Journal of Experimental Psychology: General
2013, Vol. 142, No. 3, 934–943

0096-3445/13/$12.00 DOI: 10.1037/a0029794

Social Categories as a Context for the Allocation of Attentional Control

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Recent studies of cognitive control have highlighted the idea that context can rapidly cue the control of attention. The present study shows that faces can be quickly categorized on the basis of gender, and these gender categories can be used as a contextual cue to allocate attentional control. Furthermore, the results reported here reveal processes implicated in the development and operation of implicit social stereotypes. Three of 4 faces from 1 gender group were associated with a high proportion of congruent trials in a flanker task, while 3 of 4 faces of the other gender group were associated with a low proportion of congruent trials. A single inconsistent face within each gender group was associated with the proportion congruency of the opposite gender group. A social context-specific proportion congruent effect (PCE) was observed (i.e., larger interference for the gender category associated with a high proportion of congruent trials), even for inconsistent members of the category. This effect is consistent with the view that a new implicit stereotype was created, linking gender with a specific proportion of congruency. In Experiment 2, the task goals modulated the use of the new created stereotype. Instructions to categorize versus individuate the target faces, respectively, led participants to allocate attention either toward the category-diagnostic or the identity-diagnostic facial features. Furthermore, and in line with stereotyping research, under instructions to categorize faces this social-context-specific PCE generalized to new faces of the same gender group with whom participants did not have previous experience. These results link attention with social categorization processes.

Keywords: categorization, individualization, attentional control, social-context-specific-PCE

Efficient behavior often requires flexible and dynamic responses to deal rapidly with changing social interactions. For example, imagine yourself in a situation where you have encountered your boss in a corridor while chatting with your best work mate. Would you be able to instantly change your casual and uninhibited behavior with your work mate for a more formal and serious tone? Of course you would. Cognitive control seems to allow information processing to vary adaptively rather than remaining rigid and inflexible (Verguts & Notebaert, 2008). Although casual observation suggests that people are good at applying control over social performance in a fast and flexible manner, social processes related to the modulation of cognitive control have not yet been the subject of extensive research.

Outside social psychology, however, there has been increasing research interest in the fast and flexible control of performance. These studies have highlighted the role of contextual cues that dynamically modulate selective attention processes. The logic underlying these studies builds on a well-established procedure for studying cognitive control.

It has long been known that effects such as flanker interference and Stroop interference can be modulated by factors that affect top-down control over perceptual processing. In particular, when most of the trials in an experimental session contain distractors that are congruent (or compatible) with the target dimension (e.g., a left pointing arrow surrounded by left pointing arrows, or the word blue printed in blue), the distractor interference effect (i.e., the difference in performance between congruent and incongruent trials) is larger than when relatively few trials have congruent targets and distractors (Gratton, Coles, & Donchin, 1992; Lowe & Mitterer, 1982). When the relative proportions of congruent and incongruent trials are manipulated between blocks of trials, it follows that participants may detect the likelihood of congruency and voluntarily adapt processing of distractors in accordance with this likelihood, ensuring that distractor processing is attenuated when the likelihood of congruent trials is low.

Recent studies have built on this logic by examining whether distractor processing might be controlled rapidly in response to items (Jacoby, Lindsay, & Hessels, 2003) or contexts in which

This article was published Online First August 20, 2012.

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This research was financially supported by the Spanish Ministry of Education, Culture, and Sports with Pre-Doctorate Grant FPU: AP2007-04250 to Elena Cañadas and Research Grants PSI2010-17877, PSI2008-04223PSIC, P09-HUM-5422, and PSI2011-22416 to Rosa Rodríguez-Bailón and Juan Lupiáñez.

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items appear (Crump, Gong, & Milliken, 2006), rather than deliberately in response to awareness of contingencies. For example, in a study by Crump et al. (2006), participants were briefly presented with a color word prime at fixation, followed by a to-be-named colored-shape probe displayed randomly above or below fixation. Probes presented in one location were more likely (75%) to be congruent than probes presented in the other location (25%). The random presentation of the probes in the two locations ensured that participants were unable to anticipate the likelihood of probe congruency (which was 50% overall). Nonetheless, the Stroop effect was larger in the high-proportion-congruent location context than in the low-proportion-congruent location context. These results suggest that contextual cues, such as location in this case, can rapidly control the extent to which word reading affects color naming. A number of different perceptual dimensions have been used in similar studies of context-specific attentional control (Bugg, Jacoby, & Toth, 2008; Crump et al., 2006; Crump, Vaquero, & Milliken, 2008; Lehle & Hübner, 2008; Vietze & Wendt, 2009; Wendt & Kiesel, 2011).

