Behavioral Patterns of Activation Effects of Different Warmth-Competence Stereotypes of Social Groups Based on the Stereotype Content Model

Authors: Yang Yaping, Xu Qiang, Tingting Zhu, Zheng Xutao, Dong Xiaoye, Chen Qingwei, Chen Qingwei

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Abstract

Stereotype activation is a crucial cognitive process in social perception. Previous research on stereotype activation has primarily focused on one or two types of social groups, resulting in a lack of holistic understanding of stereotype activation. The present study, grounded in the classic Stereotype Content Model (SCM) for categorizing social groups, systematically investigated the behavioral patterns of stereotype activation effects for four social groups differing in warmth and competence under this model, at both explicit and implicit levels using priming-target consistency judgment tasks and lexical decision tasks. The results revealed that, at both explicit and implicit levels, three social groups—high warmth-high competence, high warmth-low competence, and low warmth-high competence—all followed the classic stereotype activation pattern, with faster and more accurate responses under consistent conditions. In contrast, the low warmth-low competence group exhibited a reversed pattern of stereotype activation effects in both explicit and implicit processing, showing faster and more accurate responses under inconsistent conditions than under consistent conditions. This study broadens the research perspective on stereotype activation and, for the first time, identifies a reversed stereotype activation effect pattern for the low warmth-low competence group, providing new evidence for the specificity of processing this group. Future research could further investigate the processing mechanisms underlying this reversed pattern of stereotype activation effects from the perspectives of attention and disgust emotion.

Full Text

Preamble

Behavioral Patterns of Stereotype Activation Effects for Different Warmth-Competence Social Groups Based on the SCM

YANG Yaping[1], XU Qiang[1], ZHU Tingting[1], ZHENG Xutao[1], DONG Xiaoye[1], CHEN Qingwei[2,3]
[1] Department of Psychology, Ningbo University, Ningbo 315211, China
[2] Lab of Light and Physiopsychological Health, National Center for International Research on Green Optoelectronics, South China Academy of Advanced Optoelectronics, South China Normal University, Guangzhou 510006, China
[3] School of Psychology, South China Normal University, Guangzhou 510631, China

Abstract

Stereotype activation is a crucial cognitive process in social perception. Previous research on stereotype activation has primarily focused on one or two specific social groups, resulting in a lack of holistic understanding. Grounded in the classic Stereotype Content Model (SCM) for classifying social groups, this study employed priming-target consistency judgment tasks and lexical decision tasks to systematically investigate the behavioral patterns of stereotype activation effects across four warmth-competence social groups at both explicit and implicit levels. The results revealed that, at both explicit and implicit levels, three social groups—high warmth-high competence, high warmth-low competence, and low warmth-high competence—followed the classical stereotype activation pattern, with faster response times under consistent conditions. In contrast, the low warmth-low competence group exhibited a reversal pattern in both explicit and implicit processing, showing faster and more accurate responses under inconsistent compared to consistent conditions. This study broadens the research perspective on stereotype activation and, for the first time, identifies a reversed stereotype activation pattern for low warmth-low competence groups, providing new evidence for the specificity of processing this group. Future research should explore the underlying mechanisms of this reversal pattern from the perspectives of attention and disgust emotion.

Keywords: stereotype; stereotype content model; stereotype activation; implicit; explicit

1. Problem Statement

Stereotypes have long been a core issue in social psychology. As mental representations of social group attributes, stereotypes are typically stored in long-term memory in a dormant state. Because social cognition often involves processing complex and abundant information under limited time and cognitive resources, people rapidly activate stereotypes to facilitate social cognitive tasks such as

forming impressions of others and making judgments (Hamilton & Sherman, 1994; Macrae & Bodenhausen, 2001). Stereotype activation refers to the cognitive process through which perceivers access stereotypical information (e.g., trait constructs, behavioral characteristics) about a target' s group via relevant cues (e.g., faces, skin color, or social category labels) (Kunda & Spencer, 2003; Macrae & Bodenhausen, 2000, 2001). According to models of stereotype processing, stereotype activation is a critical link in the stereotype processing chain —it is both an inevitable outcome of social categorization and a necessary prerequisite for stereotype application (Krieglmeyer & Sherman, 2012; Kunda & Spencer, 2003; Macrae & Bodenhausen, 2001; Quadflieg & Macrae, 2012; Sherman, Macrae, & Bodenhausen, 2000). Investigating and revealing its processing characteristics and mechanisms is therefore of significant theoretical and practical importance for understanding the entire stereotype processing sequence and various social cognitive phenomena based on stereotype activation (e.g., stereotype threat, impression formation, prejudice, and discrimination).

How can researchers examine the activation of stereotypes about a particular social group in perceivers' minds? Previous studies have typically employed sequential priming paradigms to assess whether stereotypes are activated (Kidder, White, Hinojos, Sandoval, & Crites, 2018; White, Danek, Herring, Taylor, & Crites, 2018). Specifically, in this paradigm, stimuli consist of prime-target pairs. A prime stimulus—typically a social category cue (e.g., a face or social category label word)—is presented first, followed immediately by a target stimulus that is experimentally designed to be either consistent or inconsistent with the activated stereotype. Consistency means the target word matches the stereotype activated by the prime (e.g., prime "female" and target "gentle"), whereas inconsistency means the target word conflicts with the activated stereotype (e.g., prime "male" and target "gentle"). Since the late 1980s, researchers have used this classic paradigm with reaction time technology to investigate stereotype activation. Despite examining different stereotypes (e.g., gender, race, age, occupational stereotypes), numerous behavioral studies have consistently found a basic pattern of stereotype activation: when target words are consistent with the stereotype activated by the preceding prime, participants show faster response times and often higher accuracy rates compared to inconsistent conditions (Devine, 1989; Dovidio, Evans, & Tyler, 1986; Kidder et al., 2018; Macrae, Milne, & Bodenhausen, 1994; White, Crites, Taylor, & Corral, 2009; White et al., 2018; Zarate & Smith, 1990; Wang, Yang, & Zhao, 2010). This pattern has been confirmed without exception in studies using reaction time and accuracy (especially reaction time) as dependent variables. Consequently, faster responses under consistent versus inconsistent conditions have become the standard criterion for determining stereotype activation effects in social cognition research.

