European Journal of Social Psychology
Eur. J. Soc. Psychol. **37**, 793–805 (2007)
Published online 6 November 2006 in Wiley InterScience
(www.interscience.wiley.com) **DOI**: 10.1002/ejsp.406

A boy primed Sue: Feature-based processing and person construal

C. NEIL MACRAE* AND DOUGLAS MARTIN
University of Aberdeen, UK

Abstract

Everyday social interaction is often dominated by categorical thinking, with generic group-based knowledge structures guiding people's dealings with others. Noting the important influence that category-cueing facial features exert during the initial stages of person construal, the current work explored the effects of hair cues on the process and temporal dynamics of sex categorization. Using a standard priming paradigm to index the products of person construal (i.e., categorical and stereotype-based knowledge), the results of three experiments revealed that: (i) hair cues alone are sufficient to trigger category and stereotype activation; and (ii) during the early stages of person perception, these cues have the capacity to reverse conventional priming effects and generate errors of categorical assignment (e.g., female faces prime male knowledge). These findings are considered in the context of contemporary accounts of person construal. Copyright © 2006 John Wiley & Sons, Ltd.

Understanding other people is one of the primary objectives of social-cognitive functioning. An orderly world is a predictable world, hence perceivers continually strive to simplify the challenging demands of the person-perception process (Allport, 1954; Bodenhausen & Macrae, 1998; Brewer, 1988; Fiske & Neuberg, 1990; Kunda & Spencer, 2003; Macrae & Bodenhausen, 2000). One way in which they can satisfy this objective is by responding to other people on the basis of the social groups to which they belong (i.e., categorical thinking). The benefits of this approach to person perception are considerable. Once activated, category-based knowledge structures streamline information processing, assist memorial organization, and guide response generation (Bodenhausen & Macrae; Macrae & Bodenhausen). Put simply, categorical thinking economizes the process of person understanding.

Notwithstanding its association with a range of beneficial cognitive effects, categorical thinking does come with strings attached. In particular, when erroneous beliefs are associated with membership of specific social groups, categorization can set the stage for some of the less savory aspects of person construal—notably, stereotyping and discrimination (Brewer, 1988; Fiske & Neuberg, 1990). Given these dual facets of categorical thinking (i.e., cognitive benefits & behavioral costs), recent research efforts have focused on delineating the operational characteristics and associated outputs of this core

*Correspondence to: Neil Macrae, School of Psychology, University of Aberdeen, King's College, Aberdeen AB24 2UB, Scotland, UK. E-mail: c.n.macrae@abdn.ac.uk

Received 29 June 2006
Accepted 14 July 2006

social-cognitive processing strategy (Cloutier, Mason, & Macrae, 2005; Macrae, Quinn, Mason, & Quadflieg, 2005; Quinn & Macrae, 2005). The current investigation comprises a continuation of this important line of inquiry.

PERSON CATEGORIZATION: PROCESS AND PRODUCTS

Prior to shaping the course of their interactions with others, people must first activate relevant category-based knowledge structures in memory (Gilbert & Hixon, 1991). In this respect, the face is unquestionably the most prominent category-cueing stimulus in the person-perception process (Bruce & Young, 1986; Haxby, Hoffman, & Gobbini, 2000, 2002; Zebrowitz, 1997). Daily experience attests that even the briefest of glances at a face is sufficient to furnish information about the sex, age, race, and emotional status of its owner (Bruce & Young). Given this observation, it is, therefore, surprising to learn that work in social cognition has tended to overlook the functional significance of facial information during the initial stages of person construal (but see Blair, Judd, Sadler, & Jenkins, 2002; Livingston & Brewer, 2002; Zebrowitz, 1997). Two factors have contributed to this oversight. First, an extensive literature has used verbal labels to trigger category activation (see Macrae & Bodenhausen, 2000), a methodological strategy that necessarily sidesteps the issue of how facial appearance may modulate person construal. Second, when facial primes have been used to trigger category activation, researchers have ignored the variability inherent in facial appearance, thus the possibility that category activation may be moderated by the relative diagnosticity of particular facial features.

When research has considered the effects of facial typicality on person construal, the results have been revealing. Person categorization is indeed sensitive to subtle differences in people's facial appearance (Blair, Chapleau, & Judd, 2005; Blair, Judd, & Chapleau, 2004; Blair et al., 2002; Livingston & Brewer, 2002; Locke, Macrae, & Eaton, 2005; Maddox & Gray, 2002; Uhlmann, Dasgupta, Elgueta, Greenwald, & Swanson, 2002). For example, targets with Afrocentric facial features are more likely to elicit negative evaluations and stereotype-based reactions than their less prototypical counterparts (Blair et al., 2004, 2005; Livingston & Brewer). That these effects are driven by the diagnosticity of category-cueing information is evident from the demonstration that European Americans trigger similar reactions, if these targets possess Afrocentric facial characteristics (Blair et al., 2002). In other words, featural cues can function independent of category membership in the generation of stereotype-based responses, at least for certain racial groups (Blair et al., 2002; Livingston & Brewer). As Livingston and Brewer have reported, '. . . automatic evaluations of facial primes reflect affective responses to perceptual cues per se rather than conceptual evaluation of the racial categories that the cues represent' (p. 15).

