2019-10

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http://hdl.handle.net/10026.1/15519

10.1177/1747021819844219
Quarterly Journal of Experimental Psychology
SAGE Publications

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Predictably Confirmatory:

The Influence of Stereotypes During Decisional Processing

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Abstract

Stereotypes facilitate the processing of expectancy-consistent (vs. expectancy-inconsistent) information, yet the underlying origin of this congruency effect remains unknown. As such, here we sought to identify the cognitive operations through which stereotypes influence decisional processing. In six experiments, participants responded to stimuli that were consistent or inconsistent with respect to prevailing gender stereotypes. To identify the processes underpinning task performance, responses were submitted to a hierarchical drift diffusion model (HDDM) analysis. A consistent pattern of results emerged. Whether manipulated at the level of occupational (Expts. 1, 3, & 5) or trait-based (Expts. 2, 4 & 6) expectancies, stereotypes facilitated task performance and influenced decisional processing via a combination of response and stimulus biases. Specifically: (i) stereotype-consistent stimuli were classified more rapidly than stereotype-inconsistent stimuli; (ii) stereotypic responses were favored over counter-stereotypic responses (i.e., starting-point shift towards stereotypic responses); (iii) less evidence was required when responding to stereotypic than counter-stereotypic stimuli (i.e., narrower threshold separation for stereotypic stimuli); and (iv) decisional evidence was accumulated more efficiently for stereotype-inconsistent than stereotype-consistent stimuli and when targets had a typical than atypical facial appearance. Collectively, these findings elucidate how stereotypes influence person construal.

Keywords: stereotypes, person construal, congruency effects, decisional processing, drift diffusion model.

Predictably Confirmatory:
The Influence of Stereotypes During Decisional Processing

A ubiquitous facet of daily life is that, absent individuating information, stereotypes influence person construal (Dovidio, Hewstone, Glick, & Esses, 2010; Jussim, Cain, Crawford, Harber, & Cohen, 2009; Kunda & Thagard, 1996; Stangor & Crandall, 2013). Whether the beliefs in question pertain to matters of gender, race, age, or sexuality, responding to people on the basis of the groups to which they belong is a pervasive social-cognitive tactic. It is somewhat surprising therefore that, despite decades of research on this core psychological topic, several unresolved issues remain (Bodenhausen & Macrae, 1998; Brewer, 1988; Fiske & Neuberg, 1990; Freeman & Ambady, 2011; Kawakami, Amodio, & Hugenberg, 2017; Kunda & Thagard, 1996; Macrae & Bodenhausen, 2000). Prominent among these is the question of how exactly stereotypes impact decisional processing. Accordingly, here we sought to enhance understanding of this matter.

Inspection of the available literature reveals what is arguably the signature outcome of stereotypical thinking — stereotypes facilitate the processing of expectancy-consistent (vs. expectancy-inconsistent) information (Freeman & Ambady, 2011; Hamilton, 1979; Kawakami et al., 2017; Macrae & Bodenhausen, 2000). Not only is confirmatory (vs. disconfirmatory) material easy to encode, represent, and remember; it is also detected with rapidity, processed fluently, and exerts disproportionate influence on person understanding (e.g., Blair & Banaji, 1996; Bodenhausen, 1988; Bodenhausen & Lichtenstein, 1987; Bodenhausen & Wyer, 1985; Duncan, 1976; Macrae, Milne, & Bodenhausen, 1994; Macrae, Stangor, & Milne, 1994). Generally speaking, when sensory information is congruent with pre-existing knowledge, stimuli are recognized more quickly than when sensory inputs and prior beliefs conflict in some way (e.g., Corbetta, Miezin, Dobmeyer, Schulman, & Peterson, 1990; Posner, Snyder, & Davidson, 1980). What is not yet known, however, are the cognitive mechanisms through which such congruency effects arise during person-related processing.

Much like other expectations, stereotypes have the capacity to influence decision-making through processes pertaining to the efficiency of stimulus evaluation and the evidential requirements of response generation (Ashby, 1983; Leite & Ratcliff, 2011; Link, 1975; Link & Heath, 1975; Summerfield & de Lange, 2014; van Ravenzwaaij, Mulder, Tuerlinckx, & Wagenmakers, 2012; White & Poldrack, 2014). Take, for example, responses to targets that confirm or disconfirm prevailing stereotype-related expectancies (Quadflieg et al., 2011). Consistent targets (e.g., male pilots) may be identified more rapidly than their inconsistent counterparts (i.e., female pilots) because: (i) expectancy-consistent (vs. expectancy-inconsistent) stimuli are processed with greater perceptual efficiency (i.e., stimulus bias); and/or (ii) less evidence is needed to generate confirmatory than dis-confirmatory responses (i.e., response bias). Of importance, therefore, is the ability to decompose decision-making and isolate the extent to which these independent processes underpin the emergence of stereotype-based congruency effects (Freeman & Ambady, 2011; Hamilton, 1979; Kawakami et al., 2017; Macrae & Bodenhausen, 2000). Usefully, in the context of binary decision tasks, the drift diffusion model affords just such a possibility (Johnson, Hopwood, Cesario, & Pleskac, 2017; Ratcliff, 1978; Ratcliff & Rouder, 1998; Ratcliff, Smith, Brown, & McKoon, 2016; Voss, Nagler, & Lerche, 2013; Voss & Voss, 2007; Voss, Voss, & Lerche, 2015).

The drift diffusion model uses both accuracy and latency to represent the decision-making process as it unfolds over time, thereby enabling the latent cognitive operations associated with task performance to be estimated (Ratcliff et al., 2016). During binary decision-making (e.g., is a stimulus stereotype-consistent or stereotype-inconsistent), information is continuously accumulated from a stimulus until sufficient evidence is acquired to make a response. In this task context, congruency effects could originate via either of the pathways described previously (White & Poldrack, 2014). For example, during stimulus processing, stereotype-based beliefs may facilitate information uptake for expected compared to unexpected stimuli (i.e., stereotypes influence the efficiency of stimulus processing). Alternatively, stereotypic presumptions may modulate information-sampling requirements, such that less evidence is needed to generate stereotype-consistent than stereotype-

inconsistent responses (i.e., stereotypes influence the evidential requirements of response selection). Used successfully to identify the processes underpinning performance across a range of tasks (Wagenmakers, 2009) — including categorization (Klauer, Voss, Schmitz, & Teige-Mocigemba, 2007), priming (Voss, Rothermund, Gast, & Wentura, 2013), perceptual discrimination (Voss, Rothermund, & Brandtstädter, 2008), race-related shooting decisions (Correll, Wittenbrink, Crawford, & Sadler, 2015; Johnson, Cesario, & Pleskac, 2018; Pleskac, Cesario, & Johnson, 2018), and self-prioritization (Golubickis, Falbén, Cunningham, & Macrae, 2018; Golubickis et al., 2017, in press; Macrae, Visokomogilski, Golubickis, Cunningham, & Sahraie, 2017) — drift diffusion modeling was applied in the current investigation to explicate how stereotypes influence decisional processing.

