A 300-ms inter-stimulus interval separated the end of a trial and the beginning of the next trial. A trial ended when the participant pressed the space bar or when the response deadline was reached. During each block, the target category label remained in the upper part of the computer screen as a reminder.

For the first two practice blocks, the stimuli consisted of 10 passive (e.g., *meek*, *submissive*) and 10 hostile (e.g., *combative*, *violent*) words, selected randomly and without replacement from pools of 24 passive and 24 hostile words. In the first practice block, participants were to press their space bars if a hostile word appeared, and passive words were to be treated as distractors, requiring no response. In the second block, participants were to press their space bars if a passive word appeared, and hostile words were distractors.

After these two blocks, six other practice blocks were presented in random order. For these blocks, the stimuli were four pictures each of Black men, Black women, White men, and White women, and two pictures each of Asian men and Asian women that were selected randomly and without replacement from a pool of 21 pictures of Black men, Black women, White men, and White women, and five pictures of Asian men and Asian women. Each of the six Race × Sex categories served as the target category in one of the six practice blocks, with the other five categories serving as distractors. For example, in one case, participants were told to press their space bar if a picture of a White woman appeared and to do nothing if any other kind of picture appeared.

Throughout the GNAT, trials on which the space bar was pressed incorrectly in response to a distractor item (i.e., false alarms) and trials on which a response was withheld incorrectly in response to a target item (i.e., misses) were scored as errors. On these trials, the word *Error* appeared in red below the stimulus item for 100 ms during the inter-stimulus interval to provide performance feedback. Trials on which the space bar was pressed in response to a target item (i.e., hits) and trials on which no response was offered to distractor items (i.e., correct rejections) were noted as correct responses with a green *correct*.

After completion of the eight practice blocks, the two key blocks were given in random order. The stimuli for these blocks included 12 passive and 12 hostile words, eight pictures of Black men, Black women, White men, and White women, and four pictures of Asian men and Asian women, for a total of 64 trials. The stimuli were randomly selected from the pools used for the practice trials, described above. In one of the blocks, participants were instructed to press their space bars only if either a picture of a Black man or

[1] Because no participants incorrectly reported more than four of the digits, all were retained for analyses (e.g., Sherman et al., 1998).

passive word appeared and to do nothing if any other type of stimulus appeared. In the other block, participants were instructed to press their space bars only if either a picture of a Black man or hostile word appeared and to do nothing if any other type of stimulus appeared. A response deadline of 500 ms was given for each trial. The extent to which it is easier to categorize together pictures of Black men and hostile concepts than it is to categorize together pictures of Black men and passive concepts reflects the strength of association between Black men and hostility.

Results and discussion

Calculation of stereotype strength

With the GNAT, implicit associations are calculated via response sensitivity (Nosek & Banaji, 2001). Sensitivity indicates the ability to discriminate target items (signal) from distractors (noise), while controlling for response bias. The assumption is that sensitivity (separating signal from noise) ought to be easier when the two targets are positively associated than when they are not related or are negatively associated. Thus, to the extent that Black men are implicitly associated with hostility and not with passivity, it should be easier to correctly categorize Black targets and hostile terms than Black targets and passive terms, and fewer false alarms should occur.

The proportion of hits (correct responses to target items) and false alarms (incorrect responses to distractors) were used to compute separate A' measures of sensitivity for the pairings of Black men with hostile words and Black men with passive words. Like other sensitivity measures, A' reflects the degree to which the participant is able to correctly discriminate signal from noise, while controlling for response biases. The formula for A' is as follows: $A' = .5 + \{[\text{hits} - \text{false alarms}][1 + \text{hits} - \text{false alarms}]/[4(\text{hits})(1 - \text{false alarms})]\}$.

We calculated individual estimates of stereotype strength for each participant by subtracting response sensitivity for pairing Black men with passive words from response sensitivity for pairing Black men with hostile words. Thus, higher scores reflect greater relative ease of pairing Black men with hostility than with passivity (i.e., stereotype strength). To reduce multicollinearity between stereotype strength and the interaction term, we centered this index around the mean ($M = .0041$; Aiken & West, 1991).