However, previous research has focused only on specific social groups. For instance, White et al. (2009) and Wang et al. (2010) examined gender stereotype activation, Wang et al. (2011) investigated migrant worker stereotype activation, and Hehman, Volpert, and Simons (2014) explored racial stereotype activation.

In short, most previous studies on stereotype activation patterns have used gender, race, age, and other limited social groups as research objects, making it impossible to draw general conclusions about how stereotype activation patterns differ across various social groups. The critical question of how stereotype activation patterns vary for different social groups urgently requires investigation. To address this, the present study uses behavioral reaction time technology and priming paradigms to reveal the behavioral patterns of stereotype activation effects across different social groups. Answering this question requires introducing a more inclusive theoretical framework for social group classification beyond the traditional focus on single groups. The Stereotype Content Model (SCM) is a typical representative of such frameworks.

As a foundational model describing and predicting how a group is positioned within a given social classification system, the SCM' s basic proposition is that numerous social groups can be divided into four categories based on two dimensions: warmth and competence. These are high warmth-high competence (HW-HC), high warmth-low competence (HW-LC), low warmth-high competence (LW-HC), and low warmth-low competence (LW-LC) groups (Cuddy, Fiske, & Glick, 2007; Fiske, Cuddy, Glick, & Xu, 2002; Fiske, Cuddy, & Glick, 2007). Previous research has demonstrated the cross-cultural consistency and universality of this model (Cuddy et al., 2009; Asbrock, 2010; Bye, Herrebrøden, Hjetland, Røyset, & Westby, 2014; Durante et al., 2017; Fiske, 2018). Chinese scholars Guan and Cheng (2011) collected 32 typical social group categories in mainland China through open-ended questionnaires and asked participants to evaluate these groups, finding that the SCM also has good predictive validity for social groups in mainland China.

Domestic scholars have conducted detailed summaries and reviews of the SCM' s theoretical development, model assumptions, dimensional debates, cognitive neuroscience research, and applications in marketing (Dai, Zuo, & Wen, 2014; Guan, 2009; Wang, Cheng, & Guan, 2014; Wu & Li, 2013; Zuo, Dai, Wen, Suo, & Wen, 2015; Zuo, Dai, Wen, & Teng, 2014; Zuo, Zhang, Zhao, & Wang, 2006), and have also conducted some theoretical validation attempts (Gao, 2010; Guan & Cheng, 2011; Shi & Wang, 2017). However, these studies have only conducted localized validation and revision of the model from a theoretical dimension (Wang & Cheng, 2015). Internationally, since proposing the SCM, Fiske' s team has paid attention to China. In addition to an unpublished study in 2008 (Chen & Fiske, 2008), they published SCM survey results from Hong Kong in 2002 and 2009 (Cuddy et al., 2009; Fiske et al., 2002), and recently published SCM survey results from mainland China (Wu, Bai, & Fiske, 2018). Recent domestic researchers have conducted diverse empirical explorations of the SCM, yielding many noteworthy results, such as the relationship between warmth and competence (Wei, Li, & Chen, 2018; Zuo, Wen, Wu, & Dai, 2018). In summary, although domestic researchers have conducted a series of empirical explorations of the SCM from different perspectives, these studies have also only used one or two social groups as research objects, lacking empirical research that comprehensively examines all four SCM social groups. More importantly,

no study to date, domestic or international, has systematically investigated the critical and fundamental scientific question of how stereotype activation patterns differ across the four SCM social groups. The present study was designed to address this gap.

In summary, the SCM divides social groups into four categories based on warmth and competence dimensions: high warmth-high competence (HW-HC), high warmth-low competence (HW-LC), low warmth-high competence (LW-HC), and low warmth-low competence (LW-LC). Previous research on stereotype activation has focused only on single categories of social groups, such as gender (Ma, Shu, Wang, Dai, & Che, 2008; Wang, Yang, Tan, Chen, & Van Cantfort, 2017; White et al., 2009; Zhang, Li, Sun, & Zuo, 2018; Chen & Wang, 2015; Wang et al., 2010; Yang, Wang, Yin, Chen, & Feng, 2015; Zhang & Zuo, 2012), age (Casper, Rothermund, & Wentura, 2011), race (Hehman et al., 2014), ethnicity (Dang & Wan, 2017), and migrant workers (Wang et al., 2011). Thus, the groups involved in previous studies represent only one or two categories within the SCM—for example, elderly people and migrant workers are classified as high warmth-low competence groups in China (Guan & Cheng, 2011). Such research "cannot see the whole picture from a single spot." To date, no study has simultaneously examined and compared the behavioral patterns of stereotype activation effects across the four SCM social groups. Therefore, it remains unclear whether stereotype activation patterns differ across social groups with varying warmth-competence profiles, and it is impossible to form an integrated and comprehensive understanding of the characteristics of stereotype activation patterns across SCM social groups.

To this end, the present study, based on the Stereotype Content Model and using reaction time technology, systematically investigates the behavioral patterns of stereotype activation effects for different warmth-competence social groups. We aim to comprehensively reveal these patterns and thereby deepen holistic understanding of stereotype activation across different SCM social groups while further expanding empirical research on the Stereotype Content Model. Specifically, this study uses the SCM as its theoretical foundation. Based on existing domestic and international research classifying social groups according to the SCM, and using a pretest with a sample homogeneous to the formal experimental participants (college students), we identified four warmth-competence social groups as research objects. Using a priming paradigm with four social group labels as prime stimuli and their respective stereotypical words as target stimuli, prime-target pairs formed consistent and inconsistent conditions. Two experiments were conducted: Experiment 1 used an explicit priming-target consistency judgment task, which requires conscious processing of the relationship between prime and target to respond correctly. Previous research has shown that this task can reveal typical stereotype activation patterns (White et al., 2009; Wang et al., 2010). In summary, Experiment 1 employed an explicit task to investigate stereotype activation patterns across different warmth-competence social groups. We expected all four groups (HW-HC, HW-LC, LW-HC, and LW-LC) to show the classical stereotype activation pattern, with faster and more accu-

rate responses under consistent conditions.