An important issue in this literature is whether context-specific proportion congruent effects (PCEs) truly reflect the allocation of varying amounts of control as a function of the specific proportion congruency context, or alternatively that they reflect a form of specific stimulus–response associative learning (Schmidt & Besner, 2008). This issue has been addressed in two different ways in recent studies (Bugg, Jacoby, & Chanani, 2011; Crump & Milliken, 2009). First, Crump and Milliken (2009) demonstrated that the association between proportion congruent and a context learned with one set of items transfers and affects the congruency effect measured for another set of items for which proportion congruency is not manipulated. Second, Bugg et al. (2011) demonstrated that the association between proportion congruent and one set of items transfers to another set of categorically related items with which the participant has had to that point no experience. Together, these results indeed suggest that attentional control can be allocated flexibly in response to rapidly processed contextual cues.

If the allocation of attentional control depends on the fast categorization of a context as either demanding or not demanding control, this fast categorization is likely to occur automatically on the basis of salient categorical features. Although such fast categorization processes are likely to occur in a wide range of contexts in which people have high levels of perceptual expertise, social contexts are one arena in which they have been shown to be very frequent (e.g., Brewer, 1988; Cuddy, Fiske, & Glick, 2004; Fiske & Neuberg, 1990; Kawakami, Dion, & Dovidio, 1998; Nelson, 2005). Yet, to our knowledge, no prior study has used social stimuli, such as human faces, as cues for the allocation of attentional control. Human faces might well be particularly good cues for attentional control, as they offer valuable information to perceivers and are crucial to social interactions from birth onward (Johnson & Morton, 1991). With this idea in mind, one of the purposes of the current study was to examine whether social stimuli (i.e., human faces) might serve as contextual cues for rapid adjustment of attentional control.

Attention and Social Categorization

Both variant (e.g., emotional expression, gaze direction) and invariant (e.g., sex, age) features of person knowledge can be extracted from facial cues (Bruce & Young, 1986; Burton, Bruce, & Johnston, 1990; Tarr & Gauthier, 2000). These cues are crucial for people's understanding of others and give perceivers information about individuals and their group membership. Contemporary models of social perception and face processing study the conditions under which person construal is based on unique entities (i.e., individual identities), rather than on social categories (Brewer, 1988; Bruce & Young, 1986; Fiske & Neuberg, 1990; Hugenberg, Young, Bernstein, & Sacco, 2010; Macrae & Bodenhausen, 2001). Whereas categorization requires attention to facial characteristics diagnostic of category membership, individualization requires attention to facial characteristics that are identity diagnostic (Hugenberg et al., 2010).

Research in this area demonstrates that, in general, category-based perception plays a more prominent role in person construal (Cloutier, Mason, & Macrae, 2005) than individual-based perception. People readily perceive the gender, ethnicity, and age of a briefly presented face (Fiske & Neuberg, 1990; Haxby, Hoffman, & Gobbini, 2000; Parkinson, 2005; Zebrowitz & Montepare, 2008). Intriguingly, once a face has been categorized as belonging to a certain group, that social categorization can, in turn, influence the perception of the face (e.g., Corneille, Huart, Becquart, & Brédart, 2004; Huart, Corneille, & Becquart, 2005) and, consequently, behavior toward the individual. Furthermore, once a social category is activated, it is used to rapidly and efficiently perceive new members of the group (Le Pelley et al., 2010), even when these group members possess category-inconsistent traits (Fiske, Lin, & Neuberg, 1999; Hastie, 1980; Rothbart, Evans, & Fulero, 1979). There is also evidence, however, that individuation is dependent on the availability of attentional resources (Gilbert & Hixon, 1991), people's processing goals (Macrae, Bodenhausen, Milne, Thorn, & Castelli, 1997), prejudice level (Lepore & Brown, 1997), contextual variables (Wittenbrink, Judd, & Park, 2001), and other moderators.

One of the factors that most theorists agree can trigger social categorization is attentional focus on category-relevant knowledge (e.g., Cloutier et al., 2005; Macrae et al., 1997; McGarty, Yzerbyt, & Spears, 2002). Manipulations that highlight this social dimension therefore should bias perception toward social categorization, rather than individuation, processes. Up to now, however, most studies along these lines analyzed the content of well-established cultural stereotypes and their effects (e.g., Deaux & Lewis, 1984; Fabes & Martin, 1991; Kashima, 2000; Krueger, 1996). Few of these studies investigated the processes through which new stereotypes are developed, maintained, and efficiently applied to consistent, inconsistent, and new members of the category. Therefore, an important goal of the present research was to investigate the processes associated with the creation and subsequent use of implicit stereotypes. Here we consider stereotypes in the broad sense as involving an association between a social category and particular attributes, characteristics, and/or behaviors (Hilton & von Hippel, 1996). In the current study we used gender as the social category and associated gender with a particular proportion of congruency (the category associated attribute). We were interested specifically in whether gender of a face can be used as a contextual cue to control attention by establishing new implicit associations between the gender category and the need for attentional control (varied by manipulating proportion congruent; Experiment 1). Furthermore, we explored whether, as is the case for well-established stereotypes, this social-context controlled attention will generalize to group members with whom participants had category-inconsistent experience and to new group members with whom they had no experience (Experiment 2). An additional goal of the second experiment was to investigate whether these social categorization processes are sensitive to instructions to attend to individual versus category-related features of the faces.

