CHAPTER 13

Psychology and Neuroscience of Person Perception

JEFFREY A. BROOKS AND JONATHAN B. FREEMAN

INTRODUCTION

Understanding other people amounts to one of the most important and complex challenges humans regularly encounter. And yet, despite the enormously variable and noisy nature of social stimuli (e.g., faces and bodies, both in static and in dynamic configurations), humans reliably extract information about one another in a process that appears automatic and obligatory. Among the information spontaneously extracted from viewing even a static image of another's face are social categories, such as sex, race, and age; personality traits, such as trustworthiness and competence; emotion; identity; and intentions. The initial perceptual operations giving rise to such impressively efficient information processing are undoubtedly important and consequential for social interaction. However, most research on person perception carried out by social psychologists during the 20th century was not focused on people as perceptual targets. Instead of focusing on the role of external appearance and perceptual input (visual, auditory, etc.) that contributes to perceiving and understanding others, research typically focused on the internal states (intentions, beliefs, traits) that can be inferred about a person, the internal cognitive mechanisms responsible for processing such social knowledge, and the downstream consequences these inferences might have for interpersonal interaction (e.g., Brewer, 1988; Hassin, Bargh, & Uleman, 2002; Kunda & Thagard, 1996; for a review, see Gilbert, 1998).

Indeed, early research typically investigated person perception by presenting research participants with written descriptions of a person's behavior or personality characteristics or by directly presenting participants with social category labels and observing the kinds of assumptions and inferences made about a person based solely on category membership. Thus, within social psychology, early research focused on primarily postperceptual processes downstream of visually based perceptions, investigating the effects of placing someone in a social category on memory for and behaviors enacted toward that individual. Indeed, social categorization in particular has a long history in social psychology of being considered a precursor to the more consequential act of stereotyping (Allport, 1954; Bargh et al., 1996; Fiske & Taylor, 1991).

Although social psychologists amassed an extensive literature on the downstream consequences of person perception and social categorization, a great deal of research in cognitive psychology and neuroscience began to unravel the specific perceptual operations performed on social stimuli. such as faces. Researchers in these fields were not necessarily interested in the social consequences of person perception, but understanding the process of perceiving complex stimuli, such as faces, provided an important tool for probing visual perception in general. This work largely focused on the perceptual mechanisms responsible for successful face recognition. Prominent theoretical models emerging from this research focused on the distinction between static facial cues and dynamic facial movements and the distinct perceptual processes these two types of cues elicit in the perceiver (Haxby, Hoffman, & Gobbini, 2000, 2002). These models were built off of early observations that visual processing of faces diverged between recognizing the identity of faces (invariant or static qualities of a face) and understanding dynamic qualities of the face, such as those occurring during speech production and transient displays of emotion (Bruce & Young, 1986).

Such research demonstrated the utility of integrating vision and face perception into person perception research. As research on the mechanisms of face processing developed, the field began to appreciate what a privileged status faces and bodies have in the perceptual system. Humans disproportionately deploy attention toward faces in particular, a tendency that emerges early in development. From birth, infants prefer looking at faces and facelike stimuli, and the ability to distinguish faces by sex and overt emotional expression begins to develop soon after (Nelson, 2001), suggesting at the very least an innate predisposition to attend to faces as motivationally (i.e., adaptively) relevant stimuli in the environment, although some work suggests that these early effects are due more to the perceptual features of faces rather than their functional relevance (e.g., Macchi, Turati, & Simion, 2004; Simion & Di Giorgio, 2015). Seminal work in face recognition also documented the face inversion effect (Yin, 1969), the phenomenon of extremely poor face recognition when faces are presented upside-down, which does not happen nearly as severely for nonface objects. Further research demonstrated that this unique effect occurs because faces are processed configurally, with recognition and understanding of face stimuli depending on successful encoding of the spatial layout of a face's individual features. Interestingly, bodies also exhibit an inversion effect to a similar degree as faces (Reed, Stone, Bozova, & Tanaka, 2003) and also have a similarly privileged role in sensory processing, with considerably more attention deployed to bodies than to objects in the environment (Downing, Bray, Rogers, & Childs, 2004). These results for faces and bodies were interpreted as clear evidence that they are an extremely special class of stimuli that convey a wealth of relevant information about people, and the human perceptual system is differentially tuned to their detection and understanding as a result.

Contemporary work by social psychologists and interdisciplinary researchers working from social neuroscience and "social vision" approaches have begun to integrate these insights by shifting person perception research to focus more on the early perceptual processes that underpin more sophisticated understanding of other people. Of importance to this chapter, this increased interest in the insights offered from studying visual perceptual processes was concurrent with the introduction of cognitive neuroscience techniques (particularly functional magnetic resonance imaging [fMRI]) into social psychology. The combination of new methods and theoretical approaches allowed researchers to integrate insights from vision science as well as cognitive neuroscience into their theories of person perception. This shift has depended largely on researchers integrating visual perceptual stimuli, such as faces and bodies, into their studies, allowing research on person perception to reflect the kinds of implicit and spontaneous perceptual inferences occurring in everyday social interaction.

Early work from this approach yielded the surprising insights that humans can be quite accurate in their ability to glean social information from brief glimpses of faces and bodies. Much of this work used research paradigms such as presenting participants with silent "thin slices" of a stranger's behavior, usually video clips as short as a few seconds long, and observing the inferences participants were able to make about people from these brief behavioral displays. Stunningly, participants were able to confidently rate the individuals in the video clips along a number of dimensions, such as personality (e.g., extraversion, warmth; Gangestad, Simpson, DiGeronimo, & Biek, 1992), trait anxiety (Harrigan, Harrigan, Sale, & Rosenthal, 1996), sexual orientation (Ambady, Hallahan, & Conner, 1999), and even racial bias (Richeson & Shelton, 2005). Moreover, multiple perceivers exhibit a high agreement in their judgments of a target's personality traits (termed "consensus at zero acquaintance"; Kenny, 1991), and such reliable and consensual inferences about other people often can accurately predict real-world outcomes. For example, early work on thin slices showed that judgments of college professors' nonverbal behavior from 30-second silent video clips accurately predicted the professors' end-of-semester evaluations by students (Ambady & Rosenthal, 1993; for a review, see Weisbuch & Ambady, 2011).

Inspired by the observation that humans are rapid, consistent, and often accurate in the impressions they draw from the external appearance of another person, much research has focused on the facial features that are most informative to perceivers. This work has benefited from preexisting theoretical movements in vision research known as ecological or Gibsonian approaches (Zebrowitz & Montepare, 2006). The Gibsonian approach to visual perception (Gibson, 1979) stresses the importance of directly perceptible bottom-up cues of objects in the environment and how those cues are inherently informative about the "affordances" of those objects—their function, capacity to be acted on, and possible benefits or dangers to the perceiver. A basic type of affordance would be the graspability of an object, information that is readily present in the object's stimulus features. The Gibsonian approach also allows for the influence of the perceiver in the form of "attunements"—individual differences in the sensitivity to particular affordances in the environment. The information in conscious perception thus reflects a direct perception of the world that is weighted by the adaptive function of objects in the environment as well as by an individual perceiver's attunements to which affordances are most important to pick up on. An ecological approach to person perception (McArthur & Baron, 1983) thus emphasizes the importance of bottom-up facial cues and the adaptive information they directly convey to the perceiver, such as the potential personality characteristics of an individual; whether an individual should be approached or avoided; and related opportunities for behavioral response by the perceiver (e.g., caregiving, mating). A great deal of work from this perspective has outlined the types of facial cues humans are most attuned to and how the social affordances gleaned from another person's face (e.g., whether someone looks young or old due to the invariant structure of their face) can bias impressions of their personality and behaviors enacted toward them; in this view, even bottom-up input can serve as a biasing factor in perceptions of other people (discussed later in the subsection titled "Facial Cues").

Despite how basic and obligatory these processes seem to be, they are nonetheless malleable and susceptible to influence from a variety of factors that reside outside of sensory input. Vision science is replete with work investigating such "top-down" influences on perception, with a particular focus on the systematic biases and errors that can be caused from motivations or expectations harbored in the perceiver. This approach to vision can be traced back to early observations in psychology (e.g., Helmholtz, 1867) that sensory input often is impoverished, lacking, or brief but nonetheless must be rapidly understood and acted on by the perceiver. Thus, perception consists of the concurrent and interactive processing of ongoing sensory input with the memories, thoughts, emotions, and conceptual knowledge of the observer, together leading to a probabilistic interpretation of a given stimulus.

An influential movement in cognitive psychology beginning in the 1950s (called the New Look; Erdelyi, 1974) was the first research program to investigate these perceiver effects experimentally. For instance, researchers found that children of lower socioeconomic status tend to overestimate the size of coins in their hands (Bruner & Goodman, 1947) and individuals are more perceptually sensitive to faces when they are highly motivated to affiliate with others (Atkinson & Walker, 1956). Contemporary research also has examined the influence of transient motivational states on visual perception, showing that participants are more likely to interpret an ambiguous visual stimulus (such as two adjacent lines that could either be perceived as the letter *B* or the number *13*) in a certain way when they anticipate a positive outcome from that interpretation (Balcetis & Dunning, 2006), and ambiguous blends of two colors are more likely to be interpreted as one color instead of the other when that color is associated with financial gain for the participant (Voss, Rothermund, & Brandtstadter, 2008).

Indeed, such top-down influences on visual perception tend to have a pronounced impact when the target of perception is ambiguous (Bruner & Goodman, 1947; Pauker, Rule, & Ambady, 2010; Trope, 1986). Within the realm of person perception, this finding has important consequences for the social categorization of individuals of ambiguous social category membership (e.g., biracial individuals) or members of a perceptually ambiguous social category (e.g., gay individuals). Indeed, if top-down factors exert more of an influence when sensory input is ambiguous, then their importance to person perception cannot be understated, as social stimuli such as faces and bodies typically provide sensory input that is variable and ambiguous.

Recent research integrating perspectives from vision science, cognitive neuroscience, and social psychology has permitted investigation into the basic processes through which social information is extracted from social perceptual cues, such as faces, bodies, and voices. In this chapter, we describe the wealth of bottom-up cues and top-down factors that contribute to the process of perceiving another person. For descriptive purposes, we discuss bottom-up cues and top-down influences in separate sections, but we emphasize that there is a rich interplay between bottom-up and top-down processes during person perception, and the two may be difficult to tease apart in practice. After discussing the particular bottom-up perceptual cues and top-down factors that interact to produce stable perceptions and impressions of other people, we turn to a discussion of the neural mechanisms that have been observed to contribute to the person perception process and computational models that have been proposed to account for the complex interplay of environmental cues and top-down constraints in person perception. We end the chapter with a discussion of the downstream consequences in social interaction that can result from subtle components of these early perceptual processes.

BOTTOM-UP PERCEPTUAL CUES AND THE TARGET OF SOCIAL PERCEPTION

Facial Cues

An extensive body of research has documented the kinds of social information that can be gleaned from the human face and what specific facial cues and characteristics drive these perceptions. Indeed, person perception may be prone to systematic biases due to the underlying characteristics of face perception. Facial cues convey variant qualities of a person, such as their current emotional state and health, but they also can convey relatively invariant qualities of a person, such as sex, race, age, and personality characteristics. Social categories, particularly the "Big Three" (sex, race, and age; Brewer, 1988), have received a great deal of attention in the person perception literature because they can be gleaned reliably and efficiently from specific salient biological cues, and consequently they come to dominate our perceptions of other people.

Following advances in statistical face modeling, researchers became capable of experimentally manipulating the features of face stimuli in order to assess the differential role of certain cues in determining an individual's social category membership. Early work considered the differential impact of specific facial cues, such as the shape and size of the jaw, brows, and chin, on determining social category memberships in the domain of gender (Brown & Parrett, 1993) and age (Berry & McArthur, 1986). Specific facial cues also have been proposed to give rise to categorization along perceptually ambiguous dimensions, such as sexual orientation. Seminal work on "thin slices" of behavior found that sexual orientation could be classified reliably with above-chance accuracy from brief presentations of dynamic nonverbal cues (Ambady et al., 1999), and succeeding studies found that extremely brief exposure to static faces (e.g., 50 ms) is sufficient for accurate categorization of sexual orientation (Rule & Ambady, 2008a). These researchers additionally found that specific features of target faces—hair, eyes, and mouth—were able to yield, as a whole, relatively accurate categorizations of sexual orientation even when these cues were presented independently of any other facial features (Rule, Ambady, Adams, & Macrae, 2008). Interestingly, participants underestimated their own accuracy on these tasks, suggesting an implicit fluency for the diagnosticity of certain facial cues on seemingly ambiguous dimensions, such as sexual orientation.

Although less is known about the relative importance of specific facial cues to different social category dimensions, researchers agree that several broader qualities of the face contribute to social categorization. These patterns of features include the shape of the face (encompassing broad patterns of structural variation) as well as face pigmentation, alternately referred to as color and texture in the literature. Early studies focused on the role of face shape, and researchers theorized a primacy for face shape in driving evaluations and categorizations of faces (Biederman, 1987). Later work showed an important additional role for pigmentation cues in determining social categories such as age, race, and gender (Price & Humphreys, 1989; Hill, Bruce, & Akamatsu, 1995), but many researchers still emphasized the importance of shape, assuming that pigmentation cues (to the extent that they are informative at all) are integrated later in the perceptual process. However, recent work has shown that both patterns of shape and pigmentation cues are integrated into the social categorization process in a temporally dynamic fashion, with parallel processing of shape and pigmentation giving rise to coherent perceptions (although pigmentation actually appears to have primacy in the perception of gender, showing an influence on the perceptual process at earlier time points; Freeman & Ambady, 2011b).

Researchers also have considered the impact of a face's width-to-height ratio (fWHR), a useful measure of face shape and structure with particular importance for the perception of male faces. The fWHR is defined as the distance between the cheekbones divided by the distance between the upper lip and mid-brow, and the magnitude of the fWHR is driven by pubertal testosterone in men (Lefevre, Lewis, Perrett, & Penke, 2013). As predicted by an ecological approach to person perception (McArthur & Baron, 1983), perceivers seem to use the fWHR as a relatively accurate index of behavior. Larger fWHR is correlated with deceptive (Haselhuhn & Wong, 2012) and aggressive behaviors (Carré & McCormick, 2008), and perceivers readily evaluate individuals with high fWHR as less friendly (Hehman, Carpinella, Johnson, Leitner, & Freeman, 2013), less trustworthy (Stirrat & Perrett, 2010), and more aggressive (Carré, McCormick, & Mondloch, 2009).