Calculation of attentional bias

Analyses of attentional allocation focused on the key trials in which one item was stereotype-consistent and the other item was stereotype-inconsistent. On these trials, consistent and inconsistent information directly compete for attention, thus providing the clearest test of the different models' hypotheses. Responses two standard deviations slower than a given participant's mean were deleted. For each participant, we then subtracted the average reaction time for trials in which the X-probe appeared on the same side of the screen as inconsistent items from the average reaction time for trials in which the X-probe appeared on the same side of the screen as consistent items. Note that, because faster response times reflect greater attention, higher numbers indicate relatively greater attention to inconsistent than consistent behaviors.

We conducted a two-step hierarchical regression analysis, in which we regressed the relative amount of attention paid to inconsistent versus consistent items on the main effects of stereotype strength and cognitive load in the first step, and their interaction in the second step. Cognitive load was coded as low load = 0 and high load = 1, and stereotype strength (centered at the mean) was entered as a continuous variable. The interaction added a significant amount of explained variance, $R^2_{change} = .16$, $F_{change}(1, 24) = 4.81$, $p < .04$. The main effects for cognitive load and stereotype strength were not reliable ($p = .40$ and $p = .62$, respectively). However, there was a significant interaction between cognitive load and stereotype strength, $\beta = .57$, $t(25) = 2.19$, $p < .04$ (see Fig. 1). Analyses of the interaction

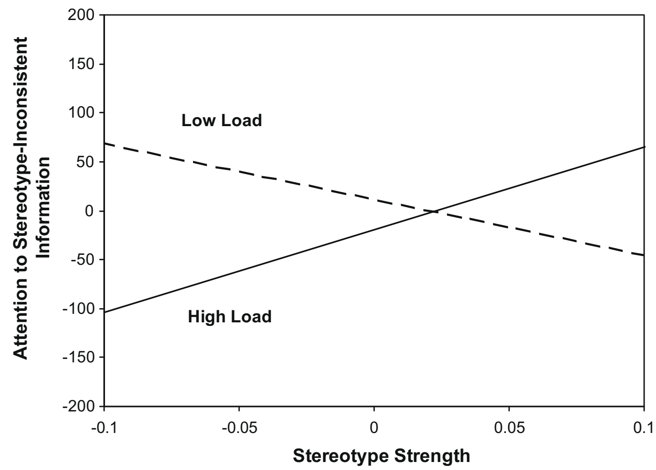

Fig. 1. Experiment 1. Regression lines predicting X-probe latencies to stereotype-inconsistent versus stereotype-consistent items as a function of stereotype strength and cognitive load. Higher scores on the *y*-axis indicate greater attention to inconsistent information. Higher scores on the *x*-axis indicate a relatively stronger association between Black men and hostility.

demonstrated that the relationship between stereotype strength and attention to inconsistent information was marginally significant and negative in the low load condition, $r = -.46$, $p < .08$, whereas it was positive in the high load condition, $r = .41$, $p < .17$.

The results in the low load condition are consistent with schema-filter models, demonstrating that, as stereotype strength increased, relatively greater attention was paid to stereotype-consistent than -inconsistent information. That is, attention shifted away from inconsistent and toward consistent items that appeared simultaneously. The interaction between cognitive load and stereotype strength is consistent with the Encoding Flexibility Model (Sherman et al., 1998) in showing that the effect of stereotype strength on attention reverses when processing capacity is limited. Whereas stereotype strength was associated with shifting attention toward consistent items under full capacity conditions, it was associated with shifting attention toward inconsistent items when capacity was depleted.[2]

Experiment 2

The purpose of Experiment 2 was to replicate these results with a positive stereotype, in order to demonstrate their generality.