Experiment 2 further employed a lexical decision task (LDT)—which does not require participants to process the relationship between prime and target, only to judge whether the target is a word—to examine stereotype activation patterns across different warmth-competence social groups in this implicit task unrelated to stereotype activation. We expected that stereotype activation effects for HW-HC, HW-LC, LW-HC, and LW-LC groups would not be affected by experimental task, showing similar patterns in Experiment 2' s implicit task as in Experiment 1.

2. Experiment 1: Explicit Priming-Target Consistency Judgment Task

2.1.1 Participants

Fifty college student participants were recruited (15 male, 35 female), aged 19-25 years (M = 20.68, SD = 2.08). None had participated in previous material collection or evaluation for this study. To ensure adequate statistical power, sample size was estimated using G*Power 3 analysis before the experiment (Faul, Erdfelder, Buchner, & Lang, 2009). Specifically, based on a medium effect size (f^2 = 0.20, Cohen, 1988), an alpha level of 0.01, and Experiment 1' s design, G*Power analysis recommended 46 participants to achieve power of 0.953. Considering potential invalid participants, 50 participants were actually recruited, and valid data were obtained from all 50.

2.1.2 Materials

Experimental materials consisted of prime-target stimulus pairs.

Prime stimuli: The primes were 24 social group labels obtained from a pretest (see Appendix 2) based on SCM measurements, divided into four categories according to warmth-competence dimensions, with six groups per category. Specifically, high warmth-high competence (HW-HC) groups included soldiers, firefighters, psychological counselors, flight attendants, yoga instructors, and university professors; high warmth-low competence (HW-LC) groups included elderly people, farmers, housewives, migrant workers, left-behind children, and sanitation workers; low warmth-high competence (LW-HC) groups included businessmen, returnees, government officials, civil servants, wealthy people, and entertainment stars; low warmth-low competence (LW-LC) groups included criminals, unemployed vagrants, beggars, drug addicts, terrorists, and urban management officers.

Target stimuli: Target stimuli were stereotypical trait words corresponding to each social group. Based on the classic Katz-Braly measurement approach and referencing methods from previous stereotype activation studies measuring gender stereotype words (Wang & Yang, 2007), we obtained stereotypical words for the four warmth-competence social groups through a pretest (30 words per

group), i.e., "consistent words" (see Appendix 3 for details). Following previous research, we then determined "inconsistent words" for each social group (Contreras, Banaji, & Mitchell, 2012; Wang et al., 2010). Each group' s inconsistent words were formed based on consistent words from other groups. Specifically, we paired other groups' consistent words with the target group to create inconsistent (conflict) relationships. For example, the consistent word "quick-acting" for the "firefighter" group was paired with "elderly people" to form an inconsistent word for that group (see Appendix 4 for consistent and inconsistent stereotypical words used in the experiment).

All stimuli were presented at the center of a 17-inch LCD monitor (resolution $1024\$\times768, refreshrate60Hz).Thetargetwordbackgroundwaswhite, andthefontwasKaiTi(asshowninthetarg$
$seeoriginalpaper]).Thestimuluspresentationanglewas6.06°\times\$6.06°$.

2.1.3 Design

The independent variables were the primed social group and prime-target consistency (hereinafter referred to as social group and consistency). A 4 (social group: HW-HC, HW-LC, LW-HC, LW-LC) × 2 (consistency: consistent, inconsistent) within-subjects design was employed, creating eight experimental conditions: consistent and inconsistent trials for each of the four social group categories. As shown in Table 1 (left half for Experiment 1), each condition included 30 trials. The dependent variables were accuracy and response time.

2.1.4 Procedure

The experiment was programmed using E-prime 2.0. Before the formal experiment, participants completed 24 practice trials, followed by a short break. In the formal experiment, participants completed 240 randomly presented trials, with a break after every 80 trials. The stimulus sequence for each trial is shown in Figure 1: a fixation cross "+" (500 ms) was followed by the prime stimulus (700 ms), then a 500 ms blank screen, then the target stimulus (350 ms). After the target, a blank screen appeared until the participant responded, followed by a random interval of 600–800 ms before the next trial began. Participants were instructed to judge as accurately and quickly as possible whether the target word was consistent with the prime: press the "consistent" key if yes, and the "inconsistent" key if no. Before the experiment, "consistent" and "inconsistent" response labels were placed on the "E" and "I" keys, respectively, with key assignment counterbalanced across participants[2]. Participants were reminded to maintain fixation on the screen center throughout the experiment and could relax during breaks. Practice phase target words did not appear in the formal experiment. The entire experiment lasted approximately 15 minutes.

[2] We treated the key assignment variable (left vs. right hand for consistent responses) as an independent variable and conducted a 2 (key assignment: left-hand consistent, right-hand consistent) × 4 (social group: HW-HC, HW-LC, LW-HC, LW-LC) × 2 (consistency: consistent, inconsistent) repeated

measures ANOVA on accuracy and response time, with key assignment as a between-subjects factor and all other factors within-subjects. Results showed no significant main effects of key assignment on accuracy or response time, F_{accuracy}(1, 48) = 1.59, p = .214, partial ^{2} = 0.032; F_{RT}(1, 48) = 0.36, p = .554, partial ^{2} = 0.007, and no significant interactions with other factors or three-way interactions (all ps > .05). This indicates that key assignment did not significantly affect results, so data from both groups were combined in subsequent analyses, focusing on the two main manipulated independent variables (social group and consistency).

2.2 Results

A 4 (social group: HW-HC, HW-LC, LW-HC, LW-LC) × 2 (consistency: consistent, inconsistent) repeated measures ANOVA was conducted on response time and accuracy, with all factors within-subjects. Response times for incorrect responses and outliers beyond two standard deviations from the mean were excluded before analysis (Ratcliff, 1993).

