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Disentangling Stereotype Activation and Stereotype Application in the Stereotype Misperception Task

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When forming impressions about other people, stereotypes about the individual's social group often influence the resulting impression. At least 2 distinguishable processes underlie stereotypic impression formation: stereotype activation and stereotype application. Most previous research has used implicit measures to assess stereotype activation and explicit measures to assess stereotype application, which has several disadvantages. The authors propose a measure of stereotypic impression formation, the stereotype misperception task (SMT), together with a multinomial model that quantitatively disentangles the contributions of stereotype activation and application to responses in the SMT. The validity of the SMT and of the multinomial model was confirmed in 5 studies. The authors hope to advance research on stereotyping by providing a measurement tool that separates multiple processes underlying impression formation.

Keywords: stereotype activation, stereotype application, implicit measures, multinomial modeling

A central human concern is to make sense of the social environment, including other people. In so doing, we frequently form impressions of other people and the behaviors we expect them to exhibit. These impressions, especially first impressions, are often influenced by social categories and associated stereotypes. Therefore, it is important to understand the processes underlying the impact of stereotypes on impression formation. Present research distinguishes at least two separate processes. First, encountering a member of a stereotyped group can activate associated stereotypes in memory. Second, people may apply the stereotype when forming an impression of the target. A large body of research shows that the degree of stereotype activation and stereotype application can vary as a function of individual differences and situational factors (for reviews, see Hamilton & Sherman, 1994; Kunda & Spencer, 2003). Although researchers have made considerable progress in studying stereotype activation and application, there is still an ongoing debate about how to measure these two distinct processes reliably and validly. The aim of the present work was to develop and validate a measure together with a multinomial model that disentangles stereotype activation and application.

Stereotype Activation and Stereotype Application

Since the early days of research on impression formation and stereotyping, researchers have made a distinction between stereotype activation and application (e.g., Brewer, 1988; Devine, 1989; Fiske & Neuberg, 1990; Gilbert & Hixon, 1991; Hamilton, 1981). *Stereotype activation* is an increased accessibility of knowledge about social groups. In contrast, *stereotype application* is the use of this knowledge in perception and judgment (Gilbert & Hixon, 1991; Kunda & Spencer, 2003). As such, stereotype application depends on the stereotype being activated, whereas stereotype activation is independent of stereotype application.

Stereotypes are typically activated when an individual encounters a member of a social category. The extent to which stereotypes are activated depends on a number of factors, such as the prototypicality of the group member (Blair, Judd, Sadler, & Jenkins, 2002; Freeman & Ambady, 2009) and the learning history of the perceiver (Gawronski, Deutsch, Mbirkou, Seibt, & Strack, 2008; Weisbuch, Pauker, & Ambady, 2009). Stereotype activation can be described as a partially automatic process in the sense that it can happen relatively quickly (e.g., Dovidio, Evans, & Tyler, 1986) and outside of awareness (e.g., Wittenbrink, Judd, & Park, 1997), while at the same time it depends on processing goals (e.g., Macrae, Bodenhausen, Milne, Thorn, & Castelli, 1997) as well as processing resources (e.g., Gilbert & Hixon, 1991).

Stereotype activation does not inevitably result in application of the stereotype in judgments. Individuals use stereotypes in judgments to a greater extent when processing resources are scarce or time pressure is high (e.g., Gilbert & Hixon, 1991; Macrae, Milne, & Bodenhausen, 1994). In contrast, when individuals are motivated to respond without prejudice and they have sufficient cognitive resources, they try to control the influence of stereotypes on judgments (e.g., Neuberg & Fiske, 1987). Naturally, individuals differ in their chronic motivation to respond without prejudice and, hence, in their tendency to apply stereotypes (Fazio, Jackson, Dunton, & Williams, 1995; Plant & Devine, 1998). There are

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many different strategies to control the influence of activated stereotypes on judgments (for reviews, see Devine & Monteith, 1999; Monteith, Sherman, & Devine, 1998). For instance, if additional individuating information is available, perceivers may compute their judgment based solely on individuating information (e.g., Sherman, Stroessner, Conrey, & Azam, 2005). If no individuating information is available, perceivers may attempt to correct for the perceived bias by adjusting the judgment, guided by a theory about the direction and magnitude of the bias (cf. Strack & Hannover, 1996; Wegener & Petty, 1997).

Measures of Stereotype Activation and Stereotype Application

Traditionally, stereotype activation has been measured with implicit tasks and stereotype application has been measured with explicit tasks. Although research in which this strategy has been used has impressively advanced researchers' knowledge about stereotype activation and application, there are some shortcomings with this approach. Let us first focus on explicit measures of stereotype application. There are a great variety of measures, but all of them present participants with information about a target person, including social category information (e.g., race, gender, or age), and ask participants to make judgments about the target. In some measures, participants rate the target on several stereotype-relevant traits (e.g., Gilbert & Hixon, 1991). In other tasks, participants judge the guilt of a defendant that is accused of a stereotype-relevant crime (e.g., Bodenhausen & Lichtenstein, 1987), or decide whether they would hire a job candidate for a stereotype-related job (e.g., Glick, Zion, & Nelson, 1988). The strategy to use explicit judgments as a measure of stereotyping has one severe disadvantage. In particular, effects on explicit judgments might be due either to differences in the extent to which stereotypes are applied or to differences in the extent to which stereotypes were activated in the first place. That is because stereotype activation precedes stereotype application and, thus, necessarily contributes to measures of stereotype application. As such, there remains some ambiguity as to which factor (i.e., changes in activation or changes in application) causes observed changes in explicit judgments. As we describe later, we suggest multinomial modeling as a solution to this problem.

Stereotype activation is typically assessed with implicit measures, such as priming tasks (e.g., Correll, Park, Judd, & Wittenbrink, 2002; Dovidio et al., 1986; Macrae et al., 1997; Payne, 2001; Wittenbrink et al., 1997), stereotype variants of the Implicit Association Test (IAT; e.g., Amodio & Devine, 2006; Nosek, Banaji, & Greenwald, 2002; Rudman, Greenwald, & McGhee, 2001), or word-fragment completion (e.g., Gilbert & Hixon, 1991; Spencer, Fein, Wolfe, Fong, & Dunn, 1998). In their early years, implicit measures were celebrated as providing direct access to activated representations in memory. However, recent research has shown that implicit measures are not as process-pure as researchers have hoped (e.g., Sherman, 2006). In particular, even implicit measures are influenced by the motivation and the ability to control the impact of activated associations on open responses (Conrey, Sherman, Gawronski, Hugenberg, & Groom, 2005; Payne, 2001; Payne & Bishara, 2009; Sherman et al., 2008). For instance, restraining cognitive resources or using time pressure leads to higher scores on these measures, not because stereotypes

are activated more strongly, but because people are less able to exhibit control (e.g., Conrey et al., 2005; Govorun & Payne, 2006). Furthermore, participants high in the motivation to control prejudice show lower scores on implicit measures, partly due to the fact that they are more motivated and better able to exert control over stereotypic response tendencies (Gonsalkorale, Sherman, Allen, Klauer, & Amodio, 2011; Payne, 2005). Similarly, counterstereotypic contexts may reduce implicit bias, not by altering the activation of associations but by encouraging the inhibition of those associations on implicit task performance (e.g., Allen, Sherman, & Klauer, 2010). Thus, implicit measures may reflect changes in the associations that are activated or in more controlled processes that affect the influence of those associations on task responses.

Aside from the problem that neither implicit nor explicit measures solely reflect stereotype activation and stereotype application, respectively, there exists another shortcoming with the strategy of measuring two different processes (i.e., stereotype activation vs. stereotype application) with two different tasks (i.e., implicit vs. explicit measures). In particular, two tasks always differ in many aspects, including specific procedural features that are unrelated to the processes of interest. Thus, finding differences between two tasks as a function of a manipulation might be due either to the fact that the manipulation affected one but not the other process of interest or to the fact that the manipulation affected method-related processes that are confounded with the tasks (cf. Deutsch & Gawronski, 2009; Gawronski, Cunningham, LeBel, & Deutsch, 2010). Therefore, if one wants to test and compare the effects of a manipulation on two different processes (e.g., stereotype activation vs. stereotype application), it is desirable to keep the procedural features of the measures constant. One solution to this problem is to use a single task that reflects the joint contributions of both processes and apply a multinomial model to disentangle the processes of interest (Sherman et al., 2008; Sherman, Klauer, & Allen, 2010).

Stereotype Activation and Stereotype Application in the Stereotype Misperception Task

The aim of the present work was to develop a task that reflects the joint contributions of stereotype activation and stereotype application, along with a multinomial model to disentangle the relative impact of each of the processes. In what follows, we first describe the task and then the multinomial model.

The Stereotype Misperception Task (SMT)

In the SMT, participants are asked to form impressions of people whose faces are shown in blurred drawings (see Figure 1 for examples). Participants work through several trials and judge each person, one at a time, on a certain trait. For instance, if one wants to assess the extent to which African Americans are stereotyped as threatening, one would ask participants to judge the faces on threat. Immediately before the presentation of the target drawing, a nonblurred prime picture of a real face is presented. On some trials, the prime picture shows the face of a person belonging to the stereotyped group of interest (e.g., a Black face). On other trials, the prime picture shows the face of a person belonging to another social group (e.g., a Caucasian face) or a neutral stimulus, such as a facelike shape (see Figure 1). For the purpose of the multinomial

Figure 1. Examples of the stimuli: A target face low in threat (left), a target face high in threat (middle), and a gray facelike shape used as a neutral prime stimulus (right).

modeling (see next section), the SMT requires participants to make a dichotomous judgment of each drawing (i.e., whether the drawing is high or low on a particular trait). Also for the purpose of the multinomial model, the target drawings vary slightly in the extent to which they convey the respective trait. This allows us to estimate the extent to which participants are able to base their judgment on the target (instead of on the prime).

The rationale behind the SMT is the following. In line with research on stereotype activation, we assume that the presentation of the prime picture may activate associated stereotypes (Macrae & Bodenhausen, 2000). When participants form an impression of the person shown in the blurred drawing, they may apply the activated stereotypes. Because the blurred drawings provide only ambiguous information, participants may use any accessible knowledge to make their judgment. As a consequence, stereotypes about the person shown in the prime picture may bias the impression of the person shown in the blurred drawing. At the same time, participants might be able to correct for any bias if they are motivated to do so. Because participants have as much time as they want to give their response, it should be possible to adjust the judgment on the basis of a theory about the direction of the bias. The SMT can be characterized as an indirect measure of stereotyping because participants are not asked to self-assess the to-be-measured construct (cf. De Houwer, 2009; Fazio & Olson, 2003). More specifically, they are not asked to judge the primes on the respective (stereotypic) traits. Instead, the stereotypicality of participants' impression of the primes is inferred from their responses to the target drawings as a function of the preceding primes.