[2] To examine these results in greater detail, we examined the attention paid to consistent and inconsistent items separately within each load condition, rather than as a difference score. First, we used a general linear model to conduct a 2 (cognitive load: between subject high versus low) × 2 (item type: within subject stereotype-consistent versus -inconsistent) × stereotype strength (between subject continuous variable) analysis on attention. General linear models are recommended for analyses examining treatment by continuous variable interactions when treatment varies within subject (Judd, McClelland, & Smith, 1996). This analysis yielded a reliable 3-way interaction among the variables, $F(1, 24) = 4.81$, $p < .04$, $\eta = .17$. Analyses of responses in the low cognitive load condition revealed a significant interaction between stereotype strength and item consistency, $F(1, 13) = 4.83$, $p < .05$, $\eta = .27$. Closer examination showed a marginal negative correlation between stereotype strength and X-probe latencies for consistent information, $r = -.47$, $p = .08$ and a non-significant negative correlation between stereotype strength and X-probe latencies for inconsistent information, $r = -.12$, $p = .66$. Analyses of responses in the high cognitive load condition revealed a marginal interaction between stereotype strength and item consistency, $F(1, 12) = 3.56$, $p = .08$, $\eta = .23$. Closer examination showed a non-significant positive correlation between stereotype strength and X-probe latencies for consistent information, $r = .01$, $p = .97$ and a non-significant negative correlation between stereotype strength and X-probe latencies for inconsistent information, $r = -.30$, $p = .30$.

Method

Participants

Forty-nine female undergraduates at the University of California, Davis completed the experiment for partial course credit.[3] Three participants were dropped for having poor English reading ability.

Materials and procedure

Attention measure. The materials and procedure were the same as in Experiment 1, except that a young adult White female target was used. Because women typically associate warmth with female (Rudman, Greenwald, & McGhee, 2001), the pro-social behaviors were stereotype-consistent and the anti-social behaviors were stereotype-inconsistent. All stimuli were presented using DirectRT (Jarvis, 2002b) and MediaLab (Jarvis, 2002a) software.

Manipulation of processing capacity. Again, approximately half of the participants were placed under cognitive load via mental rehearsal of an 8-digit number during the impression formation task.[4]

Measure of stereotype strength. Upon completion of the X-probe task, participants engaged in a filler task before completing an Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998). This IAT used male and female as the contrast categories and cold and warm as the contrast attributes (Rudman et al., 2001). The first two blocks were 20-trial practice blocks, in which participants first practiced assigning cold words to the left-hand category and warm words to the right-hand category, and then practiced assigning male faces to the left-hand category and female faces to the right-hand category. After the practice blocks, participants were instructed to press the right-hand key for warm words and pictures of female targets, and the left-hand key for cold words and pictures of male targets in a 60-trial compatible test block, with a short break following the first 20 trials. This block was followed by another 20-trial practice block, in which participants practiced pressing the right-hand key for male targets and the left-hand key for female targets. Finally, participants completed a 60-trial incompatible test block, with warm words and male targets assigned to the right-hand key, and cold words and female targets assigned to the left-hand key, with a short break following the first 20 trials. In all blocks, trial types (female, male, cold, warm) were presented randomly.[5]

Results and discussion

Calculation of stereotype strength

IAT scores were calculated according to the algorithm described by Greenwald, Nosek, and Banaji (2003). We centered this index on the mean ($M = .7026$) to reduce multicollinearity between stereotype strength and the interaction term (Aiken & West, 1991). Higher scores indicated a stronger association between women and warmth.

Calculation of attentional bias

The same procedure as in Experiment 1 was used to calculate attentional bias, with higher scores reflecting relatively faster responses to X-probes appearing with inconsistent versus consistent items (i.e., greater attention to inconsistent versus consistent information).[6]

We conducted a two-step hierarchical regression analysis, in which we regressed the relative amount of attention paid to inconsistent versus consistent items on the main effects of stereotype strength and cognitive load in the first step, and their interaction in the second step. Cognitive load was coded as low load = 0 and high load = 1, and stereotype strength (centered at the mean) was entered as a continuous variable. The interaction added a significant amount of explained variance, $R^2_{change} = .12$, $F_{change}(1, 37) = 5.35$, $p < .03$. The main effects for cognitive load and stereotype strength were not reliable ($p = .45$ and $p = .21$, respectively). However, there was a significant interaction between cognitive load and stereotype strength, $\beta = .49$, $t(38) = 2.31$, $p < .03$ (see Fig. 2). Analyses of the interaction demonstrated that the relationship between stereotype strength and attention was marginally significant and negative in the low load condition, $r = -.40$, $p < .06$, whereas it was positive in the high load condition, $r = .30$, $p < .22$.