Overview

Across six experiments, using different experimental paradigms (Expts. 1-4: explicit face-label classification task; Expts. 5 & 6: sequential priming task), participants responded to stimuli that were consistent or inconsistent with respect to prevailing stereotype-related beliefs about the sexes (Blair & Banaji, 1996; Macrae & Cloutier, 2009; Macrae & Martin, 2007; Martin & Macrae, 2007; Osterhout, Bersick, & McLaughlin, 1997; Wang, Tan, Zhang, Wang, & Luo, 2018; White, Crites Jr., Taylor, & Corral, 2009). Compared to stereotype-inconsistent material, stereotype-consistent stimuli were expected to elicit faster responses (Freeman & Ambady, 2011; Kawakami et al., 2017; Macrae & Bodenhausen, 2000). To identify the origin of this congruency effect, data were submitted to a Hierarchical Drift Diffusion Model (HDDM) analysis (Wiecki, Sofer, & Frank, 2013).

Experiment 1

Method

Participants and Design

Thirty-four undergraduates (4 male, M_{age} = 20.38, *SD* = 3.30) took part in the research.[1] All participants had normal or corrected-to-normal visual acuity. Informed consent was obtained from participants prior to the commencement of all the current experiments and the protocols were reviewed and approved by the Ethics Committee at the School of Psychology, University of Aberdeen. The experiment had a 2 (Face: female or male) X 2 (Item: feminine or masculine) repeated measures design.

Stimulus Materials and Procedure

Participants arrived at the laboratory individually, were greeted by the experimenter, seated in front of a desktop computer, and told they would be performing a person-classification task. Using two buttons on the keyboard (i.e., N & M), participants had to report whether a series of face-occupation stimulus pairs (i.e., male face & plumber, male face & florist, female face & florist, female face & plumber) were consistent or inconsistent given prevailing stereotype-related beliefs about the sexes (Eagly, 1987; Quadflieg et al., 2011; Wood & Eagly, 2010). The experimenter made clear that it was not participants' personal views that were under investigation, but rather wider societal beliefs pertaining to men and women. The faces were taken from the Chicago Face Database (Ma, Correll, & Wittenbrink, 2015) and were 140 x 176 pixels in size, greyscale, and depicted young adults aged 20-30 years.

[1] Based on a medium effect size, G*Power revealed a requirement of 29 participants. An additional ~10-15% were recruited to allow for counter-balancing and drop out. This sample size was adopted for each of the reported experiments. All data are available from the first author (JKF) on request. See Supplementary Material for the complete results for each of the reported experiments.

Each trial began with the presentation of a central fixation cross for 1000 ms, followed by the pairing of a face and occupational label above and below the fixation cross, respectively, for 100 ms. After each face-occupation pairing was presented, the screen turned blank until participants reported whether the combination of stimuli was consistent or inconsistent with respect to prevailing gender stereotypes by pressing the appropriate button on the keyboard as quickly and accurately as possible. Eighty faces (40 male & 40 female) were used. Face-occupation assignments and the meaning of the response buttons were counterbalanced across the sample. Participants initially performed 12 practice trials, followed by two blocks of 160 trials in which stereotype-consistent (i.e., female face + florist or male face + plumber) and stereotype-inconsistent (i.e., female face + plumber or male face + florist) stimulus-pairs appeared equally often in a random order. On completion of the task, participants were debriefed and dismissed.

Results

Person Stereotyping

Responses faster than 200 ms and slower than 2500 ms were excluded from the analysis, eliminating approximately 3% of the overall number of trials (see Table 1 for treatment means). A multilevel model was used to examine the response time (RT) and accuracy data. Analyses were conducted with the R package 'lmer4' (Pinheiro, Bates, DebRoy, Sarkar, & R Development Core Team, 2015), with participants and facial stimuli treated as crossed random effects (Judd, Westfall, & Kenny, 2012).[2] This yielded a significant Face X Item interaction, (b = -.049, SE = .003, t = -15.80, p < .001). Further analysis of the interaction revealed that, when paired with female faces, responses were faster when occupations were feminine than masculine, (b = -.051, SE = .004, t = -11.40, p < .001). In contrast, when paired with male faces, responses were faster when occupations were masculine compared to feminine, (b = .047, SE = .004, t = 10.85, p < .001).

[2] In all the current experiments, participants and facial stimuli were treated as crossed random effects.

A multilevel logistic regression model on the accuracy of participants' responses yielded a significant Face X Item interaction (b = .136, SE = .028, z = 4.92, p < .001). Further analysis of the interaction revealed that, when paired with female faces, responses were more accurate when occupations were feminine than masculine (b = .159, SE = .038, z = 4.19, p < .001). In contrast, responses were more accurate when occupations were masculine than feminine when paired with male faces (b = -.113, SE = .040, z = -2.79, p = .005).

Table 1. Response Times (ms) and Accuracy (%) as a Function of Face and Item (Expts. 1 & 2).

	Face			
	Female		Male	
Item	Feminine	Masculine	Feminine	Masculine
Expt. 1 (occupations)				
RT	869 (227)	958 (176)	953 (191)	867 (209)
accuracy	82 (18)	80 (14)	83 (13)	84 (18)
Expt. 2 (traits)				
RT	863 (201)	905 (194)	908 (207)	805 (180)
accuracy	81 (13)	80 (13)	84 (13)	89 (11)

Note. RT = response time. Standard deviation (SD) in parentheses.

Diffusion Modeling

To identify the processes underpinning task performance, data were submitted to an HDDM analysis (see Supplementary Material for a description of drift diffusion modeling and details of the

current analysis). Models were response coded, such that the upper threshold (i.e., 1) corresponded to a stereotype-consistent response, and the lower threshold (i.e., 0) to a stereotype-inconsistent response. Inspection of the posterior distributions for the best fitting model revealed that task performance was underpinned by a combination of response and stimulus biases. Comparison of the observed starting value (z = .55) with no bias (z = .50) indicated a prior bias toward stereotype-consistent compared to stereotype-inconsistent responses (p_{Bayes}(bias > 0.50) < .001, d = .70).[3] In addition, threshold separation was narrower (i.e., less evidence was required) when responding to stereotypic than counter-stereotypic stimulus pairings (p_{Bayes}(female face/feminine item < female face/masculine item) = .109, d = .30; p_{Bayes}(male face/masculine item < male face/feminine item) = .048, d = .41). Finally, when occupations were paired with male faces, suggestive evidence for a stimulus bias (i.e., rate of information uptake) was observed, such that information gathering was faster for stereotype-inconsistent than stereotype-consistent stimulus pairs (p_{Bayes}(male face/feminine item > male face/masculine item) = .155, d = .26).

