Infants’ Differential Processing of Female and Male Faces

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ABSTRACT—Infants show an interesting asymmetry in face processing: They are more fluent in processing female faces than they are at processing male faces. We hypothesize that such processing asymmetry results from greater experience with female faces than with male faces early in development. Asymmetrical face processing may have long-lasting implications for development of face recognition, development of knowledge structures regarding females and males, and social-information processing. We encourage researchers to use both female and male faces in their face-perception research and to conduct separate analyses for female and male faces.

KEYWORDS—face processing; gender categorization; face recognition; knowledge structures; information processing

Categorization is a fundamental information-processing capability that allows reliable recognition and response to novel examples of familiar category members. For example, if Ariana walks into an unfamiliar room containing a telephone, she knows she can use the phone to talk to someone even though she has never before seen this particular telephone. Categorization of objects enables people to allocate cognitive resources efficiently—Ariana will expend more energy in figuring out what to say on the phone than in determining how it works.

Because of the adaptive nature of categorization, it is not surprising that categorization abilities emerge early in infancy (e.g., Quinn, 2002). Such abilities facilitate infants’ early and rapid learning about the many different objects in the world. But what about categorization of people? Like categorizing objects, categorizing people has important benefits. For example, categorizing age allows one to interact with infants and children in a developmentally appropriate manner. Categorizing gender allows one to determine if a person would be an appropriate mate. There are, however, problems related to categorization of people—these categories could become linked to positive and negative attributions that might not be accurate characterizations of a particular member of that group. Thus, one byproduct of this otherwise adaptive process of categorization is the formation of stereotypes (e.g., Bargh & Chartrand, 1999).

Our work has focused on infants and the early origins of stereotypes, particularly on how infants recognize, evaluate, and categorize the facial appearance of adults. Our research in this area has led us to conclude that there is a potentially important asymmetry in how infants process male and female faces. Most of our research successes involved infants’ responses to female faces (e.g., Rubenstein, Kalakanis, & Langlois, 1999). Yet, our research failures were equally illuminating because they almost always involved infants’ responses to male faces (see Ramsey, Langlois, & Marti, 2005, for an overview).

ASYMMETRIES IN INFANT PROCESSING OF FACES

Two different types of studies illustrate the asymmetry we observed. First, as part of our research program to understand the cognitive mechanisms underlying infants’ preferences for attractive faces, we examined infants’ ability to abstract an averaged (summary) representation, or prototype, of sets of female or male faces. Abstracting a facial prototype from category examples is important because a prototype (a) can facilitate processing of new exemplar faces from that category; and (b) may guide interest toward faces, as infants visually prefer faces most similar to their prototype (Rubenstein et al., 1999). Although we found that infants formed prototypes of female faces (Rubenstein et al., 1999), we could not find evidence that they formed prototypes of male faces. This asymmetry suggests that infants’ initial prototype or representation of faces may be more female-like than male-like (Ramsey et al., 2005).

A second type of study, in which infants view male and female faces when they are paired together, shows another asymmetry: Infants look longer at female faces than they do at male faces (Quinn, Yahr, Kuhn, Slater, & Pascalis, 2002). We posit that infants visually prefer female faces to male faces because female faces are more similar than male faces are to the infant’s facial

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prototype. Interestingly, however, when infants view female faces only or male faces only, they spend more time looking at male faces than they do at female faces, particularly when the task is complex (Ramsey et al., 2005). Because female faces are not available to “compete” for infants’ attention in studies presenting male faces, longer looking times may reflect infants’ lack of expertise and lack of efficiency in processing male faces. Longer looking at male faces in the absence of female faces is particularly evident when the task requires recognition or categorical abstraction, perhaps because infants do not yet have a fully developed male face prototype to facilitate processing (Ramsey et al., 2005).

These asymmetries in our work and that of Quinn et al. (2002) prompted us to explore the infant face-perception literature further for asymmetries in other areas of face processing. We discovered that most studies use only female faces to evaluate infants’ reactions to faces. The lack of male-face studies caused us to question whether conclusions about infants’ face recognition, interest in faces, understanding of emotion, and development of social expectancies from the existing infant face-perception literature really generalized to all faces, male and female, as is typically assumed.

When we examined the few studies that included male stimuli, we found further evidence of differences in infants’ processing of female and male faces. First, 3- to 4-month-olds have more difficulty discriminating among male faces and subsequently recognizing them than they do female faces (Quinn et al., 2002). Second, older infants are more skilled at categorizing female faces than they are at categorizing male faces: Whereas 10-month-olds easily recognize that a sex-ambiguous female face does not belong with a group of sex-typical female faces, they have more difficulty excluding a sex-ambiguous male face from a group of sex-typical male faces (data interpretation of Younger & Fearing, 1999, by Ramsey et al., 2005). In addition, there is a lag between when infants recognize that female voices are associated with female faces and when male voices are associated with male faces; infants reliably match female faces and voices at 9 months (Poulin-Dubois, Serbin, Kenyon, & Derbyshire, 1994) but do not reliably match male faces and voices until 18 months. Even at 18 months, infants are more accurate at matching female faces and voices than they are at matching male faces and voices (Poulin-Dubois, Serbin, & Derbyshire, 1998).