Note that stereotype application in the SMT differs from how stereotype application is typically assessed in stereotyping research. In the SMT, stereotype activation emanates from the prime, and the accessible stereotype influences perceptions of and judgments about a different target than the source of stereotype activation. In contrast, in traditional measures of stereotype application, the stereotype is applied to the same target from which stereotype activation has emanated. Despite this difference, we believe that the quality of the process is the same in the two procedures: Accessible knowledge influences perceptions of and judgments about a target in a stereotype-congruent way. Thus, in both the SMT and traditional measures of stereotype application, stereotype application is characterized as the impact of accessible

mental content on perceptions of and judgments about a target. The only difference between the two approaches is the source of the accessible knowledge (social category of the prime or the target). We empirically bolster our claim by showing that stereotype application in the SMT is correlated with explicit measures of stereotype application.

The SMT is modeled after the Affect Misattribution Procedure (AMP; Payne, Cheng, Govorun, & Stewart, 2005), which is an indirect measure of attitudes. In the AMP, participants make evaluative judgments about ambiguous target stimuli (Chinese characters) that are presented immediately after positively or negatively valenced prime stimuli. Many studies have shown that the valence of the prime biases evaluations of the Chinese characters (Payne, 2009). Because we wanted to focus on the role of stereotypes in forming impressions about people, we adapted the procedure of the AMP, as described above. Most importantly, in the SMT, participants are presented with faces as targets (instead of Chinese characters) and are asked to make trait judgments (instead of evaluative judgments). Research on stereotyping versus prejudice has shown that the nature of the judgment (i.e., whether it is evaluative or conceptual) determines the extent to which evaluative associations (i.e., general attitudes or prejudice) or semantic associations (i.e., stereotypes) influence the measurement outcome (Wittenbrink, Judd, & Park, 2001). Thus, asking participants to make trait judgments (instead of evaluative judgments) primes the use of stereotypes rather than attitudes in making the judgments.

A Multinomial Model of the SMT

Beyond developing a novel measure of stereotyping, the main goal of the present work was to formulate and validate a multinomial processing tree model that disentangles the contributions of stereotype activation and stereotype application to responses on the SMT. Multinomial processing tree models are formal models that can be used to measure latent cognitive processes that contribute to responses in a specific paradigm (Batchelder & Riefer, 1999). Though such models were used originally in memory research, they have become popular in social psychology in the past decade (for reviews, see Payne & Bishara, 2009; Sherman et al., 2008). For instance, they have been used to disentangle the underlying processes of implicit measures of attitudes (Conrey et

al., 2005; Nadarevic & Erdfelder, 2011; Payne, 2001; Payne, Hall, Cameron, & Bishara, 2010; Stahl & Degner, 2007) as well as the processes contributing to person memory (Klauer & Wegener, 1998).

With respect to the SMT, the processes of central interest are stereotype activation (SAC) and stereotype application (SAP). In addition, we assume that two more processes contribute to responses in the SMT; the detection of the target's trait (D) and a guessing tendency (G) in the absence of any other influence. The multinomial model of the SMT makes assumptions about the interplay of these four processes in determining responses in the SMT (see Figure 2). In particular, the model proposes that upon presentation of the prime picture, the stereotype is activated with probability SAC or not activated with probability $1 - \text{SAC}$.¹ If the stereotype is activated, it is applied to the judgment of the target with probability SAP or not applied with probability $1 - \text{SAP}$. If the stereotype is activated and if it is applied to the judgment of the target, participants will give a stereotype-congruent response (e.g., say high in threat after a Black face). If, however, the stereotype is activated and participants are motivated to not apply the stereotype, then they engage in control processes. In line with research on theory-based correction (Strack, Schwarz, Bless, Kübler, & Wänke, 1993; Wegener & Petty, 1997; Wilson & Brekke, 1994), the model assumes that participants will adjust their response, guided by a theory about the direction of the bias induced by the prime. Adjustment will result in giving a stereotype-incongruent response (e.g., say low in threat after a Black face).² If the stereotype is not activated and the trait of the target is correctly detected (D), participants' responses will reflect the target trait. If the target trait is not detected ($1 - D$), a guessing tendency will drive the response. The model estimates the probability of the tendency to guess that the target is high in the respective trait (G) and the probability of the tendency to guess that the target is low in the respective trait ($1 - G$).³

Analyzing Data With the Multinomial Model

When the model is applied to responses on the SMT, parameter values representing the four processes (SAC, SAP, D, G) are estimated. The parameters are estimated from the observed frequencies of the two response options given a particular prime and target. The processing tree (see Figure 2) illustrates the equations used for estimating the parameters. In particular, each branch represents a combination of cognitive processes that take place with a certain probability and result in a specific response given a particular prime and target. The probability for each branch is the product of the probabilities of all processes constituting this branch. Because a particular response can be the result of several branches (i.e., several combinations of different cognitive processes), the probability of a particular response is the sum of the probabilities of the respective branches. For instance, a high-threat response after a Black prime and a low-threat target can be due to stereotype activation and stereotype application, $\text{SAC} \times \text{SAP}$, or due to a guessing bias when the stereotype is not activated and the target trait is not detected $(1 - \text{SAC}) \times (1 - D) \times G$. Thus, the probability of a high-threat response given a Black prime and a low-threat target is $p(\text{high threat}|\text{Black prime} \& \text{low-threat target}) = \text{SAC} \times \text{SAP} + (1 - \text{SAC}) \times (1 - D) \times G$ (for all equations, see Appendix A). The parameter values are estimated

through maximum likelihood estimation. In particular, in an iteration process, the parameter values are changed until the maximum fit is reached between the observed response frequencies and the response frequencies predicted by the model. To test the goodness of fit, the likelihood ratio statistic G^2 is computed. G^2 is asymptotically chi-square distributed. A nonsignificant result indicates that the model does not significantly deviate from the observed data. This is interpreted as evidence that the model fits the data. The parameter values can be interpreted as the probability of the postulated processes. More precisely, the parameters SAP, D, and G can be interpreted as conditional probabilities, because they are conditional on the occurrence of other processes (e.g., SAP is conditional on SAC).

Specific hypotheses can be tested by restricting the model and comparing the new model fit with the fit of the unrestricted model. For instance, to test whether a parameter plays a significant role, one sets the parameter equal to zero. If this restriction leads to a significant loss of goodness of fit, one can conclude that the parameter plays a significant role. To test whether a manipulation affected a particular parameter, one sets this parameter equal across the experimental conditions. If this restriction leads to a significant loss of goodness of fit, one can conclude that the manipulation affected the parameter.

The Present Research

First, we sought to validate the SMT as a measure of stereotypes. To this end, we drew on the stereotypes about African Americans as threatening and athletic. By assessing negative as well as positive stereotypes, we can show that the SMT is not driven by general attitudes but by stereotypes (Experiment 1). Second, we sought to validate the multinomial model of the SMT. In particular, we sought to demonstrate that the parameters indeed

¹ Clearly, activation of mental content varies continuously and is not an all-or-none phenomenon, as suggested by the model. The all-or-none assumption is a necessary simplification because multinomial models are discrete-state models that cannot represent continuous processes (Batchelder & Riefer, 1999). Previous multinomial models that conceptualized activation of mental content as a discrete state have been used successfully in social cognition research (Payne & Bishara, 2009; Sherman et al., 2008).

² Of course, stereotype correction cannot only be achieved by overcorrection and, hence, giving the stereotype-incongruent response; it can also be achieved by other strategies such as recomputation of the impression (i.e., individuation) or by alternating between a stereotype-congruent and a stereotype-incongruent response across trials. We discuss alternative multinomial models in the General Discussion section.

³ Note that the model does not propose a specific temporal order of the processes, as it might appear from the processing tree. Rather, the model simply expresses the manner in which the processes interact and constrain one another in producing responses. These relationships among the parameters may be expressed in many alternate processing trees and are consistent with both parallel and serial processing (cf. Klauer & Voss, 2008). For instance, the processes of target detection and stereotype activation might engage in parallel, each producing a response proposal. The model specifies that the response proposal resulting from the process of stereotype activation is favored with probability SAC, whereas the response proposal resulting from the process of target detection is favored with probability $(1 - \text{SAC}) \times D$. As another example, it is possible to build an equivalent model in which SAP precedes SAC in the processing tree.

Figure 2. Multinomial processing tree model of the stereotype misperception task. The top part shows the model for Black and White primes, and the bottom part shows the model for neutral primes. The table on the right depicts the responses as a function of prime and target. The response “more x” is represented by a + sign, and the response “less x” is represented by a – sign (x represents the specific trait on which participants judge the targets). SAC = stereotype activation; 1 – SAC = lack of stereotype activation; SAP = stereotype application; 1 – SAP = stereotype correction; D = detection of target trait; 1 – D = lack of detection of target trait; G = tendency to guess “more x”; 1 – G = tendency to guess “less x.”

represent the postulated processes. To this end, we created conditions that could be expected on the basis of previous research to affect one but not the other processes in a certain direction. In particular, a manipulation of target detection should influence D but not the remaining parameters. A manipulation of guessing tendencies should influence G but not the remaining parameters. A manipulation of stereotype activation should influence SAC but not the remaining parameters. And finally, a manipulation of stereotype application should influence SAP but not the remaining parameters. In total, we conducted one experiment for each process (Experiments 2–5). Finally, we sought to demonstrate the predictive validity of the SAC and the SAP parameter by showing that they interactively predict explicit stereotyping (analyses of data from Experiments 2–4).

Experiment 1: Validation of the SMT as a Measure of Stereotypes

The purpose of Experiment 1 was to introduce the SMT as a measure of stereotypes. To this end, Experiment 1a measured a negative stereotype about African Americans (threatening) and Experiment 1b measured a positive stereotype about African Americans (athletic). By demonstrating that the SMT captures

negative as well as positive stereotypes, we can show that SMT effects are driven by stereotypes and not by general attitudes. In both studies, pictures of Black and White faces and facelike shapes were shown as prime stimuli. The target stimuli were blurred black-and-white drawings of faces. In Experiment 1a, the drawings varied on threat appearance, and in Experiment 1b the targets varied on athletic appearance (see the Method sections for more details). Participants were asked to form impressions of the people shown in the blurred drawings and to rate them on how threatening (Experiment 1a) or how athletic (Experiment 1b), respectively, they appeared. We expected participants to be more likely to judge a target as high in threat or high in athletic appearance when it followed a Black prime as compared with when it followed a White prime or a neutral prime (i.e., a facelike shape). In addition, variations in the target appearance (i.e., variations in threat or athletic appearance) should affect threat and athletic judgments, respectively.