With its strong suggestion of an individual's traits and behaviors, the fWHR is a prominent candidate for the type of facial cues that drive overgeneralization effects (Zebrowitz, Fellous, Mignault, & Andreoletti, 2003), prominent biases in trait attribution occurring when cues on the face tied to specific social affordances bias impressions of another person. For example, older adults (who display lower perceived fWHR due to changes in the skin) are perceived as less aggressive, less physically capable, less socially competent, less socially dominant, and friendlier as a function of decreases in fWHR (Hehman, Leitner, & Freeman, 2014b). On the other end of the age spectrum, there is a well-documented, age-related overgeneralization effect such that adults with babyish features are in turn perceived to be more childlike (e.g., weak, submissive, vulnerable, submissive, and honest; Montepare & Zebrowitz, 1998). Central to researchers' interpretation of these effects is the Gibsonian assumption that perceivers are specifically attuned to social affordances that require rapid orienting and appropriate behavioral responses. In this view, age overgeneralization effects occur because humans are attuned to rapidly detect and act on age-related cues in the environment to provide necessary care to vulnerable infants. Similar overgeneralization effects have been observed in trait impressions from emotional expressions, such that individuals with permanent resemblance to certain canonical emotional expressions are perceived to have invariant personalities related to those traits. For example, individuals with faces resembling neutral or angry expressions usually are judged to be low in affiliative traits, while individuals with faces resembling happy expressions usually are judged to be high in affiliative traits (Montepare & Dobish, 2003).

The relationship between specific facial cues and social categories and trait attributions is further complicated by the fact that specific facial cues may signal more than one social category at a time, at times subjecting social categorization to systematic biases. For example, facial cues signaling sex-category membership overlap with cues signaling emotional state, resulting in consistent biases of impressions of trait dominance and affiliation in men and women (Hess, Adams, & Kleck, 2004, 2005). Additionally, race and sex-category membership intersect such that the African American race category shares overlapping phenotypic cues with the male sex category (Johnson, Freeman, & Pauker, 2012), biasing stereotypic expectations for individuals who do not satisfy this expected congruence (e.g., Black women; Johnson et al., 2012). However, the exact degree to which these effects are due to overlapping facial cues is under debate (Johnson et al., 2012). Another strong influence on intersectionality effects is overlap in stereotype content between categories on orthogonal dimensions (e.g., the Black race category and male sex category sharing stereotypes for aggression and athleticism). We discuss such influences on category intersectionality effects further in the subsection titled "Stereotypes."

As evident in overgeneralization effects, humans infer a wealth of trait information from features of the face. Although these inferences occur impressively rapidly and with surprising consensus in the population, they also may be particularly prone to error. A prominent model of personality characteristics is the Big Five factor model (Goldberg, 1990), which describes human personality characteristics in terms of the five factors of openness, conscientiousness, extraversion, agreeableness, and neuroticism. Early research examining the ability of perceivers to glean these traits from faces showed that they were rapid, consistent, and often accurate (e.g., Watson, 1989).

However, research on the extraction of specific personality characteristics (like the Big Five) suffers from the fact that several of these judgments are intercorrelated and difficult to differentiate in terms of their associated facial cues (Sutherland et al., 2015). Thus, a large portion of the work on personality judgments of faces has focused on broader impressions, such as trustworthiness, a personality trait which some research posits as a broader personality dimension that accounts for many of the intercorrelated judgments of more granular personality characteristics, such as those in the Big Five (Oosterhof & Todorov, 2008). Researchers studying impression formation and trait attribution from faces have offered many different possibilities for a parsimonious encoding of trait information along universal dimensions, such as warmth and competence (Fiske, Cuddy, & Glick, 2007), trustworthiness and dominance (Oosterhof & Todorov, 2008), and valence and dominance (Todorov, 2011).

These theoretical approaches are united in their attempt to account for the remarkable speed and consensus with which such judgments are made. Such theoretical accounts form a Gibsonian approach that assumes that the fundamental information extracted from faces is that which is adaptively relevant to the perceiver: In the case of warmth and competence, for example, the "warmth" dimension reflects whether a novel individual is antagonistic (approachability), and the "competence" dimension reflects whether an individual can cause harm to the perceiver (Fiske et al., 2007). Several insights have been made regarding the specific facial features that give rise to these social judgments. Motivated by work on overgeneralization effects, researchers in this dimensional approach have observed that an approachability dimension like "trustworthiness" is most closely related to a face's general resemblance to an emotional facial expression, while harm capability dimensions such as "competence" or "dominance" are most closely related to cues signifying strength and maturity (Oosterhof & Todorov, 2008). Additionally, recent work has shown that trustworthiness judgments in particular are driven by a face's averageness, such that average faces (in terms of proximity to the physical average of faces in the population) consistently are rated as more trustworthy (Sofer, Dotsch, Wigboldus, & Todorov, 2015).

Averageness is also a potent contributor to perceptions of facial attractiveness (Langlois & Roggman, 1990). Early work used face-morphing techniques to show that ratings of attractiveness for a composite face are consistently higher than ratings of attractiveness for any of the individual faces used to make the composite (Langlois & Roggman, 1990). Some researchers have proposed that this tendency is due to innate drives to pursue partners with a high degree of genetic diversity (Thornhill & Gangestad, 1993). Indeed, like personality traits, attractiveness judgments for novel faces show a high level of consensus across participants, even cross-culturally (Langlois et al., 2000). In addition to facial averageness, facial symmetry also contributes to judgments of a face's attractiveness (Grammer & Thornhill, 1994). However, other research shows that the overall symmetry of a face nevertheless correlates with attractiveness judgments when only half of a face is presented to participants (Scheib, Gangestad, & Thornhill, 1999), suggesting that symmetry may covary with other featural aspects of the face that confer attractiveness. Researchers also have examined the role of sexually dimorphic facial cues, although the emerging picture is complicated: Highly feminine cues consistently increase ratings of attractiveness for female faces (M. R. Cunningham, 1986), but male faces also are rated more attractive when some feminine cues are present on the face (Little, Burt, Penton-Voak, & Parrett, 2001).

Throughout this section, we have documented facial features that give rise to remarkably consensual judgments among perceivers in the population, including inferences about personality traits. Clearly this consistency in judgments shows that perceivers draw on some perceptual heuristic that they find to be reliable, but the issue of whether face-based trait inferences truly can be accurate is complicated. One component of the problem is the difficulty of defining perceiver accuracy for personality traits in the first place: whether to assess the correspondence between perceiver inferences and the target's self-reported personality traits, consensus of the target's peers, or real-world behavioral outcomes. For example, some research has assessed the ability of perceivers to accurately predict real-world outcomes, such as a corporate firm's success based on the facial appearance of chief executives (Re & Rule, 2016), but it remains unclear to what degree findings like this reflect accuracy per se. The complexities of this issue are covered in much greater detail elsewhere (e.g., Alaei & Rule, 2016).

In general, for accurate trait inferences to arise from static facial photos in any consistent fashion across contexts, these inferences would have to rely on cues that are relatively fixed in the target. Indeed, some work has shown that the most accurate and consistent impressions are drawn from skeletal cues, such as the fWHR (discussed previously), which drive impressions of dominance and physical ability. However, perception of other traits (such as trustworthiness) relies on a static face's resemblance to a more dynamic facial expression (such as an emotional expression), and thus these inferences are relatively less stable across multiple images of a target individual, leading to less opportunity for these trait inferences to be accurate (Hehman, Flake, & Freeman, 2015). That said, there are baseline, resting levels of such resemblances, and these potentially could be able to produce accurate judgments in a context-free fashion.

Relatedly, dynamic facial cues can convey considerably more information than static images, but research on person perception, social categorization, and face processing more broadly has focused primarily on static images of faces. There is a great deal of work on dynamic facial cues in the context of emotion perception, for which dynamic facial cues appear to convey more information about emotional state than static facial cues (Ambadar, Schooler, & Cohn, 2005). In addition, there is also a large body of work on eye gaze, a dynamic facial cue that can signal social motives and intent more generally (Frischen, Bayliss, & Tipper, 2007). We omit a deeper discussion of dynamic facial cues since they have not been studied nearly to the same extent in the context of extracting social information, such as category membership and personality traits, from faces. However, as discussed earlier in the chapter, there is a long history of research looking at dynamic bodily displays and nonverbal behavior (such as thin slices), and this body of work finds that even brief displays of nonverbal bodily behavior are extremely informative to perceivers and frequently give rise to consistent impressions that can predict real-world outcomes.

Bodily Cues

In everyday interaction, human faces are, of course, rarely perceived in isolation from a human body. As such, the body can provide a powerful source of visual context for face perception as well as an ample source of social knowledge about an individual in its own right. In the case of emotion perception, cues from the body even appear to dominate input from the face, and when body posture is incongruent with facial expressions, the ultimate emotion categorization often can be consistent with the body posture rather than the facial cues (Van den Stock, Righart, & de Gelder, 2007). As with faces, the perception of human bodies in both static and dynamic configurations is greatly privileged by the perceptual system, with perceptual attunement to bodies and "biological motion" perception (i.e., the perception of bodily movement) subject to similar privileged configural visual processes as faces (Reed et al., 2003), although these processes seem to emerge more slowly and later in development than those for faces (Freire, Lewis, Maurer, & Blake, 2006).

The perception of static bodily cues has been studied mostly in the context of emotion perception. Bodily cues are strongly suggestive of the emotional state of an individual and provide such a potent source of visual information about emotional states that they can disambiguate facial displays of emotion and also influence or override initial perceptions of facial emotion (Van den Stock et al., 2007; for a review, see de Gelder, 2005). However, the majority of research on the perception of the body more generally has examined biological motion, which primarily refers to naturalistic human movement, such as walking. The study of bodily movement was propelled by the psychophysicist Gunnar Johansson, who developed a novel technique for isolating displays of human movement from their visual context (Johansson, 1973). The stimuli created using this technique generally are referred to as point-light displays, and researchers have carried out a great deal of work examining the surprising amount of information that perceivers readily extract from these perceptually minimal stimuli. To create point-light displays, researchers attach reflective or infrared markers to an individual's major joints and head and record videos of the person in displays of naturalistic movement. When participants see these videos, only the points of light are visible.

Despite the highly impoverished and context-free nature of these stimuli, perceivers display a readiness and sensitivity to detect the information present in point-light displays. Early work showed that participants can readily and accurately identify the specific actions performed by individuals in point-light displays, such as swinging a hammer or knocking on a door (Johansson, 1973, 1975). In the case of walking, point-light displays of gait contain cues to the identity of the walker, and studies have shown that participants can reliably identify themselves and known others in point-light displays (Cutting & Kozlowski, 1977; Richardson & Johnston, 2005). Early work also showed that sex-category membership is categorized accurately in biological motion paradigms (Kozlowski & Cutting, 1977). Indeed, later work established that biological motion is a reliable and determinant cue to sex-category membership because of specific variations in male and female bodies that drive stable biomechanical variants in gait, such as the "center of moment" (Cutting, Proffitt, & Kozlowski, 1978). Fascinating work also has examined the interplay between body shape and bodily motion in driving perceptions of sexual orientation (Johnson, Gill, Reichman, & Tassinary, 2007). These researchers found that gender-atypical combinations of body shape and gait (e.g., a male body exhibiting the typical "sway" gait pattern of female bodies or a female body exhibiting the typical "swagger" gait pattern of male bodies) were consistently more likely to be categorized as homosexual. Other social categories have been studied far less in the context of biological motion, but some research suggests that age can be determined reliably from point-light displays (Montepare & Zebrowitz, 1993) as well.

Emerging work also has examined perceivers' ability to make attractiveness judgments based on point-light displays. Interestingly, these studies have largely converged with the literature on facial attractiveness, showing that cues to biological fitness (e.g., symmetry and "internal consistency"; Kluver, Hecht, & Troje, 2016) as well as the presence of sexually dimorphic cues (Troje, 2003) both contribute to judgments of attractiveness from point-light displays. In addition, studies have found that perceivers are able to extract variant psychological states from point-light displays, such as discrete emotions (Atkinson, Dittrich, Gemmell, & Young, 2004) and intent (such as whether a movement was natural or purposely exaggerated; Runeson & Frykholm, 1983). The study of biological motion provides an impressive example of the inherently social nature of perception, largely because of the frequent use of point-light displays, which are able to isolate the information extracted from motion itself regardless of the visual or social context. Overall, this work demonstrates how the visual system is surprisingly attuned to the social and informational content of specific cues from both faces and bodies.

Vocal Cues

The voice is an abundant (albeit experimentally underappreciated) source of social information as well as more basic information about the physical characteristics of the speaker. Voices are enormously informative in isolation (as when one speaks to a stranger on the phone for the first time), but they also can serve as multimodal context for the perception of someone's face (as when one finally meets someone previously only spoken to on the phone). Research on social categorizations and stereotyping largely has ignored vocal contributions, perhaps because of an implicit assumption that the voice is not as salient a cue as the face. However, this assumption may be inaccurate for some aspects of social perception, as some researchers suggest that vocal cues may be even more informative than facial cues in the case of emotion perception, due to their variability and ability to convey subtle distinctions in emotional state (e.g., a loud approach-oriented anger versus a quiet brooding anger; Scherer, 2003).

An extensive body of research has studied the basic information that is rapidly inferred from vocal cues in isolation, including physical attributes, such as height and weight (Van Dommelen, 1993), body size and shape (Evans, Neave, & Wakelin, 2006), age (Hughes & Rhodes, 2010), and affective state (Bestelmeyer, Rouger, DeBruine, & Belin, 2010), all of which are gleaned from the voice in a generally accurate manner. Moreover, this information is available to perceivers even when vocal cues are presented for extremely brief durations (Latinus & Belin, 2012). A recent study has shown that more socially consequential personality information also is rapidly extracted from vocal cues (McAleer, Todorov, & Belin, 2014). This study repeatedly presented participants with the word “hello” spoken by different targets and found that participants rapidly inferred traits such as trustworthiness, aggressiveness, competence, confidence, and attractiveness from these utterances. Highly consistent impressions of these traits were reached with exposure to vocal clips that were on average less than 400 ms in length, in keeping with the oft-reported consensus in personality judgments of strangers observed in the face perception literature. The researchers found that specific aspects of the acoustic input reliably covaried with perceived personality traits in a manner that depended on the gender of the speaker. For example, perceived dominance in male voices seems to depend on decreases in pitch, while for females perceived dominance increases with increases in the pitch of the voice. However, there were some commonalities, with the acoustic variable harmonic-to-noise ratio (indicating roughness) contributing to perceptions of valence in both male and female speakers (McAleer et al., 2014).