Discussion

The results of Experiment 1 demonstrated the effects of stereotypes on person-related processing. First, stereotype-consistent stimuli were classified more rapidly than stereotype-inconsistent stimuli (Bodenhausen & Macrae, 1998; Brewer, 1988; Fiske & Neuberg, 1990; Hilton & von Hippel, 1996; Macrae & Bodenhausen, 2000). Second, the HDDM analysis revealed that this congruency effect was underpinned by a response bias. Specifically, participants favored stereotypic compared to counter-stereotypic responses and less evidence was required when responding to stereotype-consistent than stereotype-inconsistent stimuli. Interestingly, at least for male stimuli,

[3] Bayesian p values quantify the degree to which the difference in the posterior distribution is consistent with the hypothesis that the parameter is greater for consistent than inconsistent responses. For example, a Bayesian p of .05 indicates that 95% of the posterior distribution supports the hypothesis.

evidence for a stimulus bias was also observed, indicating that information uptake was faster for stereotype-inconsistent than stereotype-consistent material.

Experiment 2

Using occupational presumptions about men and women, Experiment 1 showed how stereotypes influence decision-making. Of course, stereotypic beliefs about the sexes extend well beyond expectations concerning the professions that men and women are likely to occupy (Kite, Deaux, & Haines, 2008; Wood & Eagly, 2010), touching upon the characteristics they are likely to possess, the behaviors they are likely to enact, and the settings in which they are likely to be encountered (Haines, Deaux, & Lofaro, 2016; Heilman, 2012; Meyer & Gelman, 2016; Wood & Eagly, 2010). Accordingly, to establish the generality of the effects observed in Experiment 1, in our next study — again in a face-label classification task — we paired faces with personality characteristics that either confirmed or disconfirmed prevailing societal beliefs about the sexes (Wood & Eagly, 2010). Replicating Experiment 1, we expected stereotype-consistent stimulus pairs to be classified more rapidly than stereotype-inconsistent stimuli, and this effect to be underpinned by a response bias.

Method

Participants and Design

Thirty-four undergraduates (6 male, M_{age} = 20.26, *SD* = 1.35), with normal or corrected-to-normal visual acuity, took part in the research. The experiment had a 2 (Face: female or male) X 2 (Item: feminine or masculine) repeated measures design.

Stimulus Materials and Procedure

The study closely followed Experiment 1, but with an important modification. Rather than pairing targets with occupations, on this occasion the faces of men and women were paired with gender-related traits (i.e., *dominant*, *caring*, Deaux & Lewis, 1984). In all other respects, the procedure was identical to Experiment 1.

Results

Person Stereotyping

Responses faster than 200 ms and slower than 2500 ms were excluded from the analysis, eliminating approximately 3% of the overall number of trials (see Table 1 for treatment means). A multilevel model analysis yielded main effects of Face (b = .014, SE = .004, t = 3.39, p = .002), Item (b = .015, SE = .003, t = 4.90, p < .001), and a significant Face X Item (b = -.037, SE = .003, t = -12.43, p < .001) interaction. Further analysis of the interaction revealed that, when paired with female faces, responses were faster when traits were feminine than masculine, (b = -.023, SE = .004, t = -5.20, p < .001). In contrast, when paired with male faces, responses were faster when traits were masculine compared to feminine, (b = .052, SE = .004, t = 12.58, p < .001).

A multilevel logistic regression model on the accuracy of participants' responses yielded main effects of Face (b = -.288, SE = .077, z = -3.76, p < .001), Item (b = -.090, SE = .028, z = -3.190, p = .001), and a significant Face X Item (b = .132, SE = .028, z = 4.67, p < .001) interaction. Further analysis of the interaction revealed that, when paired with male faces, responses were more accurate when traits were masculine than feminine, (b = -.222, SE = .043, z = -5.18, p < .001). No such effect emerged when traits were paired with female faces.

Diffusion Modeling

As previously, data were submitted to an HDDM analysis (see Supplementary Material). Inspection of the posterior distributions for the best fitting model showed that task performance was underpinned by a combination of response and stimulus biases. Comparison of the observed starting value (z = .55) with no bias (z = .50) yielded evidence for a prior bias toward stereotype-consistent compared to stereotype-inconsistent responses (p_{Bayes}(bias > 0.50) < .001, d = .52). In addition, for female stimuli, evidence for a stimulus bias was observed (drift rate v), revealing that information uptake was faster for stereotype-inconsistent than stereotype-consistent stimulus pairs (p_{Bayes}(female face/masculine item > female face/feminine item) = .055, d = .40).

Discussion

The results of Experiment 2 replicated those observed previously — stereotype-consistent stimulus pairs were classified more rapidly than stereotype-inconsistent stimuli (Bodenhausen & Macrae, 1998; Brewer, 1988; Fiske & Neuberg, 1990; Hilton & von Hippel, 1996; Kawakami et al., 2017; Macrae & Bodenhausen, 2000). A further HDDM analysis revealed that this congruency effect was underpinned by a response bias, such that participants favored stereotype-consistent compared to stereotype-inconsistent responses. In addition, at least for female faces, evidence for a stimulus bias was also observed, indicating that information uptake was faster for stereotype-inconsistent than stereotype-consistent stimulus pairs.

Experiment 3

Acknowledging the pivotal role that prior beliefs play in economizing person perception, empirical efforts have focused on identifying factors that moderate the expression of stereotype-based responding (Allport, 1954; Bodenhausen & Macrae, 1998; Brewer, 1988; Fiske & Neuberg, 1990; Freeman & Ambady, 2011; Kawakami et al., 2017; Macrae & Bodenhausen, 2000). Of particular significance in this regard is the typicality of a target's appearance. Work has revealed that darker

skinned Blacks and those displaying stronger Afrocentric features are perceived, evaluated, and treated more negatively than their lighter skinned and less facially prototypical counterparts (e.g., Blair, Chapleau, & Judd, 2005; Blair, Judd, & Chapleau, 2004; Dixon & Maddox, 2005; Hagiwara, Kashy, & Cesario, 2012; Livingston & Brewer, 2002). That is, person evaluation is sensitive to the facial appearance of group members (Cassidy, Sprout, Freeman, & Krendl, 2017; Freeman & Ambady, 2009; Pauker & Ambady, 2009; Walker & Wänke, 2017), such that exemplar typicality moderates the strength of stereotype activation (Locke, Macrae, & Eaton, 2005).

Pertinent to the current inquiry, the gender typicality of faces also influences person construal (Carpinella, Hehman, Freeman, & Johnson, 2016; Carpinella & Johnson, 2013; Sofer, Dotsch, Wigboldus, & Todorov, 2015). For instance, for occupations associated with men and women, the relative masculinity/femininity (i.e., typicality) of faces impacts hiring recommendations and candidate evaluations (e.g., Sczesny & Kühnen, 2004, Sczesny, Spreemann, & Stahlberg, 2006; von Stockhausen, Koeser, & Sczesny, 2013). What is not yet understood, however, is how facial typicality influences the processes that underpin decision-making. Is it the case, for example, that perceptual processing (i.e., rate of evidence gathering) is sensitive to differences in the physical appearance of targets (i.e., high vs. low typicality)? This is an important question as it has been suggested that the strength of decisional evidence (e.g., categorical ambiguity) influences processing efficiency (Dunovan, Tremel, & Wheeler, 2014; White & Poldrack, 2014). Extending the scope of the current investigation, we considered this issue in our next experiment.