Feature-based accounts of the categorization process give rise to a number of interesting questions (Schyns, 1998), particularly with respect to the impact that specific featural cues may exert on the products of person construal. Notable among these is the issue of just how potent category-cueing facial features may be in guiding the process of person categorization. For example, are facial features alone sufficient to trigger category (and stereotype) activation or must they be embedded in intact facial primes? To date, researchers have manipulated the diagnosticity of category-cueing features that appear in intact facial stimuli (Blair et al., 2002; Livingston & Brewer, 2002; Locke et al., 2005), thus it is possible that the effects of specific cues are supported by additional information (both featural and configural) that can be extracted from the face (Cloutier et al., 2005). The question remains of whether isolated cues are sufficient to trigger person categorization. This possibility, however, is consistent with recent work that emphasizes the flexible character of the categorization process (Schyns).

DOI: 10.1002/ejsp

How an object (e.g., car, person) is classified depends on a range of factors, including the quality of available perceptual inputs and the particular processing goals or objectives that are operating during stimulus appraisal. Bound inexorably to basic perceptual operations, categorization is guided by the presence of diagnostic cues in the available visual inputs, cues that can support quite different categorical judgments (Schyns & Oliva, 1999; Schyns, Bonnar, & Gosselin, 2002). When perceivers are charged with the task of explicitly classifying targets (i.e., overt categorization), then isolated featural cues are sufficient to drive the recognition process (Schyns et al.). But are these cues capable of triggering person categorization in task contexts in which perceivers are not instructed to categorize people? It is one thing to use a particular cue when overt classification is the task at hand, whether the cue spontaneously triggers person categorization, however, may be an entirely different matter (Macrae & Bodenhausen, 2000). Accordingly, we explored this possibility in the current investigation. In doing so, we considered the effects of category-cueing facial information on the products (i.e., categorical and stereotype-based knowledge) and temporal dynamics of a core social-cognitive processing operation—sex categorization.

THE CURRENT RESEARCH

When confronted with other people, perceivers use a variety of physical cues to establish the sex of the individuals in question, including textural information (e.g., stubble) and specific facial features, such as the shape and thickness of the eyebrows (Bruce et al., 1993). By far the most useful and reliable cue when it comes to sexing a face, however, is a person's hairstyle (Brown & Perrett, 1993; Burton, Bruce, & Dench, 1993; Goshen-Gottstein & Ganel, 2000). Herein, however, resides an interesting empirical question. While perceivers may routinely use hair cues as a means to overtly sex a target (Goshen-Gottstein & Ganel), is the cue itself sufficient to spontaneously trigger category activation? Based on recent accounts of the categorization process (Schyns, 1998), we suspect that it is quite possible that sex-specifying cues may be sufficient to trigger the activation of category-related knowledge structures in memory. As Schyns et al. (2002) have noted, 'People who recognize visual events do not use all the information impinging on the retina, but instead use only the elements that are most useful (i.e., diagnostic) for the task at hand' (p. 402). As such, isolated hair cues may be capable of triggering category activation.

While the relationship between hair length and sex categorization has clearly been subjected to considerable cultural and historical variation,[1] in current Western societies hair cues should have quite specific effects on the products of person construal, if these cues in isolation are capable of activating category-based knowledge structures (Blair et al., 2002; Livingston & Brewer, 2002). In particular, whereas long hair should prime female knowledge structures, short hair should trigger access to generic knowledge about men. The goal of our first two experiments was to test this prediction. Using standard semantic priming procedures, we explored the effects of both intact face primes and hair cues alone on person categorization (Expt 1a) and the accessibility sex stereotypes (Expt 1b). If isolated hair cues are

[1]At least in contemporary Western societies, the relationship between hair cues and sex categorization is quite straightforward. With a few notable exceptions, women typically have longer hair than men. However, things have not always been this way. A brief perusal of the history of hair reveals that as a sex-specifying cue, hair length has conveyed quite different categorical meanings as a function of prevailing cultural forces. For example, while in ancient Egypt it was commonplace for men and women to shave their heads (and wear wigs), in ancient Greece, it was usual for young men to have long hair. Long hair was also the preferred style for men in the Germanic and Celtic tribes that inhabited Northern Europe; indeed short hair was taken to be a mark of slavery or punishment. By the 9th century, European noblemen had short cropped hair and long, plaited hair was the style of choice for women. Things changed again in the early 17th century when European men of fashion had long flowing locks, often curled and perfumed. By the 19th century, it was commonplace for both men and women to cut their hair short.

DOI: 10.1002/ejsp

sufficient to trigger category activation (as indexed by the accessibility of category-related and stereotype-based knowledge), then the effects of intact face primes and hair cues should be identical.

EXPERIMENTS 1a AND 1b: HAIR CUES AND PERSON CONSTRUAL

Method

Participants and Design

Twenty undergraduates from the University of Aberdeen completed Experiment 1a (16 females, 4 males) and 20 undergraduates completed Experiment 1b (15 females, 5 males). Each experiment had a 2 (Prime: face or hair) × (Trial Type: matching or mismatching) repeated measures design. All that differed between the experiments was the manner in which person construal was assessed (Expt 1a—category activation, Expt 1b—stereotype accessibility).

Procedure and Stimulus Materials

Participants arrived at the laboratory individually, were greeted by a male experimenter, seated at a Viglen PC and randomly assigned to complete either Expt 1a (i.e., category activation) or Expt 1b (i.e., stereotype accessibility). Participants in Expt 1a were informed that the study comprised an investigation of people's ability to classify forenames by sex. It was explained that a series of names would appear in the center of the screen (e.g., *John*, *Julie*) and the task was simply to indicate, via a key press, whether the name was characteristically male or female (Macrae et al., 2005). Participants in Expt 1b were told that the study comprised an investigation of people's ability to classify words (e.g., *mechanic*, *flowers*), again via a key press, as stereotypically masculine or feminine in implication. All participants completed two blocks of trials in which target words were preceded by either face or hair primes.