Method

Participants and design. Thirty-nine non-Black undergraduate students (33 women and six men) at the University of California, Davis participated in Experiment 1a, and 31 non-Black

undergraduate students (15 women and 16 men) at the University of California, Davis participated in Experiment 1b. One participant in Experiment 1a was excluded from the analyses because he gave the same response to all stimuli. Participants received partial course credit as compensation. The design of Experiment 1a was a 3 (prime: White vs. neutral vs. Black) $\times$ 2 (target: low vs. high threat) within-subjects design. The design of Experiment 1b was a 3 (prime: White vs. neutral vs. Black) $\times$ 2 (target: low vs. high athletic) within-subjects design.

Materials. Photographs of 24 White and 24 Black young men were used as prime stimuli in both studies. The photographs were taken from Phillips, Kawakami, Tabi, Nadelny, and Inzlicht (2011). They showed the faces on a gray background. Neutral prime stimuli were 24 gray facelike shapes (see Figure 1). Target stimuli in Experiment 1a were 48 drawings of male faces, half of which were low in threat and half of which were high in threat (see Figure 1). These drawings were made from pictures provided by Oosterhof and Todorov (2008), who have developed a model that generates faces that vary on specific traits. It is important to note that the emotional expression of these faces is neutral. The faces differ only in facial features (e.g., shape of eyes, eyebrows, chin, etc.) that people use to form trait impressions of people. Twenty-four faces with a threat level two standard deviations above neutral and 24 faces with a threat level two standard deviations below neutral were selected. Then, the pictures were converted into blurred black-and-white drawings using picture editing software. This resulted in two groups of target drawings that differed in their threat appearance. The target stimuli in Experiment 1b were 24 randomly computer-generated male faces taken from Oosterhof and Todorov (2008). Because there is no model yet for generating faces that vary on athletic appearance, a pilot study was conducted in which 61 students rated 144 randomly computer-generated male faces on a scale from 1 (*not at all athletic*) to 9 (*very athletic*). The 12 faces with the lowest ($M = 3.02$, $SD = 0.37$) and the 12 faces with the highest ($M = 5.79$, $SD = 0.25$) mean athletic ratings were selected and converted into blurred drawings, using the same procedure as in Experiment 1a.

Procedure. Participants were told that the study was about impression formation under suboptimal conditions. The SMT consisted of two test blocks of 72 trials each. Before the test blocks,

participants completed two practice blocks of six trials each, with the first practice block presenting only targets and the second practice block presenting primes and targets. A test trial started with the presentation of a fixation cross in the center of the screen for 500 ms, followed by a prime picture for 150 ms, and then a blank screen for 50 ms. After that, a target picture appeared for 100 ms, followed by a gray pattern mask until participants responded. The next trial started after 500 ms. All trials appeared in random order. Each prime category was paired equally often with each target category.

Participants were asked to form an impression of the people shown in the target drawing. They were asked to indicate whether the target is threatening (Experiment 1a) or athletic (Experiment 1b). If they felt the person was more threatening (athletic) than the average target presented, then they were told to press the *K* key. If they felt the person was less threatening (athletic) than the average target presented, then they were told to press the *D* key. To remind participants of the meaning of the response keys, the response labels “less threatening” (“less athletic”) and “more threatening” (“more athletic”) appeared together with the gray pattern mask on the left and right side of the screen. Participants were asked to make relative instead of absolute judgments of the targets to prevent possible floor effects because the targets might generally look relatively unthreatening and unathletic. Participants were told that there were no right or wrong answers and that they should rely on their first impression and respond as quickly as possible. In addition, they were asked to not respond to the prime pictures but to pay attention to them. They were informed that they would be asked questions about the people shown in the prime pictures after they had finished the task.

Results

Analyses of variance (ANOVAs). First, we tested whether participants’ responses were affected by the prime and target manipulations. We subjected the proportion of “more threatening” responses in Experiment 1a to a 3 (prime: White vs. neutral vs. Black) $\times$ 2 (target: low vs. high threat) ANOVA. As can be seen in Figure 3, participants judged the drawing more often as threatening when it was preceded by a Black prime as compared with a White or a neutral prime, $F(2, 74) = 10.77$, $p < .001$, $\eta_p^2 = .23$.

Figure 3. Proportion of threat responses (left side) and athletic responses (right side) as a function of prime (White vs. neutral vs. Black) and target (low vs. high threat/athletic appearance) in Experiment 1. Error bars represent standard errors of the mean.

Simple comparisons confirmed that threat judgments were more frequent after Black primes relative to White primes, $F(1, 37) = 20.71, p < .001$, as well as relative to neutral primes, $F(1, 37) = 13.50, p = .001$. Responses after White and neutral primes did not differ ($F < 1$). Furthermore, participants judged high-threat targets as more threatening than low-threat targets, $F(1, 37) = 17.48, p < .001, \eta_p^2 = .32$. Finally, the interaction between prime and target was significant, $F(2, 74) = 5.98, p = .004, \eta_p^2 = .14$. Simple comparisons indicated that high- and low-threat targets were judged differently after White primes, $F(1, 37) = 4.86, p = .034$, and after neutral primes, $F(1, 37) = 27.04, p < .001$, but not after Black primes, $F(1, 37) = 2.09, p = .16$.

As in Experiment 1a, a significant prime effect emerged in Experiment 1b, $F(2, 60) = 15.07, p < .001, \eta_p^2 = .33$. Simple comparisons indicated that the proportion of “more athletic” responses was higher after Black relative to White primes, $F(1, 30) = 35.08, p < .001$, and relative to neutral primes, $F(1, 30) = 10.43, p = .003$. Furthermore, the proportion of “more athletic” responses was marginally lower after White primes compared with neutral primes, $F(1, 30) = 3.13, p = .087$. Neither the main effect of target ($F < 1$) nor the interaction between prime and target ($F < 1.2$) was significant.

Sensitivity. We estimated the size of the stereotype effect (SMT effect) as an index for the sensitivity of the task. More specifically, we calculated Cohen’s d for dependent groups from the proportion of more threatening (athletic) responses on Black-prime trials as compared with White-prime trials, across low- and high-threat (athletic) target trials. The effect size was $d = 1.04$ in Experiment 1a and $d = 1.50$ in Experiment 1b. According to Cohen’s standards (Cohen, 1988), these effect sizes are large.

Reliability. To examine the reliability of the SMT effect, we calculated two SMT effect scores, one for each block of trials, by subtracting the proportion of more threatening (athletic) responses on White-prime trials from the proportion of more threatening (athletic) responses on Black-prime trials, across low- and high-threat (athletic) targets. Then, we correlated these two scores while applying a Spearman-Brown correction. The correlation was $r = .92$ in Experiment 1a and $r = .90$ in Experiment 1b. Thus, the internal consistency of the SMT is high.

Multinomial model. We conducted model-based analyses of the data separately for Experiment 1a and Experiment 1b, using the computer program multiTree (Moshagen, 2010). For each experiment, we estimated four different parameters: one SAC parameter, one SAP parameter, one D parameter, and one G parameter. The model fit was good in Experiment 1a, $G^2(2) = 1.04, p = .596$, and satisfactory in Experiment 1b, $G^2(2) = 5.03, p = .081$. The parameter estimates are depicted in Table 1. First, we examined

whether the SAC parameter plays a role in the SMT. To this end, we tested whether SAC differed significantly from zero. As expected, SAC was significantly greater than zero in Experiment 1a, $\Delta G^2(1) = 187.97, p < .001$, and in Experiment 1b, $\Delta G^2(1) = 358.28, p < .001$, indicating that SAC played a significant role in both the threat and the athletic SMT. Second, we tested whether participants showed a tendency to apply the stereotype or a tendency to correct for the stereotype. To this end, we tested whether SAP was greater than .5 (indicating stereotype application) or smaller than .5 (indicating stereotype correction). SAP was greater than .5 in Experiment 1a, $\Delta G^2(1) = 154.84, p < .001$, and in Experiment 1b, $\Delta G^2(1) = 344.05, p < .001$, suggesting that participants showed a tendency to apply the stereotype in both the threat and the athletic SMT. Third, we examined whether D played a role in the SMT. D differed significantly from zero in Experiment 1a, $\Delta G^2(1) = 42.58, p < .001$, but not in Experiment 1b, $\Delta G^2(1) = 0.13, p = .715$. Finally, we investigated whether participants exhibited a systematic response bias (G). A value greater than .5 would indicate that participants showed a bias toward the response “more threatening” or “more athletic,” respectively, whereas a value smaller than .5 would indicate that participants showed the opposite bias. In Experiment 1a, participants exhibited a bias toward the response “less threatening,” $\Delta G^2(1) = 179.24, p < .001$, and in Experiment 1b participants exhibited a bias toward the response “less athletic,” $\Delta G^2(1) = 15.40, p < .001$.

Discussion

Experiment 1 demonstrated that the SMT captures negative and positive racial stereotypes. In particular, the race of the prime faces influenced participants’ judgments of the target drawings on threat and athletic ability. The effect sizes were large for both stereotypes, and the SMT proved to be highly reliable across the two blocks of trials. By showing that the SMT captures negative as well as positive stereotypes, we can rule out that the effect is driven by general attitudes. We assume that the prime pictures activate racial stereotypes, which participants use when making judgments about the ambiguous drawings.

The model fit was good in Experiment 1a and satisfactory in Experiment 1b. The worse model fit in Experiment 1b may be due to the fact that the targets were too similar on athletic appearance, and, thus, the D parameter did not play a significant role. Supporting this reasoning, the model fit was better when we tested the model with D set equal to zero, $G^2(3) = 5.16, p = .16$. The SAC parameter played a significant role in both the threat and the athletic SMT, whereas the D parameter played a significant role only in the threat SMT. This finding is in line with the results from the ANOVA that the variations in target appearance affected the responses in the threat SMT but not in the athletic SMT. This suggests that participants were able to discriminate between the low- and high-threat targets in Experiment 1a, but they were not able to discriminate between the low- and high-athletic targets in Experiment 1b. Thus, future studies in which the athletic SMT is used should use more extreme targets. At the same time, the targets need to be ambiguous enough to allow effects of the primes on target judgments. The SAP parameter was larger than .5, indicating that participants exhibited a tendency to apply the activated stereotype. Finally, the G parameter was smaller than .5 in both the

Table 1
Parameter Estimates [and 95% Confidence Intervals] in
Experiments 1a and 1b

Parameter	Experiment 1a	Experiment 1b
SAC	.55 [.42, .68]	.99 [.64, 1.36]
SAP	.68 [.63, .73]	.67 [.61, .73]
D	.12 [.09, .16]	.01 [−.04, .06]
G	.35 [.33, .38]	.45 [.42, .48]

Note. SAC = stereotype activation; SAP = stereotype application; D = target detection; G = guessing.

threat- and the athletic SMT, suggesting that participants tended to respond with “less threatening” or “less athletic,” respectively.