Vocal cues also carry social category information in a way that appears to depend on specific characteristics of the acoustic input. Gender is rapidly and accurately perceived from vocal cues, which are particularly distinct between males and females because of dimorphism in the body (Fitch & Giedd, 1999). Perceivers are very sensitive to diagnostic gender cues in the voice and can discriminate subtle differences in the femininity versus masculinity of a voice within gender categories (e.g., feminine versus masculine male voices), in a process that automatically activates relevant stereotypes (e.g., males with feminine vocal cues present in the voice are expected to be feminine and possess attributes stereotypically linked to femininity, such as sensitivity and kindness; Ko, Judd, & Blair, 2006). Research also has found that race is categorized accurately from isolated vocal cues (Walton & Orlikoff, 1994). African American voices tend to have larger frequency perturbation (varying pitch in the voice) and amplitude perturbation (varying loudness in the voice) as well as significantly lower harmonic-to-noise ratio than White voices. Participants were more successful at discriminating African American versus Caucasian speakers when these characteristics of the auditory signal were most distinct, suggesting a specific sensitivity to certain vocal cues in race perception (Walton & Orlikoff, 1994).

A growing body of research also has shown how vocal cues interact with facial cues during social categorization of faces. Notable effects have been observed in emotion perception, in which sad facial expressions are mistakenly perceived as happy when they are accompanied by a happy voice, even when participants are instructed to disregard the voice (de Gelder & Vroomen, 2000). The voice is also a salient multimodal cue in the categorization of a face's gender, and studies have shown that gender-congruent voices facilitate accurate detection of gender on a face (Smith, Grabowecky, & Suzuki, 2007) and incongruent voices can disrupt processing of face gender (Masuda, Tsujii, & Watanabe, 2005; for a review, see Campanella & Belin, 2007). Work in gender categorization also has shown that vocal cues can bias processing of gender-atypical faces (e.g., feminine male faces and masculine female faces). In one study (Freeman & Ambady, 2011c), researchers employed a computer mouse-tracking paradigm, measuring the trajectory of computer mouse movements as participants reached to click on a "male" or "female" category response in a gender categorization task. The stimuli were slightly gender-atypical male and female faces accompanied by voices that were either gender typical (e.g., a masculine male voice) or gender atypical (e.g., a feminine male voice). The researchers found that when faces were accompanied by a sex-atypical voice, participants' mouse movements continuously deviated toward the opposite category response (e.g., participants were continuously attracted to the "female" category response when categorizing a male face accompanied by a feminine male voice). This work suggests an important role for the voice as a continual source of information during person perception, interacting with and even biasing an evolving visual interpretation as participants develop a stable categorization of a face's gender (Freeman & Ambady, 2011c).

Vocal cues comprise an important source of social and nonsocial information about an individual. Humans are reliably attuned to subtle distinctions in the acoustic properties of vocal cues that signal such information, ranging from perceptions of the body size of the speaker to inferences about that individual's trustworthiness and competence. As such, vocal cues signal important information about perceptual targets in isolation and provide a source of multimodal context that can enhance or constrain the perception of faces. In such paradigms, participants integrate information present in the voice into their categorical judgments of face stimuli, even when asked to disregard the vocal input. These findings together indicate an important role for vocal cues in developing stable perceptions of other people, both on their own and embedded in the variety of bottom-up sensory cues discussed in this section. We now turn to a discussion of top-down factors, which can impact, guide, and bias the person perception process.

TOP-DOWN FACTORS IN THE ENVIRONMENT AND HARBORED IN THE PERCEIVER

Because of the abundance of information present in sensory input, the perceptual system is necessarily strategic. In addition to processing cues from the environment, person perception also must utilize the visual and social context in the environment and preexisting perceptual heuristics in the observer to make sense of ongoing sensory input. These additional top-down factors can be social or nonsocial in nature and can take the form of extraneous perceptual input (i.e., external cues in the environment that guide the perception of a target stimulus, such as the surrounding context influencing the perception of a face) or inputs from the perceiver (i.e., motivations and expectations that structure and potentially bias the processing of novel stimuli). Many of these influences on perception have not always been treated as such: Stereotypes, for example, were long considered to be triggered after the perception of an associated stimulus (Allport, 1954), while contemporary approaches appreciate the influence that stereotypes can have on a visual percept before it has fully stabilized and reached conscious awareness (Freeman & Ambady, 2011a). Indeed, a hallmark of top-down effects is that they co-occur with and even constrain basic visual processing, despite often consisting of high-level information, such as social factors that intuitively seem distinct from perception.

Visual Context

In the realm of person perception, "context" encompasses a broad range of visual aspects of the environment that provide a source of expectations and predictions about the social targets likely to be perceived in that environment. A basic and intuitive example of context in person perception is the visual scene in which a person is encountered, which is certainly relevant for determining their identity. For example, the process of deciding whether someone who looks like your boss is actually your boss likely will differ depending on whether the person is encountered in an office setting or in a nightclub. However, in person perception, "context" is multifaceted. The immediate visual context inherent to an individual (e.g., their clothes or the positioning of their body) can provide visual context for the perception of their face. A multimodal cue, such as a person's voice (discussed previously in the "Vocal Cues" subsection), can impact and even bias perception of their face, and one social category that a person belongs to can serve as context for the perception of that person's other group and category memberships due to overlapping physical cues (discussed earlier in the "Facial Cues" subsection) or stereotypes (discussed later in the "Stereotypes" subsection). Here we restrict our discussion to the influence of the immediate visual context and scene on perception of an individual's face.

Even cues inherent to the individual (e.g., hair and clothing) can be understood as a source of visual context, supplying a source of expectation and prediction for the perception of someone's face and identity. Hairstyle in particular has been studied in the context of social categorization, and studies have shown that racially ambiguous faces are more likely to be categorized as Black when they have a stereotypically Black hairstyle. Following this categorization, the faces subsequently are perceived to have more Afrocentric cues on the face (MacLin & Malpass, 2001). Clothing also can bias race perception by exerting a contextual cue to the social status of an individual, eliciting predictions about the person's race. In one study, researchers presented participants with faces morphed along a Black–White continuum, each of which was presented with low-status attire (e.g., a janitor uniform) or high-status attire (e.g., a business suit). In a mouse-tracking paradigm, participants categorized the faces as either White or Black while their computer mouse trajectories were recorded. The study found that low-status attire biased perceptions toward the Black category while high-status attire biased perceptions toward the White category. When race and status were stereotypically incongruent (e.g., a White face with low-status attire or a Black face with high-status attire), participants' mouse movements showed a continuous attraction to the opposite category, indicating that the social status associated with clothing exerted a top-down influence on the visual categorization of race. This effect was greater for more racially ambiguous faces (Freeman, Penner, Saperstein, Scheutz, & Ambady, 2011).

The visual scene also provides a useful source of prediction about the types of individuals likely to be encountered in a given environment, which in turn can bias the perception of individuals in certain contexts.

For example, salient cultural contexts provide a predictive framework for the potential races and ethnicities likely to be encountered in that context (such as a Shinto shrine eliciting the prediction that Japanese individuals will be encountered nearby). Behavioral work has shown that race categorization is facilitated by race-congruent contexts, such that Asian faces are categorized more rapidly and accurately in Asian scenic contexts, and that race-incongruent contexts interfere with race categorization (Freeman, Ma, Han, & Ambady, 2013). The scenic context also may play a particularly important role in emotion perception. Given the ambiguous and highly variable nature of emotional facial expressions, perceiving discrete emotions on another's face seems particularly reliant on contextual and multimodal cues (Barrett, Mesquita, & Gendron, 2011), as discussed earlier in the subsections on bodily (e.g., de Gelder, 2005) and voice (e.g., Scherer, 2003) cues. There is a great deal of behavioral evidence to suggest that identical facial expressions of emotion are perceived differently depending on the visual scene in which they are encountered (e.g., a neutral context, such as standing in front of a house, or a fearful context, such as a car crash; Righart & de Gelder, 2008). Similar effects occur when participants are just given prior knowledge about the social context emotional facial expressions were originally displayed in (Carroll & Russell, 1996). Social information immediately present in a scene also can influence emotion perception. For example, emotion perception can be influenced by the facial expressions of other individuals in a visual scene (Masuda et al., 2008), an effect that is impacted by perceivers' cultural differences in sensitivity to context (Ito, Masuda, & Hioki, 2012). These results are widely consistent with insights in the vision science community about the inherently predictive nature of perception, rendering these processes particularly prone to expectations guided by the environment (Bar, 2004; Summerfield & Egner, 2009).

Prior Knowledge and Familiarity

Most of the research considered thus far has dealt with the knowledge that can be inferred from a complete stranger based on their face and body. However, a great deal of early work on face perception focused instead on the ability to recognize the identity of previously encountered faces. Although taken for granted on a daily basis, the ability to rapidly recognize another person's identity is an incredible feat, given the large variety of social contexts and visual perspectives a person can be encountered in, from dim lighting, to a new haircut, to age-related changes in the face. Indeed, research has demonstrated that changes in viewpoint, lighting, and distance rarely cause difficulty in the recognition of familiar faces, but such variables greatly impede recognition of recently learned faces (Hancock, Bruce, & Burton, 2000). The visual features of a face can serve as a potent a priori source of expectations about a person, as we have observed, but familiarity with and prior knowledge about a person exert additional forces on person perception in the form of affective responding and spontaneous retrieval of semantic knowledge related to that person (Gobbini & Haxby, 2007). Classic early work showed that familiarity with an individual's identity sensitizes perception to categorically perceive that identity (Beale & Keil, 1995). Researchers morphed the faces of famous politicians (e.g., John F. Kennedy, Bill Clinton) to create a continuum of face stimuli from one individual to the other. When prompted to categorize the faces by identity, participants perceived face identity categorically, with an abrupt shift from one identity to the other despite the objectively gradient nature of the stimuli. Importantly, participants' self-reported familiarity with the identities in question predicted the degree to which they perceived the identities categorically.

Prior knowledge about an individual also can influence person perception, even if there is no firsthand familiarity with the target. In some cases, this influence seems to arise from the spontaneous extraction of person-specific semantic knowledge. For example, when participants are asked to judge the personality traits of faces, they are influenced by information previously paired with that face, even when that information (and its face pairing) is not explicitly recalled (Uleman, Blader, & Todorov, 2005). Such prior knowledge has an even more powerful biasing effect on trait attribution when the knowledge is affectively salient (e.g., knowledge that the target has previously engaged in disgusting behaviors; Todorov, Gobbini, Evans, & Haxby, 2007). However, the impact of prior knowledge also may occur at earlier processing stages, influencing visual processing via top-down attentional routes. Recent research has shown that the affective and social content about prior knowledge learned about a person can influence visual perception of their face, even at subliminal levels of processing (Anderson, Siegel, Bliss-Moreau, & Barrett, 2011). In this study, participants rehearsed face stimuli that were paired with negative, positive, or neutral information and subsequently completed a binocular rivalry task. In binocular rivalry tasks, perceptually dissimilar images are presented to the left and right visual fields of a participant, and one of the two images eventually dominates conscious visual perception (Blake, 2001). Although this dominance is not always long lasting, the duration of perceptual dominance and the particular stimulus that is most likely to dominate perception often are interpreted as evidence for a top-down attentional bias toward that particular percept. The researchers in this study found that faces previously paired with negative social affective information were more likely to dominate in binocular rivalry, and dominate for a longer period of time. Fascinatingly, this work suggests that prior knowledge about a person can become activated during preconscious processing of a target, in turn modulating attention and perception to enhance processing of the face. Thus, the perceptual system appears particularly sensitive to recognizing known others in the environment and biasing attention toward individuals who have previously been associated with socially and affectively salient knowledge. These characteristics of face perception in particular are consistent with the idea that the perceptual system is most attuned to information in the environment that is motivationally relevant to the perceiver.

Stereotypes

Stereotypes are comprised of conceptual knowledge about social groups—the types of traits, behaviors, and physical features members of a specific social group are expected to display (Allport, 1954). Stereotypes are a complex example of top-down influences on person perception since in many cases they are linked directly to specific bottom-up cues. Although all influences of stereotypes on perception depend in part to the expectations and social knowledge of the perceiver, they also rely on specific features of the environment (i.e., facial cues) that have become associated with such expectations (e.g., Afrocentric facial cues trigger stereotypes associated with the "Black" race category, including negative stereotypes, such as hostility, and more positive stereotypes, such as athleticism). As discussed at length in this chapter, when specific visual cues become linked to likely relevant outcomes in the environment, they also provide a source of prediction and expectation that influences visual processing. A fundamental aspect of stereotypes is that they are generalized to all members of a social group, and researchers traditionally assumed that these assumptions were triggered after placing an individual in a social category, as a cognitive strategy to guide effective and appropriate social interaction (Allport, 1954). However, contemporary work has come to appreciate the ability of stereotypes to continuously guide perception as well, before the process of social categorization is complete.

Social categorization has a powerful organizing effect on perception. For example, racially ambiguous faces that have been categorized as "Black" are subsequently perceived to have a darker skin tone (Levin & Banaji, 2006) and more Afrocentric facial cues (MacLin & Malpass, 2001). However, accumulating evidence suggests that this kind of top-down feedback from stereotypes to the visual system also can occur before social categorizations are complete. In one study, researchers presented participants with face stimuli that were morphed to be highly sex typical (e.g., masculine male face) or sex atypical (e.g., feminine male face). Participants were tasked with stereotyping these targets by choosing one of two adjectives (e.g., "caring," "aggressive") that they felt was most stereotypically associated with the target face. By recording the trajectories of participants' computer mouse movements en route to one of the two responses, researchers found that when participants were stereotyping atypical targets (e.g., male faces with some female cues), mouse movements continuously deviated toward the adjective stereotypically associated with the competing category (e.g., the stereotypically female adjective "caring"). When stereotyping an atypical target, the correct social category ("male") and the incorrect social category ("female") both become tentatively activated as potential ways to categorize a face. This study provided initial evidence that stereotypes associated with specific social categories also are activated before a stable categorization has been reached (Freeman & Ambady, 2009).