The priming stimuli used in both experiments comprised grayscale digital headshots (250 × 320 pixels) of 90 unfamiliar people (45 men and 45 women) in frontal pose, displaying neutral facial expressions. These stimuli served as primes in both the face and hair conditions (see Figure 1, top panel). In the face-priming condition, the original stimuli were used as primes. In the hair-priming condition, the stimuli were digitally altered using Adobe Photoshop (version 8.0) to remove all facial information from the images (i.e., only the hair remained). The target items in Expt 1a were 90 English forenames (45 male and 45 female) that were unambiguously male or female (Mason, Cloutier, & Macrae, 2006). The target items in Expt 1b were 90 stereotyped words (45 masculine and 45 feminine) taken from Crawford, Leynes, Mayhorn, and Bink (2004).

Each trial comprised the appearance of a fixation cross which remained on screen for 500 milliseconds. This was then replaced by a priming stimulus (i.e., face or hair) which appeared for 200 milliseconds, followed by a target item which remained on screen until a response was made. The inter-trial interval was 1500 milliseconds. Face and hair trials were presented in separate blocks, with each block comprising 10 practice trials and 80 experimental trials. Block order was counterbalanced across participants, as was the meaning of the response keys. Each experimental block comprised 40 matching (i.e., prime-target congruent) and 40 mismatching trials (i.e., prime-target incongruent), giving a total of 160 trials across the 2 blocks. The order of presentation of trials was

DOI: 10.1002/ejsp

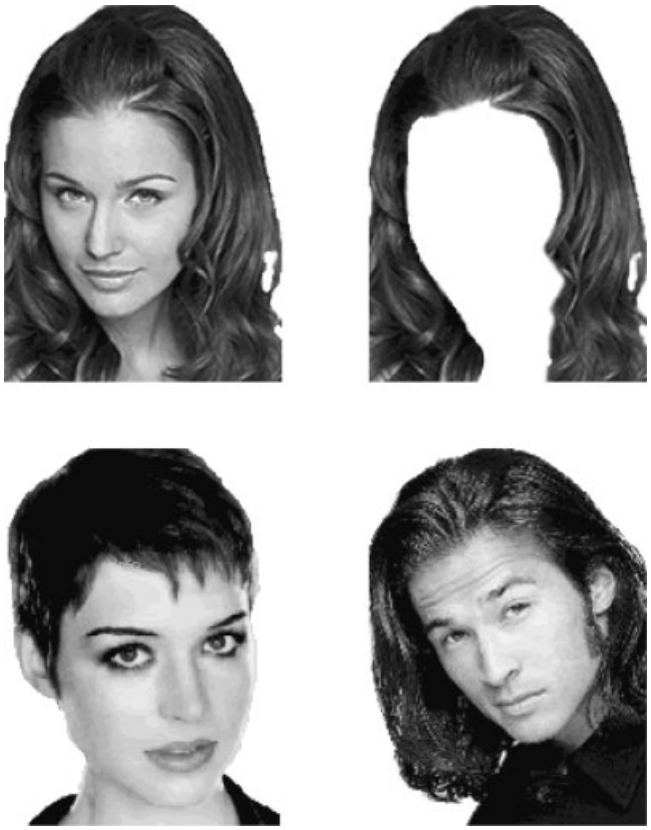

Figure . Examples of stimulus materials (Expt 1a/1b top panel; Expt 2, bottom panel)

randomized and the computer measured the accuracy and latency of each response. On completion of the task, participants were debriefed and dismissed.

Results and Discussion

The dependent measures of interest were the time taken by participants to classify the target items by sex (Expt 1a) and stereotypicality (Expt 1b). Trials on which errors were committed were excluded from the analyses (Expt 1 a = 3%, Expt 1b = 8%). Median response times were calculated for each participant and separate 2 (Prime: face or hair) × 2 (Trial Type: matching or mismatching) repeated measures analysis of variance (ANOVA) were undertaken on the data from each experiment, the results of which are summarized below.

Forename Classification (Expt 1a)

The only effect to emerge in the analysis was a main effect of Trial Type ($F(1,19) = 7.91$, $p < .05$, $d = .645$), indicating that participants responded more quickly on matching than mismatching trials

DOI: 10.1002/ejsp

(respective *M*s: 615 vs. 639 milliseconds). Neither the main effect of Prime nor the Prime × Trial Type interaction was significant, both Fs < 1 (see Figure 2, top panel).

Stereotype Accessibility (Expt 1b)

Replicating Expt 1a, the only effect to emerge in the analysis was a main effect of Trial Type [$F(1,19) = 8.55$, $p < .05$, $d = .671$], revealing that response latencies were faster on matching than