Experiment 2: Validation of the D Parameter

The next studies were designed to validate the parameters of the SMT multinomial model. For this purpose, we focused on the threat SMT. First, we sought to validate the D parameter. D represents the likelihood that the trait of the target is detected correctly. It is important to note that the SMT is designed in such a way that D will always be relatively low. That is, participants may use the prime when judging the target only if the target is relatively ambiguous. Nevertheless, if the targets vary to some degree on the respective trait, then participants should be able to discriminate them, and, thus, D should be higher than zero. If, however, the targets do not vary on the respective trait, then discrimination will be impossible and D should not differ from zero. Following this reasoning, we used two different sets of targets: One set contained faces that differed in threat appearance, and the other set contained faces that did not differ in threat appearance. First, this manipulation should affect responses in the SMT such that the main effect of target threat disappears when the targets do not differ in threat appearance. Second, this manipulation should affect the parameter estimates of the multinomial model. We expected D to be higher when the target faces differed in threat appearance as compared with when they did not differ in threat appearance. Furthermore, D should be different from zero in the former case but not in the latter case. Finally, none of the other parameters should be affected by this manipulation.

Method

Participants and design. Thirty-five non-Black undergraduate students (27 women and eight men) at the University of California, Davis participated for partial course credit. The design was a 3 (prime: White vs. neutral vs. Black) $\times$ 2 (target set: different threat levels vs. same threat level) $\times$ 2 (target subset: Subset A vs. Subset B) within-subjects design. More specifically, Subset A and Subset B of the *different threat levels* condition differed in threat such that Subset A contained low-threat faces and Subset B contained high-threat faces. In contrast, Subset A and Subset B of the *same threat level* condition did not differ in threat. Both subsets contained faces that were moderately threatening.

Materials and procedure. The prime stimuli were the same as in Experiment 1. Two sets of target stimuli were created. One set (*different threat levels*) contained two subsets of targets that

differed in their threat level. Half of the targets were low in threat, and half of the targets were high in threat. These target stimuli were the same as in Experiment 1. The second set (*same threat levels*) contained two subsets of targets that did not differ in their threat level. Both subsets contained the exact same target stimuli that were moderately threatening (Oosterhof & Todorov, 2008). The procedure was the same as in Experiment 1. After the SMT, explicit stereotypes were measured with a questionnaire. This questionnaire is described in more detail in the final part of this article, where the results on the predictive validity of the SMT parameters across Experiments 2–4 are reported.

Results

ANOVA. We subjected the proportion of “more threatening” responses to a 3 (prime: White vs. neutral vs. Black) $\times$ 2 (target set: different threat level vs. same threat level) $\times$ 2 (target subset: subset A vs. subset B) ANOVA for repeated measures. Most importantly, we predicted an interaction between target set and target subset. Furthermore, we expected to replicate the main effect of prime. These hypotheses were confirmed (see Table 2). The ANOVA yielded a significant interaction between target set and target subset, $F(1, 34) = 11.42, p = .002, \eta_p^2 = .25$. In the different threat levels condition, threat responses were more frequent in the subset with high-threat targets than in the subset with low-threat targets, $F(1, 34) = 6.35, p = .017$. In the same threat level condition, however, the proportion of threat responses did not differ between both subsets, $F(1, 34) = 2.77, p = .11$. Furthermore, the ANOVA yielded a significant prime effect, $F(2, 68) = 13.97, p < .001, \eta_p^2 = .29$. Simple comparisons indicated that Black primes led to more threat judgments than White primes, $F(1, 34) = 12.78, p = .001$, or neutral primes, $F(1, 34) = 22.96, p < .001$. White primes led to marginally more threat judgments than neutral primes, $F(1, 34) = 3.44, p = .072$. No other effects were significant ($F_s < 1$).

Multinomial model. We estimated separate parameters for each target set, resulting in a total of eight parameters (see Figure 4). The model fit the data well, $G^2(4) = 4.84, p = .304$. Then, we tested whether the parameters differed between the target sets. As expected, D was higher in the different threat levels condition than in the same threat level condition, $\Delta G^2(1) = 6.08, p = .014$. Furthermore, D was significantly greater than zero in the different threat levels condition, $\Delta G^2(1) = 6.85, p = .009$, but did not differ from zero in the same threat level condition, $\Delta G^2(1) < 1, p = .99$. The remaining parameters did not differ between target sets (all $\Delta G^2 < 1, p_s > .4$).

Table 2
Proportion of Threat Judgments as a Function of Prime (White vs. Neutral vs. Black), Target Set (Same vs. Different Threat Levels), and Target Subset (Subset A vs. Subset B) in Experiment 2

Condition	White prime		Neutral prime		Black prime	
	Subset A	Subset B	Subset A	Subset B	Subset A	Subset B
Same threat levels	.34 (.19)	.32 (.17)	.26 (.28)	.23 (.28)	.54 (.21)	.50 (.25)
Different threat levels	.31 (.20)	.37 (.22)	.23 (.26)	.28 (.30)	.47 (.20)	.53 (.25)

Note. In the Different threat levels condition, Subset A contained low-threat targets and Subset B contained high-threat targets. Standard deviations appear in parentheses.

Figure 4. Probability estimates of the parameters SAC (stereotype activation), SAP (stereotype application), D (target detection), and G (guessing) as a function of target set (same vs. different threat levels) in Experiment 2. Error bars represent 95% confidence intervals.

Discussion

Experiment 2 successfully validated the D parameter. To this end, we manipulated the threat level of the target faces. As expected, this manipulation influenced the responses in the SMT such that the main effect of target disappeared when the target faces did not differ in threat appearance. At the same time, we replicated the influence of the Black relative to the White and neutral primes on the threat judgments. Most importantly, the manipulation of target threat affected the D parameter but not the remaining parameters. D was greater in the condition in which the targets differed in threat appearance (low vs. high threat) than in the condition in which the targets did not differ in threat appearance. Furthermore, D was greater than zero in the condition in which the targets differed in threat appearance, but did not differ from zero in the condition in which the targets did not differ in threat appearance. Together, this suggests that the D parameter indeed represents the process of detecting the target trait. The manipulation of target threat appearance did not affect the remaining parameters of the model. Thus, the remaining parameters do not represent processes that are involved in target detection. In sum, Experiment 2 provides empirical evidence for the convergent and discriminant validity of the D parameter.

Experiment 3: Validation of the G Parameter

In the next experiment, we sought to validate the G parameter. To manipulate the guessing tendency, we gave participants instruc-

tions about how to respond when being uncertain. In particular, we told half the participants to respond with “less threatening” when uncertain and the other half the participants to respond with “more threatening” when uncertain. First, this instruction should influence responses in the SMT across all prime and target manipulations, such that threat responses are less frequent in the former as compared with the latter condition. This finding can be considered as a manipulation check. Second, the G parameter but not the remaining parameters should be affected by the instruction.

Method

Participants and design. Fifty-four non-Black undergraduate students (27 women and 27 men) at the University of California, Davis participated for partial course credit. The design was a 3 (prime: White vs. neutral vs. Black) $\times$ 2 (target: low vs. high threat) $\times$ 2 (instruction: “respond less threatening when uncertain” vs. “respond more threatening when uncertain”) mixed design, with the last factor varied between participants. Two participants were excluded from the analyses because their mean proportion of “more threatening” responses deviated more than 2.5 standard deviations from the mean proportion of their respective instruction group. This indicated that these participants did not follow the instructions to respond “less (or “more) threatening” when uncertain in the same way as the remaining participants did.

Materials and procedure. The materials and procedures were identical to Experiment 1a, with the exception that participants received instructions about how to respond when uncertain:

Sometimes it might be difficult to form an impression of the person shown in the drawing and you might be uncertain how to respond. If you are uncertain how to respond choose the answer “*less threatening*” [“*more threatening*”]. Better to say “*less threatening*” [“*more threatening*”] too often than too seldom!

Results

ANOVA. We subjected the proportion of “more threatening” responses to a 3 (prime: White vs. neutral vs. Black) $\times$ 2 (target: low vs. high threat) $\times$ 2 (instruction: “respond less threatening” vs. “respond more threatening”) mixed ANOVA for repeated measures, with the last factor as a between-subjects factor. Most importantly, we predicted a main effect of instruction. Furthermore, we expected to replicate the main effects of prime and target. These hypotheses were confirmed (see Table 3). The two instruction groups differed in their mean proportions of “more threatening” responses, $F(1, 50) = 30.61, p < .001, \eta_p^2 = .38$. Furthermore, the ANOVA yielded the expected main effect of

Table 3

Proportion of Threat Judgments as a Function of Prime (White vs. Neutral vs. Black), Target (Low vs. High Threat) and Guessing Instructions (“Respond Less Threatening” vs. “Respond More Threatening”) in Experiment 3

Response instruction	White prime		Neutral prime		Black prime	
	Low threat	High threat	Low threat	High threat	Low threat	High threat
“Respond less”	.28 (.17)	.30 (.20)	.13 (.24)	.22 (.26)	.45 (.23)	.49 (.20)
“Respond more”	.34 (.19)	.39 (.20)	.43 (.28)	.52 (.28)	.58 (.23)	.60 (.22)

Note. Standard deviations appear in parentheses.

prime, $F(2, 100) = 13.93$, $p < .001$, $\eta_p^2 = .22$. As in previous studies, participants more often responded “more threatening” after Black primes as compared with White primes, $F(1, 51) = 25.61$, $p < .001$, and as compared with neutral primes, $F(1, 51) = 16.80$, $p < .001$. Responses after White and neutral primes did not differ ($F < 1$). Also, the expected main effect of target was confirmed, $F(1, 50) = 10.08$, $p = .003$, $\eta_p^2 = .17$.