Stereotypes also can guide categorizations of perceptually ambiguous groups, as in the domain of sexual orientation. Some work has shown that participants utilize specific facial cues when tasked with categorizing sexual orientation (Rule & Ambady, 2008a; Rule et al., 2008), but these cues often reflect a top-down stereotypic heuristic. Specifically, in one set of studies, researchers found that faces were more likely to be categorized as gay or lesbian when a greater degree of gender "inversion" was present on the face—gender incongruency among multiple gendered facial cues (Freeman, Johnson, Ambady, & Rule, 2010). Thus, due to the culturally pervasive stereotype that gay men are feminine and lesbian women are masculine, the presence of feminine cues on a male face or masculine cues on a female face consistently biased categorization. This is finding consistent with other research that found similar effects among multiple gendered bodily cues (Johnson et al., 2007) and is an example of the impact of top-down stereotypes on social categorization as well as the link between stereotypic assumptions and specific cues present in the environment.

Intersectionality effects, discussed briefly in the subsection titled "Facial Cues," have attracted increasing attention in the literature as an interesting example of stereotype feedback on visual perception and social categorization. Although multiple social categories certainly can intersect because of an overlap in diagnostic phenotypic cues (e.g., Afrocentric features also contain cues to the "male" sex category; Johnson et al., 2012), multiple social categories can become linked based on an overlap in stereotype associations. When cues on a face activate one social category and its associated knowledge structures and expectations (e.g., male cues on a face activating the concept "male" and associated expectations about an individual, such as "aggressive"), this facilitates the categorization of other social categories that incidentally share similar stereotypic expectations (e.g., the race category "Black," which shares the implicit expectation of aggression with the "male" category). Behaviorally, these stereotype overlaps can cause one category (e.g., "male") to facilitate recognition of another category along a different dimension (e.g., "Black"). They can provide a top-down source of prediction on the categorization of ambiguous stimuli, such that gender-ambiguous Black faces consistently are categorized as males. This overlap also means that certain individuals, such as Black females, experience stereotype incongruence during social categorization. Stereotype overlap between the "Black" and "male" categories means that Black female faces partially activate the "male" category, which impedes sex categorization (as with Asian male faces, which partially activate the "female" category; Johnson et al., 2012). Similar effects have been shown between intersecting race and emotion categories (e.g., "Black" and "angry"; Hugenberg & Bodenhausen, 2004) and sex and emotion categories (e.g., "female" and "joy"; Hess et al., 2000). In this case, the conceptual structure of stereotypes and their inherently predictive nature allow social categories and the facial cues associated with them to provide a visual context for the perception of other social categories, even those from orthogonal dimensions (for a review, see Johnson & Freeman, 2010). Indeed, a recent study showed that individual differences in stereotype overlap (e.g., similarity in conceptual content of stereotypes for the "Black" and "male" social categories) predicted the amount of perceptual intersectionality effects as measured with computer mouse-tracking (Stolier & Freeman, 2016).

Motivation

Motivation has been explored extensively as an influence on perception harbored in the perceiver. Transient motivational states can influence visual perceptions, such that individuals will perceive ambiguous stimuli in line with whatever interpretation will have a positive outcome for them (Balcetis & Dunning, 2006; Voss et al., 2008). However, motivation also can be thought of as a chronic tuning of perception toward whatever aspects of the environment are most adaptively relevant or useful, as we addressed in the introduction in our discussion of the environmental cues preferentially attended to by perceivers. Typically, these motivational influences bear weight on perception even when they reside outside of conscious awareness. For example, participants are more likely to identify an impoverished image of a gun as a gun when primed with a Black face, because of the association of African Americans with crime in the United States and the motivation to recognize and respond to potential threats in the environment (Eberhardt, Goff, Purdie, & Davies, 2004). In the realm of social categorization, researchers have shown that unconscious biological factors, such as fertility in women (Johnston, Arden, Macrae, & Grace, 2003), and conscious motivational states, such as sexual desire (Brinsmead-Stockham, Johnston, Miles, & Macrae, 2008), can modulate the process of sex categorization to increase efficiency (speed and accuracy) of the recognition of potential mates.

Individual differences in overall vigilance to certain social cues also modulate person perception. These can be thought of as individual differences in "attunements" to particular aspects of the environment, in the Gibsonian sense. For example, adults high in attachment anxiety have a speed-accuracy trade-off in perceiving emotional expressions on faces: Although they are hypervigilant to the presence of emotion cues on a face and fast to identify an emotion when a neutral face dynamically changes its expression, these assessments typically are less accurate than those made by nonanxious individuals (Fraley, Niedenthal, Marks, Brumbaugh, & Vicary, 2006). As with visual context, perceivers rely more on motivation and other perceiver inputs when the target of perception is ambiguous. (For a discussion, see Pauker et al., 2010.) For example, individuals high in stigma consciousness (the expectation of being stereotyped and stigmatized by others; Pinel, 1999) are more likely to interpret an ambiguous emotional expression as expressing contempt (Inzlicht, Kaiser, & Major, 2008). On the other end of the spectrum, White individuals high in racial prejudice are significantly more likely to categorize racially ambiguous angry faces as Black (Hugenberg & Bodenhausen, 2004; Hutchings & Haddock, 2008). Although the intersection between the emotion concept "anger" and the race category Black is common in the United States, as previously discussed, White individuals high in racial prejudice have an exaggerated version of this effect due to their particular motivation to recognize what they view as a threatening social group.

Intergroup Processes

Humans possess an intrinsic drive to form social groups and behave in ways that sustain those groups. From this tendency to support and protect the in-group while remaining suspicious of the out-group, a number of perceptual consequences emerge when categorizing an individual as an in-group or out-group member. Indeed, a growing body of research suggests a fundamental divergence in the early visual processing of in-group versus out-group faces. A substantial amount of early evidence for an in-group/out-group processing distinction came from observations of the "cross-race effect," a robust phenomenon where recognition memory is better for own-race rather than other-race faces (Meissner & Brigham, 2001). A great deal of research looked into the underlying mechanisms of this effect, with evidence accumulating to suggest possible contributions of perceptual expertise and greater familiarity with the racial in-group (MacLin & Malpass, 2001), increased individuation (versus mere categorization) of own-race faces (Hugenberg, Young, Bernstein, & Sacco, 2010), and, importantly, poorer encoding of other-race faces due to a divergence in the way other-race faces are processed visually. In particular, findings suggest that perception of racial out-group faces relies on featural processing (encoding of isolated focal cues on a face) versus configural processing (better encoding of the gestalt spatial layout of a face; Michel, Rossion, Han, Chung, & Caldara, 2006) and that the effect may manifest at a very low level in differences in how attention is allocated to different parts of the face (Hills & Lewis, 2006, 2011; Hills & Pake, 2013). Early evidence began to suggest that this shift in processing was the fundamental mechanism behind the cross-race effect, over and above a lack of familiarity or expertise with bottom-up cues more prevalent in racial out groups. For example, researchers showed that identical racially ambiguous faces, which contain both own-race and other-race cues, were processed more holistically whenever categorized as own race (Michel, Corneille, & Roisson, 2007).

Meanwhile, research also accumulated to suggest that the cross-race effect might be one instance of a broader cross-category effect, where there is simply better encoding of in-group versus out-group faces in all cases. A powerful paradigm used to investigate these and other effects in intergroup relations is the minimal group paradigm, in which participants are assigned to an arbitrary "minimal" group with which they have no prior knowledge, familiarity, or stereotypes (Tajfel, 1970). Studies have shown that when such arbitrary coalitions are created in an experimental setting, participants rapidly adapt to this new context and even come to spontaneously categorize individuals along new arbitrary category dimensions more readily than they do by race. Researchers have speculated that these effects show that race dominates perception only because it is such a visually salient category dimension, not necessarily because it is the most important or primary of human coalitional divisions (Kurzban, Tooby, & Cosmides, 2001). Other work has shown that these effects extend to evaluative dimensions, such that participants show implicit favoritism for minimal in-group members (Van Bavel & Cunningham, 2009). Importantly, cross-category effects also have been shown for minimal groups, such that participants have better recognition memory for in-group versus out-group faces even when these groups are minimal (Van Bavel, Packer, & Cunningham, 2012). In both of these studies, the minimal groups included both Black and White individuals.

The impressive effects observed in minimal group paradigms hint at a social-cognitive influence on face perception that is driven mainly by group membership. Indeed, the salience of group identity also can impact the perception of natural groups, such as race. Chiao, Heck, Nakayama, and Ambady (2006) explored this by priming biracial individuals with either a Black or White identity. When primed with their Black identities, participants subsequently performed a visual search task with Black and White faces much like Black participants (i.e., faster visual search times for Black faces). The opposite effect was observed when participants were primed with their White identities, suggesting that top-down effects of group membership on perception can be modulated by individual differences in the salience of group identity. These effects also are influenced by enduring characteristics of the perceiver, such as individual differences in lay beliefs about traits and categories (i.e., essentialism versus incrementalism). For example, biracial individuals tend to have more flexible conceptions of group membership, which leads to differences in their reliance on context cues to categorize faces along the race dimension. Specifically, individuals belonging to only one race tend to have more essentialist conceptions of group identity, leading to a greater reliance on contextual cues (e.g., verbal race labels) to disambiguate processing of racially ambiguous faces (Pauker & Ambady 2009).

However, there also is some evidence for the role of familiarity and personal experience with out-group members in cross-category perception. An extensive literature has documented these effects by examining perceptual boundaries between social categories—the point in a continuum of morphed faces where participants perceive a transition from one category to another. Importantly, these boundaries are malleable and can be influenced by very recent context. For example, repeated exposure to male faces moves the gender category boundary toward the male category (making participants more conservative about categorizing faces as male, ultimately categorizing more faces as female; Webster, Kaping, Mizokami, & Duhamel, 2004). Similarly, the category boundary between White and Asian faces shifts toward the White category when target faces are presented in a sequence of White faces. These shifts also can be induced by more chronic changes in exposure and frequency of encounters with out-group faces. For example, Asian college students show a shift in their perceptual boundary between the White and Asian categories when they live in the United States for approximately 1 year (Webster et al., 2004). In general, researchers find that people tend to shift boundaries toward their own social identity, which potentially reflects an adaptive mechanism—humans are conservative about categorizing novel individuals as in-group members, particularly when such individuals are ambiguous in-group membership, since mistakes in this categorization could be costly (Tajfel & Turner, 1979).

Finally, it is important to note the difficulty in separating genuine top-down effects on perception from top-down influences on postperceptual processes, such as response biases or recognition behavior. This issue has led some researchers to criticize the idea that top-down factors are able to penetrate perceptual representations (Firestone & Scholl, 2016), drawing on older ideas of functional modularity (Fodor, 1983; Pylyshyn, 1999). In this ongoing debate, we believe more implicit behavioral measures (such as mouse-tracking) and neuroimaging methods that can better assess perceptual representations (e.g., multivariate fMRI) and do not require explicit responses may be helpful in addressing to what extent higher-order social cognition can shape lower-level perceptual representations.

COMPUTATIONAL AND NEURAL MECHANISMS

A great deal of work in social neuroscience has aimed to determine which aspects of the brain's visual processing regions are selective for faces and bodies. This work built on prominent early models of face processing (Bruce & Young, 1986), which focused on isolating the neural systems responsible for processing invariant qualities of a face, such as a face's identity, versus variant qualities, such as dynamic facial expressions. Research on the neural systems of face perception in turn built on the incredible progress in neuroscience describing the structure of basic visual processing. After visual sensory information hits the retina, it is relayed via optic nerve fibers that largely terminate in the lateral geniculate nucleus of the thalamus. The lateral geniculate nucleus in turn relays information to primary visual cortex (striate cortex), where it initially retains its retinotopic coding (i.e., purely veridical neural processing of the light on the retina) (Bullier, 2002). Visual information is further processed by two extrastriate pathways, known as the dorsal and the ventral visual streams (Goodale & Milner, 1992). The ventral visual stream, also known as the "what" stream, comprises ventral aspects of occipitotemporal cortex, key processing regions for the visual recognition and categorization of objects. A great deal of work in social and cognitive neuroscience has focused on delineating which aspects of the ventral visual stream are selective for faces and bodies and how these neural systems interact with larger-scale brain networks. Indeed, the increasing capabilities of social and cognitive neuroscience to characterize individual cognitive functions in terms of the collaborative activity of multiple large-scale brain networks stands to revolutionize theory development in social and cognitive psychology, including the field of person perception (Barrett & Satpute, 2013)

In person perception, the ventral visual stream is primarily responsible for processing static facial cues (Haxby et al., 2000). In particular, early feature-based processing is undertaken by the occipital face area (OFA), with higher-level representation of the configural properties of a face occurring in the fusiform gyrus (FG). The FG in particular has been the focus of intense scrutiny regarding its precise role in face processing. This debate follows from the discovery of a functionally defined region in the FG commonly referred to as the fusiform face area (FFA; Kanwisher, McDermott, & Chun, 1997), which appears strongly selective for faces and has been posited as a face perception module. Regardless of the specific computations performed by the FFA and its status as a truly distinct functional module, the FG/FFA has undisputed primacy in the neural processing of faces (Haxby et al., 2000). Moreover, because of the ventral visual stream's role in categorizing visual objects in general, and its particular sensitivity to faces, it is unsurprising that these regions are routinely implicated in social category representation. Multi-voxel pattern analyses (MVPA) of fMRI data, which are able to isolate the unique patterns of neural activity associated with specific stimulus conditions (Norman, Polyn, Detre, & Haxby, 2006), are consistently able to isolate specific representations for social categories in the race (Contreras, Banaji, & Mitchell, 2013) and sex (Kaul, Rees, & Ishai, 2011) dimensions. Similarly, processing of static bodily cues is subserved by the extrastriate body area and fusiform body area (Peelen & Downing, 2007). However, when bodies provide a disambiguating context for the social categorization of faces, the meaningful social category information still appears to be encoded in the FG/FFA (Cox, Meyers, & Sinha, 2004). Additionally, fascinating work shows that gender-specific olfactory cues (i.e., compounds that mimic sex hormones) also elicit FG activity (Savic, Berglund, Gulyas, & Roland, 2001), suggesting a more general sensitivity to social category information in the FG.