Experiment 1

A Flanker task was used to measure attentional control. The flanker stimulus on each trial was presented in the context of a face, and gender of that face served as a contextual cue; male faces were associated with a high proportion of congruent trials (HPC), while female faces were associated with a low proportion of congruent trials (LPC), or vice versa. In line with prior studies (e.g., Bugg et al., 2008; Crump et al., 2006), larger congruency effects in the flanker task were predicted to occur for the HPC context than for the LPC context.

Furthermore, we created consistent and inconsistent category members within each of these two gender contexts. Thus, three faces of one category (e.g., men) were associated with a high proportion of congruent trials (the consistent faces), whereas a fourth face of the same category was associated with a low proportion of congruent trials (the inconsistent face), and vice versa for the other group. The key empirical issue concerned whether the predicted larger congruency effect for the HPC gender context would be specific to the consistent faces or, instead, would generalize to the inconsistent face of the same gender. This empirical issue has important conceptual implications within the domains of both cognitive control and categorization processes.

Within the domain of cognitive control, generalization of the proportion congruency effect to the inconsistent face would contradict any account of the effect that hinges strictly on item-specific learning processes. Indeed, item frequency within a class of items is often confounded with proportion congruent for that class of items, which makes it difficult to discern whether proportion congruent effects reflect adjustments in cognitive control in response to items of a particular class or stimulus–response learning that speeds responses to items that occur with a particularly high frequency (Schmidt & Besner, 2008). Generalization of the proportion congruency effect here to the inconsistent face would constitute one of a small number of context-specific control effects that are not subject to an item-specific learning interpretation (see also Bugg et al., 2011; Crump & Milliken, 2009).

Within the domain of social categorization, generalization of the proportion congruency effect to the inconsistent face would implicate the creation of a new implicit stereotype, as well as its application to other members of the same category. Again, the sense in which we use the term *stereotype* here is broad, implying only that participants may learn an association between a social category (i.e., gender) and a particular attribute (i.e., proportion congruent) that is typical of that category (Hilton & von Hippel, 1996). Such a result would align well with the idea that social categorization plays a prominent role in person perception, even when inconsistent members within the category are encountered (e.g., Brewer, 1988; Fiske & Neuberg, 1990). Indeed, it would serve as strong evidence that the mere perception of a social context (i.e., gender categories) can, in principle, trigger an attentional response that modulates relatively early processing in that context (i.e., processing subject to selective attention).

Method

Participants. Thirty undergraduate students (15 women, *M* age = 23 years) participated in exchange for course credit. All participants reported normal or corrected-to-normal vision and hearing and were naïve to the purpose of the experiment.

Apparatus, stimuli, and procedure. Stimulus presentation, timing, and data collection were controlled using the E-prime 2.0 software package run on standard Pentium 4 PCs. Stimuli were presented on a 17-in. (43.18-cm) computer screen and consisted of full color photographs (taken from the NimStim Set of Facial Expressions; MacArthur Foundation Research Network on Early Experience and Brain Development, n.d.), each containing a face in an emotionally neutral state with a direct gaze. Eight different photographs were used, four portraying faces of young Caucasian men and four portraying faces of young Caucasian women.

The experiment used a modification of Eriksen's Flanker task (e.g., Eriksen & Eriksen, 1974). As can be seen in Figure 1, each trial consisted of a 200-ms fixation cross followed by the presentation of a face looking straight ahead. After a 400-ms interval, five arrows were presented above or below the face for 2,000 ms or until response. The faces therefore were the context for the flanker task stimulus. In the congruent condition, all five arrows pointed in the same direction. In the incongruent condition, the central arrow and the four flanking distracters pointed in opposite directions. Participants were required to respond as quickly and accurately as possible to the direction of the central arrow by pressing either the "Z" (left) or "M" (right) key. Participants were instructed to attend to the faces, as they would be asked about them at the end of the experiment. The interstimulus interval (blank screen) was 1,000 ms. Participants were allowed to rest between blocks. We used faces to create two types of contexts: the individual context and the group context. These two contexts were associated with different proportions of congruency in the flanker task, which result in congruent/incongruent group conditions and consistent/inconsistent individual face conditions. In particular, in the congruent group condition three faces of one category (e.g., men) were associated with a high proportion of congruent (HPC) trials (75% congruent, 25% incongruent). These were the consistent individual faces within this group. In contrast, one face from that same category was associated with a low proportion of congruent (LPC) trials (25% congruent, 75% incongruent, the inconsistent individual face). The opposite set of associations was established for the other gender group (i.e., incongruent group context). The group and the specific face associated to high or low proportion congruent was counterbalanced across participants. Also, faces assigned to Consistent and Inconsistent faces were randomly selected between participants (see Figure 2).

