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People Automatically Extract Infants' Sex from Faces

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Abstract People can reliably distinguish the sex of faces across age groups. Rates of accuracy are lower for infants, however, likely because they lack the pronounced sexually dimorphic features that develop during puberty. Given that previous research has shown that perceivers categorize adult sex automatically, we wondered whether this would extend to the faces of infants for whom sex is less legible. We tested this using a semantic priming paradigm in which infant faces preceded the categorization of stereotypically male and female names. Results showed that participants categorized the sex of male names significantly faster following perceptions of male versus female infant faces (though female faces did not significantly facilitate the processing of female names). The asymmetry in interference for male but not female faces supports evidence for a male default in conceptions of sex among infants previously found for adults. Individuals may therefore process sex automatically in the absence of overt cues (e.g., post-pubertal sexually dimorphic features or stereotypical clothing), providing additional evidence for the depth and flexibility of social categorization.

Keywords Age · Face · Person perception · Sex categorization · Automaticity

Humans possess a remarkable ability to quickly, accurately, and effortlessly extract information from brief observations of others' behavior and appearance (Ambady and Rosenthal 1992; Zebrowitz 1997). Sometimes this information is valid, whereas in other domains it is not (Rule et al. 2013). One set of judgments that people do make with high accuracy is the categorization of others along the three basic social dimensions of age, race, and sex (Brewer 1988; Fiske and Neuberg 1990). Data suggest that individuals

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classify targets on these characteristics rapidly, spontaneously, and automatically at first sight (Macrae and Bodenhausen 2000).

As one of the most basic forms of social perception, sex categorization is typically a facile endeavor. People can extract information about adult sex efficiently from facial features (e.g., eyes and brows; Brown and Perrett 1993), cues in voice and speech (Crosby and Nyquist 1977), body movement (Kozlowski and Cutting 1977), and even body shape (i.e., waist-to-hip ratios; Johnson and Tassinary 2005). Moreover, accurate sex categorization occurs both explicitly (Brown and Perrett 1993; Freeman and Ambady 2011; Johnson and Tassinary 2005) and implicitly (Macrae and Martin 2007) with nearly perfect accuracy (Macrae and Bodenhausen 2000), largely because of the pronounced sexual dimorphism in facial features that develops at puberty (Antoszewska and Wolanski 1991; Brown and Perrett 1993). Evolutionary theories thus suggest that perceivers' robust capacity for sex categorization may be due, at least in part, to its importance for mate selection (Macrae et al. 2002; Thornhill and Gangestad 1996). Yet, considering its importance, we wondered whether the rapid, spontaneous, and implicit nature of sex categorization might generalize to targets who have not yet reached sexual maturity.

Previous research suggests that people can accurately perceive others' sex at a variety of ages, including infancy (Wild et al. 2000). For example, adults and school-aged children can accurately extract the sex of newborn babies and young children better than chance (Kaminski et al. 2011; Porter et al. 1984; Round and Deheragoda 2002; Wild et al. 2000). Accuracy tends to be lower for newborns and children than for adults, however; perhaps because pubertal changes highlight sex differences in appearance (Antoszewska and Wolanski 1991; Brown and Perrett 1993; see also Cheng et al. 2001). Wild et al. (2000) also found that adults took longer to decide the sex of children than the sex of adults, suggesting that recognizing prepubescent individuals' sex requires conscious deliberation and controlled processing. Furthermore, Cloutier et al. (2014) showed that adults' sex influenced perceptions of their age but children's sex did not, suggesting that people may not even process sex when categorizing children's or infants' faces. Rather, judgments of infants' sex may rely heavily on environmental and social cues: Stern and Karraker (1989), for instance, found that clothing babies in gender-neutral attire often altered perceptions of their sex, rendering perceivers' categorizations malleable to whichever gender labels the experimenters assigned. Parents accordingly go to great lengths to express the sex of their child through toys, clothing, and surroundings (Rheingold and Cook 1975), and perceivers grow distraught, frustrated, and angry when parents seem to obstruct recognition of their child's sex (Poisson 2011). Although people may categorize adult sex automatically (e.g., Brewer 1988), it seems they need to exert deliberate effort to categorize the sex of neonates and young children because of its ambiguity.