The ventral visual stream is also sensitive to several of the top-down factors discussed previously. An important aspect of visual processing is that sensory input becomes more constrained by conceptual and predictive factors along more anterior aspects of the ventral visual stream (Grill-Spector & Weiner, 2014). Although early feature processing occurs in the OFA, more anterior regions, such as the FG, involved in forming higher-order perceptual characteristics of a face largely are constrained by dense structural and functional connections with higher-order regions, such as the orbitofrontal cortex (OFC), which comprises the most ventral aspects of the prefrontal cortex (PFC; Zanto, Rubens, Thangavel, & Gazzaley, 2011). Some evidence also suggests that the anterior temporal lobe, at the end of the ventral visual processing stream, houses amodal representations of face identity (Anzellotti & Caramazza, 2014). However, even the FG appears to be sensitive to complex information about a face's identity (e.g., prior knowledge and familiarity; Rotshtein, Henson, Treves, Driver, & Dolan, 2005). Moreover, the FG shows an in-group/out-group distinction even when the groups in question are minimal groups, suggesting that intergroup effects in the FG reflect higher-level coding of perceptual targets beyond visual features or familiarity effects (Van Bavel et al., 2008). It is worth noting that in this case, "in-group/out-group distinction" simply means that there was greater activity in the right FG. Since FG activity reflects higher-level processing of faces, including configural processing and enhanced encoding, this simple distinction in activity could suggest a potential contributing mechanism to cross-category effects. However, examining neural activity just in terms of overall mean activation across a brain region sometimes obscures a more nuanced story. A recent fMRI study divided participants into mixed-race minimal groups and showed that even though the FG shows increased activity for minimal in-group faces, face race still is representationally distinct in the FG as measured by MVPA (Ratner, Kaul, & Van Bavel, 2013). MVPA also reveals an interesting pattern of effects for individuals who are implicitly prejudiced, who show more distinct (i.e., dissimilar) neural representations of own- and other-race faces in the FG (Brosch, Bar-David, & Phelps, 2013). Since evaluative bias causes individuals to see out-group members as more similar (and thus more different from in-group members; Ostrom & Sedikides, 1992), these findings suggest that these individual differences in evaluative bias are detectable at the level of neural representations of social categories and reflect a perceptual bias.

Recent work also has used MVPA approaches to examine how stereotype intersectionality effects can bias neural representations of faces in the FG and OFC. Importantly, the OFC is theorized to constrain face representations in the FG via automatic activation of stereotypes and associated predictions and expectations (Knutson, Mah, Manly, & Grafman, 2007; Milne & Grafman, 2001). In a recent set of studies, researchers presented participants with faces crossed on gender, race, and emotion categories. Participants also completed a mouse-tracking task that indexed individual differences in perceptual biases (e.g., subjective perceptions of similarity between the "Black" and "male" categories) as well as a stereotype contents task to assess individual differences in conceptual knowledge (i.e., stereotypes) about each social category. Categories exhibiting greater conceptual similarity (e.g., Black and Angry) predicted greater perceptual biases, and this biased similarity was in turn reflected in the representational similarity of categories' patterns of neural activity in the FG and OFC. For example, a participant whose stereotypes overlapped between the "Black" and "male" categories tended to be see faces belonging to those categories more similarity (perceptual biases assessed with mouse-tracking), and FG and OFC neural patterns representing the "Black" and "male" categories were consistently more similar, even when controlling for any bottom-up physical similarity (Stolier & Freeman, 2016). This study provides evidence that stereotype overlap indeed can bias relatively low-level perceptual representations of a face in a top-down direction.

Although extrastriate regions along the ventral visual stream are widely acknowledged substrates of static cue processing, with important implications for social categorization, dynamic facial expressions and human movement in general appear to be processed primarily by the superior temporal sulcus (STS), an aspect of the lateral temporal lobe (Haxby et al., 2000). MVPA approaches implicate the STS in representing emotion category information (Said, Moore, Engell, Todorov, & Haxby, 2010b), which largely depends on dynamic facial cues. The STS also has been implicated in fMRI studies of biological motion (Grossman et al., 2000). Ongoing research is attempting to resolve how static and dynamic cues are integrated into stable percepts in the brain. The STS processes and represents both static and dynamic cues but seems to receive this information through divergent pathways. For example, transcranial magnetic stimulation (which temporarily produces effects similar to a focal lesion) to the OFA reduces STS responses to static cues but not to dynamic cues (Pitcher, Duchaine, & Walsh, 2014), suggesting that the STS receives information about static cues from the OFA but receives information about dynamic cues from another, as-yet undescribed pathway.

This is particularly interesting, given the fact that there are no direct white matter pathways from the OFA to the STS (Gschwind, Pourtois, Schwartz, Van De Ville, & Vuilleumier, 2012), further complicating the nature of the relationship. Additional work is necessary to disentangle the processes that integrate static and dynamic cues in person perception.

Researchers interested in trait attribution and impression formation have focused a large amount of their work on the medial PFC (MPFC), which appears to represent the abstract knowledge about personality traits and mental states inferred about another person (Mitchell, Banaji, & Macrae, 2005). This work has isolated an interesting distinction between ventral and dorsal aspects of the MPFC, observing that DMPFC has a more central role in integrating person knowledge with trait attributions gleaned from faces (Ferrari et al., 2016). However, the visual perception of personality traits, as discussed previously, depends on many of the same perceptual mechanisms responsible for representing social category information, and as such, similar regions like the FG also are recruited during trait attributions, such as judgments of trustworthiness (Todorov & Engell, 2008) and baby-facedness (which correlate with judgments of competence/dominance; Zebrowitz, Luevano, Bronstad, & Aharon, 2009). The amygdala, a subcortical structure located deep in the medial temporal lobes, also plays an interesting role tin perceptions of trustworthiness. The amygdala is responsive to trustworthy and untrustworthy faces (Engell, Haxby, & Todorov, 2007), and tracks trustworthiness cues even when faces are presented subliminally (Freeman, Stolier, Ingbretsen, & Hehman, 2014). The amygdala seems preferentially involved in spontaneous trait inference (i.e., rapid personality judgments made without prior knowledge about faces; Todorov & Engell, 2008), consistent with interpretations of amygdala activity as reflecting motivational salience in the environment more generally, signaling relevant details in the visual field and prompting increased processing (W. A. Cunningham & Brosch, 2012). Consistent with recent evidence of the role of facial averageness in trustworthiness judgments (Sofer et al., 2015), the amygdala also has been shown to respond to the atypicality of faces broadly, which may contribute to its observed role in tracking trustworthiness (Said, Dotsch, & Todorov, 2010a).

Although much work in neuroimaging has focused on specific regions that seem selectively tuned to faces, recent work in social and cognitive neuroscience has examined the collaborative role of multiple domain-general neural regions in face perception, with a particular focus on the regions responsible for implementing top-down effects. To characterize a large-scale network involved in top-down face perception, researchers in one study "trained" participants to recognize faces embedded in visual noise. Participants saw faces increasingly obscured by noise and, on critical trials, saw only noise, with no face present. However, participants still reported the ability to detect faces in the pure noise trials (Li et al., 2009). Researchers examined these trials to explore face processing from a completely top-down direction (i.e., when literally no bottom-up facial cues were visually present), and they found greater activity in bilateral FFA and OFA. They additionally examined which regions were most connected functionally with the FFA during illusory face trials and found consistently increased connectivity with the left STS, bilateral OFC, left anterior cingulate cortex (ACC, involved in conflict monitoring; Botvinick, Braver, Barch, Carter, & Cohen, 2001), left dorsolateral prefrontal cortex (DLPFC, involved in response inhibition; MacDonald, Cohen, Stenger, & Carter, 2000), left inferior parietal lobule (IPL), and left premotor cortex (Li et al., 2009). Based on further analysis of both intrinsic and task-based functional connectivity between these regions (Li et al., 2010), the researchers outline a specific model for top-down face processing, wherein the OFC shifts feature processing in the OFA based on predictive assumptions, which can then cause false or biased detection of features in the environment, in turn biasing percepts formed in the FG.

More work is needed to further characterize the top-down face-processing network, but it is interesting to note in the meantime that these neural regions were implicated previously in downstream evaluative aspects of social categorization, such as implicit evaluation (e.g., amygdala, OFC) and regulatory processes exerted on these evaluative biases (e.g., ACC, DLPFC; for a review, see Amodio, 2014). However, additional recent research converges with the idea of a top-down face-processing network, implicating these regions in mechanisms of social categorization when faces simply are viewed passively. A recent neuroimaging study examined neural responses when participants passively viewed face stimuli crossed on race and emotion. Participants also completed a mouse-tracking task to determine individual differences in subjective stereotype overlap between race and emotion categories. As discussed previously, race and emotion categories are linked perceptually because of stereotypic associations (e.g., Black faces are expected to be angry, White faces are expected to be joyful). As faces became more stereotypically incongruent (e.g., joyful Black faces and angry White faces), activity in the ACC increased linearly, and functional connectivity increased between the ACC and FG, reflecting the need to resolve a processing conflict: Due to stereotypes, participants expect to see angry Black faces, and regulatory processing is required to manage the conflict presented by a joyful Black face. Importantly, in individuals high in stereotype overlap, the DLPFC also showed increased activity in response to stereotype-incongruent targets, suggesting a potential inhibition of the initial (incorrect) stereotypical prediction of the face's emotion (Hehman, Ingbretsen, & Freeman, 2014c). The fact that regions involved in conflict monitoring and response inhibition responded when participants were viewing faces passively is an important insight into the large-scale mechanisms of face perception.

Ongoing findings from social neuroscience and social vision have inspired theoretical models that account for the dynamic interactivity between bottom-up and top-down factors observed in person perception. In particular, a computational model has provided a framework for understanding how perceptual cues interact with top-down factors during social categorization and how the precise nature of these interactions can result in many of the perceptual biases reviewed in this chapter (Freeman & Ambady, 2011a). The dynamic interactive (DI) model describes computationally the multiple levels of person perception and how these different levels interact dynamically. At the cue level, the model accounts for visual (face, body, and visual contextual) and auditory (voice) cues, which have ascendant connections to higher-level nodes at the category and stereotype level in addition to feedback connections from those nodes. The category level models social categories, such as sex, race, age, and emotion, which have bidirectional connections to nodes at the stereotype level, allowing stereotypes to provide a dynamic constraint on early-level visual processing of social categories, as we have observed. At each level, nodes are activated in parallel and share lateral connections. For example, individual facial cues can facilitate processing of one another, or they can inhibit one another via feedback connections from stereotype nodes linked to a particular facial feature. The model also accounts for higher-level cognitive states, such as goals, motivations, and attention, which provide an additional constraint on processing. For example, a typical behavioral experiment that tasks a participant with categorizing race activates race-related attentional and goal-oriented processing, which can guide and constrain processing at all levels of the model.

Thus far, the DI model appears to model successfully many of the top-down effects on person perception discussed in this chapter, including complex interactions between perceptual cues and stereotypes, such as intersectionality (Johnson et al., 2012) and overgeneralization effects (Zebrowitz et al., 2003). Recent work also has used the DI model to demonstrate the role of interracial exposure in influencing perceptions of racially ambiguous individuals. Using a large online sample from across the United States, researchers used computer mouse-tracking to show that White participants who live in parts of the country with higher exposure to Black individuals show stable coactivation of the White and Black race categories when categorizing a mixed-race individual. In contrast, White participants who live in areas with low exposure to Black individuals showed highly unstable coactivation of the White and Black categories, with abrupt shifts between the two categories reflected in their computer mouse movements en route to the “White” or “Black” category labels on the screen. Additional modeling work suggested that these unstable dynamics arose in low-exposure individuals because they hold stereotypes that White and Black individuals are highly dissimilar. Thus, when encountering a mixed-race face, bottom-up visual processing attempts to push the system to an in-between point between the White and Black categories, while top-down conceptual knowledge in a low-exposure perceiver tries to rapidly pull the system into a given race category, creating unstable dynamics (Freeman, Pauker, & Sanchez, 2016). Importantly, unstable shifts in race category activation also predicted participants’ evaluative bias toward mixed-race individuals, demonstrating that such downstream effects can be represented by individual differences in the structure and dynamics of the broader system (Freeman et al., 2016).

The strength of the DI model may lie in modeling the system as massively interactive, allowing bottom-up perceptual cues, conceptual processing, and high-level cognitive states to interact flexibly in real time during the processing of visual input. Future work is required to refine the model to account for additional cognitive and affective states of the perceiver (e.g., goals, emotional state, attention) and how these inputs affect lower-level perception. To further situate our discussion of person perception in the complex and variable nature of everyday social contexts, we now briefly discuss the impact that certain aspects of the person perception process can have on interpersonal interaction and downstream behavior.

DOWNSTREAM CONSEQUENCES OF PERSON PERCEPTION

Historically, social psychologists studied the downstream consequences of person perception and social categorization while cognitive psychologists and neuroscientists studied the perceptual processes leading to these categorizations and impressions. Much early work in social psychology discussed the consequences of social categorization and stereotyping, recognizing the ability of these processes to guide behavior and evaluative dimensions in an unintended and implicit manner (Bodenhausen & Macrae, 1998). However, this approach assumes a perceptual endpoint: Perceptual processes give rise to an initial impression or categorization, which in turn triggers related stereotypes and their associated biasing power on behavior and interaction. Moreover, researchers also typically assumed that stereotypes were applied to the same degree to all individuals placed in a given social category (Fiske & Taylor, 1991). However, many of the ongoing contributions summarized in this chapter—from interdisciplinary "social vision" approaches to current theoretical models of person perception—suggest that these processes are best thought of as interactive and continuous, and many of the downstream effects of person perception (such as attitudes and biases that can come to pervade society at an institutional level) are rooted in the subtle dynamics of earlier processing stages (Freeman & Ambady, 2011a).