Note that the method described above ensured that there was no association between the direction of the target arrow (i.e., the response) and either the identity or gender of the face, nor was there an association between the direction of the flanker arrows and either the identity or gender of the face. Rather, the association that was introduced was limited to the relation between identity/gender of the face and congruency of the target/distractor dimensions of the flanker stimuli.

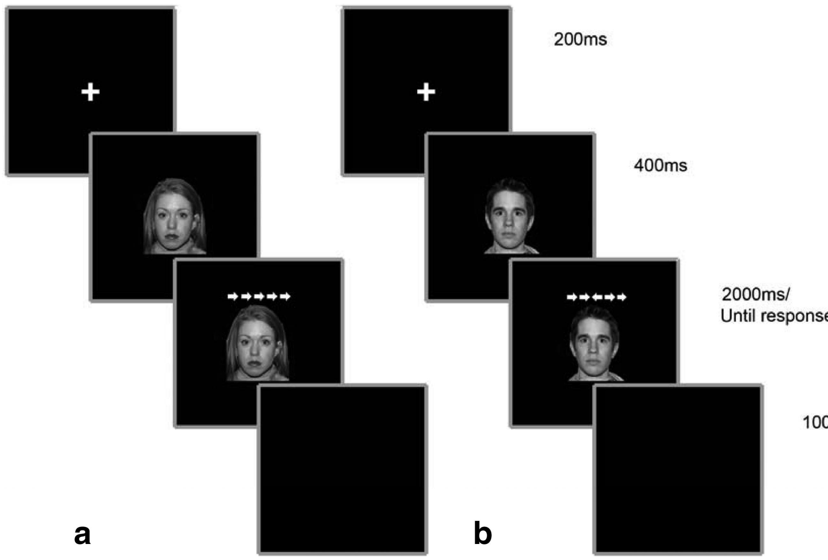

Figure 1. Examples of time course of stimulus presentation in Experiments 1 and 2. a. A congruent flanker trial, with a female context face. b. An incongruent trial, with a male context face. Stimuli were taken from the taken from the NimStim Set of Facial Expressions (MacArthur Foundation Research Network on Early Experience and Brain Development, n.d.).

Design. The three within-subject variables were Group Congruency (High vs. Low proportion of congruency associated with the gender group), Individual Face Consistency (Consistent vs. Inconsistent proportion of congruency relative to the gender category), and Arrows Congruency (Congruent vs. Incongruent).

Participants performed one practice block of 16 trials followed by five experimental blocks of 128 trials each.

Results

Practice trials and the first block were not included in the analysis. Experimental trials with errors (2.1%) or with response times (RT) shorter than 200 ms (anticipations) or longer than 1,100 ms (lapses; 2.9%) were eliminated from the analyses. Mean RTs were computed and submitted to a 2 (Group Congruency; HPC vs. LPC) × 2 (Individual Face Consistency; consistent vs. inconsistent with the group) × 2 (Arrows Congruency; Congruent vs. Incongruent) repeated-measures analysis of variance (ANOVA; see Table 1).

The analysis revealed a main effect of Arrows Congruency, $F(1, 29) = 300.32$, $p < .001$. Responses on congruent trials ($M = 539$ ms) were faster than on incongruent trials ($M = 634$ ms). Importantly, Group Congruency qualified this effect, $F(1, 29) = 5.08$, $p = .032$. The congruency effect (incongruent-congruent response latency) for the HPC condition was larger ($M = 100$ ms) than that for the LPC condition ($M = 86$ ms), thus showing a 14-ms social-context-specific PCE.

Notably, there was no hint of an interaction between Group Congruency, Arrows Congruency, and Individual Face Consistency ($F < 1$), showing that, as can be observed in Table 1, the modulation of Group Congruency was similar for the two face types, with 12-ms and 15-ms social-context-specific PCEs, respectively, for inconsistent and consistent faces.[1]

Discussion

The results of Experiment 1 extend the context-specific control findings of prior studies (Bugg et al., 2008; Crump et al., 2006; Lehle & Hübner, 2008; Vietze & Wendt, 2009; Wendt & Kiesel, 2011) to the domain of social categories. Whereas prior studies have shown that spatial location, font, and color serve as a contextual cues to control attention, here we demonstrate that faces can also serve as such a contextual cue. However, our results go beyond those of all prior studies by demonstrating that the context-specific control learned through associations with the consistent category members (i.e., the three faces that were paired with mostly congruent flanker trials) generalized to inconsistent category members (i.e., the one face that was paired with mostly incongruent flanker trials). These results rule out explanations of the effect that are based on entirely on specific stimulus–response associations (Schmidt & Besner, 2008; Schmidt, Crump, Cheesman, & Besner, 2007) and, instead, support the view that an adaptive change in attentional control is responsible for the effect (Bugg et al., 2011; Crump & Milliken, 2009; Jacoby et al., 2003).