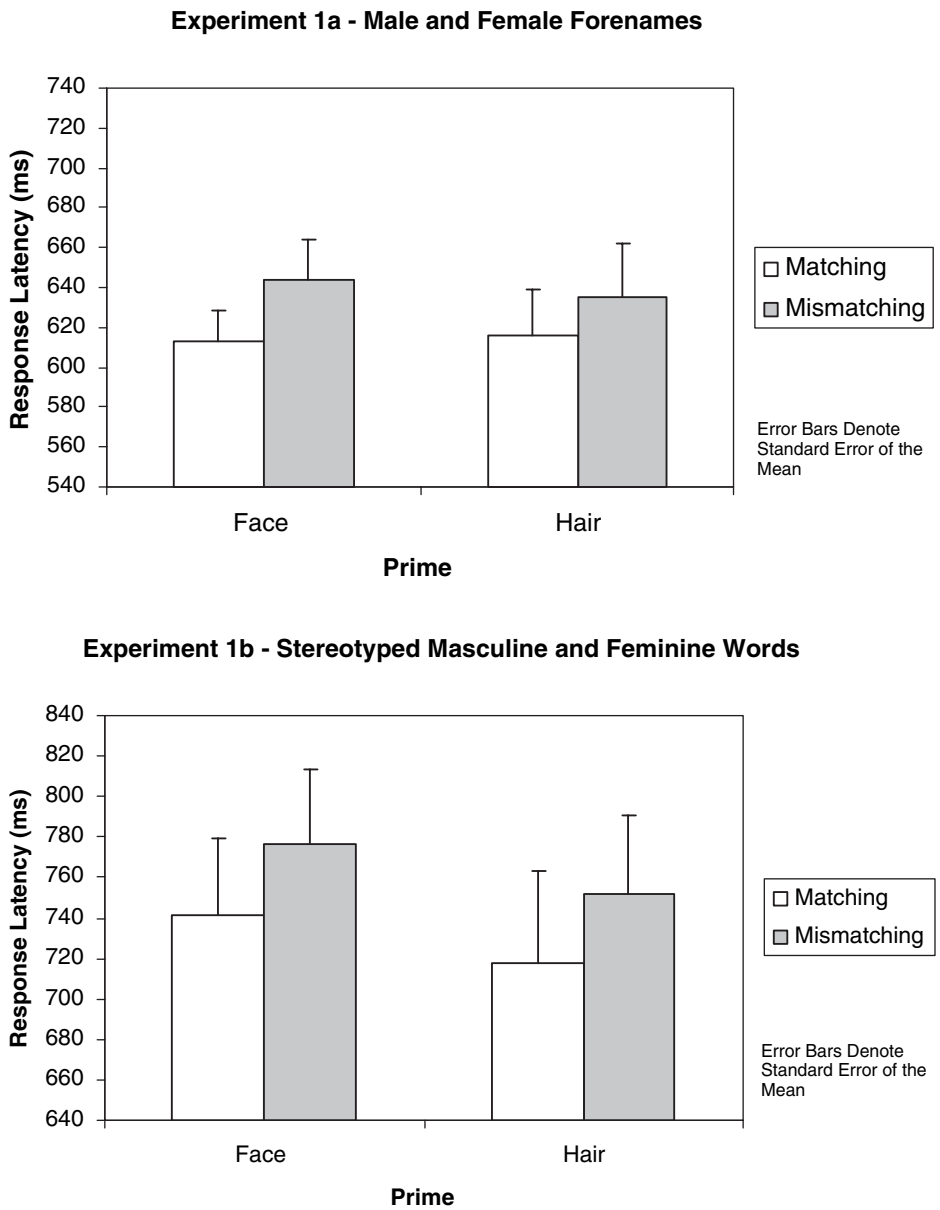

Figure 2. Task performance as a function of prime and trial type (Expt 1a, top panel; Expt 1b, bottom panel)

DOI: 10.1002/ejsp

mismatching trials (respective *M*s: 730 vs. 764 milliseconds). Again, neither the main effect of Prime nor the Prime × Trial Type interaction was significant, both Fs < 1 (see Figure 2, bottom panel).

The results of Expts 1a and 1b confirm that hair cues alone are sufficient to trigger category and stereotype activation. While long hair triggered access to female knowledge, short hair primed the contents of generic beliefs about males. Identical effects were observed when intact faces served as the priming stimuli. These findings are noteworthy as they provide further evidence for the utility of feature-based accounts of person construal (Schyns & Oliva, 1999; Schyns et al., 2002; Zebrowitz, 1997). In addition, however, they extend previous work in a couple of important ways. First, they demonstrate that category-specifying features need not be embedded in intact facial primes to moderate the process of person categorization (e.g., Blair et al., 2004, 2005; Livingston & Brewer, 2002; Locke et al., 2005). Second, they highlight the impact that isolated facial cues exert in tasks in which perceivers are not explicitly required to identify the sex of targets (Schyns et al.)—mere registration of a featural cue is sufficient to trigger category activation.

That isolated person-related features can trigger stereotype activation has important implications for everyday social interaction. To date, researchers have directed limited attention to the cues that initiate stereotypical thinking (but see Blair et al., 2004, 2005; Livingston & Brewer, 2002). Instead, empirical emphasis has centered on the products of this mode of thought. Understanding the minimal conditions under which stereotyping is activated, however, is also an issue worthy of consideration. As demonstrated herein, the mere detection of hair cues is sufficient to trigger the activation of sex stereotypes. What this suggests is that other featural cues (e.g., posture) may exert similar effects on the person perception process. Elsewhere, it has been shown that head motion can be used to establish the sex of targets (Hill & Johnston, 2001), thereby delineating another route through which person categorization can be triggered. A useful task for future research will, therefore, be to identify exactly which person-related features trigger the process of person construal.

EXPERIMENT 2 ELICITING A CATEGORICAL SEX CHANGE

If the registration of a diagnostic sex-specifying cue, such as a person's hairstyle, is sufficient to trigger category activation, a number of intriguing possibilities arise. In particular, could the presence of the cue ever prompt people to misconstrue the sex of a target (Schyns, 1998)? Consider, for example, two individuals, a woman with short, cropped hair and a man with long, flowing locks. Is it possible that these category-mismatching hair cues could induce people to assign the targets to the wrong sex (i.e., elicit a categorical sex change)? We suspect that it is, but only temporarily and under conditions in which the processing of facial information is compromised or obstructed in some way (Cloutier et al., 2005).