In addition to these predicted effects, we found a significant interaction between prime and instruction, $F(2, 100) = 3.59$, $p = .031$, $\eta_p^2 = .07$. Simple comparisons indicated that the guessing instruction was effective on neutral-prime trials, $F(1, 50) = 18.49$, $p < .001$, and on Black-prime trials, $F(1, 50) = 4.55$, $p = .038$, but not on White-prime trials, $F(1, 50) = 2.29$, $p = .137$. Furthermore, we found a significant interaction between prime and target, $F(1, 50) = 3.79$, $p = .026$, $\eta_p^2 = .07$. Simple comparisons indicated that the target effect was significant after neutral primes, $F(1, 50) = 14.55$, $p < .001$, but not after White or Black primes ($F_s < 2.6$, $p_s > .10$). No other effect was significant ($F_s < 1$).

Multinomial model. We estimated separate parameters for each instruction condition, resulting in a total of eight parameters (see Figure 5). The model fit the data well, $G^2(4) = 2.07$, $p = .722$. As expected, G differed between instruction conditions, $\Delta G^2(1) = 241.25$, $p < .001$. In particular, G was higher in the “respond more threatening when uncertain” condition than in the “respond less threatening when uncertain” condition. Because G represents a response bias toward the response “more threatening,” this finding is in line with expectations. The remaining parameters did not differ between instruction conditions (all $\Delta G^2 < 1.9$, $p_s > .17$).

Discussion

Participants complied with the guessing instruction, as indicated by the observation that the overall proportion of threat responses was higher when participants were told to respond with threatening when uncertain as compared with when they received the opposite instruction. We replicated the finding from previous studies that Black primes led to more threat judgments than White or neutral

primes. Most importantly, Experiment 3 provides empirical evidence for the validity of the G parameter. As expected, instructing participants to prefer one response when uncertain affected the G parameter but not the remaining parameters. This indicates that G indeed represents guessing tendencies, whereas the remaining parameters are immune to guessing tendencies. Together, these findings demonstrate the convergent and discriminant validity of the model parameters.

Experiment 4: Validation of the SAC Parameter

The aim of Experiment 4 was to validate the SAC parameter. To this end, we drew on previous research showing that the typicality of group members influences the extent to which stereotypes are activated (Blair et al., 2002; Freeman & Ambady, 2009). For instance, Blair and colleagues showed that Black faces with more Afrocentric features lead to greater stereotype activation than Black faces with less Afrocentric features, while leaving stereotype control unaffected (Blair, Judd, & Fallman, 2004; Blair et al., 2002). Following this research, we manipulated the degree of Afrocentric features of the Black primes. First, we predicted a higher proportion of threat judgments following primes with more Afrocentric features than primes with less Afrocentric features. Second, we expected a higher SAC parameter for Black faces with more Afrocentric features than for Black faces with less Afrocentric features, while the remaining parameters should not be affected.

Method

Participants and design. Thirty-two non-Black undergraduate students (24 women and eight men) at the University of California, Davis participated for partial course credit. The design was a 3 (prime: White vs. neutral vs. Black) $\times$ 2 (prime set: low- vs. high-Afrocentric Black primes) $\times$ 2 (target: low vs. high threat) within-subjects design.

Materials and procedure. To select pictures of Black faces with low- versus high-Afrocentric features, 35 participants rated 65 Black faces on a scale from 1 (*not at all African*) to 9 (*very African*). The faces were taken from various sources (Gawronski et al., 2010; Minear & Park, 2004; Phills et al., 2011). The 12 faces that received the highest rating ($M = 7.90$, $SD = 0.28$) and the 12 faces that received the lowest rating ($M = 5.89$, $SD = 0.39$) were selected. The White faces were the same as in Experiment 1. The White faces were divided in two sets that were equal in threat appearance, based on the proportion of threat responses to these faces in Experiment 1. The facelike shapes, which served as neutral primes, were randomly divided into two sets. As a result, two sets of primes were obtained that differed with respect to Black faces (low vs. high Afrocentric), but were similar with respect to White and neutral faces. The procedure was the same as in Experiment 1a.

Results

ANOVA. We subjected the proportion of “more threatening” responses to a 3 (prime: White vs. neutral vs. Black) $\times$ 2 (prime set: low- vs. high-Afrocentric Black primes) $\times$ 2 (target: low vs. high threat) ANOVA. Most importantly, we predicted an interac-

Figure 5. Probability estimates of the parameters SAC (stereotype activation), SAP (stereotype application), D (target detection), and G (guessing) as a function of guessing instructions (“respond less threatening” vs. “respond more threatening”) in Experiment 3. Error bars represent 95% confidence intervals.

tion between prime and prime set. Furthermore, we expected to replicate the main effect of target. These predictions were confirmed (see Table 4). In particular, the analysis revealed significant main effects of prime, $F(2, 62) = 14.68, p < .001, \eta_p^2 = .32$, and prime set, $F(1, 31) = 38.18, p < .001, \eta_p^2 = .55$, that were qualified by the predicted interaction between prime and prime set, $F(2, 62) = 34.74, p < .001, \eta_p^2 = .53$. Simple comparisons indicated that high-Afrocentric Black primes led to more threat judgments than low-Afrocentric primes, $F(1, 31) = 89.85, p < .001$. In contrast, threat judgments following White and neutral primes did not differ between prime sets, $F(1, 31) < 1, p = .95$; and $F(1, 31) = 2.32, p = .14$, respectively. Furthermore, in both prime sets, threat judgments were more frequent after Black primes than White primes, $F(1, 31) = 7.84, p = .009$; and $F(1, 31) = 41.61, p < .001$, respectively, as well as neutral primes, $F(1, 31) = 7.89, p = .009$; and $F(1, 31) = 31.27, p < .001$, respectively. White primes did not differ from neutral primes in either set ($F_s < 1$).

Finally, the main effect of target did not reach significance, $F(1, 31) = 2.60, p = .117, \eta_p^2 = .08$, but the interaction between target and prime was significant, $F(1, 31) = 4.72, p = .012, \eta_p^2 = .13$. Simple comparisons indicated that judgments of low- and high-threat targets differed as expected after neutral primes, $F(1, 31) = 7.68, p = .009$, but did not differ after White and Black primes ($F_s < 1$). No other effects were significant ($F_s < 1.7$).

Multinomial model. We estimated separate parameters for each prime set, resulting in eight parameters (see Figure 6). The model fit the data well, $G^2(4) = 2.97, p = .562$. As expected, SAC was higher for the prime set containing high-Afrocentric Black primes than for the prime set containing low-Afrocentric Black primes, $\Delta G^2(1) = 32.78, p < .001$, whereas SAP did not differ between prime sets, $\Delta G^2(1) = 2.17, p = .140$. Also, D and G did not differ between prime sets (all $\Delta G^2 < 1.4, p_s > .25$).

Discussion

Experiment 4 demonstrated the validity of the SAC parameter. Variations in Afrocentric features of the Black primes affected responses in the SMT as well as parameter estimates as predicted. In particular, high-Afrocentric Black primes led to more threat judgments than low-Afrocentric Black primes. Most importantly, this effect corresponded to variations in the SAC parameter. More specifically, SAC was higher for Black faces with more Afrocentric features than for Black faces with less Afrocentric features. Because previous research has shown that typicality affects stereotype activation (Blair et al., 2004, 2002; Freeman & Ambady, 2009), these results indicate that the SAC parameter indeed rep-

Figure 6. Probability estimates of the parameters SAC (stereotype activation), SAP (stereotype application), D (target detection), and G (guessing) as a function of prime set (low- vs. high-Afrocentric Black primes) in Experiment 4. Error bars represent 95% confidence intervals.

resents stereotype activation. Furthermore, the remaining parameters were not affected by the typicality manipulation, providing evidence for discriminant validity.

Experiment 5: Validation of the SAP Parameter

In Experiment 5, we sought to validate the SAP parameter. Because the SMT relies on judgments, and participants are not under time pressure, we assumed that it would be possible for participants to control stereotyping. Therefore, manipulating the goal to apply stereotypes versus to control stereotyping should affect responses in the SMT and, in particular, the SAP parameter. We manipulated participants' goals in three conditions. Participants in the stereotype application condition were told to apply stereotypes when judging the drawings; participants in the stereotype correction condition were told to correct for stereotypes when judging the drawings; and participants in the no-instruction condition did not receive additional instructions and served as a baseline. First, these instructions should affect threat judgments in the SMT as a function of the prime. More specifically, the application instruction should increase the SMT effect (i.e., the difference in threat judgments after Black vs. White primes), whereas the correction instruction should reduce the SMT effect. Second, these effects should correspond to changes in SAP. We expected SAP to be highest in the stereotype application condition and to be

Table 4

Proportion of Threat Judgments as a Function of Prime (White vs. Neutral vs. Black), Target (Low vs. High Threat), and Prime Set (Low- vs. High-Afrocentric Black Primes) in Experiment 4

Set	White prime		Neutral prime		Black prime	
	Low threat	High threat	Low threat	High threat	Low threat	High threat
Low Afrocentric	.31 (.19)	.29 (.19)	.21 (.24)	.31 (.30)	.42 (.24)	.46 (.22)
High Afrocentric	.29 (.20)	.31 (.19)	.25 (.30)	.33 (.32)	.68 (.28)	.67 (.25)

Note. Standard deviations appear in parentheses.

lowest in the stereotype correction condition. The remaining parameters should not be affected by the goal manipulation.

Method

Participants and design. Seventy non-Black undergraduate students (37 women and 33 men) at the University of California, Davis participated for partial course credit. One participant was excluded from the analyses because he gave the same response to all stimuli. A further participant was excluded because his SMT effect deviated more than 2.5 standard deviations from the mean SMT effect of his condition, indicating that he did not follow the instructions in the same way as the majority of participants. The design was a 3 (prime: White vs. neutral vs. Black) $\times$ 2 (target: low vs. high threat) $\times$ 3 (instructions: stereotype application vs. no instruction vs. stereotype correction) mixed design, with the last factor varied between participants.

Materials and procedure. The materials and procedures were identical to Experiment 1, with the exception that participants received additional instructions in the stereotype application and stereotype correction conditions:

If somebody has the stereotype that Blacks are threatening and Whites are not threatening, then he/she will be more likely to judge the face shown in the drawing as threatening when it follows the photograph of a Black person and more likely to judge it as non-threatening when it follows the photograph of a White person. The present study investigates the extent to which responses on this task can be faked. To this end, **we ask you to respond like somebody who holds** [is trying to **correct for**] the stereotype that Blacks are threatening and Whites are not threatening. Regardless of what you really believe, respond like somebody who holds [is trying to correct for] these stereotypes. Remember: Your main task is still to judge the person shown in the drawing. Just alter your responses a little bit to behave like a person who holds [is trying to correct for] the stereotype that Blacks are threatening and Whites are not threatening.