Note that in the current study the context faces were presented 400 ms before the flanker stimuli used to measure attentional control. It might be argued that this 400-ms lead time allows for strategic shifts in control in response to the faces contexts. However, an additional experiment was conducted in which the flanker stimuli were presented simultaneously with the context face, and this new experiment showed the same pattern of results observed

[1] A corresponding analysis of errors revealed only a main effect of Arrows Congruency, $F(1, 29) = 32.33$, $p < .001$; error rates were higher for incongruent trials (4.12%) than for congruent trials (.05%). Specific analyses showed that neither gender of the participants nor gender of the faces have any significant effect on the results.

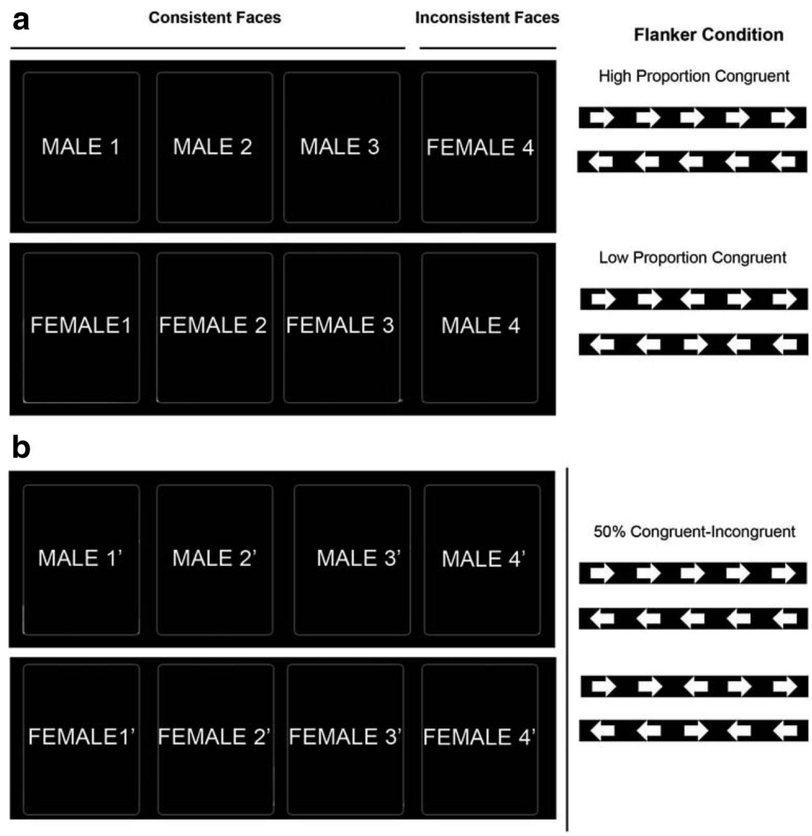

Figure 2. a. Example of stimuli presented and group congruency manipulation when male participants were paired with High Proportion Congruent and female participants with Low Proportion Congruent. b. Example of stimuli presented in the transfer block (Experiment 2).

in Experiment 1.[2] Therefore, it appears that social categories can serve as a cue for rapid and flexible adjustments in attentional control.

From a social perspective, the results represent a clear case of person categorization; mere exposure to faces that are irrelevant to the conflict task seems to be sufficient to trigger the retrieval of a social category (i.e., gender). In turn, the association between gender and the need for selective attention triggers adaptive changes in attentional control. These findings provide strong support for the prominent role of category-based perception in person construal and its automatic behavioral effects. When participants are not motivated to focus on unique entities, they tend to rapidly categorize faces using the available physiognomic cues (e.g., features indicative of gender). In the present context, as a consequence of this categorization, it appears that participants activated information they learned about the likelihood of congruency that was associated with gender categories, rather than with specific faces. Consequently, the same congruency effects were observed for consistent and inconsistent faces, despite the fact that consistent and inconsistent faces were associated with different congruency likelihoods.

Experiment 2

In Experiment 1, female and male faces were associated with either a high or low proportion of congruent flanker trials, and a social-context-specific PCE was observed. Importantly, this effect was observed even for category-inconsistent faces, which had an

[2] A new experiment was conducted with 30 new participants (21 women, *M* age = 23 years) from the same pool. This new experiment was exactly the same as Experiment 1, except that the face context was presented simultaneously with the flanker task, instead of appearing 400 ms before.

The results perfectly replicated those from Experiment 1. The analysis revealed a main effect of Arrows Congruency, $F(1, 29) = 211.80$, $p < .001$. Responses on congruent trials ($M = 569$ ms) were faster than on incongruent trials ($M = 657$ ms). Importantly, Group Congruency qualified this effect, $F(1, 29) = 6.69$, $p = .015$. The congruency effect (incongruent-congruent trials' response latency) for the HPC condition was larger ($M = 92$ ms) than that for the LPC condition ($M = 84$ ms), thus showing an 8-ms social-context-specific PCE.

Notably, there was no hint of an interaction between Group Congruency, Arrows Congruency, and Individual Face Consistency ($F < 1$).