Table 1 Accuracy and response time (M; SE) for target consistency judgments under different social group primes in the categorization-confirmation task

Social Group	Consistency	Accuracy	RT (ms)
HW-HC	Consistent (C)	0.971 (0.006)	774 (23)
	Inconsistent (I)	0.944 (0.007)	851 (26)
	Difference (I-C)	-0.027	77
HW-LC	Consistent (C)	0.938 (0.007)	839 (24)
	Inconsistent (I)	0.935 (0.010)	875 (28)
	Difference (I-C)	-0.003	36
LW-HC	Consistent (C)	0.877 (0.012)	872 (24)
	Inconsistent (I)	0.903 (0.010)	911 (26)
	Difference (I-C)	0.026	39
LW-LC	Consistent (C)	0.843 (0.010)	937 (29)
	Inconsistent (I)	0.918 (0.012)	856 (26)
	Difference (I-C)	0.075	-81

2.2.1 Accuracy The ANOVA on accuracy revealed a significant main effect of social group, F(3, 147) = 45.04, p < .001, partial ^{2} = 0.48, a non-significant main effect of consistency, F(1, 49) = 3.27, p = .077, partial ^{2} = 0.06, and a significant interaction between social group and consistency, F(3, 147) = 16.51, p < .001, partial ^{2} = 0.25.

Simple main effects of consistency were tested at each level of social group with follow-up multiple comparisons. As shown in Table 1 and Figure 2A [Figure 2: see original paper], when primed with HW-HC social groups, participants' accuracy for consistent targets (M = 0.971) was significantly higher than for inconsistent targets (M = 0.944), p = .003. For HW-LC and LW-HC social

groups, no significant differences were found between consistent and inconsistent targets (ps > .05). However, when primed with LW-LC social groups, the opposite pattern emerged: accuracy for consistent targets (M = 0.843) was significantly lower than for inconsistent targets (M = 0.918), p < .001.

2.2.2 Response Time The ANOVA on response time showed a significant main effect of social group, F(3, 147) = 37.33, p < .001, partial ^{2} = 0.43, a non-significant main effect of consistency, F(1, 49) = 3.11, p = .084, partial ^{2} = 0.06, and a significant interaction, F(3, 147) = 29.83, p < .001, partial ^{2} = 0.38.

Simple main effects of consistency were tested at each social group level with post-hoc comparisons. As shown in Table 1 and Figure 2B [Figure 2: see original paper], when primed with HW-HC, HW-LC, and LW-HC social groups, participants responded significantly faster to consistent than inconsistent targets (ps < .023). However, when primed with LW-LC social group labels, the opposite pattern emerged: response time for consistent targets (M = 937 ms) was significantly slower than for inconsistent targets (M = 856 ms), p < .001.

2.2.3 Comparison of Consistency Effects on Accuracy As described above (see Figure 2A), accuracy was higher for consistent than inconsistent targets when primed with HW-HC and HW-LC groups, but lower for consistent than inconsistent targets when primed with LW-HC and LW-LC groups. To further examine the magnitude of stereotype activation effects across different social group primes, we conducted a one-way repeated measures ANOVA on the accuracy difference between inconsistent and consistent conditions (i.e., inconsistent minus consistent accuracy) with social group (HW-HC, HW-LC, LW-HC, LW-LC) as the factor.

The ANOVA revealed a significant main effect of social group, F(3, 147) = 16.51, p < .001, partial ^{2} = 0.25. Follow-up post-hoc comparisons showed (see Figures 2A and 3A [Figure 3: see original paper]) that the consistency difference was largest for LW-LC social group primes, significantly greater than for HW-HC and HW-LC primes (ps < .001) and significantly greater than for LW-HC primes (p = .005). This trend was opposite to that for HW-HC primes: specifically, as shown in Figures 2A and 3A, accuracy for inconsistent targets was significantly higher than for consistent targets following LW-LC primes, whereas accuracy for consistent targets was significantly higher than for inconsistent targets following HW-HC primes. The consistency difference for HW-HC primes was significantly different from the other three groups (ps < .002). No significant difference was found between HW-LC and LW-HC groups (p = .115).

2.2.4 Comparison of Consistency Effects on Response Time As described above (see Figure 2B), response times were faster for consistent than inconsistent targets when primed with HW-HC, HW-LC, and LW-HC groups, but significantly slower for consistent than inconsistent targets when primed

with LW-LC groups. To further examine the magnitude of activation effects across different social group primes, we conducted a one-way repeated measures ANOVA on response time differences between inconsistent and consistent conditions (i.e., inconsistent minus consistent RT) with social group as the factor.

The ANOVA revealed a significant main effect of social group, $F(3, 147) = 29.83$, $p < .001$, partial $^2 = 0.38$. Follow-up post-hoc comparisons showed (see Figure 3B [Figure 3: see original paper]) that the consistency difference was largest for HW-HC social group primes, significantly greater than for HW-LC ($p = .02$) and LW-HC primes ($p = .041$). No significant difference was found between HW-LC and LW-HC groups ($p = .779$). When primed with LW-LC social groups (see Figures 2B and 3B), a reversed stereotype activation effect emerged: response times for consistent targets were significantly slower than for inconsistent targets. This difference was significantly different from the other three groups (ps $< .001$).

Experiment 1 used an explicit priming-target consistency judgment task in which participants needed to consciously process the relationship between the activated stereotype and the target to respond correctly. The results revealed classical stereotype activation patterns for three SCM groups, particularly in response time. Specifically, when primed with HW-HC groups, participants showed higher accuracy and significantly faster response times for consistent versus inconsistent targets. When primed with HW-LC and LW-HC groups, responses to consistent targets were faster than to inconsistent targets. However, when primed with LW-LC social groups, the opposite pattern emerged: accuracy and response time were significantly worse for consistent versus inconsistent targets. Experiment 1 discovered a reversal of stereotype activation effects for LW-LC groups, contrary to previous single-category group studies (e.g., male/female, Black/White) (Hehman et al., 2014; White et al., 2009; Wang et al., 2010). To test the reliability and robustness of these findings, Experiment 2 used an implicit LDT to further examine this phenomenon.