To investigate the effects of target typicality on decisional processing, as in Experiment 1, participants were presented with a series of male and female faces, paired with occupational information, and asked to report if the stimuli (i.e., face + occupation) were consistent or inconsistent with respect to prevailing stereotypic beliefs about the sexes. On this occasion, however, different occupations were used (i.e., hairdresser & mechanic) and the faces varied in typicality, such that targets were either high or low in masculinity/femininity (von Stockhausen et al., 2013). Based on

previous research, we expected target-occupation classification to be moderated by facial appearance (e.g., Freeman & Ambady, 2009; Livingston & Brewer, 2002; Locke et al., 2005). Specifically, responses were expected to be faster when targets were high than low in typicality. As in Experiments 1 and 2, an HDDM analysis was used to identify the origins of decisional bias during task performance (Wiecki et al., 2013).

Method

Participants and Design

Thirty-four undergraduates (12 male, M_{age} = 19.85, *SD* = 2.40), with normal or corrected-to-normal visual acuity, took part in the research. One participant (female) failed to follow the instructions, thus was excluded from the analyses. The experiment had a 2 (Face: female or male) X 2 (Typicality: high or low) X 2 (Item: feminine or masculine) repeated measures design.

Stimulus Materials and Procedure

The study closely followed Experiment 1, but with an important modification. On this occasion, the male and female targets paired with occupational information (i.e., mechanic or hairdresser) varied in facial typicality (i.e., masculinity/femininity). As in Experiment 1, the faces were taken from the Chicago Face Database (Ma et al., 2015) and were 140 x 176 pixels in size, greyscale, and depicted young adults aged 20-30 years. In total, 60 faces were used (30 male & 30 female). Critically, using the ratings from the database, the faces varied in typicality. For males, 15 faces were high (M = 5.12, SD = 0.18) and 15 faces were low (M = 3.51, SD = 0.29) in masculinity ($t(14) = 17.44$, $p < .001$, $d = 4.50$); for females, 15 faces were high (M = 5.52, SD = 0.14) and 15 faces were low (M = 3.38, SD = 0.31) in femininity ($t(14) = 24.94$, $p < .001$, $d = 6.44$).

The procedure was as in Experiment 1. Participants initially performed 16 practice trials, followed by three blocks of 120 trials in which stereotype-consistent/high-typicality, stereotype-consistent/low-typicality, stereotype-inconsistent/high-typicality, and stereotype-inconsistent/low-

typicality stimuli occurred equally often in a random order. In total, across all blocks, there were 90 trials in each condition.

Results

Person Stereotyping

Responses faster than 200 ms and slower than 2500 ms were excluded from the analysis, eliminating approximately 3% of the overall number of trials (see Table 2 for treatment means). A multilevel model analysis yielded a main effect of Typicality (b = -.020, SE = .004, t = -4.87, p < .001), such that responses were faster when faces were high (M = 964 ms, SD = 198 ms) than low (M = 1003 ms, SD = 217 ms) in typicality. In addition, significant Face X Item (b = -.036, SE = .003, t = -10.55, p < .001) and Face X Typicality X Item (b = -.009, SE = .003, t = -2.69, p = .007) interactions were also observed. To explore the 3-way interaction, separate analyses were conducted for faces high and low in typicality. For faces high in typicality, the analysis yielded a significant Face X Item interaction (b = -.045, SE = .005, t = -9.80, p < .001). Further analysis revealed that, when paired with female faces, responses were faster when occupations were feminine than masculine (b = -.052, SE = .007, t = -7.89, p < .001). In contrast, when paired with male faces, responses were faster when occupations were masculine compared to feminine (b = .039, SE = .007, t = 5.93, p < .001). For faces low in typicality, the analysis also yielded a significant Face X Item (b = -.026, SE = .005, t = -5.15, p < .001) interaction. Further analysis revealed that, when paired with female faces, responses were faster when occupations were feminine than masculine (b = -.024, SE = .007, t = -3.40, p < .001). In contrast, when paired with male faces, responses were faster when occupations were masculine compared to feminine (b = .028, SE = .007, t = 3.94, p < .001).

A multilevel logistic regression model on the accuracy of participants' responses yielded main effects of Typicality (b = .219, SE = .061, z = 3.59, p < .001), Item (b = -.101, SE = .024, z = -4.18, p < .001), a significant Typicality X Item (b = .058, SE = .024, z = 2.38, p = .017) interaction, and a significant Face X Typicality X Item (b = .086, SE = .024, z = 3.57, p < .001) interaction. To explore

the 3-way interaction, separate analyses were conducted for faces high and low in typicality. For faces high in typicality, the analysis yielded a significant Face X Item (b = .117, SE = .036, z = 3.25, p = .001) interaction. Further analysis of the interaction revealed that, when paired with male faces, responses were more accurate when occupations were masculine than feminine (b = -.158, SE = .051, z = -3.09, p = .002). No such effect emerged for occupations paired with female faces. For faces low in typicality, the analysis yielded a main effect of Item (b = -.160, SE = .033, z = -4.89, p < .001), such that responses were more accurate to masculine (M = 78%, SD = 14%) compared to feminine (M = 72%, SD = 22%) occupations.

Table 2. Reaction Times (ms) and Accuracy (%) as a Function of Face, Typicality, and Item (Expts. 3 & 4).

Face	Typicality	Item	Response Time (ms)	Accuracy (%)
Expt. 3 (occupations)				
female	high	feminine	917 (185)	82 (18)
		masculine	1014 (184)	80 (16)
	low	feminine	989 (228)	69 (21)
		masculine	1024 (198)	77 (15)
male	high	feminine	1002 (222)	80 (17)
		masculine	922 (202)	84 (12)
	low	feminine	1032 (229)	75 (22)
		masculine	966 (214)	78 (13)
Expt. 4 (traits)				
female	high	feminine	853 (159)	80 (14)
		masculine	946 (180)	71 (20)
	low	feminine	898 (165)	68 (19)
		masculine	966 (175)	66 (21)
male	high	feminine	941 (173)	75 (18)
		masculine	864 (179)	82 (14)
	low	feminine	938 (177)	68 (20)
		masculine	886 (179)	70 (24)

Note. Standard deviations (*SD*) appear within parentheses.