Previous research suggests that people may categorize ambiguous group membership from faces both explicitly (i.e., with deliberation) *and* implicitly, however. Similar to perceptions of neonates, people perceive all of sexual orientation (Rule and Ambady 2008; Rule et al. 2008), political affiliation (Rule and Ambady 2010; Samochowiec et al. 2010), and religious following (Rule et al. 2010) from faces and facial features significantly better than chance, despite the absence of obvious visual markers (see Tskhay and Rule 2013, for review). Although people know some of the features that they use to make these judgments (e.g., hairstyles), they process other features without conscious awareness (e.g., cues in the eyes and mouth; Rule et al. 2008).

Similar implicit processes may facilitate perceptions of neonates' sex. Indeed, research suggests that multiple indirect cues may aid sex categorizations (see Antoszewska and Wolanski 1991). For instance, O'Toole et al. (1997) found that holistic compositions of

features support sex categorization beyond specific features (e.g., Brown and Perrett 1993). Moreover, Wild et al. (2000) observed a bias to categorize children's faces as male (consistent with the socially-constructed male default evident among adults; Zaraté and Smith 1990) and that younger participants categorized sex less accurately than older participants, perhaps because their implicit representations of sex were not yet well formed. People may therefore rely upon their implicit, default conceptions to disambiguate infants' sex in the absence of obvious cues (e.g., adornment or post-pubertal sexually dimorphic facial features). Like sexual orientation, political affiliation, and religious ideology, delineating infants' sex may therefore constitute another instance of perceptually ambiguous social categorization.

We tested this possibility using a semantic priming task adapted from that used by Macrae and Martin (2007). Participants categorized the sex of names presented to them on a computer screen. Critically, male or female target faces preceded each name. If people process infant sex implicitly, we would expect them to categorize the sex of the names more quickly when the sex of the face matches the sex of the name; but more slowly when the sex of the name and sex of the face do not match. In other words, brief exposure to male (female) faces should activate thoughts about male (female) concepts to consequently facilitate (if congruent) or inhibit (if incongruent) processing the succeeding names. This would suggest that people process infant sex implicitly, extending previous accounts of the deliberative processes involved in infant sex judgments (e.g., Stern and Karraker 1989) and expanding research demonstrating automaticity in the social categorization of both obvious and ambiguous social groups (e.g., Rule et al. 2009).

Methods

Participants

A total of 57 North American undergraduates participated in the study for partial course credit in an introductory psychology course or for monetary compensation. We excluded the data for five participants from analysis because they did not finish the study (final $N = 52$; 26 female, 26 male; $M_{age} = 20.88$ years, $SD = 3.23$ years). Only five participants reported extended exposure to infants (i.e., more than 30 hours per week in response to the request "Please indicate how much exposure you have to children in a typical week in hours").[1] We determined our sample size based on a power analysis assuming a large effect size (as sex categorization studies typically find strong effects; e.g., Cohen's $d = 0.65$; Macrae and Martin 2007) in a within-subjects design to assure more than 99 % power.

Stimuli

We downloaded photographs of 100 Caucasian male ($n = 50$) and female ($n = 50$) infants 1–24 months old from online websites where parents had publicly shared pictures of their children.[2] The infants were looking directly into the photographer's camera in all photos.

[1] Participants did not report spending much time with children: $Mdn = 1$ hours/week, $SD = 10.35$. All results remained consistent when we removed the five outlier participants from the sample.

[2] The photographs of two male and one female infant had to be excluded from analysis due to a programming error that caused the pictures to not load during the experiment. We excluded a picture of another female infant from the database due to low image quality.

We converted each image to grayscale, removed it from its original background, cropped it to the limits of the face, and standardized it to a uniform height. Furthermore, we generated a list of 50 male (e.g., Paul) and 50 female (e.g., Paula) names to serve as targets. Pilot testing revealed that participants consistently assigned the correct sex to the names ($N = 30$; $M = 99$ %, $SD = 2$ %).