It is widely accepted that object categorization is characterized by a timeline in which the information extracted by the visual system shifts from course to fine-grained aspects of the available perceptual inputs (Marr, 1982). In face processing, it is possible that this temporal sequence of events may have a direct impact on the products of person construal. In the present context, for example, it suggests that during the initial stages of person perception, targets with long and short hair may be categorized as female and male respectively, even if these judgments are inaccurate. Later in the processing stream, however, these errors of construal are likely to be overridden by veridical categorical responses as perceptual operations have sufficient time to extract additional sex-specifying information from the face (e.g., eyebrow shape and thickness). In other words, how much time is available to process a face may determine whether or not hair cues give rise to errors of categorical

DOI: 10.1002/ejsp

construal (Cloutier et al., 2005). By varying the presentation duration of face primes (i.e., 25 vs. 200 milliseconds), we explored this issue in our final experiment.

Method

Participants and Design

Twenty undergraduates from the University of Aberdeen completed the experiment. The experiment had a 2 (Sex of Prime: male or female) × 2 (Length of Hair: short or long) × (Prime Duration: 25 or 200 milliseconds) × 2 (Trial Type: matching or mismatching) repeated measures design.

Procedure and Stimulus Materials

The experiment was identical to Expt 1a, but with some important modifications. First, only face primes were used prior to the presentation of male and female forenames. Second, the priming stimuli were presented for either 25 or 200 milliseconds (Cloutier et al., 2005). The priming faces comprised grayscale digital headshots (250 × 320 pixels) of 160 unfamiliar people (80 men and 80 women) in frontal pose, displaying neutral facial expressions. Four sets of priming stimuli were created: (i) males with short hair; (ii) males with long hair; (iii) females with short hair; and (iv) females with long hair (see Figure 1, bottom panel). Each trial comprised the appearance of a fixation cross which remained on screen for 500 milliseconds. This was then replaced by a priming face which appeared for 25 or 200 milliseconds, followed by a forename which remained on screen until a response was made. The inter-trial interval was 1500 milliseconds. The prime-presentation durations were based on previous investigations into the perceptual efficiency of person categorization (Cloutier et al.). The order of presentation of trials was randomized and the computer measured the accuracy and latency of each response. On completion of the task, participants were debriefed and dismissed.

RESULTS AND DISCUSSION

Trials on which errors were made on the task were excluded from the analysis (3.5% of trials). Median response times were computed for each participant and the resulting data were submitted to a 2 (Sex of Prime: male or female) × 2 (Length of Hair: short or long) × (Prime Duration: 25 or 200 milliseconds) × 2 (Trial Type: matching or mismatching) repeated measures ANOVA. The analysis revealed a main effect of Trial Type [$F(1,19) = 4.86$, $p < .05$, $d = .506$] and a Sex of Prime × Length of Hair × Trial Type interaction [$F(1,19) = 10.23$, $p < .01$, $d = .733$]. These effects were subsumed, however, within a Sex of Prime × Length of Hair × Prime Duration × Trial Type interaction, $F(1,19) = 5.09$, $p < .05$, $d = .518$. To further explore the effects of theoretical interest, separate 2 (Sex of Prime: male or female) × 2 (Length of Hair: short or long) × 2 (Trial Type: matching or mismatching) repeated measures ANOVAs were undertaken on the data obtained in each prime-duration condition (see Figure 3).

Analysis of the 200 milliseconds prime-duration condition revealed only a main effect of Trial Type [$F(1,19) = 8.51$, $p < .01$, $d = .669$] on task performance, such that responses were faster on matching than mismatching trials (respective *M*s: 672 vs. 695 milliseconds, see Figure 3, top panel). As expected, a quite different pattern of effects emerged in the 25 milliseconds prime-duration condition.