Diffusion Modeling

Data were submitted to an HDDM analysis (see Supplementary Material). Inspection of the posterior distributions for the best fitting model revealed that task performance was underpinned by both response and stimulus biases during decisional processing. Comparison of the observed starting

value (z = .53) with no bias (z = .50) yielded evidence for a prior bias toward stereotype-consistent compared to stereotype-inconsistent responses (p_{Bayes}(bias > 0.5) < .001, d = .30). In addition, less evidence was required (i.e., narrower threshold separation) when responding to stereotypic than counter-stereotypic stimulus pairs (p_{Bayes}(female face/feminine item < female face/masculine item) = .145, d = .26; p_{Bayes}(male face/masculine item < male face/feminine item) = .089, d = .33). Evidence for a stimulus bias was also observed. Specifically, for both female and male stereotype-consistent targets, information uptake (i.e., drift rate) was faster when faces were high than low in typicality (p_{Bayes}(high typicality female face/feminine item > low typicality female face/feminine Item) < .001, d = .87; p_{Bayes}(high typicality male face/masculine Item > low typicality male face/masculine Item) = .032, d = .49). For stereotype-inconsistent stimulus pairs, evidence of a stimulus bias was observed for male faces, p_{Bayes}(high typicality male face/feminine item > low typicality male face/feminine Item) = .094, d = .33). Finally, for low typicality faces, information uptake was faster for stereotype-inconsistent than stereotype-consistent stimulus pairs (p_{Bayes}(counter-stereotypic > stereotypic) = .009, d = .45).

Discussion

Extending the results reported thus far, Experiment 3 demonstrated that stereotype-consistent stimulus pairs were classified more quickly than stereotype-inconsistent stimuli, an effect that emerged when faces were both high and low in typicality (Bodenhausen & Macrae, 1998; Brewer, 1988; Fiske & Neuberg, 1990; Hilton & von Hippel, 1996; Kawakami et al., 2017; Macrae & Bodenhausen, 2000). In addition, the HDDM analysis revealed that decisional processing was underpinned by a combination of response and stimulus biases (Dunovan et al., 2014). Specifically, participants favored stereotypic compared to counter-stereotypic responses and less evidence was required when responding to stereotype-consistent than stereotype-inconsistent material. Evidence for a stimulus bias was also observed for low typicality faces, such that information uptake was faster for stereotype-inconsistent than stereotype-consistent stimulus pairs.

Experiment 4

Experiment 3 revealed how facial typicality impacts the operations that underpin person-related processing. To establish the replicability of these effects, in our next study — again in a face-label classification task — we paired faces high and low in typicality (i.e., masculinity/femininity) with personality characteristics (see Expt. 2) that either confirmed or disconfirmed stereotype-based beliefs about the sexes (Wood & Eagly, 2010). Corroborating Experiment 3, we expected facial appearance to influence person classification, with typicality moderating the rate of information uptake during decisional processing.

Method

Participants and Design

Thirty-four undergraduates (8 male, M_{age} = 20.12, *SD* = 2.39), with normal or corrected-to-normal visual acuity, took part in the research. One participant's (female) data file was corrupted, thus was excluded from the analyses. The experiment had a 2 (Face: female or male) X 2 (Typicality: high or low) X 2 (Item: feminine or masculine) repeated measures design.

Stimulus Materials and Procedure

The study closely followed Experiment 3, but with an important modification. Rather than pairing targets (i.e., high vs. low typicality) with occupations, on this occasion the faces were paired with personality traits associated with the sexes (i.e., *competitive*, *sympathetic*, Deaux & Lewis, 1984). In all other respects, the procedure was identical to Experiment 3.

Results

Person Stereotyping

Responses faster than 200 ms and slower than 2500 ms were excluded from the analysis, eliminating approximately 2% of the overall number of trials (see Table 2 for treatment means). A multilevel model analysis yielded a main effect of Typicality (b = -.011, SE = .004, t = -2.88, p = .006)., such that responses were faster when faces were high (M = 901 ms, SD = 173 ms) than low (M = 922 ms, SD = 174 ms) in typicality. In addition, significant Face X Typicality (b = -.008, SE = .004, t = -2.11, p = .039) and Face X Item (b = -.038, SE = .003, t = -11.58, p < .001) interactions were also observed. When paired with female faces, responses were faster when traits were feminine than masculine (b = -.042, SE = .005, t = -8.93, p < .001). In contrast, when paired with male faces, responses were faster when traits were masculine compared to feminine (b = .036, SE = .005, t = 7.57, p < .001).

A multilevel logistic regression model on the accuracy of participants' responses yielded main effect of Typicality (b = .266, SE = .048, z = 5.52, p < .001) and significant Face X Item (b = .158 SE = .023, z = 6.98, p < .001) and Face X Typicality X Item (b = .111, SE = .023, z = 4.90, p < .001) interactions. To explore the 3-way interaction, separate analyses were conducted for faces high and low in typicality. For faces high in typicality, the analysis yielded a significant Face X Item (b = .268, SE = .033, z = 8.02, p < .001) interaction. Further analysis of the interaction revealed that, when paired with female faces, responses were more accurate when traits were feminine than masculine (b = .292, SE = .047, z = 6.27, p < .001). In contrast, when paired with male faces, responses were more accurate when traits were masculine compared to feminine (b = -.244, SE = .048, z = -5.07, p < .001). For faces low in typicality, no effects were observed.

Diffusion Modeling

Data were submitted to an HDDM analysis (see Supplementary Material). Inspection of the posterior distributions for the best fitting model provided evidence of both response and stimulus biases during decisional processing. Comparison of the observed starting value (z = .54) with no bias (z = .50) revealed a prior bias toward stereotype-consistent compared to stereotype-inconsistent responses (p_{Bayes}(bias > 0.5) < .001, d = .67). In addition, for male stimulus pairings, less evidence was required when responding to stereotypic than counter-stereotypic stimuli (p_{Bayes}(male face/masculine item < male face/feminine item) = .182, d = .24). Evidence for a stimulus bias was also observed. Specifically, for stereotype-consistent targets, information uptake (i.e., drift rate) was faster when faces were high than low in typicality (p_{Bayes}(high typicality female face/feminine item > low typicality female face/feminine Item) < .002, d = .75; p_{Bayes}(high typicality male face/masculine Item > low typicality male face/masculine Item) = .006, d = .66). For stereotype-inconsistent stimulus pairs, evidence accumulation was also faster when faces where high than low in typicality (p_{Bayes}(high typicality female face/masculine item > low typicality female face/masculine item) = .110, d = .31; high typicality male face/feminine item > low typicality male face/feminine Item) = .110, d = .31). Finally, for low typicality faces, information uptake was faster for stereotype-inconsistent than stereotype-consistent stimulus pairs (p_{Bayes}(counter-stereotypic > stereotypic) = .079, d = .80).

Discussion

These results directly replicate the effects observed in Experiment 3. First, stereotype-consistent stimulus pairs were classified more rapidly than stereotype-inconsistent stimuli (Freeman & Ambady, 2011; Hilton & von Hippel, 1996; Kawakami et al., 2017; Macrae & Bodenhausen, 2000). Second, both consistent and inconsistent stimuli elicited faster (and more accurate) responses when faces were high than low in facial typicality (Livingston & Brewer, 2002; Locke et al., 2005). As previously, task performance was underpinned by a combination of response and stimulus biases.