Procedure

We used a classic semantic priming paradigm to determine whether participants implicitly categorized the infants according to their sex (Macrae and Martin 2007). On each of 96 trials (one per photo), participants saw a fixation cross for 500 ms, followed by an infant's face presented for 200 ms, which was then replaced by one of the male or female names. We instructed the participants to categorize the name according to its sex via key-press as quickly as they could once it appeared. The trials were separated by a 1500-ms inter-trial interval. Half of the male faces were followed by male names (24 trials) and half were followed by female names (24 trials); reciprocally, half of the female faces were followed by female names (24 trials) and the other half were followed by male names (24 trials). Each face and name appeared in random order and only once.

Analytic Strategy

We first eliminated all trials in which participants categorized the name incorrectly (i.e., identified the male name as female, or vice versa; 8.39 % of all trials). We then removed reaction times less than 300 ms (0.62 %) and greater than three standard deviations from each participant's individual mean (1.92 %), and computed the median reaction time for each of the four trial types within each participant (e.g., Chen and Bargh 1999). The grand mean of participants' reaction time scores confirmed that they worked to categorize the names quickly, as instructed ($M = 858.22$ ms, $SD = 218.63$ ms). Prior to analysis, we transformed the participants' median scores to reflect a normal distribution using log-transformation ($Skew = .72$; Lilliefors Test: $D = .06$, $p = .06$) and then submitted them to a 2 (Name: male, female) × 2 (Face: male, female) within-subjects ANOVA.

Results

Participants' reaction times did not significantly vary according to the sex of the face, $F(1, 51) = 2.55$, $p = .12$, $\eta^2 = .002$; however, the participants categorized the male names faster than the female names, $F(1, 51) = 5.45$, $p = .02$, $\eta^2 = .01$. More important, the predicted Name × Face interaction qualified this main effect, $F(1, 51) = 22.07$, $p < .001$, $\eta^2 = .02$. We thus decomposed the interaction according to the sex of the priming face. This showed that participants categorized male names faster than female names when they followed male faces, $t(51) = 4.24$, $p < .001$, $r = .51$, but categorized male and female names at a similar pace when they followed female faces, $t(51) = 0.40$, $p = .69$, $r = .06$ (see Fig. 1). This suggests that male faces affected name categorization but female faces did not, perhaps because male faces represent the social default in North American society and female identity serves as a modification of this identity in perceivers' minds (e.g., Zaraté and Smith 1990). Including the participants' own sex as a moderator did not change

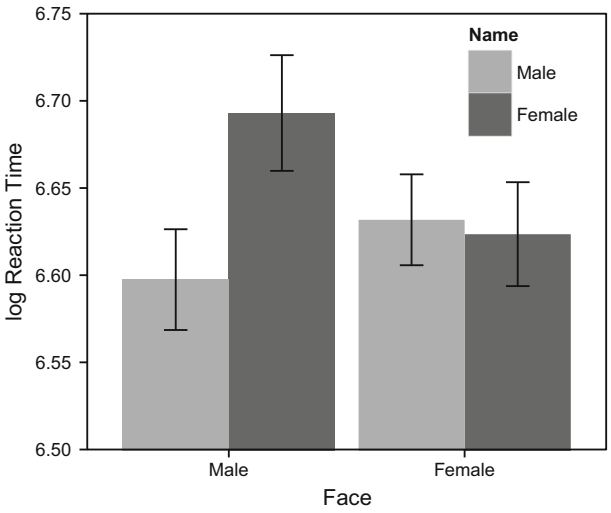

Fig. 1 Log-transformed means and standard errors for participants' reaction times in categorizing names as male and female following the presentation of photos of male and female infants' faces

the pattern of results and the three-way interaction with participant sex did not reach traditional levels of statistical significance, $F(1, 50) = 1.21$, $p = .91$, $\eta^2 < .001$.