DOI: 10.1002/ejsp

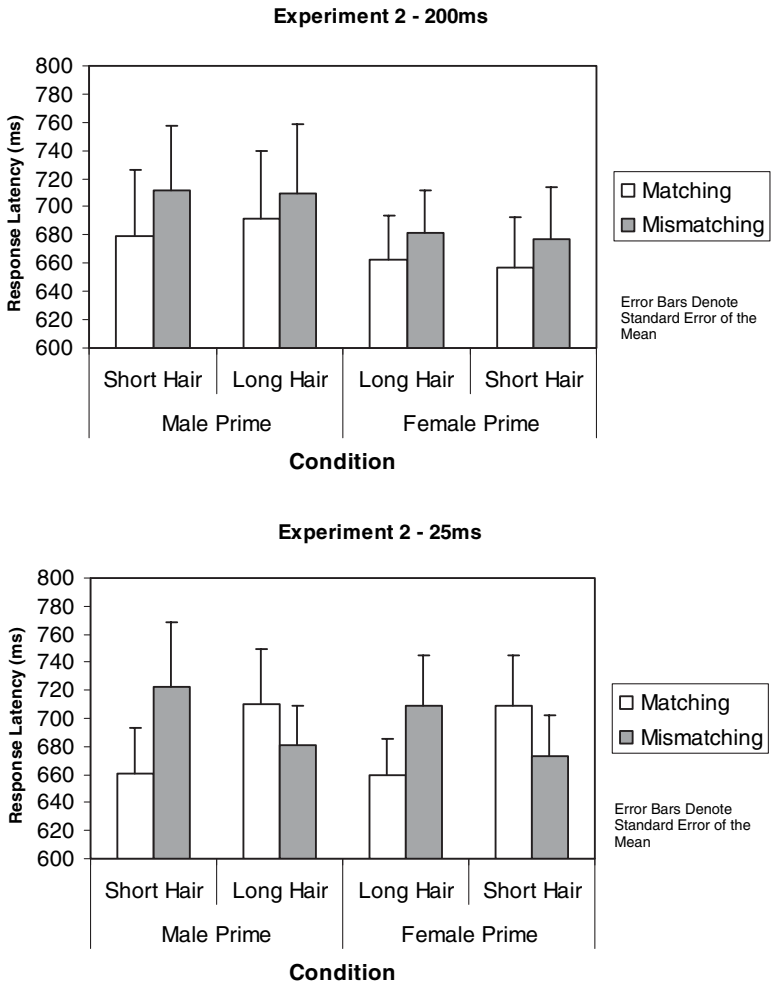

Figure 3. Task performance as a function of prime, hair length, and trial type (200 milliseconds prime, top panel; 25 milliseconds prime, bottom panel)

Specifically, a Sex of Prime × Length of Hair × Trial Type interaction was observed, $F(1,19) = 11.88$, $p < .01$, $d = .791$ (see Figure 3, bottom panel). Closer inspection of this interaction revealed that whereas standard priming effects (i.e., matching trials < mismatching trials) emerged when male primes had short hair [$t(19) = -2.28$, $p < .05$, $d = .523$] and female primes had long hair [$t(19) = -2.49$, $p < .05$, $d = .571$], priming was reversed (i.e., matching trials = > mismatching trials) when female primes had short hair [$t(19) = 2.53$, $p < .05$, $d = .580$]. A similar reversed-priming effect was observed when male primes had long hair, although this effect was not reliable.

These findings corroborate our assumption that hair cues can prompt errors of categorical construal when people have insufficient time to extract additional sex-specifying information from a face. When faces were presented very briefly (i.e., 25 milliseconds), participants categorized targets on the basis of their hair, even when this classification was at odds with other information conveyed by the face. For example, as indexed by the emergence of a reversed-priming effect, females with short hair triggered access to knowledge about men. When, however, additional time was available to extract additional

DOI: 10.1002/ejsp

sex-specifying information from faces (i.e., 200 milliseconds), hair cues no longer led participants astray and veridical categorical responses were returned.

The current findings underscore the importance of examining the time-course of person construal. Depending upon how much time is available to process a face, perceivers seemingly extract quite different solutions to the problem of person construal. As demonstrated herein, a rapid (though errant) feature-driven categorization is overridden by an accurate classification when additional sex-specifying information is extracted from the face. In this way, person categorization is a puzzle for the perceptual system, a puzzle that can offer quite different categorical solutions (Schyns & Oliva, 1999; Schyns et al., 2002). When sufficient time is available to process canonical facial representations, it is unlikely that errors of categorical construal will arise. In many settings, however, perceivers do not enjoy the luxury of these optimal processing conditions; instead target-related judgments are based on a rapid assessment of impoverished stimulus inputs (Cloutier et al., 2005). Of interest, therefore, are the questions of why, when, and for whom limitations in perceptual processing can prompt the generation of errors of categorical assignment? Closer inspection of the temporal aspects of person construal, we suspect, is likely to illuminate this issue.

GENERAL DISCUSSION

Person perception poses a range of challenges to individuals as they strive to make sense of other social agents. Notable among these is the issue of how differences in facial appearance may modulate the strategies that people employ to facilitate their dealings with others (Macrae & Bodenhausen, 2000). With regard to this fundamental social-cognitive question, recent research tells a pretty consistent tale. Differences in the typicality of faces moderate the activation and application of generic knowledge structures in memory, such that targets with facial features deemed characteristic of the groups to which they belong, elicit more stereotype-based responses than their less prototypic counterparts (Blair et al., 2002, 2004, 2005; Livingston & Brewer, 2002; Locke et al., 2005). The current findings extend these observations in a number of important ways. First, featural cues need not be embedded in intact faces to modulate the products of person construal. Second, mere detection of a diagnostic sex-specifying cue (i.e., hairstyle) is sufficient to trigger category activation, even when attention is not directed towards the cue (Macrae & Bodenhausen). Third, when face processing is constrained through rapid stimulus presentation (Cloutier et al., 2005), cue detection can prompt the generation of errors of construal; specifically, categorical sex changes. Collectively, these findings highlight the potent influence that category-specifying facial features exert on the process and products of person construal.

That person categorization can be triggered quickly and easily through the registration of a category-specifying facial feature has important implications for extant models of social perception (Bodenhausen & Macrae, 1998; Brewer, 1988; Fiske & Neuberg, 1990). One of the vexing issues in social cognition is why people tend to construe others on the basis of the groups to which they belong, rather than in terms of their unique, personal identities. While conventional wisdom asserts that this preference derives from the inherent cognitive efficiency of categorical thinking (Macrae & Bodenhausen, 2000), it is likely that perceptual factors also contribute to the dominance of category-based processing (Cloutier et al., 2005). Of relevance is the ease with which person-based representations (i.e., category-based vs. identity-based) can be activated in memory. Whereas sex categorization can be triggered via the detection of simple featural properties of the face—notably a person's hairstyle—judgments of identity require more complex patterns of configural information (Bartlett & Searcy, 1993; Diamond & Carey, 1986; Farah, Tanaka, & Drain, 1995; Maurer, Le Grand, & Mondloch, 2002; Rhodes, Brake, & Atkinson, 1993; Searcy & Bartlett, 1996). What this suggests is that, through the rapid and efficient detection of

DOI: 10.1002/ejsp

category-cueing facial features, perceptual processes provide the initial impetus for people to think about others in a categorical manner (Schyns, 1998; Schyns et al., 2002). One ironic limitation of social-cognitive models of person perception is that little emphasis is actually given to perception during the process of person construal (Bodenhausen & Macrae; Brewer; Fiske & Neuberg). If process models are to provide a complete account of the operations through which people come to understand others, this oversight requires attention (Mason & Macrae, 2004).