Results

ANOVA. We subjected the proportion of “more threatening” responses to a 3 (prime: White vs. neutral vs. Black) $\times$ 2 (target: low vs. high threat) $\times$ 3 (instructions: stereotype application vs. no instruction vs. stereotype correction) mixed ANOVA for repeated measures, with the last factor varying between subjects.⁴ Most importantly, we predicted an interaction between prime and instruction. Furthermore, we expected to replicate the main effect of target. These hypotheses were confirmed (see Table 5). The analysis yielded a significant main effect of prime, $F(2, 130) = 21.25$, $p < .001$, $\eta_p^2 = .25$, that was qualified by a significant interaction between prime and instructions, $F(4, 130) = 13.09$, $p < .001$, $\eta_p^2 = .29$. Simple comparisons indicated that Black relative to White primes caused a higher proportion of threat responses in the stereotype application condition, $F(1, 18) = 167.31$, $p < .001$, and in the no-instruction condition, $F(1, 28) = 8.94$, $p = .006$, but not in the correction condition ($F < 1$). The same was true for the comparison between Black and neutral primes, $F(1, 18) = 75.82$, $p < .001$; $F(1, 28) = 6.87$, $p = .014$, and $F < 1$, respectively. White primes caused a lower proportion of threat responses than neutral primes in the stereotype application condition, $F(1, 18) = 33.47$, $p < .001$, whereas no difference was found in the remaining

conditions ($F_s < 1$). Furthermore, the ANOVA revealed the expected main effect of target, $F(1, 65) = 20.45$, $p < .001$, $\eta_p^2 = .24$.

Besides these predicted findings, the ANOVA revealed a significant interaction between target and prime, $F(2, 130) = 7.28$, $p = .001$, $\eta_p^2 = .10$, and a significant interaction between target, prime, and instructions, $F(4, 130) = 2.50$, $p = .045$, $\eta_p^2 = .07$. Simple comparisons indicated that high-threat targets caused more threat judgments than low-threat targets in the stereotype application condition after neutral primes, $F(1, 18) = 11.65$, $p = .003$, but not after White or Black primes ($F < 1$); in the no-instruction condition after White primes, $F(1, 28) = 11.76$, $p = .002$, and neutral primes, $F(1, 28) = 13.06$, $p = .001$, but not after Black primes ($F < 1$); in the stereotype correction condition after neutral primes, $F(1, 19) = 5.11$, $p = .036$, and after Black primes, $F(1, 19) = 3.81$, $p = .066$, but not after White primes ($F < 1$). The ANOVA revealed no other significant effects (all $F_s < 1.4$).

Multinomial model. We estimated separate parameters for each instruction condition, resulting in 12 parameters (see Figure 7). The model fit was good, $G^2(6) = 7.02$, $p = .319$. Most importantly, SAP was higher in the stereotype application condition as compared with the stereotype correction condition, $\Delta G^2(1) = 9.86$, $p = .002$. The no-instruction condition lay in between and differed significantly from the stereotype correction condition, $\Delta G^2(1) = 9.86$, $p = .002$, but not from the stereotype application condition, $\Delta G^2(1) = 1.33$, $p = .248$. Furthermore, SAP was higher than .5 in the no-instruction condition, $\Delta G^2(1) = 50.52$, $p < .001$, as well as in the stereotype application condition, $\Delta G^2(1) = 1217.72$, $p < .001$, indicating that participants exhibited a tendency to apply the stereotype. In contrast, SAP in the stereotype correction condition was smaller than .5, $\Delta G^2(1) = 7.61$, $p = .006$, indicating that participants gave the stereotype-inconsistent response more often than the stereotype-consistent response. SAC did not differ between the no-instruction condition and the stereotype correction condition, $\Delta G^2(1) = .01$, $p = .932$. However, SAC was higher in the stereotype application condition as compared with the no-instruction condition, $\Delta G^2(1) = 27.45$, $p < .001$. The remaining parameters did not differ between instruction conditions (all $\Delta G^2 < 1.9$, $p_s > .17$).

Discussion

Telling participants to apply versus correct for stereotypes changed the responses in the SMT as predicted. In particular, participants responded more often with judgments of threat following Black than White or neutral primes when they were told to apply stereotypes or when they did not receive any instructions. This priming effect disappeared when participants were told to correct for stereotypes. Most importantly, Experiment 5 demonstrates the validity of the SAP parameter as representing the extent to which stereotypes are applied or corrected for. As expected, SAP was highest when participants were told to apply the stereotypes and lowest when participants were told to correct for stereotypes, with the baseline condition lying in the middle. Furthermore, participants exhibited a significant tendency to apply the stereotype when told to do so as well as when given no instruc-

⁴ The data from the second block of the SMT were lost from 14 participants due to a computer error.

Table 5

Proportion of Threat Judgments as a Function of Prime (White vs. Neutral vs. Black), Target (Low vs. High Threat), and Instructions (Stereotype Application vs. No Instruction vs. Stereotype Correction) in Experiment 5

Instruction	White prime		Neutral prime		Black prime	
	Low threat	High threat	Low threat	High threat	Low threat	High threat
Stereotype application	.13 (.16)	.12 (.13)	.35 (.19)	.47 (.21)	.89 (.13)	.90 (.13)
No instruction	.32 (.17)	.42 (.17)	.29 (.30)	.44 (.30)	.52 (.25)	.55 (.25)
Stereotype correction	.49 (.35)	.50 (.35)	.40 (.32)	.47 (.30)	.38 (.32)	.47 (.33)

Note. Standard deviations appear in parentheses.

tions, whereas they exhibited a significant tendency to overcorrect for the stereotype (i.e., give a stereotype-inconsistent response) when told to do so.

The SAC parameter was not affected by the instruction to correct for stereotypes. Interestingly, SAC increased when participants were instructed to apply stereotypes. This finding may indicate that participants who were told to apply stereotypes intentionally activated stereotypes beyond baseline activation of stereotypes as they attempted to base their judgment on these stereotypes. Alternatively, this finding may indicate that continued application eventually increases the level of activation. The remaining parameters were not affected by the manipulations, demonstrating the discriminant validity of the parameters.

Prediction of Explicit Stereotyping From SAC and SAP Across Experiments 2–4

The aim of the final analysis was to provide evidence for the predictive validity of the SAC and SAP parameters. Individuals differ in the extent to which they are motivated to respond without prejudice and, hence, in the extent to which they apply stereotypes (Devine, 1989; Fazio et al., 1995). Individuals also differ in the

extent to which stereotypes are represented in memory and, hence, in the extent to which stereotypes are activated upon encountering a member of a stereotyped group. As we have argued in the introduction, both processes contribute to explicit measures of stereotyping such as trait judgments. Most importantly, they should contribute in an interactive way. For individuals who are high in the tendency to apply stereotypes, the degree of SAC should predict explicit stereotyping. Thus, for individuals with relatively high estimates of SAP, estimates of SAC should positively correlate with explicit stereotyping. In contrast, individuals who are low in the tendency to apply stereotypes ($1 - \text{SAP}$) should try to not use stereotypes in explicit judgments and, thus, should show no relationship between estimates of SAC and explicit stereotyping. To test these hypotheses, we predicted explicit stereotyping from individual estimates of SAC and SAP and the interaction between SAC and SAP across Experiments 2–4. In all these experiments, explicit stereotyping was assessed after participants had completed the SMT. We did not use the parameter estimates from Experiment 5 because this experiment manipulated the goal to apply or correct for stereotypes, and, hence, the parameter estimates did not reflect participants' natural tendency to apply stereotypes. The parameter estimates from the remaining experiments, however, can be assumed to be estimates of participants' natural degrees of stereotype activation and stereotype application.

Method

Participants. The total number of participants in Experiments 2–4 was $N = 119$.

Procedure. Immediately after completing the SMT in Experiments 2–4, participants completed a questionnaire designed to assess explicit stereotypes about Black and White people. The computer determined randomly whether participants started with questions about White people or questions about Black people. Participants were told that they would be presented with a series of traits and that they should rate the extent to which they believe that each trait is typical for White [Black] people. Participants gave their answers on a 9-point scale ranging from 1 (*not at all typical for White [Black] people*) to 9 (*very typical for White [Black] people*). Traits that were related to the stereotype of African Americans as threatening were selected, as well as several filler traits, presented in random order. The target traits were *aggressive*, *threatening*, *hostile*, *criminal*, and *violent*.

Figure 7. Probability estimates of the parameters SAC (stereotype activation), SAP (stereotype application), D (target detection), and G (guessing) as a function of instructions (stereotype application vs. no instruction vs. stereotype correction) in Experiment 5. Error bars represent 95% confidence intervals.

Results

We computed separate means of the trait ratings for White people (Cronbach's $\alpha = .81$) and for Black people (Cronbach's $\alpha = .93$). To obtain an index of explicit stereotyping, we subtracted the mean for White people from the mean for Black people. To test the hypothesis that individual estimates of SAC predict explicit stereotyping when SAP is high but not when SAP is low, we conducted a moderated regression analysis with explicit stereotyping scores as the dependent variable (Aiken & West, 1991). We entered SAC, SAP, and the interaction term $SAC \times SAP$ as predictors. All variables were z -standardized prior to computing the interaction term (Aiken & West, 1991).

The regression analysis ($R^2 = .22$) yielded a marginally significant main effect of SAC ($\beta = .15$, $t(115) = 1.79$, $p = .076$; a significant main effect of SAP ($\beta = .52$, $t(115) = 5.33$, $p < .001$; and the predicted interaction between SAC and SAP ($\beta = .17$, $t(115) = 2.43$, $p = .017$). A simple slope analysis (Aiken & West, 1991) revealed that SAC positively predicted explicit stereotyping for participants whose SAP was one standard deviation above the mean SAP ($\beta = .32$, $t(115) = 2.81$, $p = .006$, whereas SAC was unrelated to explicit stereotyping for participants whose SAP was one standard deviation below the mean SAP ($\beta = -.02$, $t(115) = -.020$, $p = .85$ (see Figure 8).

Discussion

The present results demonstrate the predictive validity of the SAC and SAP parameters. As expected, SAC and SAP interactively predicted explicit stereotyping. More specifically, individual estimates of SAC positively related to explicit stereotyping for participants exhibiting a high tendency to apply stereotypes. In other words, explicit stereotyping reflected individual differences in stereotype activation for participants who tended to apply stereotypes. In contrast, individual estimates of SAC were unrelated to explicit stereotyping for participants exhibiting a low tendency to apply stereotypes. In other words, explicit stereotyping did not

reflect stereotype activation for participants who did not apply stereotypes to judgments.