Specifically, participants favored stereotypic compared to counter-stereotypic responses and less evidence was required when responding to stereotype-consistent than stereotype-inconsistent material. Also replicating Experiment 3, for low typicality faces, information uptake was faster for stereotype-inconsistent than stereotype-consistent stimulus pairs.

Combined Analysis (Experiments 1-4)

Experiments 1 to 4 yielded a consistent pattern of effects. Stereotype-based efficiencies in decisional processing were underpinned by a response bias; notably, participants favored stereotypic compared to counter-stereotypic responses and less evidence was required when responding to stereotype-consistent than stereotype-inconsistent stimuli. Interestingly, however, across the four experiments, mixed evidence was also observed for a stimulus bias, indicating that information uptake was faster for stereotype-inconsistent than stereotype-consistent material. To investigate the reliability of this latter effect, we therefore conducted an exploratory HDDM analysis across the combined data from Experiments 1 to 4 (see Pleskac et al., 2018). In so doing, we used only the conditions that were common across the four experiments.

Inspection of the posterior distributions for the best fitting model revealed that task performance was underpinned by a combination of response and stimulus biases (see Supplementary Material). Comparison of the observed starting value (z = .55) with no bias (z = .50) yielded evidence for a prior bias toward stereotype-consistent compared to stereotype-inconsistent responses (p_{Bayes}(bias > 0.50) < .001, d = .47). In addition, less evidence was required (i.e., narrower threshold separation) when responding to stereotypic than counter-stereotypic stimulus pairs (p_{Bayes}(female face/feminine item < female face/masculine item) = .064, d = .33; p_{Bayes}(male face/masculine item < male face/feminine item) = .001, d = .44). Importantly, evidence was also observed for the operation of a stimulus bias during decisional processing. Specifically, information uptake was faster for stereotype-inconsistent than stereotype-consistent stimuli (p_{Bayes}(female face/masculine item > female

face/feminine item) = .006, d = .32; p_{Bayes}(male face/feminine item > male face/masculine item) = .057, d = .20). This combined analysis highlights the complex and adaptive character of stereotype-based processing. Once activated, stereotypes increase sensitivity to both expectancy-consistent and expectancy-inconsistent information via a combination of response and stimulus biases.

Experiment 5

Thus far, the effects of stereotypes on decisional processing have been explored using an explicit face-label classification task. Driving these experiments was the assumption that participants arrive in the laboratory with pre-existing stereotypic beliefs about the sexes (Wood & Eagly, 2010), beliefs that impact task performance (i.e., participants expect to encounter stereotype-consistent vs. stereotype-inconsistent) individuals (Bar, 2004, 2007). While the results corroborated this viewpoint, a more direct way to investigate (and model) expectancy-based effects on person construal would be to employ a sequential priming paradigm in which participants respond to stereotype-related items (e.g., occupations, traits) following the presentation of male or female faces (Wentura & Rothermund, 2014). If facial primes prompt participants to expect stereotype-consistent rather than stereotype-inconsistent stimuli, then differences in information sampling requirements (i.e., starting point, z; threshold separation, a) should underpin the emergence of stereotype-based congruency effects (Blair & Banaji, 1996; Castelli, Macrae, Zogmaister, & Arcuri, 2004; Macrae & Martin, 2007). We explored this possibility in the current experiment.

Following the presentation of male and female faces (i.e., primes), participants had to report whether occupations were feminine or masculine in implication given prevailing stereotypes about the sexes (Wood & Eagly, 2010). Whereas on half of the trials, stimuli were consistent with stereotype-related beliefs about men and women, on the remaining trials the items were inconsistent with respect to gender stereotypes. We expected responses to be faster to stereotype-consistent than stereotype-

inconsistent stimuli and this congruency effect to be underpinned by the evidential requirements of response generation.

Method

Participants and Design

Thirty-seven undergraduates (13 male, M_{age} = 20.85, *SD* = 1.15), with normal or corrected-to-normal visual acuity, took part in the research. Three participants (females) failed to follow the instructions, thus were excluded from the analyses. The experiment had a 2 (Prime: female or male) X 2 (Item: feminine or masculine) repeated measures design.

Stimulus Materials and Procedure

Participants arrived at the laboratory individually, were greeted by the experimenter, seated in front of a desktop computer, and told they would be performing a word-classification task. Following the presentation of a male or female face, participants had to report, using two buttons on the keyboard (i.e., N & M), whether an occupational label was feminine (i.e., *hairdresser, nurse, secretary, receptionist, & beautician*) or masculine (*mechanic, builder, farmer, engineer, & pilot*) in implication given prevailing gender stereotypes (Wood & Eagly, 2010). The faces (30 female & 30 male) were taken from the Chicago Face Database (Ma et al., 2015) and were 140 x 176 pixels in size, greyscale, and depicted young adults aged 20-30 years.

Each trial began with the presentation of a central fixation cross for 500 ms, followed by a face (i.e., female or male), which remained on screen for 250 ms, after which it disappeared and was replaced by an occupational label for 1000 ms. Participants had to report, by pressing the appropriate button on the keyboard as quickly and accurately as possible, whether the occupation was feminine or masculine with respect to societal beliefs about the sexes. The meaning of the response buttons was counterbalanced across the sample. Participants initially performed 12 practice trials, followed by five

blocks of 120 experimental trials in which stereotype-consistent (i.e., female face/feminine occupation or male face/masculine occupation) and stereotype-inconsistent (i.e., female face/masculine occupation or male face/feminine occupation) stimuli appeared equally often in a random order.

Results

Stereotype Priming

Responses faster than 200 ms and slower than 2500 ms were excluded from the analysis, eliminating approximately 3% of the overall number of trials (see Table 3 for treatment means). A multilevel model analysis yielded a main effect of Item (b = .002, SE = .001, t = 2.03, p = .042) and a significant Prime X Item (b = -.008, SE = .001, t = -7.23, p < .001) interaction. Further analysis of the interaction revealed that, when primed by female faces, responses were faster when occupations were feminine than masculine, (b = -.006, SE = .001, t = -3.68, p < .001). In contrast, when primed by male faces, responses were faster when occupations were masculine compared to feminine, (b = .010, SE = .001, t = 6.52, p < .001).

A multilevel logistic regression model on the accuracy of participants' responses yielded a main effect of Item (b = -.090, SE = .026, z = -3.47, p < .001), and a significant Face X Item (b = .155, SE = .026, z = 5.98, p < .001) interaction. Further analysis of the interaction revealed that, when primed by male faces, responses were more accurate when occupations were masculine than feminine, (b = -.245, SE = .037, z = -6.65, p < .001). No such effect emerged when occupations were primed by female faces.

Table 3. Response Times (ms) and Accuracy (%) as a Function of Prime and Item (Expts. 5 & 6).

	Prime			
	Female		Male	
Item	Feminine	Masculine	Feminine	Masculine
Expt. 5 (occupations)				
RT	590 (73)	601 (65)	603 (75)	583 (65)
accuracy	91 (6)	90 (7)	89 (8)	92 (5)
Expt. 6 (traits)				
RT	603 (69)	628 (62)	618 (64)	608 (66)
accuracy	93 (6)	90 (6)	91 (6)	94 (5)

Note. RT = response time. Standard deviation (*SD*) in parentheses.