These results replicate the findings from Experiment 1. Consistent with schema-filter models, under low load, increasing stereotype strength was associated with directing relatively greater attention to consistent than inconsistent information. That is, attention shifted away from inconsistent and toward consistent items that appeared simultaneously. In contrast, the interaction between cognitive load and stereotype strength is consistent with the Encoding Flexibility Model (Sherman et al., 1998) in showing that the effect of stereotype strength on attention reverses when processing capacity is limited. Whereas stereotype strength was associated with shifting attention toward consistent items under full capacity conditions, it was associated with shifting attention toward inconsistent items when capacity was depleted.[7]

General discussion

This research examined the relationships among stereotype strength, processing capacity, and attention to stereotype-relevant information. These are the first studies on the topic to directly measure stereotype strength and attention, and to test the interaction of stereotype strength and processing capacity. The results from both experiments showed that, with full processing capacity, stronger stereotypes were associated with attending more carefully to stereotype-consistent than -inconsistent information. However, when capacity was depleted, stronger stereotypes were associated with a shift in attention away from stereotype-consistent and toward -inconsistent information. These results were replicated with a negative and a positive stereotype, and with two

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[3] Consistent with previous research (e.g., Rudman et al., 2001), a pilot test showed that male undergraduates did not associate women with warmth. Thus, only females participated in this experiment.

[4] Data from three participants were dropped for reporting more than four digits incorrectly, suggesting that they did not attend to the load manipulation.

[5] In compliance with the new scoring algorithm for the IAT (Greenwald et al., 2003), we discarded data from one participant who respond faster than 300 ms on more than 10% of her trials.

[6] Analyses could not be calculated for one participant because she responded incorrectly to all of the trials in which the X-probe followed an inconsistent behavior.

[7] To examine these results in greater detail, we examined the attention paid to consistent and inconsistent items separately within each load condition, rather than as a difference score. First, we used a general linear model to conduct a 2 (cognitive load: between subject high versus low) × 2 (item type: within subject stereotype-consistent versus –inconsistent) × stereotype strength (between subject continuous variable) analysis on attention. This analysis yielded a reliable 3-way interaction among the variables, $F(1, 37) = 5.35$, $p < .03$, $\eta = .13$. Analyses of responses in the low cognitive load condition revealed a marginally significant interaction between stereotype strength and item consistency, $F(1, 21) = 4.00$, $p < .06$, $\eta = .16$. Closer examination showed a marginal negative correlation between stereotype strength and X-probe latencies for consistent information, $r = -.28$, $p = .20$ and a non-significant negative correlation between stereotype strength and X-probe latencies for inconsistent information, $r = -.02$, $p = .94$. Analyses of responses in the high cognitive load condition revealed a non-significant interaction between stereotype strength and item consistency, $F(1, 16) = 1.60$, $p = .22$, $\eta = .09$. Closer examination showed a non-significant correlation between stereotype strength and X-probe latencies for consistent information, $r = .00$, $p = .99$ and a non-significant negative correlation between stereotype strength and X-probe latencies for inconsistent information, $r = -.15$, $p = .55$.