3. Experiment 2: Implicit Lexical Decision Task

3.1.1 Participants

Forty-eight college student participants were recruited (16 male, 32 female), aged 19–25 years ($M = 20.64$, $SD = 1.93$). None had participated in previous material collection or evaluation, and none had participated in Experiment 1. Sample size was estimated using G*Power 3 analysis (Faul et al., 2009) with the same parameters as Experiment 1, which recommended 46 participants for power of 0.953. Considering potential invalid participants, 48 were recruited. Two participants' data were excluded: one due to accuracy (51.13%) far below the mean accuracy (93.58%, see Table 2), and one who did not complete the experiment, leaving 46 participants for statistical analysis.

3.1.2 Materials

Experimental stimuli consisted of prime-target pairs. Prime stimuli were identical to Experiment 1. Target stimuli included the same stereotypical words as Experiment 1 plus pseudowords—meaningless non-existent Chinese characters formed from visually similar characters to the stereotypical words (see Appendix 5).

3.1.3 Design

Identical to Experiment 1, a 4 (social group: HW-HC, HW-LC, LW-HC, LW-LC) × 2 (consistency: consistent, inconsistent) within-subjects design was used. Dependent variables were accuracy and response time.

3.1.4 Procedure

The procedure was identical to Experiment 1 except for two differences: First, the number of formal experiment trials doubled (i.e., in addition to the 240 "real word" trials from Experiment 1, 240 "pseudoword" trials were included, as shown in Table 1), making Experiment 2 approximately 30 minutes long. Second, the experimental task differed. In Experiment 2, participants judged as accurately and quickly as possible whether the target was a word, pressing "yes" or "no" keys. "Yes" and "no" response labels were placed on the "E" and "I" keys, respectively, with key assignment counterbalanced across participants[3]. As in Experiment 1, participants were reminded to maintain fixation and could relax during breaks. Practice phase targets did not appear in the formal experiment.

[3] As in Experiment 1, we treated key assignment as an independent variable and conducted a 2 (key assignment) × 4 (social group) × 2 (consistency) repeated measures ANOVA on accuracy and response time. Results showed no significant main effects of key assignment on accuracy or response time, F_{accuracy}(1, 44) = 0.99, p = .324, partial ^{2} = 0.22; F_{RT}(1, 44) = 3.04, p = .088, partial ^{2} = 0.065, and no significant interactions (all ps > .05). This confirms that key assignment did not significantly affect results, so data were combined for subsequent analyses focusing on the two main manipulated variables.

3.2 Results

As in Experiment 1, a 4 (social group: HW-HC, HW-LC, LW-HC, LW-LC) × 2 (consistency: consistent, inconsistent) repeated measures ANOVA was conducted on accuracy and response time, with all factors within-subjects. Response times for incorrect responses and outliers beyond two standard deviations from the mean were excluded (Ratcliff, 1993).

Table 2 Accuracy and response time (M; SE) for lexical decisions under different social group primes

Social Group	Consistency	Accuracy	RT (ms)
HW-HC	Consistent (C)	0.967 (0.010)	582 (18)
	Inconsistent (I)	0.914 (0.015)	638 (19)
	Difference (I-C)	-0.053	56
HW-LC	Consistent (C)	0.953 (0.011)	588 (17)
	Inconsistent (I)	0.927 (0.014)	618 (18)
	Difference (I-C)	-0.026	30
LW-HC	Consistent (C)	0.931 (0.011)	607 (17)
	Inconsistent (I)	0.914 (0.016)	625 (18)
	Difference (I-C)	-0.017	18
LW-LC	Consistent (C)	0.928 (0.009)	631 (18)
	Inconsistent (I)	0.952 (0.010)	576 (16)
	Difference (I-C)	0.024	-55

3.2.1 Accuracy The ANOVA on accuracy revealed a significant main effect of social group, $F(3, 135) = 3.53$, $p = .017$, partial $^2 = 0.07$, a significant main effect of consistency, $F(1, 45) = 5.67$, $p = .022$, partial $^2 = 0.11$, and a significant interaction, $F(3, 135) = 12.35$, $p < .001$, partial $^2 = 0.22$.

Simple main effects of consistency were tested at each social group level. As shown in Table 2 and Figure 2C [Figure 2: see original paper], when primed with HW-HC and HW-LC groups, accuracy for consistent targets was significantly higher than for inconsistent targets (ps $< .027$). For LW-HC primes, a similar trend emerged (consistent $M = 0.931$ vs. inconsistent $M = 0.914$), but it did not reach statistical significance, $p = .090$. However, when primed with LW-LC groups, the opposite pattern appeared: accuracy for consistent targets ($M = 0.928$) was significantly lower than for inconsistent targets ($M = 0.952$), $p = .024$.

3.2.2 Response Time The ANOVA on response time showed a significant main effect of social group, $F(3, 135) = 2.91$, $p = .037$, partial $^2 = 0.06$, a significant main effect of consistency, $F(1, 45) = 11.87$, $p = .001$, partial $^2 = 0.06$, and a highly significant interaction, $F(3, 135) = 34.77$, $p < .001$, partial $^2 = 0.44$.

Simple main effects of consistency were tested at each social group level with post-hoc comparisons. As shown in Table 2 and Figure 2D [Figure 2: see original paper], when primed with HW-HC, HW-LC, and LW-HC groups, participants responded significantly faster to consistent than inconsistent targets (ps $< .032$). However, when primed with LW-LC groups, the opposite pattern emerged: response time for consistent targets ($M = 631$ ms) was significantly slower than for inconsistent targets ($M = 576$ ms), $p < .001$.

3.2.3 Comparison of Consistency Effects on Accuracy As described above (see Figure 2C), accuracy was higher for consistent than inconsistent tar-

gets when primed with HW-HC, HW-LC, and LW-HC groups, but significantly lower for consistent than inconsistent targets when primed with LW-LC groups. To further examine the magnitude of stereotype activation effects, we conducted a one-way repeated measures ANOVA on accuracy differences (inconsistent minus consistent) with social group as the factor.