The present results corroborate our reasoning that stereotype application as measured in the SMT corresponds to stereotype application as measured with traditional explicit judgment tasks. Whereas in the SMT, stereotype activation emanates from a source different than the target of the judgment, the source of stereotype activation and the target of stereotype application were identical in the explicit stereotyping measure. Despite this difference, estimates of SAP from the SMT were related to explicit stereotyping. This confirms our reasoning that the same processes underlie both tasks. Furthermore, we found that the main effect of SAP on explicit stereotyping was larger than the main effect of SAC on explicit stereotyping. This observation further supports the construct validity of SAP as a measure of stereotype application. In particular, SAP but not SAC should be highly correlated with explicit measures of stereotype application, because only the former but not the latter parameter should represent stereotype application.

General Discussion

The aim of the present research was to develop and validate a measure of stereotyping together with a multinomial model that disentangles stereotype activation and stereotype application. Experiment 1 demonstrated that the SMT captures positive as well as negative stereotypes. Furthermore, the SMT possesses high sensitivity and reliability—desired features of a measure. Experiments 2–5 demonstrated the convergent and discriminant validity of the model parameters. In particular, the four parameters—SAC, SAP, D, and G—were shown to vary independently and in theoretically meaningful ways. Across all experiments, the model proved to fit the data well. Finally, the predictive validity of the SAC and SAP parameters was demonstrated across Experiments 2–4. In particular, individual estimates of SAC and SAP interactively predicted explicit stereotyping in a theoretically meaningful way. More specifically, SAC was positively related to explicit stereotyping for participants who showed a high tendency of SAP, whereas SAC was unrelated to explicit stereotyping for participants who showed a low tendency of SAP. In sum, the present experiments demonstrate the validity of the SMT and the multinomial model.

Features of the SMT

How can the SMT be characterized and how does it compare with other similar measures such as the AMP (Payne et al., 2005)? As described in the introduction, we modeled the SMT after the AMP but changed some key features. Most importantly, participants make trait judgments about people instead of evaluative judgments about Chinese pictographs. On the basis of previous research on stereotyping versus prejudice, we reasoned that these changes would increase the impact of stereotypes (i.e., semantic associations) on judgments and decrease the impact of evaluative associations (Wittenbrink et al., 2001). The results from Experiment 1 support this reasoning, as negative as well as positive stereotypes about a negatively evaluated group influenced participants' responses.

Interestingly, research on the AMP has shown that participants are not able to control the influence of the primes (Payne et al.,

Figure 8. Prediction of explicit stereotyping by stereotype activation (SAC) and stereotype application (SAP) across Experiments 2–4.

2005). In contrast, Experiment 5 from the present research demonstrated that participants could control the influence of the primes in the SMT. Why is that? For now, we can only speculate about explanations. Payne et al. (2005) hypothesized that transfer of affect might occur very quickly:

The rapid transfer of affect from prime to target may explain why participants are ineffective at correcting because by the time participants consider whether they are being biased on any particular trial, the pictograph itself is a source of affect. (Payne et al., 2005, p. 291)

In contrast, transfer of stereotypes might happen more slowly. It has been suggested by many researchers that affective processes are faster and more automatic than nonaffective cognitive processes (LeDoux, 1996; Zajonc, 1984; for a recent overview, see Eder, Hommel, & De Houwer, 2007). As a consequence, transfer of stereotypes might be easier to control than transfer of affect. Furthermore, individuals have considerable experience making and controlling judgments about people, whereas evaluating Chinese pictographs is a rather unusual task. Thus, trait judgments about faces, as in the SMT, might be easier to control than the responses in the AMP. In other words, differences in controllability between the AMP and the SMT might be due to differences in practice of control.

There have been other semantic variants of the AMP, in which participants made semantic judgments about the Chinese pictographs, such as guessing the semantic meaning of the pictograph (Deutsch & Gawronski, 2009; Imhoff, Schmidt, Bernhardt, Dierksmeier, & Banse, 2011). Our procedure differs from these tasks in the following way: The targets are pictures of people instead of Chinese pictographs, and participants make trait judgments instead of guessing the meaning of the pictograph. These differences are important, given our goal to measure stereotype application in addition to stereotype activation. Because stereotype application is defined as using stereotypes in social perception or judgments, a measure of stereotype application should involve social targets.

What processes underlie stereotype application in the SMT? As discussed in the introduction, stereotype application in the SMT differs from how stereotype application is conceptualized in traditional measures, because the stereotype is applied to a different target than the source of stereotype activation. As such, stereotype application may be based on a misattribution mechanism (cf. Loersch & Payne, 2011; N. Schwarz & Clore, 2007). In particular, the activated stereotype may be misattributed to one's own thoughts about the target. As a consequence, the stereotype may be used to inform the judgment at hand. In addition to misattribution, other mechanisms may play a role in the SMT. For instance, the activated stereotype may lead to selective processing of stereotype-consistent facial features of the target or to stereotype-consistent interpretation of ambiguous facial features (cf. Hugenberg & Bodenhausen, 2003). As a consequence, the perception or interpretation of the target's appearance may be biased by the activated stereotype. According to this explanation, the activated stereotype changes the representation of the target. In contrast, the misattribution explanation does not imply changes in the representation of the target. A key assumption of the misattribution explanation is that participants use the accessible mental content in judgment if they assume that it was caused by the perception of the target (Loersch & Payne, 2011). Future research needs to elucidate

the processes contributing to priming effects in the AMP and the SMT.

Features of the Multinomial Model

The multinomial model of the SMT contains at least two assumptions that might be the focus of some debate. First, it assumes that if the stereotype is activated, it will influence the response, regardless of whether the trait of the target is detected or not. An alternative assumption would be that the stereotype influences the response only if the target trait is not detected (cf. A-dominant vs. C-dominant process dissociation model; Jacoby, 1991; Lindsay & Jacoby, 1994). To evaluate this possibility, we formulated and tested an alternative D-dominant model. This model starts with the assumption that if the target trait is detected (D), it determines responses. Only if the target trait is not detected ($1 - D$), stereotype activation and stereotype application come into play and determine the responses in the same way as in the original SMT model. Finally, if neither the target trait is detected ($1 - D$) nor the stereotype is activated ($1 - SAC$), a guessing tendency (G) determines responses. We tested this model in all experiments of the present research and compared its model fit with the fit of the original (SAC-dominant) SMT model, using the Akaike (AIC) and Bayesian (BIC) information criteria (Akaike, 1974; G. Schwarz, 1978). AIC and BIC provide information about model fit, while adjusting for the complexity of the model. In particular, the statistics include a penalty term for the number of parameters in a model and, hence, favor simpler over more complex models. Thus, these information criteria can be used to evaluate the fit of models differing in complexity. To facilitate the comparison of the information criteria between different models, we computed the AIC and BIC weights (Moshagen, 2010; Wagenmakers & Farrell, 2004). When two models are compared, $wAIC$ and $wBIC$ can be interpreted as normalized weight ratios. They represent the probability that one model is better than the other model in terms of expected information loss. According to the $wAIC$ and $wBIC$ statistics, the original (SAC-dominant) model fit the data better than the D-dominant model in four of the six experiments (see Appendix B). We believe that the D-dominant model may not fit the data as well for the following reason. In the SMT, the target is highly ambiguous, and it is presented only for a very brief time. In contrast, the prime stimulus provides easily perceivable information about the social category of the individual. As a consequence, information from the prime stimulus may overshadow information from the target stimulus. Hence, information from the target may only influence responses when the prime stimulus does not result in strong activation of stereotypic knowledge structures in memory. In other words, D may only play a role when the stereotype is not activated by the prime stimulus ($1 - SAC$).

A second assumption of the SMT model concerns the way participants attempt to avoid applying the stereotype ($1 - SAP$). In the present model, $1 - SAP$ represents theory-based overcorrection, resulting in stereotype-incongruent responses. An alternative assumption would be that participants try to form a more accurate impression of the target. Thus, they would not simply adjust their response, but they would attempt to base their response on the features of the target (i.e., individuation; Fiske & Neuberg, 1990). Hence, D would determine the responses in this case. In the processing tree of the alternative model, D is included between

SAC and SAP. In particular, if the stereotype is activated (SAC) and the target trait is detected (D) and the stereotype is applied (SAP), participants give a stereotype-congruent response. If the stereotype is activated (SAC) and the target trait is detected (D) and the stereotype is not applied ($1 - \text{SAP}$), the target trait determines responses. Finally, if the stereotype is activated (SAC) and the target trait is not detected ($1 - \text{D}$), participants give a stereotype-congruent response. This model is structurally equivalent to the Quad model, which has been developed for reaction time-based measures of attitudes such as the IAT (Conrey et al., 2005). The Quad model assumes that a process called overcoming bias (OB) determines whether automatically activated associations or detection of the correct answer determines responses when those two sources of information are in conflict. If OB fails, activated associations determine responses, whereas if OB succeeds, detection of the correct answer determines responses. As such, OB in the Quad model is functionally equivalent to ($1 - \text{SAP}$) in the alternative SMT model. We tested this alternative SMT model in all experiments of the present research and compared its model fit with the fit of the original SMT model. According to the $w\text{AIC}$ and $w\text{BIC}$ statistics, the original SMT model fit the data better than the alternative SMT model in all six experiments (see Appendix B). We believe that this alternative model does not appropriately explain responses in the SMT for the same reason why the D-dominant model did not fit the data well. If the stereotype is activated in memory, it may overshadow any information coming from the target because the target stimulus is highly ambiguous and presented for a short time. Even if participants attempted to form a more accurate impression of the target that is not biased by the prime, they may not be able to do so because the necessary information may not be available in memory.

Finally, it is interesting to compare the SMT model with the multinomial model of the AMP (Payne et al., 2010). The AMP model proposes three processes: misattribution (i.e., confusion of the apparent source of affect for the real source), prime affect (i.e., the affective response to the prime), and target evaluation (i.e., the affective response to the target). The misattribution process determines whether prime affect or target evaluation influences responses. In particular, if misattribution occurs, prime affect determines the response. If misattribution does not occur, target evaluation determines the response. As such, the AMP and the SMT model differ in their assumptions about what processes determine responses when misattribution/stereotype application does not happen. Whereas the AMP model assumes that target evaluation determines the response when misattribution does not happen, the SMT model assumes that participants give a stereotype-incongruent response when they try not to apply the stereotype. Furthermore, the models differ in their assumptions about a guessing parameter. Whereas the AMP model does not contain a guessing parameter and assumes that either prime affect or target evaluation determines the responses, the SMT allows the possibility that a guessing tendency determines responses if stereotype activation and target detection did not occur. We compared the model fit of the two models to our data, using the $w\text{AIC}$ and $w\text{BIC}$ statistics. The SMT model fit the data better than the AMP model in four of six experiments. In two experiments, $w\text{AIC}$ and $w\text{BIC}$ did not agree such that according to $w\text{BIC}$, the SMT model

fit the data better, and according to $w\text{AIC}$, the AMP model fit the data better (see Appendix B).