Diffusion Modeling

Data were submitted to an HDDM analysis (see Supplementary Material). Inspection of the posterior distributions for the best fitting model revealed that task performance was underpinned by a response bias. Models were response coded, such that the upper threshold (i.e., 1) corresponded to a feminine response, and the lower threshold (i.e., 0) to a masculine response. Comparison of the observed starting values (female prime: $z = .52$; male prime: $z = .46$) with no bias ($z = .50$) indicated that participants favored stereotype-consistent compared to stereotype-inconsistent responses following both female ($p_{\text{Bayes}}(\text{bias} > 0.5) = .003$, $d = .14$) and male ($p_{\text{Bayes}}(\text{bias} < 0.5) < .001$, $d = .27$) primes. In addition, following male primes, less evidence was required when responding to stereotypic than counter-stereotypic occupations (p_{Bayes}(male face/masculine item < male face/feminine item) $= .160$, $d = .23$). No evidence for the operation of a stimulus bias was observed.

Discussion

Using a sequential priming paradigm, the results of Experiment 5 corroborated the effects of stereotypes on person-related processing. First, stereotype-consistent stimuli were classified more rapidly than stereotype-inconsistent stimuli. Second, the HDDM analysis revealed that this congruency effect was underpinned by a response bias. Specifically, participants favored stereotypic compared to counter-stereotypic responses and, following males faces, less evidence was required when responding to stereotype-consistent than stereotype-inconsistent stimuli. In our final experiment, again using a priming paradigm, we sought to replicate these effects using personality traits as the stimuli of interest.

Experiment 6

Participants and Design

Thirty undergraduates (8 male, M_{age} = 20.96, *SD* = 1.19), with normal or corrected-to-normal visual acuity, took part in the research. One participant (male) failed to follow the instructions, thus was excluded from the analyses. The experiment had a 2 (Prime: female or male) X 2 (Item: feminine or masculine) repeated measures design.

Stimulus Materials and Procedure

The study closely followed Experiment 5, but with an important modification. Rather than following targets with occupations, on this occasion gender-related traits comprised the target stimuli (i.e., feminine traits – *affectionate*, *caring*, *gentle*, *shy*, & *understanding*; masculine traits - *assertive*, *athletic*, *competitive*, *dominant*, & *strong*; Bem, 1974). In all other respects, the procedure was identical to Experiment 5.

Results

Stereotype Priming

Responses faster than 200 ms and slower than 2500 ms were excluded from the analysis, eliminating approximately 1% of the overall number of trials (see Table 3 for treatment means). A multilevel model analysis yielded a main effect of Item (b = -.004, SE = .001, t = -3.37, p < .001) and a significant Prime X Item (b = -.009, SE = .001, t = -7.84, p < .001) interaction. Further analysis of the interaction revealed that, when primed by female faces, responses were faster when traits were feminine than masculine, (b = -.012, SE = .002, t = -7.85, p < .001). In contrast, when primed by male faces, responses were faster when traits were masculine compared to feminine, (b = .005, SE = .002, t = 3.19, p = .001).

A multilevel logistic regression model on the accuracy of participants' responses yielded a main effect of Prime (b = -.072, SE = .033, z = -2.15, p = .032), and a significant Prime X Item (b = .196, SE = .030, z = 6.54, p < .001) interaction. Further analysis of the interaction revealed that, when primed by female faces, responses were more accurate when traits were feminine than masculine (b = .150, SE = .041, z = 3.67, p < .001). In contrast, when primed by male faces, responses were more accurate when traits were masculine compared to feminine (b = -.242, SE = .044, z = -5.52, p < .001).

Diffusion Modeling

Data were submitted to an HDDM analysis (see Supplementary Material). Inspection of the posterior distributions for the best fitting model revealed that task performance was underpinned by a response bias. Comparison of the observed starting values (female prime: z = .54; male prime: z = .46) with no bias (z = .50) indicated that participants favored stereotype-consistent compared to stereotype-inconsistent responses following both female (p_{Bayes}(bias > 0.5) < .001, d = .23) and male (p_{Bayes}(bias < 0.5) < .001, d = .19) primes. In addition, following male primes, less evidence was required when

responding to stereotypic than counter-stereotypic traits (p_{Bayes}(male face/masculine item < male face/feminine item) = .066, d = .37). No evidence for the operation of a stimulus bias was observed.

Discussion

These results replicate the effects observed in Experiment 5. Stereotype-consistent stimuli were classified more rapidly than stereotype-inconsistent stimuli, an effect that was underpinned by a response bias.

General Discussion

In six experiments, participants had to report if stimuli confirmed or disconfirmed stereotype-related beliefs about the sexes. Based on the existing literature, we expected stereotype-consistent stimuli to elicit faster responses than their stereotype-inconsistent counterparts (Freeman & Ambady, 2011; Kawakami et al., 2017; Macrae & Bodenhausen, 2000). In addition, computational modeling (i.e., HDDM, Wiecki et al., 2013) was used to explore the processes underpinning task performance. Across the reported experiments, a consistent pattern of effects was observed. First, corroborating prior research, responses were faster to stereotype-consistent than stereotype-inconsistent stimuli (Expts. 1-6). Second, for both consistent and inconsistent stimuli, responses were faster when targets were high than low in facial typicality (Expts. 3 & 4). These findings reaffirm the functional benefits of stereotypical thinking. Through congruency effects, stereotype-based expectancies facilitate person-related processing (Freeman & Ambady, 2011; Kawakami et al., 2017; Macrae & Bodenhausen, 2000).

Further exploring the current findings, an HDDM analysis revealed that congruency effects were underpinned by a response (i.e., information sampling requirements) bias during decisional processing (White & Poldrack, 2014). Specifically, information sampling requirements were reduced for stereotype-consistent compared to stereotype-inconsistent responses (Expts. 1-6). Reflecting the multifaceted character of person-related processing (Freeman & Ambady, 2011; Kawakami et al.,

2017), the operations underpinning decision-making were also influenced by targets' facial appearances (Freeman & Ambady, 2009; Livingston & Brewer, 2002; Locke et al., 2005). For both stereotype-consistent and stereotype-inconsistent stimuli, information uptake was faster when targets had a typical than atypical facial appearance (Expts. 3 & 4). In addition, at least in Experiments 1 to 4, evidence accumulation was more efficient for counter-stereotypic than stereotypic stimulus pairs. Collectively these findings are important, as they illustrate the utility of drift diffusion modeling in identifying the latent cognitive operations that underpin stereotype-related processing (Plescak et al., 2018; Ratcliff et al., 2016).