The ANOVA revealed a significant main effect of social group, $F(3, 135) = 12.35$, $p < .001$, partial $^2 = 0.22$. Follow-up post-hoc comparisons showed (see Figure 3C [Figure 3: see original paper]) that the consistency difference was largest for LW-LC primes, significantly greater than for HW-HC and HW-LC primes (ps $< .001$) and significantly greater than for LW-HC primes ($p = .002$). This trend was opposite to that for HW-HC, HW-LC, and LW-HC primes: specifically, as shown in Figures 2C and 3C, accuracy for inconsistent targets was significantly higher than for consistent targets following LW-LC primes, whereas accuracy for consistent targets was significantly higher than for inconsistent targets following the other three group primes. The consistency difference for HW-HC primes was significantly different from the other three groups (ps $< .002$). No significant difference was found between HW-LC and LW-HC groups ($p = .515$).

3.2.4 Comparison of Consistency Effects on Response Time As described above (see Figure 2D), response times were faster for consistent than inconsistent targets when primed with HW-HC, HW-LC, and LW-HC groups, but significantly slower for consistent than inconsistent targets when primed with LW-LC groups. To further examine the magnitude of activation effects, we conducted a one-way repeated measures ANOVA on response time differences (inconsistent minus consistent) with social group as the factor.

The ANOVA revealed a significant main effect of social group, $F(3, 135) = 34.77$, $p < .001$, partial $^2 = 0.44$. Follow-up post-hoc comparisons showed (see Figure 3D [Figure 3: see original paper]) that the consistency difference was largest for HW-HC primes, significantly greater than for HW-LC ($p = .017$) and LW-HC primes ($p = .003$), and highly significantly greater than for LW-LC primes ($p < .001$). No significant difference was found between HW-LC and LW-HC groups ($p = .25$). As shown in Figures 2D and 3D, when primed with LW-LC groups, a reversed stereotype activation effect emerged: response times for consistent targets were significantly slower than for inconsistent targets. This difference was significantly different from the other three groups (ps $< .001$).

Experiment 2 used an implicit LDT and found that stereotype activation patterns for different SCM groups were not affected by experimental task: significant stereotype activation effects or reversed activation effects appeared in the implicit task as well. The results were highly consistent with Experiment 1' s explicit task—particularly in response time. Specifically, when primed with HW-HC and HW-LC groups, participants showed higher accuracy and significantly faster response times for consistent versus inconsistent targets. When primed with LW-HC groups, consistent targets were judged significantly faster than inconsistent targets. When primed with LW-LC groups, the reversed pat-

tern again emerged: accuracy and response time were significantly worse for consistent versus inconsistent targets.

Furthermore, the magnitude of consistency differences in both accuracy and response time was significantly largest for HW-HC and LW-LC primes, but in opposite directions. For HW-LC and LW-HC primes, consistency differences were significantly smaller than for HW-HC and LW-LC primes in both accuracy and response time. This indicates that the magnitude of stereotype activation effects differs across SCM social groups, being significantly largest for HW-HC and LW-LC primes—a phenomenon also unaffected by experimental task.

4. General Discussion

Based on the classic Stereotype Content Model (SCM)—which classifies social groups into four categories from warmth and competence dimensions: high warmth-high competence (HW-HC), high warmth-low competence (HW-LC), low warmth-high competence (LW-HC), and low warmth-low competence (LW-LC)—this study systematically investigated the behavioral patterns of stereotype activation effects across these four warmth-competence groups through two experiments using priming-target consistency judgment (Experiment 1) and LDT (Experiment 2) at both explicit and implicit processing levels. The results partially supported our hypotheses: at both explicit and implicit levels, HW-HC, HW-LC, and LW-HC groups showed the classical stereotype activation pattern—significantly faster response times for consistent versus inconsistent targets. This aligns with numerous previous studies using single groups to examine stereotype activation (e.g., Dovidio et al., 1986; Hehman et al., 2014; Wang et al., 2017; Macrae et al., 1994; White et al., 2009; Chen & Wang, 2015; Wang et al., 2010; Zarate & Smith, 1990).

Accuracy results differed somewhat from our hypotheses and response time findings. Specifically, in Experiment 1, HW-LC and LW-HC groups, and in Experiment 2, the LW-HC group, did not show the expected statistically significant differences between consistent and inconsistent conditions. This aligns with some previous research (Wang et al., 2018; Wang et al., 2017). Given that previous priming studies have shown highly consistent results for response time but less consistent results for accuracy (see review by Kidder et al., 2018), this pattern is not surprising. Response time is a more sensitive measure in most priming studies, which prompted White et al. (2018) to examine only response time in their recent stereotype activation research without analyzing accuracy. This suggests that future research on stereotype activation may need to prioritize response time results.

Notably, this study revealed an unexpected finding: at both explicit and implicit processing levels, the LW-LC group exhibited a reversed stereotype activation pattern—significantly slower response times and lower accuracy for consistent versus inconsistent targets. This finding completely contradicts the classical stereotype activation pattern found in previous single-group studies (e.g., Do-

vidio et al., 1986; Hehman et al., 2014; Wang et al., 2017; Macrae et al., 1994; White et al., 2009; Chen & Wang, 2015; Wang et al., 2010; Zarate & Smith, 1990). This may relate to the specificity of the LW-LC group itself. Previous SCM research has found that the LW-LC group shows distinct processing characteristics, including vulnerability to dehumanization (Haslam & Loughnan, 2014; Yang, Jin, He, Zhang, & Fan, 2015). Neuroimaging research further reveals that processing information about this group elicits disgust emotions (amygdala and insula activation) without activating social cognition-related brain regions (medial prefrontal cortex) (Harris & Fiske, 2006, 2007). Research on emotional face processing provides indirect evidence for this explanation. Specifically, two studies by Liu et al. using dot-probe paradigms found that when processing fearful and angry faces, participants responded faster and more accurately under valid cue conditions versus invalid cue conditions; however, when processing disgusted faces, the opposite pattern emerged—participants responded faster and more accurately under invalid cue conditions, manifesting in both explicit and implicit tasks. Researchers suggested this might occur because anger and fear attract attentional resources, while disgust disperses attention (Liu, Zhang, & Luo, 2015; Zhang, Liu, Wang, Ai, & Luo, 2017). According to the BIAS map theory derived from the SCM (Cuddy et al., 2007; Guan, 2009), LW-LC groups elicit disgust emotions. Therefore, similar results should appear when processing information about this group. Specifically, relative to the inconsistent condition in our study (similar to invalid cues in dot-probe paradigms), the consistent condition (similar to valid cues) for LW-LC group information should elicit disgust that disperses attention, leading to slower and less accurate responses, unaffected by explicit versus implicit task demands. However, this explanation is based on integration and speculation from previous research and awaits future experimental verification.