As hinted at in the earlier discussion of facial cues, visual context, and stereotypes, there is a complex relationship between features of the face and their related stereotypes. Consistent with these insights, emerging work shows that attitudes and behaviors emerging from stereotypes and related trait assumptions are not applied categorically to all members of a social category but are often nuanced inferences that depend on the degree to which an individual displays specific category-relevant facial features (Blair, Chapleau, & Judd, 2004a). For example, members of marginalized racial groups experience more stigma and bias when they possess facial cues that are highly typical and diagnostic for their race (Maddox, 2004). In many cases, these biases are enormously consequential for members of marginalized social groups. For example, there exists an unfortunate and well-documented "shooter bias," in which law enforcement officers are more likely to shoot individuals belonging to social categories commonly stereotyped as hostile and aggressive, such as African Americans (Correll, Park, Judd, & Wittenbrink, 2002; but see James, Vila, & Daratha, 2013; James, Klinger, & Vila, 2014). Additionally, researchers found that Black felony offenders with more Afrocentric facial features are given longer criminal sentences, even when controlling for the number and severity of crimes committed and the individuals' past criminal histories (Blair, Judd, & Chapleau, 2004b). These featural biases underscore the importance of studying the impact of bottom-up cues in person perception.

Facial cues also can lead to consequential social outcomes when they introduce inconsistencies and incongruities into social categorization. For example, women with masculine facial features are less likely to be elected to political office in conservative states of the United States (Hehman et al., 2014a). There are also several negative social outcomes for individuals belonging to intersectional social categories (e.g., Black individuals and Asian individuals, because of the association of the "Black" category with masculinity and the "Asian" category with femininity). In a collection of studies, Galinsky, Hall, & Cuddy (2013) found that Black women and Asian men are less successful in heterosexual romantic relationships, and Black individuals in general are more likely to be represented in social institutions that privilege masculinity (such as business leadership and sports). These patterns were found to be consistent between lab-based paradigms and large-scale data from the United States Census and the NCAA Student-Athlete Ethnicity Report (Galinsky et al., 2013).

Rapid trait-based inferences, which depend on invariant facial cues and often are subject to systematic bias, also can result in a number of consequences for the targets of perception. The consequences of perceptions of dominance and competence have been widely studied in the context of leadership selection and compensation. For example, a number of studies show that individuals with faces judged to be competent are more likely to be elected to political office (Ballew & Todorov, 2007). In the business domain, such individuals are much more likely to be hired by successful companies and receive higher salaries (Rule & Ambady, 2008b). Additionally, individuals with untrustworthy-looking faces are more likely to receive guilty verdicts in court, even when there is scant evidence of their guilt (Porter, ten Brinke, & Gustaw, 2010). On the other end of the spectrum, baby-faced individuals (who are consistently perceived as more trustworthy and honest) are more likely to win their legal cases in court (Zebrowitz & McDonald, 1991). Although these insights are discouraging, it is remarkable that early perceptual biases in person perception can come to drive pervasive trends in society at an institutional level. Further work is needed to understand how these insights can be used to implement policies to reduce these systematic trends.

CONCLUSION

The human perceptual system is remarkably attuned to social information in the environment. As such, a particular attentional focus on faces, bodies, and voices emerges early in development and remains a potent force in social perception and interaction throughout the life span. Emerging from the vast cognitive resources deployed to make sense of the social environment is an incredible human propensity to infer quickly and often accurately information from the qualities of another person's face and body, although, as we have discussed, the efficiency of this system sometimes renders it vulnerable to systematic biases. Since interpersonal perception, communication, competition, and cooperation are such integral parts of social life, these biases can be incredibly costly, marring social behavior. Recent theoretical insights, motivated by interdisciplinary collaboration among the social, cognitive, neural, and vision sciences, have provided a deeper understanding and appreciation for how the complexity of the social environment is perceived and understood. The emerging scientific understanding of person perception yields a fascinating picture: a complex and dynamic system encompassing interaction among the perceptual cues available in the environment and the cognitive systems inherent to the perceiver. In this chapter, we have but scratched the surface of this fascinating research domain, and we look forward to future work building an increasingly rich understanding of how we perceive and shape the social world.

REFERENCES

Alaei, R., & Rule, N.O. (2016). Accuracy of perceiving social attributes. In J. A. Hall, M. Schmid Mast, & T. V. West (Eds.), *The social psychology of perceiving others accurately* (pp. 125–142). New York, NY: Cambridge University Press.

Allport, G. W. (1954). *The nature of prejudice*. Oxford, UK: Addison-Wesley.

Ambadar, Z., Schooler, J. W., & Cohn, J.F. (2005). Deciphering the enigmatic face: the importance of facial dynamic in interpreting subtle facial expressions. *Psychological Science*, *16*, 403–410.

Ambady, N., Hallahan, M., & Conner, B. (1999). Accuracy of judgments of sexual orientation from thin slices of behavior. *Journal of Personality and Social Psychology*, *77*, 538–547.

Ambady, N., & Rosenthal, R. (1993). Half a minute: predicting teacher evaluations from thin slices of nonverbal behavior and physical attractiveness. *Journal of Personality and Social Psychology*, *64*(3), 431–441.

Amodio, D. M. (2014). The neuroscience of prejudice and stereotyping. *Nature Reviews Neuroscience*, *15*(10), 670–682.

Anderson, E., Siegel, E. H., Bliss-Moreau, E., & Barrett, L. F. (2011). The visual impact of gossip. *Science*, *332*, 1446–1448.

Anzellotti, S., & Caramazza, A. (2014). The neural mechanisms for the recognition of face identity in humans. *Frontiers in Psychology*, *5*, 672.

Atkinson, A. P., Dittrich, W. H., Gemmell, A. J., & Young, A. W. (2004). Emotion perception from dynamic and static body expressions in point-light and full-light displays. *Perception*, *33*, 717–746.

Atkinson, J. W., & Walker, E. L. (1956). The affiliation motive and perceptual sensitivity to faces. *Journal of Abnormal Psychology*, *53*, 38–41.

Balcetis, E., & Dunning, D. (2006). See what you want to see: motivational influences on visual perception. *Journal of Personality and Social Psychology*, *91*, 612–625.

Ballew, C. C., & Todorov, A. (2007). Predicting political elections from rapid and unreflective face judgments. *Proceedings of the National Academy of Sciences*, *104*, 17948–17953.

Bar, M. (2004). Visual objects in context. *Nature Reviews Neuroscience*, *5*, 617–629.

Bargh, J. A., Chen, M., & Burrows, L. (1996). Automaticity of social behavior: direct effects of trait construct and stereotype activation on action. *Journal of Personality and Social Psychology*, *71*, 230–244.

Barrett, L. F., Mesquita, B., & Gendron, M. (2011). Context in emotion perception. *Current Directions in Psychological Science*, *20*, 286–290.

Barrett, L. F., & Satpute, A. B. (2013). Large-scale brain networks in affective and social neuroscience: towards an integrative functional architecture of the brain. *Current Opinion in Neurobiology*, *23*, 361–372.

Beale, J. M., & Keil, F. C. (1995). Categorical effects in the perception of faces. *Cognition*, *57*, 217–239.

Berry, D. S., & McArthur, L. Z. (1986). Perceiving character in faces: the impact of age-related craniofacial changes on social perception. *Psychological Bulletin*, *100*, 3–18.

Bestelmeyer, P. E. G., Rouger, J., DeBruine, L. M., & Belin, P. (2010). Auditory adaptation in vocal affect perception. *Cognition*, *117*, 217–223.

Biederman, I. (1987). Recognition-by-components: a theory of human image understanding. *Psychological Review*, *94*, 115–147.

Blair, I. V., Chapleau, K. M., & Judd, C. M. (2004a). The use of Afrocentric features as cues for judgment in the presence of diagnostic information. *European Journal of Social Psychology*, *34*, 1–10.

Blair, I. V., Judd, C. M., & Chapleau, K. M. (2004b). The influence of Afrocentric facial features in criminal sentencing. *Psychological Science*, *15*, 674 – 679.

Blake, R. (2001). A primer on binocular rivalry, including current controversies. *Brain and Mind*, *2*, 5–38.

Bodenhausen, G. V., & Macrae, C. N. (1998). Stereotype activation and inhibition. In J. R. Wyer (Ed.), *Advances in social cognition* (Vol. 11, pp. 1–52). Mahwah, NJ: Erlbaum.

Botvinick, M., Braver, T., Barch, D., Carter, C., & Cohen, J. (2001). Conflict monitoring and cognitive control. *Psychological Review*, *108*, 624–652.

Brewer, M. B. (1988). A dual process model of impression formation. *Advances in Social Cognition*, *1*, 1–36.

Brinsmead-Stockham, K., Johnston, L., Miles, L., & Macrae, C. N. (2008). Female sexual orientation and menstrual influences on person perception. *Journal of Experimental Social Psychology*, *44*, 729–734.

Brosch, T., Bar-David, E., & Phelps, E. A. (2013). Implicit race bias decreases the similarity of neural representations of black and white faces. *Psychological Science*, *24*(2), 160–166.

Brown, E., & Perrett, D. I. (1993). What gives a face its gender? *Perception*, *22*, 829–840.

Bruce, V., & Young, A. W. (1986). A theoretical perspective for understanding face recognition. *British Journal of Psychology*, *77*, 305–327.

Bruner, J. S., & Goodman, C. C. (1947). Value and need as organizing factors in perception. *Journal of Abnormal and Social Psychology*, *42*, 33–44.

Bullier, J. (2002). Neural basis of vision. In H. Pashler & S. Yantis (Eds.), *Stevens' handbook of experimental psychology, Vol. 1: Sensation and perception* (pp. 1–40). Hoboken, NJ: Wiley.

Campanella, S., & Belin, P. (2007). Integrating face and voice in person perception. *Trends in Cognitive Sciences*, *11*, 535−543.

Carré, J. M., & McCormick, C. M. (2008). In your face: facial metrics predict aggressive behaviour in the laboratory and in varsity and professional hockey players. *Proceedings of the Royal Society B: Biological Sciences*, *275*(1651), 2651–2656.

Carré, J. M., McCormick, C. M., & Mondloch, C. J. (2009). Facial structure is a reliable cue of aggressive behavior. *Psychological Science*, *20*, 1194–1198.

Carroll, J. M., & Russell, J. A. (1996). Do facial expressions signal specific emotions? Judging emotion from the face in context. *Journal of Personality and Social Psychology*, *70*, 205–218.

Chiao, J., Heck, H. E., Nakayama, K., & Ambady, N. (2006). Priming race in biracial observers affects visual search for Black and White faces. *Psychological Science*, *17*, 387–392.

Contreras, J. M., Banaji, M. R., & Mitchell, J. P. (2013). Multivoxel patterns in fusiform face area differentiate faces by sex and race. *PLoS ONE*, *8*(7), e69684.

Correll, J., Park, B., Judd, C. M., & Wittenbrink, B. (2002). The police officer's dilemma: using ethnicity to disambiguate potentially threatening individuals. *Journal of Personality and Social Psychology*, *83*(6), 1314–1329.

Cox, D., Meyers, E., & Sinha, P. (2004). Contextually evoked object-specific responses in human visual cortex. *Science*, *304*(5667), 115–117.

Cunningham, M. R. (1986). Measuring the physical in physical attractiveness: Quasi-experiments on the sociobiology of female facial beauty. *Journal of Personality and Social Psychology*, *50*, 925–935.

Cunningham, W. A., & Brosch, T. (2012). Motivational salience: amygdala tuning from traits, needs, values, and goals. *Current Directions in Psychological Science*, *21*(1), 54–59.

Cutting, J. E., & Kozlowski, L. T. (1977). Recognizing friends by their walk: gait perception without familiarity cues. *Bulletin of the Psychonomic Society*, *9*, 353–356.

Cutting, J. E., Proffitt, D. R., & Kozlowski, L. T. (1978). A biomechanical invariant for gait perception. *Journal of Experimental Psychology: Human Perception and Performance*, *4*, 357–372.

de Gelder, B. (2005). Toward a neurobiology of emotional body language. *Nature Reviews Neuroscience*, *7*, 242–249.

de Gelder, B., & Vroomen, J. (2000). The perception of emotions by ear and by eye. *Cognition and Emotion*, *14*, 289−311.

Downing, P. E., Bray, D., Rogers, J., & Childs, C. (2004). Bodies capture attention when nothing is expected. *Cognition*, *93*, B27–B38.

Eberhardt, J. L., Goff, P. A., Purdie, V. J., & Davies, P. G. (2004). Seeing black: race, crime, and visual processing. *Journal of Personality and Social Psychology*, *87*, 876–893.

Engell, A. D., Haxby, J. V., & Todorov, A. (2007). Implicit trustworthiness decisions: automatic encoding of face properties in the human amygdala. *Journal of Cognitive Neuroscience*, *19*(9), 1508–1519.

Erdelyi, M. H. (1974). A new look at the new look: perceptual defense and vigilance. *Psychological Review*, *81*(1), 1–25.

Evans, S., Neave, N., & Wakelin, D. (2006). Relationships between vocal characteristics and body size and shape in human males: an evolutionary explanation for a deep male voice. *Biological Psychology*, *72*, 160–163.

Ferrari, C., Lega, C., Vernice, M., Tamietto, M., Mende-Siedlecki, P., Vecchi, T., Todorov, A., & Cattaneo, Z. (2014). The dorsomedial prefrontal cortex plays a causal role in integrating social impressions from faces and verbal descriptions. *Cerebral Cortex*, *26*(1), 156–165.

Firestone, C., & Scholl, B. J. (2016). Cognition does not affect perception: evaluating the evidence for "top-down" effects. *Behavioral and Brain Sciences*, *39*: e229.

Fiske, S. T., Cuddy, A. J. C., & Glick, P. (2007). Universal dimensions of social cognition: Warmth and competence. *Trends in Cognitive Sciences*, *11*, 77–83.

Fiske, S. T., & Taylor, S. E. (1991). *Social Cognition*, 2nd ed. New York, NY: McGraw-Hill.

Fitch, W. T., & Giedd, J. (1999). Morphology and development of the human vocal tract: a study using magnetic resonance imaging. *Journal of the Acoustical Society of America*, *106*, 1511–1522.

Fodor, J. A. (1983). *The modularity of mind: an essay on faculty psychology*. Cambridge, MA: MIT Press.

Fraley, R. C., Niedenthal, P. M., Marks, M. J., Brumbaugh, C. C., & Vicary, A. (2006). Adult attachment and the perception of emotional expressions: probing the hyper-activating strategies underlying anxious attachment. *Journal of Personality*, *74*, 1163–1190.