Thus, the infant perception literature shows that (a) infants have more difficulty processing male faces than female faces, (b) infants prefer female to male faces, and (c) differential processing of male and female faces is related to the fluency with which infants form categories of male versus female faces. Why?

THE ROLE OF EXPERIENCE WITH FACES

Early visual experience with faces appears to be very important for specialized processing of upright relative to inverted faces and within-species face recognition (e.g., Nelson, 2001; Pas-
certain faces (e.g., female) during infancy results in expert processing of those faces (Nelson, 2001). Indeed, 9-month-olds perform almost like adults in being better able to recognize human faces than monkey faces, whereas 6-month-olds perform equally well in their recognition of human and monkey faces (Pascalis et al., 2002). The similarities between 9-month-olds and adults in their poorer recognition of monkey faces, as compared to 6-month-olds, is likely due to their greater experience with and specialization in processing human faces over monkey faces. Unlike infants’ experience with the native language relative to other languages and with human faces relative to monkey faces, the disparity between infants’ experience with female faces and their experience with male faces is not as large, making this a unique type of problem regarding discrepancies in experience. We suggest, therefore, that differences in early experience with faces can have qualitative, long-lasting impact on how male and female faces are processed, but that these processing disparities may be subtle.

**IMPLICATIONS OF EARLY DIFFERENTIAL PROCESSING**

What might be the enduring implications of differential processing of female and male faces? The fluency or ease with which infants more expertly discriminate, recognize, and categorize female faces relative to male faces has the potential to contribute to later face-recognition abilities, knowledge acquisition of the sex categories, and social-information processing.

Early fluency in processing female faces during infancy should contribute to a later advantage in adults’ recognition of female faces. Indeed, adult females are better at recognizing female faces than they are at recognizing male faces, and they perform better than males do at recognizing female faces (e.g., Lewin & Herlitz, 2002). Why should the advantage seen in both female and male infants’ recognition of female faces be sustained only in female adults? An important developmental task for young children is to learn about their gender. Because preschoolers typically learn about their own gender before they learn about the other gender (Martin & Halverson, 1981), girls may maintain or enhance their processing of female faces whereas boys may “lose” some of their expertise in processing female faces as male faces begin to compete for their attention. Obviously this proposed developmental pathway requires investigation and there are other mediating variables, but in a legal system that places great reliance on eyewitness testimony, a clear understanding of why females may possess an advantage in recognizing female faces relative to male faces is needed (e.g., Lewin & Herlitz, 2002).

Fluent processing of female faces should allow infants to more easily structure the female face category than the male face category, which should enable infants and young children to more readily learn about females than males because it is less effortful to make associations to the female face category (e.g., Quinn, 2002). Lack of experience with male faces will make it difficult to attain conceptual knowledge about the male face category, suggesting that knowledge structures associated with females should emerge earlier and be more elaborate than those associated with males, at least early in development. Furthermore, the variability of the male face category should make it difficult to associate and organize the conceptual knowledge that is attained. These proposed differences in knowledge structures for females and males would suggest that linking, organizing, and retrieving information should occur with greater ease when processing social information about female targets, relative to male targets.

**FUTURE DIRECTIONS**

Infants’ differential experience with female and male faces influences their discrimination, recognition, and categorization of faces, although more work is needed to understand the full extent and origins of those differences. We suggest that particular attention be paid to experience with faces and to when interactions with males increase during development. Examining when (or if) the visual preference for female faces over male faces subsides or reverses should provide insight into face-processing changes due to experience and will likely require testing older children and perhaps even adults. Because categorization is inherently linked to knowledge acquisition, it is also important to investigate how the category structure for female and male faces develops, evolves, and reorganizes over time, with attention to both perceptual and conceptual components of the categories.

Unlike other research assessing the role of experience when there is overwhelming exposure to the commonly experienced category (e.g., native language) and minimal experience with alternate categories (e.g., foreign languages), the difference between infants’ experience with female and male faces is more subtle. Understanding how subtleties in early exposure subsequently impact later face processing could be informative for researchers interested in sensitive periods in development. One question concerns whether limited early exposure to male faces extends the window for expert processing of male faces to develop or if fluency of processing male faces never develops to the same level that it does for female faces. Testing older children and adults, who should have more experience with male faces, is necessary for addressing this issue, but methods assessing reaction time or psychophysiological responses may be necessary to capture subtle differences in fluency of processing female and male faces.

Regardless of the age group being studied, we urge face-perception researchers to use both female and male faces in their studies, to make a priori hypotheses about potential differences in processing, and to conduct separate analyses for female and male faces in order to carefully examine the nature of any disparities in processing female and male faces (quantitative or qualitative divergence). Because aspects of adult face
processing have roots in infancy, we suggest that researchers check the developmental literature for clues when they cannot identify why face-processing discrepancies occur among adult participants.

Recommended Reading
Quinn, P.C., Yahr, J., Kuhn, A., Slater, A.M., & Pascalis, O. (2002). (See References)

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