This study overcomes the limitation of previous stereotype activation research that focused only on specific social groups. Using the Stereotype Content Model as a theoretical foundation, it adopts a more macroscopic perspective to holistically investigate stereotype activation patterns across the four warmth-competence groups. The results demonstrate the necessity of this systematic perspective: both experiments found that stereotype activation patterns differed markedly across these groups. Specifically, this study extends previous literature in three ways: First, it found classical stereotype activation patterns for HW-HC, HW-LC, and LW-HC groups—faster responses to consistent versus inconsistent targets. More importantly, it is the first to identify a reversed stereotype activation pattern for the LW-LC group—faster and more accurate responses to inconsistent versus consistent targets. This reversal was robust across both explicit priming-target consistency tasks and implicit lexical decision tasks, providing behavioral evidence for the specificity of LW-LC group processing and enriching research on dehumanization and stereotype activation. Third, the study found that the magnitude of stereotype activation effects (consistency differences) was significantly largest for HW-HC and LW-LC primes, but in opposite directions; for HW-LC and LW-HC primes, consistency differences did

not differ significantly in either accuracy or response time. This indicates that the magnitude of stereotype activation effects varies across SCM groups, being significantly largest for HW-HC and LW-LC primes—a phenomenon also unaffected by experimental task. In summary, this study provides methodological and theoretical reference for future stereotype activation research, suggesting that future studies should adopt a holistic perspective to investigate the cognitive processing, mechanisms, and neural basis of stereotype activation. The present findings indicate that future research should first classify social groups according to the SCM or other inclusive theoretical models to more effectively investigate this important social perception process.

Despite these important findings, this study has limitations. First, in terms of experimental tasks, it only used the classic priming-target consistency judgment task for explicit processing and only the lexical decision task for implicit processing. Future research should employ other paradigms and tasks to examine explicit and implicit processing (Kidder et al., 2018; White et al., 2018) to test the boundaries of these conclusions. Additionally, the stereotype activation process could be extended to the stereotype application process, such as using the stereotype misperception task (Wang & Chen, 2015) to simultaneously examine both processes. Second, this study unexpectedly found a reversed stereotype activation pattern for the LW-LC group and attempted to explain this through disgust emotions, but did not directly measure disgust. Therefore, whether the specificity of LW-LC group processing is truly caused by disgust emotions awaits future experimental exploration. Third, although target words were selected through rigorous pretesting using classic stereotype measurement methods, the pretest primarily considered and controlled for typicality of stereotypical words without strictly matching and controlling for word class. Although supplementary analyses found no significant effect of word class on results, future research should strictly control and match target word class to further verify and advance these findings. Finally, this study only examined behavioral patterns of stereotype activation; whether cognitive neural mechanisms differ across the four groups (Amodio, 2014; Quadflieg & Macrae, 2012; Jia, Luo, Xiao, & Zhang, 2010; Jia, Zhu, Zhang, & Zhang, 2016; Wang et al., 2014) and the underlying attention allocation mechanisms (Liu et al., 2015; Zhang et al., 2017) warrant future investigation.

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Appendix 1: Summary of Dimension Naming in Domestic SCM Empirical Research

[Content omitted as it consists primarily of a list of Chinese graduate students and their advisors, which is not essential for academic understanding.]

Appendix 2: Pretest–Measurement of the Stereotype Content Model

This pretest examined how college students classify Chinese social groups based on the Stereotype Content Model using questionnaires commonly employed in previous SCM research.

2.1 Participants

Participants were 1,403 college students, with 1,315 valid questionnaires returned. Participants had no prior experience with stereotype research, and most completed the test within 10 minutes.

2.2 Materials and Measures

(1) Materials: The materials consisted of 41 social groups. Following previous research methods (Guan & Cheng, 2011; Gao, 2010), an open-ended questionnaire asked participants: "In social life, people divide others into different groups based on various criteria (age, gender, occupation, region, income, social status, etc.). What groups do you think contemporary Chinese society can be divided into?" Two hundred questionnaires were distributed at a university, yielding 184 valid responses (84 male, 95 female, 5 unreported; mean age = 21.25 years). Frequency statistics from these questionnaires identified 41 groups with frequencies greater than 10%.

(2) Measures: Based on Fiske' s work and recent SCM measurement studies (Asbrock, 2010; Bye et al., 2014; Durante et al., 2017; Fiske et al., 2002), we identified specific items for the warmth and competence dimensions:

- Warmth dimension (9 items): warm, sincere, gentle, friendly, trustworthy, kind, honest, straightforward, helpful
- Competence dimension (9 items): independent, motivated, intelligent, talented, skilled, capable, confident, responsible, clever

Referencing previous SCM measurement studies, we developed our questionnaire asking participants to rate each group on 18 items, emphasizing "according to most people' s views in society" on a 5-point Likert scale (1 = completely uncharacteristic, 5 = completely characteristic). To reduce fatigue, the 41 groups were divided across 9 sub-questionnaires, each containing 4-5 groups.

2.3 Data Analysis

First, SPSS 13.0 was used for exploratory factor analysis with principal component analysis and oblique rotation. Items were deleted based on eigenvalues $>$ 1, factor loadings $<$ 0.40, cross-loadings, content inconsistency within factors, and extreme mean values.

Based on these criteria and SCM theory, we retained 5 items for each factor: warmth items were sincere, gentle, friendly, trustworthy, and kind; competence items were intelligent, talented, skilled, capable, and confident.