Consideration should also be given to the time-course of person construal. As demonstrated herein, depending on the time available to process a stimulus, quite different categorical solutions can be extracted from faces. To delineate the temporal aspects of person construal, researchers have recently turned to electrophysiological measures of brain activity, such as event-related potentials (ERP), functional magnetic resonance imaging (fMRI), and magnetoencephalography (MEG). These neurophysiological investigations have suggested that early visual processing (e.g., 145–185 milliseconds post stimulus onset) is attentive to differences in the sex, age, and race of social targets (e.g., Ito & Urland, 2003; Mouchetant-Rostaing & Giard, 2003, Mouchetant-Rostaing, Giard, Bentin, Aguera, & Pernier, 2000). The functional significance of these effects, however, is a matter of debate. For example, do these neural events index person categorization (Ito & Urland) or simply the perceptual extraction of featural information from faces? Interestingly, Liu, Harris, and Kanwisher (2002) have reported that what appears to be a face-selective cortical response (M100) occurring 100 milliseconds post-stimulus onset actually shows a stronger response to stimuli depicting face parts than entire facial configurations, thereby suggesting that these neural events index feature extraction rather than classification of the target face into some semantically meaningful category (see also Mouchetant-Rostaing & Giard). What this suggests is that early, task-independent visual processes extract featural information from faces, information that undoubtedly serves as the basis for—but should not be seen as interchangeable with—subsequent target categorization (VanRullen & Thorpe, 2001). One task for future research will be to chart the relationship between feature extraction and category activation and to identify the neural operations that support these fundamental aspects of person construal.

In sum, the current findings further underscore the importance of feature-based processing in a core social-cognitive activity—sex categorization. When it comes to sexing others, hair cues clearly play a pivotal role in the process of person construal, indeed these cues alone are capable of triggering the activation of category-based knowledge structures in memory. Of course, what exactly hair cues mean to people in a categorical sense is subject to considerable cultural and historical variation, thus the current work touches upon interesting socio-cultural aspects of the person perception process. Whatever the prevailing societal mores, however, it is likely that through cultural socialization and repeated exposure to confirmatory instances, hair cues will guide sex categorization in a predictable, though occasionally errant, manner.

ACKNOWLEDGEMENTS

We thank Leonel Garcia-Marques for his comments and advice. During this research, CNM was supported by a Royal Society-Wolfson Fellowship.

REFERENCES

Allport, G. W. (1954). *The nature of prejudice*. Reading, MA: Addison-Wesley.
Bartlett, J. C., & Searcy, J. H. (1993). Inversion and configuration of faces. *Cognitive Psychology, 25*, 281–316.