Discussion

The present results suggest that the automatic processes underlying accurate perceptions of sex may extend beyond adult targets to include infants (e.g., Macrae and Martin 2007). Specifically, priming participants with photos of infant male faces facilitated the speed with which they categorized male versus female names. This suggests that perceivers may categorize infant sex automatically by referencing the default male category (Wild et al. 2000; Zaraté and Smith 1990). Because default categorization is largely an inherent and uncontrolled process (e.g., Tskhay and Rule 2015; Zaraté and Smith 1990), this supports the conclusion that people process infant sex implicitly. Socially-constructed default categories may therefore facilitate the processing of both obvious and ambiguous social category information.

On a broader level, these data support previous theories describing sex as a basic social dimension that is robust in its expression and detection (e.g., Brewer 1988). Multiple redundant facial features efficiently communicate adults' sex (e.g., Brown and Perrett 1993). Because infant sex is less discernible, however, people tend to rely on adornments and objects (e.g., clothing, toys) to convey and detect their sex (Stern and Karraker 1989). The present research expands upon this by demonstrating that people may reliably perceive infants' sex without using such explicit cues. Rather, early hormonal growth patterns may produce sufficient sexual dimorphism to allow quick detection of infant sex (see also Antoszewska and Wolanski 1991; O'Toole et al. 1997). Moreover, people may devote considerable cognitive and perceptual resources to distinguishing the sex of targets across the lifespan, even if only nonconsciously.

In addition, the current findings help to expand theoretical understanding of social categorization. Although researchers have thoroughly documented the efficiency with which individuals perceive, process, and categorize obvious social categories (i.e., age,

race, and sex), the present research adds to recent studies suggesting that these privileges may extend to less overt distinctions (see Macrae and Quadflieg 2010). For instance, people appear to categorize others' sexual orientation and religious affiliation without provocation (Rule et al. 2007, 2010). Although adult sex is typically obvious, infant sex is fairly ambiguous (e.g., Wild et al. 2000). The present work thus helps to demonstrate the robustness of sex categorization by demonstrating the capacity for its automaticity to withstand moderation via its intersection with other social groups, subsequently highlighting social categorization as adaptive, flexible, and persistent.

Although this study helps to inform the nature of sex categorization, it also suffers from several limitations. First, we observed asymmetrical results whereby male faces facilitated the categorization of male names but female faces did not facilitate the categorization of female names. We speculated that this might result from the default processing inherent to men's faces (e.g., Smith and Zarate 1992). Although further investigation is needed to confirm this, we expect that parallel results might be found in prior research employing the same task with adult faces given that the male default strongly influences adult social categorization (the data for male and female primes were not reported separately in that report, however; Macrae and Martin 2007). Overall, this asymmetry does not obviate the conclusion that people perceive infant sex automatically, though it does introduce nuance to it. Second, using photographs from an online website might have inflated the results if parents had posted particularly sexually dimorphic images of their children. Our standardization procedures should have degraded such labors considerably, however, as most efforts to express infant sex manifest in apparel and other extra-facial cues not visible in the images that the participants viewed (Rheingold and Cook 1975).[3] Similarly, using photos found online prevented us from knowing the infants' exact ages. Future work may thus wish to test a larger set of laboratory-controlled stimuli that would allow greater control over the variability in targets' ages and manner of presentation. Doing so might also permit longitudinal testing to establish the milestones at which sex becomes legible through automatic processing.

In sum, we found evidence that people automatically process the sex of infants. These results therefore extend previous research by demonstrating that the implicit recognition of sex need not rely on overt cues, such as post-pubertal sexual dimorphism or explicit adornment. Moreover, they provide additional evidence that social categorization is flexible and robust, implicitly incorporating information from perceptually ambiguous cues to discern individuals' group membership. Future work should examine the details of variability in the features and processes leading to accurate categorizations of sex and other basic social categories to further understanding of the nuance, scope, and boundaries of social categorization.

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[3] Pilot testing of the images indeed revealed that the participants categorized the infants' faces more accurately than chance, though less accurately than the rates usually found for adult faces (e.g., Cheng et al. 2001), $M_{A'} = .70$, $SD = .10$, $t(22) = 10.35$, $p < .001$, $r = .90$.

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