In sum, from all considered models, the original SMT model provided the best fit to the data in the present experiments. Thus, if one wants to disentangle stereotype activation and stereotype application in the SMT, the present model seems to be the best choice. We want to emphasize that we do not want to suggest that the present model generalizes to all situations in which the postulated processes may play a role. Instead, we assume that the model describes the processes underlying behavior specifically in the SMT. There are certainly other situations in which stereotype activation, stereotype application, and target detection interact in a different way. For instance, in many situations people may attempt and be able to individuate (i.e., target detection) when they are motivated to not apply stereotypes (e.g., Sherman et al., 2005). Taken together, the present model provides a useful tool to disentangle the processes contributing to behavior in the SMT.

Limitations

One might argue that a potential problem of the target stimuli used in the SMT is that they might differ in apparent group membership (i.e., race). For instance, the high-threat targets might look more prototypically Black than the low-threat targets. If this is true, then the stereotype activated by Black primes should be more applicable to high-threat targets than to low-threat targets. However, it is important to note that the target faces taken from Oosterhof and Toderov (2008) were generated to differ in threat appearance but not in race. When creating the faces, Oosterhof and Toderov set the race of the faces to Caucasian, because they wanted to avoid that threat judgments of the faces were affected by stereotypes. By converting those pictures into blurred black-and-white drawings, we also made sure that the faces were ambiguous with respect to race. In any case, the results of the present experiments do not support the possibility that high-threat targets look more prototypically Black than low-threat targets. In particular, if the stereotype is more applicable to high-threat as compared with low-threat targets, then the priming effect (i.e., the difference between Black and White primes) should have been larger for high-threat than for low-threat targets. However, the results showed that the priming effect did not differ significantly between target stimuli. This was true for all experiments reported in this article. If anything, the priming effect was descriptively smaller for high-threat targets as compared with low-threat targets in all experiments except for Experiment 4. Thus, it is unlikely that applicability of the stereotype differed across target stimuli.

Future Directions

There are many possible avenues for future research. First, it is important to investigate the generality of the SMT and to explore possible variations of the SMT. For now, we have demonstrated the validity of the SMT for racial stereotypes. Although we see no reason to believe that the results would not generalize to different stereotypes, such as those based on age or gender stereotypes, it would nevertheless be desirable to provide empirical evidence. Furthermore, there are possible variations of the SMT that might come with some advantages. In the present experiments, the SMT presented two social categories (Black and White people), and

stereotyping was measured as the relative difference between the two categories. Also, SAC and SAP in the multinomial model were estimated from both social categories. Thus, the indices of stereotyping reflect both the extent to which Black people are stereotyped as threatening and the extent to which White people are stereotyped as nonthreatening. Yet, there might be research questions for which such a relative measure of stereotyping is problematic. It is possible to estimate separate SAC and SAP parameters for each type of prime (e.g., Black and White faces) if the model can be constrained otherwise to obtain one degree of freedom. (A model with separate SAC and SAP parameters cannot be tested because it has more parameters than response categories and hence no degrees of freedom.) Furthermore, stereotyping of a social group can be measured relative to a neutral control category, such as the gray facelike shapes included in the present experiments. It is possible to change the SMT such that only two prime categories (e.g., Black faces and gray facelike shapes) are presented. Then, the stereotype activation and stereotype application parameters would be estimated only from trials with Black faces.

Second, the SMT together with the multinomial model may provide a useful tool to investigate many open questions in the realm of stereotyping. For instance, one pressing question that has engaged researchers for decades is the extent to which stereotype activation and stereotype application are automatic processes (for overviews, see Devine & Monteith, 1999; Macrae & Bodenhausen, 2000; Sherman, Macrae, & Bodenhausen, 2000). Other important research questions concern the extent to which stereotype activation versus application is moderated by motivational, emotional, and contextual factors (for overviews, see Blair, 2002; Kunda & Spencer, 2003). To investigate these questions, one needs good measures of stereotype activation and stereotype application that are not contaminated by other processes. We hope that the SMT model will prove to be such a research tool.

Conclusions

We presented the SMT together with a multinomial model that disentangles stereotype activation and stereotype application. The validity of the SMT as a measure of (positive and negative) stereotyping was demonstrated. Furthermore, the SMT was shown to possess high sensitivity and high reliability. The validity of the multinomial model was confirmed by experimental manipulations of the postulated processes as well as by predicting individual differences in explicit stereotyping. The model showed good fit to the data, and its superiority to alternative models in terms of model fit was demonstrated. In sum, the SMT may stimulate future research on stereotyping by providing a useful measure of stereotype activation and stereotype application.

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Appendix A

Model Equations

$$\begin{aligned}
 p(\text{more threatening}|\text{Black prime \& high-threat target}) &= \text{SAC} \times \text{SAP} + (1 - \text{SAC}) \times \text{D} + (1 - \text{SAC}) \times (1 - \text{D}) \times \text{G} \\
 p(\text{less threatening}|\text{Black prime \& high-threat target}) &= \text{SAC} \times (1 - \text{SAP}) + (1 - \text{SAC}) \times (1 - \text{D}) \times (1 - \text{G}) \\
 p(\text{more threatening}|\text{Black prime \& low-threat target}) &= \text{SAC} \times \text{SAP} + (1 - \text{SAC}) \times (1 - \text{D}) \times \text{G} \\
 p(\text{less threatening}|\text{Black prime \& low-threat target}) &= \text{SAC} \times (1 - \text{SAP}) + (1 - \text{SAC}) \times \text{D} + (1 - \text{SAC}) \times (1 - \text{D}) \times (1 - \text{G}) \\
 p(\text{more threatening}|\text{White prime \& high-threat target}) &= \text{SAC} \times (1 - \text{SAP}) + (1 - \text{SAC}) \times \text{D} + (1 - \text{SAC}) \times (1 - \text{D}) \times \text{G} \\
 p(\text{less threatening}|\text{White prime \& high-threat target}) &= \text{SAC} \times \text{SAP} + (1 - \text{SAC}) \times (1 - \text{D}) \times (1 - \text{G})
 \end{aligned}$$

$$\begin{aligned}
 p(\text{more threatening}|\text{White prime \& low-threat target}) &= \text{SAC} \times (1 - \text{SAP}) + (1 - \text{SAC}) \times (1 - \text{D}) \times \text{G} \\
 p(\text{less threatening}|\text{White prime \& low-threat target}) &= \text{SAC} \times \text{SAP} + (1 - \text{SAC}) \times \text{D} + (1 - \text{SAC}) \times (1 - \text{D}) \times (1 - \text{G}) \\
 p(\text{more threatening}|\text{neutral prime \& high-threat target}) &= \text{D} + (1 - \text{D}) \times \text{G} \\
 p(\text{less threatening}|\text{neutral prime \& high-threat target}) &= (1 - \text{D}) \times (1 - \text{G}) \\
 p(\text{more threatening}|\text{neutral prime \& low-threat target}) &= (1 - \text{D}) \times \text{G} \\
 p(\text{less threatening}|\text{neutral prime \& low-threat target}) &= \text{D} + (1 - \text{D}) \times (1 - \text{G})
 \end{aligned}$$

(Appendices continue)

Appendix B

Model Comparisons

Experiment	Original SMT model (SAC-dominant)	Alternative SMT model (D-dominant)		Alternative SMT model (D after 1 – SAP)		AMP model	
	AIC, BIC	AIC, BIC	wAIC, wBIC	AIC, BIC	wAIC, wBIC	AIC, BIC	wAIC, wBIC
Experiment 1a	AIC = 7221.80 BIC = 7248.23	AIC = 7231.59 BIC = 7258.02	wAIC = .99 wBIC = .99	AIC = 7239.51 BIC = 7265.94	wAIC = .99 wBIC = .99	AIC = 7222.96 BIC = 7256.00	wAIC = .64 wBIC = .98
Experiment 1b	AIC = 5836.27 BIC = 5861.88	AIC = 5835.62 BIC = 5861.24	wAIC = .42 wBIC = .42	AIC = 5848.62 BIC = 5874.23	wAIC = .99 wBIC = .99	AIC = 5835.23 BIC = 5867.25	wAIC = .37 wBIC = .94
Experiment 2	AIC = 6362.82 BIC = 6415.03	AIC = 6360.51 BIC = 6412.71	wAIC = .24 wBIC = .24	AIC = 6469.76 BIC = 6521.96	wAIC = .99 wBIC = .99	AIC = 6362.61 BIC = 6427.87	wAIC = .47 wBIC = .99
Experiment 3	AIC = 9497.02 BIC = 9552.39	AIC = 9503.66 BIC = 9559.03	wAIC = .97 wBIC = .97	AIC = 9604.98 BIC = 9660.35	wAIC = .99 wBIC = .99	AIC = 9499.88 BIC = 9569.09	wAIC = .81 wBIC = .99
Experiment 4	AIC = 5712.74 BIC = 5764.22	AIC = 5720.37 BIC = 5771.85	wAIC = .98 wBIC = .98	AIC = 5791.68 BIC = 5843.17	wAIC = .99 wBIC = .99	AIC = 5715.57 BIC = 5779.93	wAIC = .81 wBIC = .99
Experiment 5	AIC = 10765.13 BIC = 10850.09	AIC = 10780.60 BIC = 10865.56	wAIC = .99 wBIC = .99	AIC = 10791.59 BIC = 10876.55	wAIC = .99 wBIC = .99	AIC = 10769.23 BIC = 10875.44	wAIC = .89 wBIC = .99

Note. AIC is Akaike's information criterion (Akaike, 1974) and BIC is the Bayesian information criterion (G. Schwarz, 1978). These statistics provide information about model fit, while adjusting for the complexity of the model. Smaller values indicate better model fit. wAIC and wBIC represent the probability that one model (here, the original SMT model) is the better model than the comparison models, in terms of expected information loss (Moshagen, 2010; Wagenmakers & Farrell, 2004). SMT = stereotype misperception task; SAC = stereotype activation; D = target detection; SAP = stereotype application; AMP = Affect Misattribution Procedure.

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