DOI: 10.1002/ejsp

Blair, I. V., Chapleau, K. M., & Judd, C. M. (2005). The use of Afrocentric features as cues for judgment in the presence of diagnostic information. *European Journal of Social Psychology, 35*, 59–68.
Blair, I. V., Judd, C. M., & Chapleau, K. M. (2004). The influence of Afrocentric facial features in criminal sentencing. *Psychological Science, 15*, 674–679.
Blair, I. V., Judd, C. M., Sadler, M. S., & Jenkins, C. (2002). The role of Afrocentric facial features in person perception: Judging by features and categories. *Journal of Personality and Social Psychology, 83*, 5–25.
Bodenhausen, G. V., & Macrae, C. N. (1998). Stereotype activation and inhibition. In R. S. Wyer, Jr. (Ed.), *Stereotype activation and inhibition: Advances in social cognition* (Vol. 11, pp. 1–52). Hillsdale, NJ: Erlbaum.
Brewer, M. B. (1988). A dual process model of impression formation. In R. S. Wyer, Jr., & T. K. Srull (Eds.), *Advances in social cognition* (Vol. 1, pp. 1–36). Hillsdale, NJ: Erlbaum.
Brown, E., & Perrett, D. I. (1993). What gives a face its gender? *Perception, 22*, 829–840.
Bruce, V., Burton, A. M., Hanna, E., Healey, P., Mason, O., Coombes, A.Fright, R., & Linney, A. (1993). Sex discrimination: How do we tell the difference between male and female faces? *Perception, 22*, 131–152.
Bruce, V., & Young, A. W. (1986). Understanding face recognition. *British Journal of Psychology, 77*, 305–327.
Burton, A. M., Bruce, V., & Dench, N. (1993). What's the difference between men and women? Evidence from facial measurement. *Perception, 22*, 153–176.
Cloutier, J., Mason, M. F., & Macrae, C. N. (2005). The perceptual determinants of person construal: Reopening the social-cognitive toolbox. *Journal of Personality and Social Psychology, 88*, 885–894.
Crawford, J. T., Leynes, P. A., Mayhorn, C. B., & Bink, M. L. (2004). Champagne, beer, or coffee? A corpus of gender-related and neutral words. *Behavior Research Methods, Instruments & Computers, 36*, 444–458.
Diamond, R., & Carey, S. (1986). Why faces are and are not special: An effect of expertise. *Journal of Experimental Psychology: General, 115*, 107–117.
Farah, M. J., Tanaka, J. W., & Drain, H. M. (1995). What causes the face inversion effect? *Journal of Experimental Psychology: Human Perception and Performance, 21*, 628–634.
Fiske, S. T., & Neuberg, S. L. (1990). A continuum model of impression formation from category based to individuating processes: Influences of information and motivation on attention and interpretation. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 3, pp. 1–74). San Diego, CA: Academic Press.
Gilbert, D. T., & Hixon, J. G. (1991). The trouble of thinking: Activation and application of stereotypic beliefs. *Journal of Personality and Social Psychology, 60*, 509–517.
Goshen-Gottstein, Y., & Ganel, T. (2000). Repetition priming for familiar and unfamiliar faces in a sex-judgment task: Evidence for a common route for the processing of sex and identity. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 26*, 1198–1214.
Haxby, J. V., Hoffman, E. A., & Gobbini, M. I. (2000). The distributed human neural system for face perception. *Trends in Cognitive Sciences, 4*, 223–233.
Haxby, J. V., Hoffman, E. A., & Gobbini, M. I. (2002). Human neural systems for face recognition and social communication. *Biological Psychiatry, 51*, 59–67.
Hill, H., & Johnston, A. (2001). Categorizing sex and identity from the biological motion of faces. *Current Biology, 11*, 880–885.
Ito, T. A., & Urland, G. R. (2003). Race and gender on the brain: Electrocortical measures of attention to the race and gender of multiply categorizable individuals. *Journal of Personality and Social Psychology, 85*, 616–626.
Kunda, Z., & Spencer, S. J. (2003). When do stereotypes come to mind and when do they color judgment? A goal-based theoretical framework for stereotype activation and application. *Psychological Bulletin, 129*, 522–544.
Liu, J., Harris, A., & Kanwisher, N. (2002). Stages of processing in face perception: An MEG study. *Nature Neuroscience, 5*, 910–916.
Livingston, R. W., & Brewer, M. B. (2002). What are we really priming? Cue-based versus category-based processing of facial stimuli. *Journal of Personality and Social Psychology, 82*, 5–18.
Locke, V., Macrae, C. N., & Eaton, J. L. (2005). Is person categorization modulated by goodness-of-category fit? *Social Cognition, 23*, 417–428.
Macrae, C. N., & Bodenhausen, G. V. (2000). Social cognition: Thinking categorically about others. *Annual Review of Psychology, 51*, 93–120.
Macrae, C. N., Quinn, K. A., Mason, M. F., & Quadflieg, S. (2005). Understanding others: The face and person construal. *Journal of Personality and Social Psychology, 89*, 686–695.
Maddox, K. B., & Gray, S. A. (2002). Cognitive representations of Black Americans: Re-exploring the role of skin tone. *Personality and Social Psychology Bulletin, 28*, 250–259.
Marr, D. (1982). *Vision*. San Francisco: W. H. Freeman.

DOI: 10.1002/ejsp

Mason, M. F., Cloutier, J., & Macrae, C. N. (2006). On construing others: Category and stereotype activation from facial cues. *Social Cognition, 24*, 540–562.
Mason, M. F., & Macrae, C. N. (2004). Categorizing and individuating others: The neural substrates of person perception. *Journal of Cognitive Neuroscience, 16*, 1785–1795.
Maurer, D., Le Grand, R., & Mondloch, C. J. (2002). The many faces of configural processing. *Trends in Cognitive Sciences, 6*, 255–260.
Mouchetant-Rostaing, Y., & Giard, M. H. (2003). Electrophysiological correlates of age and gender perception on human faces. *Journal of Cognitive Neuroscience, 15*, 900–910.
Mouchetant-Rostaing, Y., Giard, M. H., Bentin, S., Aguera, P. E., & Pernier, J. (2000). Neurophysiological correlates of face gender processing in humans. *European Journal of Neuroscience, 12*, 303–310.
Quinn, K. A., & Macrae, C. N. (2005). Categorizing others: The dynamics of person construal. *Journal of Personality and Social Psychology, 88*, 467–479.
Rhodes, G., Brake, S., & Atkinson, A. P. (1993). What's lost in inverted faces? *Cognition, 47*, 25–57.
Schyns, P. G. (1998). Diagnostic recognition: Task constraints, object information and their interactions. *Cognition, 67*, 147–179.
Schyns, P. G., Bonnar, L., & Gosselin, F. (2002). Show me the features! Understanding recognition from the use of visual information. *Psychological Science, 13*, 402–409.
Schyns, P. G., & Oliva, A. (1999). Dr. Angry and Mr. Smile: When categorization flexibly modifies the perception of faces in rapid visual presentations. *Cognition, 69*, 243–265.
Searcy, J. H., & Bartlett, J. C. (1996). Inversion and processing of component and spatial-relational information in faces. *Journal of Experimental Psychology: Human Perception and Performance, 22*, 904–915.
Uhlmann, E., Dasgupta, N., Elgueta, A., Greenwald, A. G., & Swanson, J. (2002). Subgroup prejudice based on skin color among Hispanics in the United States and Latin America. *Social Cognition, 20*, 198–225.
VanRullen, R., & Thorpe, S. J. (2001). The time course of visual processing: From early perception to decision-making. *Journal of Cognitive Neuroscience, 13*, 454–461.
Zebrowitz, L. A. (1997). *Reading faces: Window to the soul?*. Boulder, CO: Westview Press.

DOI: 10.1002/ejsp