Freeman, J. B., & Ambady, N. (2009). Motions of the hand expose the partial and parallel activation of stereotypes. *Psychological Science*, *20*, 1183–1188.

Freeman, J. B., & Ambady, N. (2011a). A dynamic interactive theory of person construal. *Psychological Review*, *118*(2), 247–279.

Freeman, J. B., & Ambady, N. (2011b). Hand movements reveal the time-course of shape and pigmentation processing in face categorization. *Psychonomic Bulletin & Review*, *18*, 705–712.

Freeman, J. B., & Ambady, N. (2011c). When two become one: temporally dynamic integration of the face and voice. *Journal of Experimental Social Psychology*, *47*, 259–263.

Freeman, J. B., Johnson, K. L., Ambady, A., & Rule, N. O. (2010). Sexual orientation perception involves gendered facial cues. *Personality and Social Psychology Bulletin*, *36*(10), 1318–1331.

Freeman, J. B., Ma, Y., Han, S., & Ambady, N. (2013). Influences of culture and visual context on real-time social categorization. *Journal of Experimental Social Psychology*, *49*, 206–210.

Freeman, J. B., Pauker, K., & Sanchez, D. T. (2016). A perceptual pathway to bias: interracial exposure reduces abrupt shifts in real-time race perception that predict mixed-race bias. *Psychological Science*, *27*(4), 502–517.

Freeman, J. B., Penner, A. M., Saperstein, A., Scheutz, M., & Ambady, N. (2011). Looking the part: social status cues shape race perception. *PLoS ONE*, *6*, e25107.

Freeman, J. B., Stolier, R. M., Ingbretsen, Z. A., & Hehman, E. A. (2014). Amygdala responsivity to high-level social information from unseen faces. *Journal of Neuroscience*, *34*(32), 10573–10581.

Freire, A., Lewis, T. L., Maurer, D., & Blake, R. (2006). The development of sensitivity to biological motion in noise. *Perception*, *35*(5), 647–657.

Frischen, A., Bayliss, A. P., & Tipper, S. P. (2007). Gaze cueing of attention: visual attention, social cognition, and individual differences. *Psychological Bulletin*, *133*, 694–724.

Galinsky, A. D., Hall, E. V., & Cuddy, A. J. (2013). Gendered races: implications for interracial marriage, leadership selection, and athletic participation. *Psychological Science*, *24*(4), 498–506.

Gangestad, S. W., Simpson, J. A., DiGeronimo, K., & Biek, M. (1992). Differential accuracy in person perception across traits: examination of a functional hypothesis. *Journal of Personality and Social Psychology*, *62*, 688–698.

Gibson, J. J. (1979). *The ecological approach to visual perception*. Boston, MA: Houghton Mifflin.

Gilbert, D.T. (1998). Ordinary personology. In D. T. Gilbert, S. T. Fiske, & G. Lindzey (Eds.), *The handbook of social psychology* (4th ed.). New York, NY: McGraw Hill.

Gobbini, M. I., & Haxby, J. V. (2007). Neural systems for recognition of familiar faces. *Neuropsychologia*, *45*, 32–41.

Goldberg, L. R. (1990). An alternate "description of personality": the big-five factor structure. *Personality Processes and Individual Differences*, *59*(6), 1216–1229.

Goodale, M. A., & Milner, A. D. (1992). Separate pathways for perception and action. *Trends in Neurosciences*, *15*, 20–25.

Grammer, K., & Thornhill, R. (1994). Human (*Homo sapiens*) facial attractiveness and sexual selection: the role of symmetry and averageness. *Journal of Comparative Psychology*, *108*, 233–242.

Grill-Spector, K., & Weiner, K. S. (2014). The functional architecture of the ventral temporal cortex and its role in categorization. *Nature Reviews Neuroscience*, *15*(8), 536–548.

Grossman, E., Donnelly, M., Price, R., Pickens, D., Morgan, V., Neighbor, G., & Blake, R. (2000). Brain areas involved in perception of biological motion. *Journal of Cognitive Neuroscience*, *12*(5), 711–720.

Gschwind, M., Pourtois, G., Schwartz, S., Van De Ville, D., & Vuilleumier, P. (2012). White-matter connectivity between face-responsive regions in the human brain. *Cerebral Cortex*, *22*(7), 1564–1576.

Hancock, P. J. B., Bruce, V., & Burton, A. M. (2000). Recognition of unfamiliar faces. *Trends in Cognitive Sciences*, *4*, 330–337.

Harrigan, J. A., Harrigan, K. M., Sale, B. A., & Rosenthal, R. (1996). Detecting anxiety and defensiveness from visual and auditory cues. *Journal of Personality*, *64*, 675–709.

Haselhuhn, M. P., & Wong, E. M. (2012). Bad to the bone: facial structure predicts unethical behaviour. *Proceedings of the Royal Society B: Biological Sciences*, *279*(1728), 571–576.

Hassin, R., Bargh, J. A., & Uleman, J. S. (2002). Spontaneous causal inferences. *Journal of Experimental Social Psychology*, *38*, 515–522.

Haxby, J. V., Hoffman, E. A., & Gobbini, M. A. (2000). The distributed human neural system for face perception. *Trends in Cognitive Sciences*, *4*, 223–233.

Haxby, J. V., Hoffman, E. A., & Gobbini, M. A. (2002). Human neural systems for face recognition and social communication. *Biological Psychiatry*, *51*, 59–67.

Hehman, E., Carpinella, C. M., Johnson, K. L., Leitner, J. B., & Freeman, J. B. (2014a). Early processing of gendered facial cues predicts the electoral success of female politicians. *Social Psychology and Personality Science*, *5*, 815–824.

Hehman, E., Flake, J. K., & Freeman, J. B. (2015). Static and dynamic facial cues differentially impact the consistency of social evaluations. *Personality and Social Psychology Bulletin*, *41*, 1123–1143.

Hehman, E., Ingbretsen, Z. A., & Freeman, J. B. (2014c). The neural basis of stereotypic impact on multiple social categorization. *Psychological Science*, *15*, 342–345.

Hehman, E., Leitner, J. B., & Gaertner, S. (2013). Enhancing static facial features increases intimidation. *Journal of Experimental Social Psychology*, *49*, 747–754.

Hehman, E., Leitner, J. B., & Freeman, J. B. (2014b). The face-time continuum: lifespan changes in facial width-to-height ratio impact aging-associated perceptions. *Personality and Social Psychology Bulletin*, *40*, 1624–1636.

Helmholtz, H. (1867). Concerning the perception in general. In *Readings in the history of psychology*. East Norfolk, CT: Appleton-Century-Crofts.

Hess, U., Adams, R. B., & Kleck, R. E. (2004). Facial appearance, gender, and emotion expression. *Emotion*, *4*, 378–388.

Hess, U., Adams, R. B., & Kleck, R. E. (2005). Who may frown and who should smile? Dominance, affiliation, and the display of happiness and anger. *Cognition & Emotion*, *19*, 515–536.

Hess, U., Senécal, S., Kirouac, G., Herrera, P., Philippot, P., & Kleck, R. E. (2000). Emotional expressivity in men and women: Stereotypes and self-perceptions. *Cognition & Emotion*, *14*(5), 609–642.

Hill, H., Bruce, V., & Akamatsu, S. (1995). Perceiving the sex and race of faces: the role of shape and colour. *Proceedings of the Royal Society B*, *261*, 367–373.

Hills, P. J., & Lewis, M. B. (2006). Reducing the own-race bias in face recognition by shifting attention. *Quarterly Journal of Experimental Psychology*, *59*, 996–1002.

Hills, P. J., & Lewis, M. B. (2011). Reducing the own-race bias in face recognition by attentional shift using fixation crosses preceding the lower half of a face. *Visual Cognition*, *19*, 313–339.

Hills, P. J., & Pake, J. M. (2013). Eye-tracking the own-race bias in face recognition: revealing the perceptual and socio-cognitive mechanisms. *Cognition*, *129*, 586–597.

Hugenberg, K., & Bodenhausen, G.V. (2004). Ambiguity in social categorization: the role of prejudice and facial affect in race categorization. *Psychological Science*, *15*, 342–345.

Hugenberg, K., Young, S. G., Bernstein, M. J., & Sacco, D. F. (2010). The categorization-individuation model: an integrative account of the other-race recognition deficit. *Psychological Review*, *117*(4), 1168–1187.

Hughes, S. M., & Rhodes, G. (2010) Making age assessments based on voice: the impact of the reproductive viability of the speaker. *Journal of Social, Evolutionary, & Cultural Psychology*, *4*, 290–304.

Hutchings, P. B., & Haddock, G. (2008). Look black in anger: the role of implicit prejudice in the categorization and perceived emotional intensity of racially ambiguous faces. *Journal of Experimental Social Psychology*, *44*, 1418–1420.

Inzlicht, M., Kaiser, C. R., & Major, B. (2008). The face of chauvinism: how prejudice expectations shape perceptions of facial affect. *Journal of Experimental Social Psychology*, *44*, 758–766.

Ito, K., Masuda, T., & Hioki, K. (2012). Affective information in context and judgment of facial expression: Cultural similarities and variations in context effects between North Americans and East Asians. *Journal of Cross-Cultural Psychology*, *43*, 429–445.

James, L., Klinger, D. & Vila, B. (2014). Racial and ethnic bias in decisions to shoot seen through a stronger lens: experimental results from high-fidelity laboratory simulations. *Journal of Experimental Criminology*, *10*, 323–340.

James, L., Vila, B., & Daratha, K. (2013). Influence of suspect race and ethnicity on decisions to shoot in high fidelity deadly force judgment and decision-making simulations. *Journal of Experimental Criminology*, *9*, 189–212.

Johansson, G. (1973). Visual perception of biological motion and a model for its analysis. *Perception and Psychophysics*, *14*, 201–211.

Johansson, G. (1975). Visual motion perception. *Scientific American*, *232*, 76–89.

Johnson, K. L., & Freeman, J. B. (2010). A "new look" at person construal: seeing beyond dominance and discreteness. In E. Balcetis & D. Lassiter (Eds.), *The social psychology of visual perception* (pp. 253–272). New York, NY: Psychology Press.

Johnson, K. L., Freeman, J. B., & Pauker, K. (2012). Race is gendered: how covarying phenotypes and stereotypes bias sex categorization. *Journal of Personality and Social Psychology*, *102*, 116–131.

Johnson, K. L., Gill, S., Reichman, V., & Tassinary, L. G. (2007). Swagger, sway, and sexuality: judging sexual orientation from body motion and morphology. *Journal of Personality and Social Psychology*, *93*, 321–334.

Johnston, L., Arden, K., Macrae, C. N., & Grace, R. C. (2003). The need for speed: the menstrual cycle and person construal. *Social Cognition*, *21*, 89–99.

Kanwisher, N., McDermott, J., & Chun, M. M. (1997). The fusiform face area: a module in human extrastriate cortex specialized for face perception. *Journal of Neuroscience*, *17*(11), 4302–4311.

Kaul, C., Rees, G., & Ishai, A. (2011). The gender of face stimuli is represented in multiple regions in the human brain. *Frontiers in Human Neuroscience*, *4*, 238.

Kenny, D. A. (1991). A general model of consensus and accuracy in interpersonal perception. *Psychological Review*, *98*, 155–163.

Kluver, M., Hecht, H., & Troje, N. F. (2016). Internal consistency predicts attractiveness in biological motion walkers. *Evolution and Human Behavior*, *37*(1), 40–46.

Knutson, K. M., Mah, L., Manly, C. F., & Grafman, J. (2007). Neural correlates of automatic beliefs about gender and race. *Human Brain Mapping*, *28*(10), 915–930.

Ko, S. J., Judd, C. M., & Blair, I. V. (2006). What the voice reveals: within- and between-category stereotyping on the basis of voice. *Personality and Social Psychology Bulletin*, *32*, 806−819.

Kozlowski, L.T., & Cutting, J. E. (1977). Recognizing the sex of a walker from a dynamic point-light display. *Perception and Psychophysics*, *21*, 575–580.

Kunda, Z., & Thagard, P. (1996). Forming impressions from stereotypes, traits, and behaviors: a parallel-constraint-satisfaction theory. *Psychological Review*, *103*, 284 –308.

Kurzban, R., Tooby, J., & Cosmides, L. (2001). Can race be erased? Coalitional computation and social categorization. *Proceedings of the National Academy of Sciences of the United States of America*, *98*(26), 15387–15392.

Langlois, J. H., Kalakanis, L., Rubenstein, A. J., Larson, A., Hallamm, M., & Smoot, M. (2000). Maxims or myths of beauty? A meta-analytic and theoretical review. *Psychological Bulletin*, *126*, 390–423.

Langlois, J. H., & Roggman, L.A. (1990). Attractive faces are only average. *Psychological Science*, *1*, 115–121.

Latinus, M., & Belin, P. (2012). Perceptual auditory aftereffects on voice identification using brief vowel stimuli. *PLoS ONE*, *7*, e41384.

Lefevre, C. E., Lewis, G. J., Perrett, D. I., & Penke, L. (2013). Telling facial metrics: facial width is associated with testosterone levels in men. *Evolution & Human Behavior*, *34*, 273–279.

Levin, D. T., & Banaji, M. R. (2006). Distortions in the perceived lightness of faces: the role of race categories. *Journal of Experimental Psychology: General*, *135*(4), 501–512.

Li, J., Liu, J., Liang, J., Zhang, H., Zhao, J., Huber, D. E., … Shi, G. (2009). A distributed neural system for top-down face processing. *Neuroscience Letters*, *451*(1), 6–10.

Li, J., Liu, J., Liang, J., Zhang, H., Zhao, J., Rieth, C. A., … Lee, K. (2010). Effective connectivities of cortical regions for top-down face processing: a dynamic causal modeling study. *Brain Research*, *1340*, 40–51.

Little, A. C., Burt, D. M., Penton-Voak, I. S., & Parrett, D. I. (2001). Self-perceived attractiveness influences human female preferences for sexual dimorphism and symmetry of male faces. *Proceedings of the Royal Society of London B*, *268*, 39–44.

Macchi, C. V., Turati, C., & Simion, F. (2004). Can a nonspecific bias toward top-heavy patterns explain newborns' face preference? *Psychological Science*, *15*(6), 379–383.