Combined analysis of the two experiments showed a main effect of experiment, $F(1, 58) = 3.99$, $p = .051$. Participants in Experiment 1 were faster (584 ms) than those from the control experiment (613 ms). Importantly, the interaction between Group congruency and Arrows Congruency was significant, $F(1, 58) = 9.90$, $p = .003$. The congruency effect for the HPC condition was larger ($M = 95$ ms) than that for the LPC condition ($M = 85$ ms), thus showing a 10-ms social-context-specific PCE. This effect was not significantly different between experiments ($F < 1$). Furthermore, there was no hint of a three-way interaction between Group Congruency, Arrows Congruency, and Individual Faces consistency ($F < 1$).

Table 1
Mean Correct Direction-Discrimination Response Latencies in ms and Error Percentage for Experiments 1 and 2

	Consistent faces (CF)				Inconsistent faces (IF)				Social-context specific PCE (HPC-LPC)	
	HPC		LPC		HPC		LPC			
Experiment	*M*	% error	*M*	% error	*M*	% error	*M*	% error	CF	IF
Experiment 1										
Congruent (C)	540	0.4	539	0.5	530	0.5	541	0.4		
Incongruent (I)	640	3.9	627	3.6	629	4.5	625	4.4		
Congruency effect (I-C)	100		88		99		84		12	15
Experiment 2 Learning										
Individual										
Congruent (C)	556	0.5	567	0.5	566	1.2	559	0.5		
Incongruent (I)	672	4.1	666	4.3	663	3.7	663	4.3		
Congruency effect (I-C)	116		99		97		104		17	−7
Category										
Congruent (C)	553	0.9	556	0.5	540	1.2	554	0.5		
Incongruent (I)	644	5.4	644	4.1	648	3.7	636	4.3		
Congruency effect (I-C)	91		88		108		82		3	26
Experiment 2 Transfer										
Individual										
Congruent (C)	569	0.3	560	0.6						
Incongruent (I)	672	7.9	664	5.7						
Congruency effect (I-C)	103		104						−1	
Category										
Congruent (C)	578	0.4	587	0.8						
Incongruent (I)	681	5.4	648	6.9						
Congruency effect (I-C)	103		61						42	

Note. PCE = proportion congruent effect; HPC = high proportion congruent; LPC = low proportion congruent.

opposing proportion congruency association to that of their gender group. As such, the results suggest that participants categorized faces as belonging to one of the two gender categories, rather than individuating them, and that gender categorization automatically modulated cognitive control.

To test whether this learned category contingency would generalize to new group members, with whom participants did not have previous experience, in Experiment 2 we presented an additional block of trials with new faces for which there was no proportion congruency manipulation. In this block, four new male and female faces were presented, and each face was associated with an equal proportion of congruent and incongruent flanker trials (see also Bugg et al., 2011; Crump & Milliken, 2009).

In addition, it is well known that perceivers' motivation can play an important role in directing attention to categorical or identity-specific facial characteristics (Brewer & Brown, 1998; Fiske & Neuberg, 1990; Hugenberg et al., 2010; Macrae et al., 1997). In Experiment 2 we investigated whether gender-based categorization would control attention in the same way as in Experiment 1 if participants were given explicit instructions to individuate. To that end, we manipulated the instructions given, asking participants to pay attention to the faces either as individuals or as members of gender categories.

Method

Participants. Thirty-five students (19 women, *M* age = 20 years) participated in the experiment in exchange for course credits. All participants reported normal or corrected-to-normal vision and hearing and were naïve to the purpose of the experiment.

Apparatus, stimuli, and procedure. The same apparatus and stimuli used in Experiment 1 were used in the Learning block of Experiment 2. Eight faces, however, were added in an additional Transfer block (see Figure 2b). Participants performed 16 practice trials and five experimental Learning blocks of 128 trials each. Next, they performed one additional Transfer block of 64 trials. In the Transfer block, the new stimuli (four male and four female faces) appeared equally often with congruent and incongruent trials.

Before beginning the Flanker task, we included a between group instruction manipulation that asked participants to direct their attention to different aspects of the faces. The Individualization Group ($N = 19$) was instructed to pay attention to the identity-based features of each face, whereas the Categorization Group ($N = 16$) was instructed to pay attention to the category-based features of the faces (i.e., gender).

Results

The same outlier criterion as in Experiment 1 was used. RT outliers (3.5%) and errors (3.7%) were excluded from the analysis. Practice trials and the first block were considered as practice, and they were not included in the analysis. Data from one participant in the Individualization Group were discarded due to an error rate higher than 50%. The data for the Learning block and the Transfer block were analyzed separately.

Learning block mean RTs were submitted to a repeated-measures ANOVA that included Group Congruency (HPC vs.

LPC), Face Consistency (Consistent vs. Inconsistent with the group), and Arrows Congruency (Congruent vs. Incongruent) as within-subject factors and instruction manipulation as a between-subjects factor (see Table 1).