Stereotype-Related Efficiencies

Since Allport's (1954) seminal writings, countless social-cognitive researchers have endorsed the viewpoint that stereotypes simplify information processing and response generation (Bodenhausen & Macrae, 1998; Brewer, 1988; Fiske & Neuberg, 1990; Hamilton, 1979; Hilton & von Hippel, 1996; Kawakami et al., 2017; Macrae & Bodenhausen, 2000). Quite how stereotypes exert these economizing effects, however, is less than certain. Here, using drift diffusion modeling, we identified the cognitive pathways through which stereotypic beliefs influence decisional processing. As predictive templates (Bar, 2004, 2007), stereotypes triggered a response bias during person-related processing (Dunovan et al., 2014; White & Poldrack, 2014). Specifically, in each of the reported experiments, the results revealed a lower evidential threshold for stereotype-consistent than stereotype-inconsistent responses. That is, participants required additional evidence to go against their preferred (i.e., pre-potent) confirmatory response. This suggests that seeing and judging others as stereotype-consistent (i.e., confirmatory) is the mind's default outcome, taking less time (and effort) than the stereotype-inconsistent (i.e., disconfirmatory) alternative (Bar, 2004, 2007). Of course, the current studies focused only on the effects of gender stereotypes on decisional processing, thus additional work will be required to confirm that other stereotype-related beliefs (e.g., race, age) impact person construal in a comparable manner.

To guide behavior in a flexible manner, the mind must possess two seemingly opposing cognitive skills. On the one hand, it must sensitize people to unchanging aspects of the world around them (i.e., the need for stability). On the other hand, however, to respond flexibly and adaptively to ever changing stimulus demands, the mind must also possess precisely the opposite ability (i.e., the need for plasticity), it must be responsive to the presence of unexpected inputs (Grossberg, 1987; Johnston & Hawley, 1994; McClelland, McNaughton, & O'Reilly, 1995). Interestingly, this bias towards both expected and unexpected inputs — stereotypes and counter-stereotypes — was observed in the current work. Critically, however, depending on the stereotype-related status of the stimuli, distinct cognitive mechanisms underpinned decisional processing. Whereas the enhanced identification of stereotypes (vs. counter-stereotypes) reflected the operation of a response bias toward expected material, decisional evidence was nevertheless gathered more rapidly for stereotype-inconsistent than stereotype-consistent stimuli (i.e., drift rate, stimulus bias). Thus, through separate cognitive pathways, the mind was simultaneously attuned to both expected and unexpected stereotype-related inputs (Sherman, Lee, Bessenoff, & Frost, 1998; Sherman, Macrae, & Bodenhausen, 2000).

That decisional evidence was gathered more rapidly for counter-stereotypes than stereotypes substantiates prior work revealing that people often show particular interest in unexpected targets, such as female pilots and male secretaries (e.g., Hutter, Crisp, Humphreys, Waters, & Moffitt, 2009; Kernahan, Bartholow, & Betterncourt, 2000). To date, the additional scrutiny these targets attract has been evidenced in the post-perceptual operations that follow their detection (Brewer, 1988; Fiske & Neuberg, 1990). For example, stereotype-discrepant targets trigger elaborative processing operations (e.g., attributional) that strive to resolve apparent category-based inconsistences and enhance person memory (e.g., Crocker, Hannah, & Weber, 1983; Macrae, Bodenhausen, Schloerscheidt, & Milne, 1999; Srull & Wyer, 1989). Crucially, as revealed in the current investigation (i.e., Expts. 1-4), this interest in unexpected material (i.e., prediction errors) also occurs much earlier in the person perception process. Specifically, in terms of information uptake, evidence is extracted more rapidly

from counter-stereotypic than stereotypic stimuli. It should be noted, however, that this effect emerged in an exploratory analysis. Further research will therefore be required to replicate the current findings in a confirmatory design.

In terms of existing theoretical approaches, Freeman and Ambady's (2011) dynamic interactive model provides a viable framework for interpreting the confirmatory character of person classification (see also Freeman & Johnson, 2016; Kunda & Thagard, 1996). Implemented in a recurrent connectionist network, the model outlines how person construal simultaneously accommodates both sensory (e.g., a person's appearance, movements, voice) and higher-level cognitive inputs (e.g., prior beliefs, contextual expectancies, goals). Once the network has been stimulated, activation flows among interconnected, bidirectional nodes as a function of their connection strengths. Eventually, these patterns of activation converge on a stable state, an outcome that corresponds to the construal of a person. In other words, through the dynamic process of constraint-satisfaction, multiple sources of person-related information interact over time before settling on a stable response. In this way, the model captures the ongoing interplay between top-down (i.e., prior beliefs) and bottom-up (i.e., sensory stimulation) inputs during person-related processing. Critically, after repeatedly encountering specific patterns of stimulus inputs (e.g., women working as florists, dominant men), a stable pattern of connections develops within the network, connections that are so efficient they require minimal information to evoke (Kunda & Thagard, 1996). This would explain why less evidence was required to classify stereotype-consistent compared to stereotype-inconsistent stimuli, as observed in the current investigation.

That stereotypes influence person-related processing even before any decision-relevant evidence has been acquired raises a number of interesting issues. For example, compared to their egalitarian counterparts (i.e., 'weak' stereotypic beliefs), sexist individuals (i.e., 'strong' stereotypic beliefs) may require less evidence to confirm the status (e.g., sex, occupation) of stereotype-consistent compared to stereotype-inconsistent targets. In addition, as suggested by the current findings, stronger

stereotype-related beliefs may also increase the efficiency of information gathering if targets vary in the extent to which they fit prevailing categorical expectations. That is, information uptake may be enhanced when targets are highly representative of the groups to which they belong. Additionally, a powerful element of stereotypical thinking is that it applies to the situations in which people are likely to be encountered. Just as one is more likely to find a kettle in a kitchen than a bathroom, so too employees in a nail bar would be expected to be Asian rather than Caucasian (Bar, 2004). Somewhat surprisingly, social-cognitive research has largely neglected the issue of when, why, and for whom contextual factors modulate person-related processing. In a notable exception, however, Wittenbrink, Judd, and Park (2001) demonstrated that person evaluation is influenced by the situations in which targets are embedded. Specifically, racial attitudes are activated more strongly when Black targets are located on a street corner than inside a church. What is not yet known, however, is the underlying origin of this effect. A useful task for future research will therefore be to utilize the biases that emerge during decisional processing to identify the operations that underpin person construal across different targets, contexts, and groups of participants.

Conclusions

Stereotypes routinely facilitate the processing of expectancy-consistent compared to expectancy-inconsistent information (Bodenhausen & Macrae, 1998; Brewer, 1988; Fiske & Neuberg, 1990; Freeman & Ambady, 2011; Kawakami et al., 2017; Macrae & Bodenhausen, 2000). Using drift diffusion modeling, here we showed that congruency effects of this kind are underpinned by a response bias during decision-making. Specifically, less evidence is required when making stereotype-consistent than stereotype-inconsistent responses. In addition, decisional evidence is accumulated more rapidly when targets have a typical than atypical facial appearance and stimuli are counter-stereotypic than stereotypic in implication. Collectively, these findings elucidate the cognitive pathways through which stereotypes influence person construal.

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