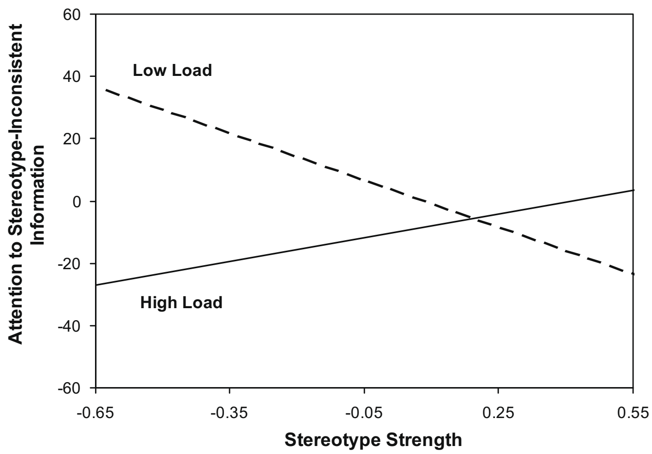

Fig. 2. Experiment 2. Regression lines predicting X-probe latencies to stereotype-inconsistent versus stereotype-consistent items as a function of stereotype strength and load. Higher scores on the *y*-axis indicate greater attention to inconsistent information. Higher scores on the *x*-axis indicate a relatively stronger association between women and warmth.

different measures of stereotype strength (GNAT, IAT). Aspects of these findings are consistent with both schema-filter models of stereotyping (for reviews, see Sherman et al., 1998, 2000) and the Encoding Flexibility Model (EFM; Sherman et al., 1998). Consistent with filter models, greater stereotype strength was associated with increasing attention to consistent information when there was full processing capacity. However, supporting the EFM, the effect of stereotype strength on attention was reversed when processing capacity was limited, with stronger stereotypes shifting attention toward inconsistent information. This is clearly inconsistent with filter models.

Other research has shown that attention is directed toward consistent and away from inconsistent information when cognitive capacity is not constrained (Sherman et al., 2004), but that attention shifts toward inconsistent information under low capacity conditions (e.g., Sherman & Frost, 2000; Sherman et al., 1998, 2004). The present results demonstrate that stronger expectancies magnify these effects, enhancing the ability to direct attention toward novel information. Thus, people may use strong stereotypes as schematic filters, as long as processing capacity is plentiful. However, when capacity is depleted and the need for efficient processing is amplified, stronger stereotypes shift attention toward unexpected information that maximizes information gain.

Though the current research focused on stereotypic expectancies, we would expect the same pattern to emerge for individual, trait-based expectancies (e.g., that the target is a friendly person). Indeed, recent research has shown that stereotype-based and trait-based expectancies affect the encoding and memory of target information in similar ways (Heider et al., 2007). Directly examining the relationships among trait expectancy strength, processing capacity, and attention to expectancy-relevant information is an important goal for future research.

Implications for stereotype change

These results allude to an ironic route toward stereotype change. As stronger stereotypes shift attention toward stereotype-inconsistent information under cognitive load, the likelihood that this information is encoded and retained for future use is increased. Not only does a cognitive load direct attention toward counter-stereotypic behaviors, but it also undermines attributional processes that may be used to discount these behaviors (Sherman et al., 2005). As counter-stereotypic information accumulates from multiple targets, it may eventually force a change in the stereotype, reducing its strength or negating it entirely. Consistent with this idea, several studies have shown that exposure to counter-stereotypic behaviors from multiple targets produces less stereotypic ratings of the target group when there is a cognitive load at encoding than when there is not (Moreno & Bodenhausen, 1999; Yzerbyt, Coull, & Rocher, 1999). The present research suggests that this effect may be accentuated by stronger stereotypes. Thus, although stronger stereotypes and cognitive loads are both associated with increased stereotyping (e.g., Greenwald et al., in press; Hamilton & Sherman, 1994), the impact of counter-stereotypic information may be greater when the perceiver has a strong stereotype and is under a cognitive load.

Conclusions

Stereotypes are useful for efficiently managing social information. How they are used, however, depends on how ingrained they are as conceptual structures, and how much cognitive capacity is available. Under different circumstances, a stereotype can act either as a gate-keeper, self-perpetuating itself by directing attention toward expected information, or as an efficient information processing device that facilitates extraction of novel information, with the potential to undermine itself.

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