As in Experiment 1, there was a main effect of Arrows Congruency, $F(1, 33) = 209.65$, $p < .001$, that was qualified by Group Congruency, $F(1, 33) = 6.84$, $p = .013$. The congruency effect was larger in the context of the gender associated to HPC (M = 103 ms) than when presented in the context of the gender associated to LPC (M = 93 ms). More important, the four-way interaction was also significant, $F(1, 33) = 7.80$, $p = .009$. A 2 (Group Congruency) × 2 (Arrows Congruency) × 2 (Instructions) partial ANOVA conducted on only the Category Inconsistent trials revealed a significant interaction between the three factors, $F(1, 33) = 7.15$, $p = .012$. As shown in Table 1, only participants in the Categorization Group showed a larger congruency effect for the HPC gender (M = 108 ms) than for the LPC gender (M = 82 ms), $F(1, 15) = 12.55$, $p = .003$. The Individualization Group showed the opposite pattern (97 ms vs. 104 ms), although the difference was not significant, $F(1, 18) < 1$. The same analysis on Category Consistent faces showed a trend toward the Social-context-specific PCE, $F(1, 33) = 3.89$, $p = .057$, independent of the instruction manipulation, $F(1, 33) = 1.85$, $p = .184$.[3]

Transfer Block mean RTs were submitted to a 2 (Group Congruency) × 2 (Arrows congruency) × 2 (Instructions) mixed ANOVA. This analysis revealed a significant Arrows Congruency effect, $F(1, 33) = 178.38$, $p < .001$, with faster responses on congruent (M = 574 ms) than on incongruent (M = 666 ms) trials. Furthermore, this effect was qualified by Group Congruency, $F(1, 33) = 4.80$, $p = .036$. However, the key result was a significant three-way interaction involving Arrows Congruency, Group Congruency, and Instructions, $F(1, 33) = 6.08$, $p = .019$. Subsequent analyses that focused on the two Instruction groups separately revealed that the Congruency × Group Congruency interaction was significant only for the group instructed to categorize. The PCE was 42 ms larger for the HPC group than for the LPC group with categorization instructions, $F(1, 33) = 9.98$, $p = .003$), whereas it was 1 ms smaller for the HPC group than for the LPC group with Individualization instructions ($F < 1$; see Table 1). The PCE effect for the categorization instructions was almost entirely attributable to differences in performance for the incongruent items across the two contexts, with RTs being 32 ms faster for incongruent trials in the LPC group than in the HPC group, $F(1, 33) = 9.84$, $p = .004$.[4]

Discussion

The purpose of Experiment 2 was to determine whether the social-context proportion congruent effect would generalize to new members of the two gender categories and to examine whether this effect is subject to instructional influences. The results from the learning block replicated those of Experiment 1, with a social-context-specific PCE occurring for group-inconsistent faces. More interestingly, this effect was also qualified by instructions. Participants instructed to pay attention to individuating information in the faces did not show the social-context-specific PCE for inconsistent faces. Furthermore, during the transfer block, participants given instructions to categorize transferred the congruency association from the learning blocks to the new faces, whereas participants given instructions to individualize showed no such effect. These findings demonstrate that when people focus on individuating information, categorical processes do not necessarily occur for other members of the same group.

An important property of this transfer effect to new faces merits note. In particular, Bugg et al. (2011; see also Schmidt & Besner, 2008) noted that if a PCE effect is due to changes in control over processing of an irrelevant stimulus dimension, rather than to changes in stimulus–response associations that might develop when items occur with different frequencies, then the context effect ought to occur primarily for the incongruent items rather than for the congruent items. This logic follows from the fact that conflict effects like Stroop and flankers are primarily due to interference from the irrelevant dimension on incongruent trials, rather than to facilitation from the irrelevant dimension on congruent trials. Indeed, the context-specific PCE effect that transferred to new faces in this experiment was almost entirely due to changes in performance across context for the incongruent trials; responses for the incongruent trials were 32 ms faster for the low proportion congruent condition than for the high proportion congruent condition. Bugg et al. (2011) has reported a similar result using a picture–word variant of the Stroop task. Together with recent neuroimaging results indicating that context-specific control effects are mediated by activity in brain structures (e.g., medial superior parietal lobe) known to play an important role in voluntary control (King, Korb, & Egner, in press), the behavioral results here and in the Bugg et al. (2011) study strongly implicate context-specific control over processing of irrelevant distractors.

General Discussion

One of the purposes of the present study was to determine whether social categories, such as the gender of facial stimuli, could serve as contextual cues that would produce “stereotypical” allocation of attentional control. To that end, we used consistent and inconsistent category members as context for the allocation of attentional control and focused on key outcomes with both the cognitive control and social cognition literatures in mind.