Table 2 Reliability, KMO values, and Bartlett' s test results for 41 groups

[Table showing all 41 groups with KMO $>$ 0.001 and Bartlett' s $p < 0.001$ for each]

2.4 Cluster Analysis Results

To classify social groups based on the SCM, we conducted hierarchical cluster analysis using Ward' s method on the 41 groups' mean warmth and competence scores. With no clear standard for optimal cluster number, we combined dendrogram interpretation, SCM theory, and distance coefficients to determine a four-cluster solution.

Table 3 Cluster analysis results for social groups

- Cluster 1: White-collar workers, private entrepreneurs, civil servants, government officials, businessmen, wealthy people, entertainment stars, returnees, strong women, upstarts
- Cluster 2: Firefighters, soldiers, flight attendants, yoga instructors, psychological counselors, university professors, college students, entrepreneurs, intellectuals, scientists, young people, sports stars
- Cluster 3: Urban management officers, sex workers, unemployed vagrants, beggars, criminals, terrorists, drug addicts
- Cluster 4: Disabled people, migrant workers, sanitation workers, left-behind children, farmers, workers, minimum living standard recipients, homosexuals, poor people, elderly people, housewives, laid-off workers

2.5 Validation of Cluster Analysis Results

(1) One-sample t-tests against the scale midpoint (3) and paired t-tests for warmth-competence differences within each cluster:

- Cluster 1 (low warmth-high competence): Warmth M = 3.05, not significantly different from 3, $t(9) = 0.87$, $p = .408$; Competence M = 3.58, significantly above 3, $t(9) = 8.24$, $p < .001$; Warmth significantly lower than competence, $t(9) = -9.49$, $p < .001$
- Cluster 2 (high warmth-high competence): Warmth M = 3.61, significantly above 3, $t(11) = 8.55$, $p < .001$; Competence M = 3.74, significantly above 3, $t(11) = 14.71$, $p < .001$; No significant warmth-competence difference, $t(11) = -2.04$, $p = .066$
- Cluster 3 (low warmth-low competence): Warmth M = 2.43, significantly below 3, $t(6) = -3.39$, $p < .05$; Competence M = 2.75, not significantly different from 3, $t(6) = -1.84$, $p = .12$; No significant warmth-competence difference, $t(6) = 1.52$, $p = .18$
- Cluster 4 (high warmth-low competence): Warmth M = 3.47, significantly above 3, $t(11) = 8.06$, $p < .001$; Competence M = 3.18, significantly above 3, $t(11) = 3.31$, $p = .007$; Warmth significantly higher than competence, $t(11) = 6.45$, $p < .001$

Table 4 Mean warmth and competence scores and paired t-test results for four clusters

[Table showing means and significance tests for each cluster]

These results support SCM theory. Based on warmth and competence scores, Cluster 1 represents low warmth-high competence (LW-HC), Cluster 2 represents high warmth-high competence (HW-HC), Cluster 3 represents low warmth-low competence (LW-LC), and Cluster 4 represents high warmth-low competence (HW-LC).

(2) One-way ANOVAs with cluster as the independent variable and warmth/competence as dependent variables showed highly significant main effects: $F(3, 37) = 34.17$, $p < .001$ for warmth; $F(3, 37) = 32.66$, $p < .001$ for competence. Post-hoc comparisons (Tamhane for warmth due to heterogeneity; Sidak for competence) confirmed the expected ordering of clusters on both dimensions.

2.6 Paired t-test Results for Individual Groups

Finally, paired t-tests for warmth and competence were conducted for all 41 individual groups (see Table 5).

Table 5 Descriptive statistics (M, SD) and warmth-competence paired t-test results for individual groups

[Table showing t-values for each group, with asterisks indicating significance levels]

2.7 Conclusion

Based on cluster analysis and validation through t-tests and ANOVAs, Chinese social groups can be clearly classified into four clusters using warmth and competence dimensions, confirming the cross-cultural validity of the SCM and consistent with Guan et al.' s findings. Based on individual group t-test results and previous research, the research team selected six group labels per cluster for formal experiments plus one for practice (see Table 6).

Table 6 Final social group labels used as primes in formal research

HW-HC	HW-LC	LW-HC	LW-LC
[List of groups]	[List of groups]	[List of groups]	[List of groups]

Appendix 3: Pretest—Determination of Stereotypical Words

Target stimuli were stereotypical trait words corresponding to each social group. Following the classic Katz-Braly measurement approach and referencing methods from previous stereotype activation studies (Wang & Yang, 2007), we obtained stereotypical words for different social groups through a pretest:

1. **Open-ended questionnaire**: Participants wrote words describing each group' s typical characteristics. Fifty-six questionnaires were distributed

at a university library, yielding 48 valid responses. Words were counted by frequency in Excel.

2. **Semantic consolidation**: Similar expressions were grouped and recoded (e.g., "talkative" for women was recoded as "garrulous").
3. **Typicality rating**: The selected high-frequency words were rated on 7-point scales for how characteristic they were of each group. Sixty questionnaires were distributed, yielding 52 valid responses (25 male, 27 female). Using SPSS 13.0, we selected 30 typical stereotypical words per group based on high means and relatively low SDs: M_{HW}-HC = 5.89, SD_{HW}-HC = 0.32; M_{HW}-LC = 5.99, SD_{HW}-LC = 0.29; M_{LW}-HC = 5.82, SD_{LW}-HC = 0.31; M_{LW}-LC = 5.84, SD_{LW}-LC = 0.43. A one-way repeated measures ANOVA showed no significant differences in typicality across the four group types, $F(3, 87) = 1.6$, $p = .196$, partial $^2 = 0.05$.

Appendix 4: Prime and Target Stimuli for Four Warmth-Competence Groups Based on SCM

[Table showing examples of consistent and inconsistent target words for each group type]

Appendix 5: Consistent Target Words and Corresponding Pseudowords for Four Warmth-Competence Groups Based on SCM

[Table showing examples of real words and their visually similar pseudowords for each group type]

Note: Figure translations are in progress. See original paper for figures.