MacDonald, A. W., Cohen, J. D., Stenger, V. A., & Carter, C. S. (2000). Dissociating the role of the dorsolateral prefrontal and anterior cingulate cortex in cognitive control. *Science*, *228*(5472), 1835–1838.

MacLin, O. H., & Malpass, R. S. (2001). Racial categorization of faces: the ambiguous-race face effect. *Psychology, Public Policy and Law*, *7*, 98–118.

Maddox, K. B. (2004). Perspectives on racial phenotypicality bias. *Personality and Social Psychology Review*, *8*(4), 383–401.

Masuda, T., Ellsworth, P. C., Mesquita, B., Leu, J., Tanida, S., & Van de Veerdonk, E. (2008). Placing the face in context: cultural differences in the perception of facial emotion. *Journal of Personality and Social Psychology*, *94*, 365–381.

Masuda, S., Tsujii, T., & Watanabe, S. (2005). An interference effect of voice presentation on face gender discrimination task: evidence from event-related potentials. *International Congress Series*, *1278*, 156−159.

McAleer, P., Todorov, A., & Belin, P. (2014). How do you say "hello"? Personality impressions from brief novel voices. *PLoS ONE*, *9*(3): e90779.

McArthur, L. Z., & Baron, R. M. (1983). Toward an ecological theory of social perception. *Psychological Review*, *90*, 215–238.

Meissner, C. A., & Brigham, J. C. (2001). Thirty years of investigating the own-race bias in memory for faces: a meta-analytic review. *Psychology, Public Policy, and Law*, *7*, 3–35.

Michel, C., Corneille, O., & Roisson, B. (2007). Race categorization modulated holistic face processing. *Cognitive Science*, *31*, 911–924.

Michel, C., Rossion, B., Han, J., Chung, C., & Caldara, R. (2006). Holistic processing is finely tuned for faces of one's own race. *Psychological Science*, *17*, 608–615.

Milne, E., & Grafman, J. (2001). Ventromedial prefrontal cortex lesions in humans eliminate implicit gender stereotyping. *Journal of Neuroscience*, *21*(12): RC150.

Mitchell, J. P., Banaji, M. R., & Macrae, C. N. (2005). General and specific contributions of the medial prefrontal cortex to knowledge about mental states. *NeuroImage*, *28*, 757–762.

Montepare, J. M., & Dobish, H. (2003). The contribution of emotion perceptions and their overgeneralizations to trait impressions. *Journal of Nonverbal Behavior*, *27*, 237–254.

Montepare, J. M., & Zebrowitz, L. A. (1993). A cross-cultural comparison of impressions created by age-related variations in gait. *Journal of Nonverbal Behavior*, *17*, 55–68.

Montepare, J. M., & Zebrowitz, L. A. (1998). "Person perception comes of age": the salience and significance of age in social judgments. In M. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 30, pp. 93–163). San Diego, CA: Academic Press.

Nelson, C. A. (2001). The development and neural bases of face recognition. *Infant and Child Development*, *10*, 3–18.

Norman, K. A., Polyn, S. M., Detre, G. J., & Haxby, J. V. (2006). Beyond mind-reading: multi-voxel pattern analysis of fMRI data. *Trends in Cognitive Sciences*, *10*, 424–430.

Oosterhof, N. N., & Todorov, A. (2008). The functional basis of face evaluation. *Proceedings of the National Academy of Sciences of the United States of America*, *105*, 11087–11092.

Ostrom, T. M., & Sedikides, C. (1992). Out-group homogeneity effects in natural and minimal groups. *Psychological Bulletin*, *112*(3), 536–552.

Pauker, K., & Ambady, N. (2009). Multiracial faces: how categorization affects memory at the boundaries of race. *Journal of Social Issues*, *65*, 69–86.

Pauker, K., Rule, N. O., & Ambady, N. (2010). Ambiguity and social perception. In E. Balcetis & D. Lassiter (Eds.), *The social psychology of visual perception* (pp. 7–26). New York, NY: Psychology Press.

Peelen, M. V., & Downing, P. E. (2007). The neural basis of visual body perception. *Nature Reviews Neuroscience*, *8*, 636–648.

Pinel, E. C. (1999). Stigma consciousness: the psychological legacy of social stereotypes. *Journal of Personality and Social Psychology*, *76*(1), 114–128.

Pitcher, D., Duchaine, B., & Walsh, V. (2014). Combined TMS and fMRI reveal dissociable cortical pathways for dynamic and static face perception. *Current Biology*, *24*(17), 2066–2070.

Porter, S., ten Brinke, L., & Gustaw, C. (2010). Dangerous decisions: the impact of first impressions of trustworthiness on the evaluation of legal evidence and defendant culpability. *Psychology, Crime, and Law*, *16*, 477–491.

Price, C. J., & Humphreys, G. W. (1989). The effects of surface detail on object categorization and naming. *Quarterly Journal of Experimental Psychology*, *41A*, 797–828.

Pylyshyn, Z. (1999). Is vision continuous with cognition?: The case for cognitive impenetrability of visual perception. *Behavioral and Brain Sciences*, *22*(3), 341–365.

Ratner, K. G., Kaul, C., & Van Bavel, J. J. (2013). Is race erased? Decoding race from patterns of neural activity when skin color is not diagnostic of group boundaries. *Social Cognitive and Affective Neuroscience*, *8*, 750–755.

Re, D. E., & Rule, N. O. (2016). Predicting firm success from the facial appearance of chief executive officers of non-profit organizations. *Perception*, *45*, 1137–1150.

Reed, C. L., Stone, V., Bozova, S., & Tanaka, J. (2003). The body inversion effect. *Psychological Science*, *14*, 302–308.

Richardson, M. J., & Johnston, L. (2005). Person recognition from dynamic events: the kinematic specification of individual identity in walking style. *Journal of Nonverbal Behavior*, *29*, 25–44.

Richeson, J. A., & Shelton, J. N. (2005). Thin slices of racial bias. *Journal of Nonverbal Behavior*, *29*, 211–236.

Righart, R., & de Gelder, B. (2008). Rapid influence of emotional scenes on encoding of facial expressions: an ERP study. *Social Cognitive and Affective Neuroscience*, *3*, 270–278.

Rotshtein, P., Henson, R. N. A., Treves, A., Driver, J., & Dolan, R. J. (2005). Morphing Marilyn into Maggie dissociates physical and identity face representations in the brain. *Nature Neuroscience*, *8*, 107–113.

Rule, N. O., & Ambady, N. (2008a). Brief exposures: male sexual orientation is accurately perceived at 50ms. *Journal of Experimental Social Psychology*, *44*, 1100–1105.

Rule, N. O., & Ambady, N. (2008b). The face of success: inferences from chief executive officers' appearance predict company profits. *Psychological Science*, *19*, 109–111.

Rule, N. O., Ambady, N., Adams, R. B., & Macrae, C. N. (2008). Accuracy and awareness in the perception and categorization of male sexual orientation. *Journal of Personality and Social Psychology*, *95*, 1019–1028.

Runeson, S., & Frykholm, G. (1983). Kinematic specification of dynamics as an informational basis for person-and-action perception: expectation, gender recognition, and deceptive intention. *Journal of Experimental Psychology: General*, *112*, 585–615.

Said, C. P., Dotsch, R., & Todorov, A. (2010a). The amygdala and FFA track both social and non-social face dimensions. *Neuropsychologia. 48*(12), 3596–3605.

Said, C. P., Moore, C. D., Engell, A. D., Todorov, A., & Haxby, J. V. (2010b). Distributed representations of dynamic facial expressions in the superior temporal sulcus. *Journal of Vision*, *10*(5), 11.

Savic, I., Berglund, H., Gulyas, B., & Roland, P. (2001). Smelling of odorous sex hormone–like compounds causes sex-differentiated hypothalamic activations in humans. *Neuron*, *31*, 661–668.

Scheib, J. E., Gangestad, S. W., & Thornhill, R. (1999). Facial attractiveness, symmetry, and cues to food genes. *Proceedings of the Royal Society of London B*, *266*, 1913–1917.

Scherer, K R. (2003). Vocal communication of emotion: a review of research paradigms. *Speech Communication*, *40*, 227–256.

Simion, F., & Di Giorgio, E. (2015). Face perception and processing in early infancy: inborn predispositions and developmental changes. *Frontiers in Psychology*, *6*(969).

Smith, E. L., Grabowecky, M., & Suzuki, S. (2007). Auditory–visual crossmodal integration in perception of face gender. *Current Biology*, *17*, 1680−1685.

Sofer, C., Dotsch, R., Wigboldus, D. H. J., & Todorov, A. (2015). What is typical is good: the influence of face typicality on perceived trustworthiness. *Psychological Science*, *26*(1), 39–47.

Stirrat, M., & Perrett, D. I. (2010). Valid facial cues to cooperation and trust: male facial width and trustworthiness. *Psychological Science*, *21*, 349–354.

Stolier, R. M., & Freeman, J. B. (2016). Neural pattern similarity reveals the inherent intersection of social categories. *Nature Neuroscience*, *19*, 795–797.

Summerfield, C., & Egner, T. (2009). Expectation (and attention) in visual cognition. *Trends in Cognitive Sciences*, *13*(9), 403–409.

Sutherland, C. A. M., Rowley, L. E., Amoaku, U. T., Daguzan, E., Kidd-Rossiter, K. A., Maceviciute, U., & Young, A. W. (2015). Personality judgments from everyday images of faces. *Frontiers in Psychology*, *6*(1616), 1–11.

Tajfel, H. (1970). Experiments in intergroup discrimination. *Scientific American*, *223*(5), 96–102.

Tajfel, H., & Turner, J. C. (1979). An integrative theory of intergroup conflict. In W. Austin & S. Worchel (Eds.), *The social psychology of intergroup relations* (pp. 33–47). Monterey, CA: Brooks/Cole.

Thornhill, R., & Gangestad, S. W. (1993). Human facial beauty: averageness, symmetry, and parasite resistance. *Human Nature*, *4*, 237–269.

Todorov, A. (2011). Evaluating faces on social dimensions. In A. Todorov, S. T. Fiske, D. A. Prentice (Eds.), *Social neuroscience: toward understanding the underpinnings of the social mind* (pp. 54–76). New York, NY: Oxford University Press.

Todorov, A., & Engell, A. D. (2008). The role of the amygdala in implicit evaluation of emotionally neutral faces. *Social Cognitive and Affective Neuroscience*, *3*(4), 303–312.

Todorov, A., Gobbini, M. I., Evans, K. K., & Haxby, J. V. (2007). Spontaneous retrieval of affective person knowledge in face perception. *Neuropsychologia*, *45*, 163–173.

Troje, N. F. (2003). Gender and attractiveness from biological motion. *Journal of Vision*, *3*(9), 86a.

Trope, Y. (1986). Identification and inferential processes in dispositional attribution. *Psychological Review*, *93*, 239–257.

Uleman, J. S., Blader, S., & Todorov, A. (2005). Implicit impressions. In R. Hassin, J. S. Uleman, & J. A. Barge (Eds.), *The new unconscious* (pp. 362–392). New York, NY: Oxford University Press.

Van Bavel, J. J., & Cunningham, W. A. (2009). Self-categorization with a novel mixed-race group moderates automatic social and racial biases. *Personality and Social Psychology Bulletin*, *35*, 321–335.

Van Bavel, J. J., Packer, D. J., & Cunningham, W. A. (2008). The neural substrates of in-group bias: a functional magnetic resonance imaging investigation. *Psychological Science*, *19*(11), 1131–1139.

Van Bavel, J. J., Swencionis, J. O'Connor, R., & Cunningham, W. A. (2012). Motivated social memory: belonging needs moderate the own-group bias in face recognition. *Journal of Experimental Social Psychology*, *48*, 707–713.

Van den Stock, J., Righart, R., & de Gelder, B. (2007). Body expressions influence recognition of emotions in the face and voice. *Emotion*, *7*, 487–494.

Van Dommelen, W. A. (1993). Speaker height and weight identification: a re-evaluation of some old data. *Journal of Phonetics*, *21*, 337–341.

Voss, A., Rothermund, K., & Brandtstadter, J. (2008). Interpreting ambiguous stimuli: separating perceptual and judgmental biases. *Journal of Experimental Social Psychology*, *44*, 1048–1056.

Walton, J. H., & Orlikoff, R. F. (1994). Speaker race identification from acoustic cues in the vocal signal. *Journal of Speech, Language, and Hearing Research*, *37*(4), 738–745.

Watson, D. (1989). Strangers' ratings of the five robust personality factors: evidence of a surprising convergence with self-report. *Journal of Personality and Social Psychology*, *57*, 120–128.

Webster, M. A., Kaping, D., Mizokami, Y., & Duhamel, P. (2004). Adaptation to natural face categories. *Nature*, *428*, 557–561.

Weisbuch, M., & Ambady, N. (2011). Thin-slice vision. In R. B. Adams, N. Ambady, K. Nakayama, & S. Shimojo, *The science of social vision* (pp. 228–247). New York, NY: Oxford University Press.

Yin, R. K. (1969). Looking at upside-down faces. *Journal of Experimental Psychology*, *81*, 141–145.

Zanto, T. P., Rubens, M. T., Thangavel, A., & Gazzaley, A. (2011). Causal role of the prefrontal cortex in top-down modulation of visual processing and working memory. *Nature Neuroscience*, *14*(5), 656–661.

Zebrowitz, L. A., Fellous, J. M., Mignault, A., & Andreoletti, C. (2003). Trait impressions as overgeneralized responses to adaptively significant facial qualities: evidence from connectionist modeling. *Personality and Social Psychology Review*, *7*, 194–215.

Zebrowitz, L. A., Luevano, V. X., Bronstad, P. M., & Aharon, I. (2009). Neural activation to babyfaced men matches activation to babies. *Social Neuroscience*, *4*(1), 1–10.

Zebrowitz, L. A., & McDonald, S. M. (1991). The impact of litigants' baby-facedness and attractiveness on adjudications in small claims courts. *Law and Human Behavior*, *15*(6), 603–623.

Zebrowitz, L. A., & Montepare, J. M. (2006). The ecological approach to person perception: evolutionary roots and contemporary offshoots. In M. Schaller, J. A. Simpson, & D. T. Kenrick (Eds.), *Evolution and social psychology* (pp. 81–113). New York, NY: Psychology Press.