More specifically, we used the context-specific proportion congruent logic introduced by other researchers (Bugg et al., 2008; Crump et al., 2006; Crump & Milliken, 2009; Crump et al., 2008; Heinemann, Kunde, & Kiesel, 2009; Lehle & Hübner, 2008; Schmidt et al., 2007; Vietze & Wendt, 2009; Wendt & Kiesel, 2011) to investigate whether male and female gender faces associated with different proportions of congruency would cue attentional control in different ways. In line with previous studies, our results demonstrate that faces are indeed effective cues to control selective attention.

Specifically, Experiment 1 showed that participants learned the association between gender categories and the proportion of congru-

[3] A corresponding analysis of error rates revealed only a main effect of Arrows Congruency, $F(1, 33) = 30.23$, $p < .001$; error rates were higher for incongruent trials (5.8%) than for congruent trials (0.60%).

[4] A corresponding analysis of error rates revealed only a main effect of Arrows Congruency $F(1, 33) = 29.76$, $p < .001$, with more errors for incongruent trials (6.47%) than for congruent trials (0.50%). Specific analyses showed that neither gender of the participants nor gender of the faces had any significant effect on the results.

ency and allocated control accordingly, using the gender category as context, rather than the individual diagnostic information within each single face. A key result from this study is that participants allocated the same attentional control to all targets within a gender category, regardless of the specific proportion of congruency associated to each individual within the category. That is, they allocated the same attentional control to category inconsistent faces (the one face in a gender group that was associated with an opposite proportion of congruency to the other three members of the same gender group). To our knowledge, there are no previous studies that have examined context-specific control that have demonstrated an effect that generalizes to items on the basis of a shared contextual cue (e.g., gender in this case), but for which the item contingencies predict the opposite result.

A second key result from the present study concerned the transfer phase of Experiment 2, in which the context-specific PCE generalized to new faces with which the participants had no prior experience. This result clearly implicates a form of control over attention that hinges on rapid categorization of the gender of faces, rather than item-specific learning. Furthermore, this context-specific PCE observed for the transfer items was almost entirely due to a difference across contexts in performance for the incongruent trials, a result that highlights the role played by the gender context in controlling the influence of the irrelevant distractors on performance (see Bugg et al., 2011).

In addition, these results support the view that social categories are automatically activated in the presence of a triggering stimulus, a crucial property of contemporary models of person perception (e.g., Brewer, 1988; Devine, 1989; Fiske & Neuberg, 1990). Indeed, research on social perception indicates that when examining information about themselves and others, people often rely on information that confirms their preconceptions (e.g., Snyder & Gangestad, 1986; Swann & Read, 1981) and then behave according to those preconceptions. The results of Experiment 2 add to this literature by demonstrating that the social-context-specific PCE can be influenced by momentary motivations. In particular, the social-context PCE was observed only for participants instructed to focus on gender categories in Experiment 2. Furthermore, in the transfer block, generalization of the social-context PCE to new items occurred only when participants were instructed to focus on gender categories and did not occur when participants were instructed to focus on individual faces. This result echoes the importance given to motivation in social perception models (e.g., Devine, 1989; Fiske & Neuberg, 1990) and the debate about unconditional automaticity of social categorization (see Macrae & Bodenhausen, 2001).

It is particularly important in our study that, instead of using the content of well established cultural stereotypes to investigate how they are activated and used when performing a task for which the stereotype is irrelevant, we investigated those processes by creating a new stereotype: Female and male faces were generally associated with different congruency proportions. Our results show that our procedure might be useful to investigate the processes underlying the creation and use of implicit stereotypes and that gender categorization can be easily used to learn new stereotypes. Future research should focus on whether other variant (e.g., emotional expression, gaze direction, smiling) and invariant (e.g., age, race, attractiveness, healthiness) features of people, which can be extracted from faces with minimal visual cues (Macrae & Quadflieg, 2010), can equally be used to learn new stereotypes.

Another interesting property of our data is that the social-context-specific PCE generalized to new category members with whom participants had no previous experience in the transfer block. As is the case with stereotype associations, these findings reveal the predictive power of the new associations built during the experimental procedure for linking gender categories with different proportions of congruency and that participants make use of these associations when responding to the task. It is important to note, however, that we used faces of people unknown to participants. We do not know whether a similar social-context-specific effect would have occurred for faces known to the participants. It will be interesting to investigate how and/or whether new stereotypes are also implicitly learned or applied to people with whom we have previous individual experience. Perhaps with familiar people the individual, rather than the categorical context, will determine the allocation of attentional control.

In sum, our results provide new evidence that social context can modulate attentional control processes rapidly and flexibly. Importantly, these shifts of attentional control were learned through associations of proportion congruency with a particular set of stimuli, and yet the shifts of attentional control transferred to both inconsistent and novel stimuli. Moreover, explicit instructions to individualize modulated this learning effect. These effects have important implications for social interactions. In particular, the application of associations learned from consistent group members to inconsistent group members that we observed here appear to implicate stereotype-like processes in shifts of attentional control. As such, the method used here may be a useful tool for further study of implicit categorization-individuation social processes.

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Received March 1, 2012
Revision received June 12, 2012
Accepted July 9, 2012 ■