# Perception of Faces and Bodies

## Similar or Different?

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ABSTRACT—*Human faces and bodies are both complex and interesting perceptual objects, and both convey important social information. Given these similarities between faces and bodies, we can ask how similar are the visual processing mechanisms used to recognize them. It has long been argued that faces are subject to dedicated and unique perceptual processes, but until recently, relatively little research has focused on how we perceive the human body. Some recent paradigms indicate that faces and bodies are processed differently; others show similarities in face and body perception. These similarities and differences depend on the type of perceptual task and the level of processing involved. Future research should take these issues into account.*

KEYWORDS—*object recognition; face perception; body schema; social information processing*

Probably the most important and complex objects we perceive are other humans. From the time we are born, other humans capture our attention and elicit complex behaviors from us. We can identify other humans as humans because they possess both a human face and a human body. Further, we identify specific individuals not only on the basis of their unique faces and body shapes, but also on the basis of their characteristic expressions, postures, and movements. Given these functional similarities between faces and bodies, how similar are the visual processing mechanisms used to recognize them?

### FACES AS SPECIAL OBJECTS

It has long been argued that the visual system uses special perceptual processing for faces that is different from the processing used for other objects. The rationale is that faces are such significant social stimuli that natural selection acted to create dedicated face-processing mechanisms in the brain. There is evidence consistent with the idea that faces are special: From early in development, infants are biased to look at faces more than other complex objects (Johnson & Morton, 1991). Also, adult perception of faces reveals unique effects, including the inversion effect (upside-down faces are more difficult to recognize than other complex inverted stimuli) and the caricature effect (a face with its distinctive features exaggerated is easier to recognize than the original face). Event-related potential studies, which measure the timing of the brain's electrical responses to stimuli, show that the brain responds differently to faces than to other objects within 170 ms after they are presented. Functional magnetic resonance imaging (fMRI) research, showing activity in the brain while participants are actively performing perceptual or cognitive tasks, further suggests that distinct brain areas respond to faces compared with other objects.

However, not all researchers agree that these apparently face-specific phenomena genuinely reflect unique processing of faces. Some authors suggest that responses to faces are driven by the abstract perceptual features of faces, such as symmetry or high contrast, rather than their face-ness per se (Turati, Simion, Milani, & Umilta, 2002). Others argue that the apparently special processing faces receive simply reflects the ubiquity and importance of faces, and that the perceptual effects adults exhibit when viewing faces will be evident for any objects that they are highly practiced at perceiving (e.g., cars for car enthusiasts or dogs for dog breeders; Tanaka & Gauthier, 1997). These authors propose that visual expertise changes the way that objects are processed: Within a given domain, novices recognize objects by focusing on their distinctive parts, but experts rely on configural processing, focusing on the spatial relationships between parts. The argument is that configural processing in general can explain perceptual effects that appear to distinguish faces.

### BODIES ARE SPECIAL, TOO

Another class of objects that may be subject to special processing is human bodies. Although there has been relatively little research on perception of the human body compared with

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that of faces, several similarities between faces and bodies suggest that they may be processed similarly. First, bodies and faces share a number of abstract configural properties that may make the perceptual system treat them similarly. All faces share the same set of parts (eyes, nose, mouth, etc.), as do all bodies (arms, legs, torso, etc.). As a result, for both faces and bodies, perceptual distinctions depend on the exact shape and position of component parts. Also, from the front, both faces and bodies are symmetrical along the vertical axis. Further, the spatial relationships between parts of faces and between parts of bodies are relatively fixed. Across individuals, the configural arrangement of the eyes, nose, and mouth of the face is relatively unchanging, as is the arrangement of the head, torso, and limbs.

Second, faces and bodies are both salient conveyors of social information. Both provide information about other individuals' attentional and emotional states, and inform basic social categorizations, including attributions of age, gender, and attractiveness. Faces and bodies are both used for communication.

Finally, our embodied internal experience of both faces and bodies could distinguish them as special object classes. Our ability to move and functionally use our faces and bodies could influence the visual recognition of other faces and bodies. Recent neurophysiological studies with monkeys have revealed a class of *mirror* neurons, so called because the same neurons are active whether a given motor action is performed or observed. There is some indirect evidence that similar motor-mirroring structures exist in humans (see Gallese & Goldman, 1998, for a review), suggesting that visual and motor representations interact. The ability both to see faces and bodies and to move our own faces and bodies may make them similarly unique compared with other perceptual objects.

Despite these arguments for special perceptual processing of bodies, there are also reasons to suppose that faces and bodies may be treated differently by the visual system. The nature of the information conveyed by faces and bodies is arguably different. Faces, although often moving, are perceptually informative even while still. We can make judgments about another person's gender, identity, emotion, attractiveness, and direction of attention (conveyed most saliently in eye gaze) from a still photograph of the face. Bodies, in contrast, are typically moving, and much of the information that bodies convey is in dynamic movement. We can identify another person's gender, emotion, and direction of attention from that person's body most easily if it is in motion.

Thus, it remains an open question whether the visual system applies similar or different perceptual processes to faces and bodies. Insight into this question may be gained by considering two factors. First, the various ways that scientists measure face and body perception may place more or less difficult demands on the visual system. Second, patterns in the development of face perception and of body perception may give insight into how and when faces are treated similarly by the visual system.

## LEVELS OF PERCEPTUAL PROCESSING OF FACES AND BODIES

Perception of faces or bodies is a multistage process. The extent to which faces and bodies are treated similarly by the perceptual system depends on the stage of processing, and thus the type of perceptual task participants are asked to perform. It may be useful to distinguish two stages of perceptual processing and two types of perceptual tasks: detection versus recognition. Face or body *detection* refers to the ability to determine whether a particular stimulus is a face or a body rather than something else, and is an early stage of visual processing. Paradigms that compare participants' responses to faces or bodies with their responses to other types of objects are measuring detection.

Face or body *recognition* is a later stage of visual processing and involves making distinctions between individuals within a category. Recognition is often tested by asking participants to distinguish individual faces or bodies. Recognition processes are invoked not only for identifying individual persons, but also for identifying specific body postures (e.g., sitting vs. running) and specific facial expressions (e.g., happy vs. angry).

### Detection of Faces and Bodies

Recent work has shown that the developmental time courses for detecting human faces and bodies are different. When young infants are presented with a typical human face image and a scrambled human face image in which the eyes, nose, and mouth are moved to noncanonical locations, they prefer to look at the typical face (Johnson & Morton, 1991). Thus, in this task, infants detect the presence of a face (as opposed to a scrambled nonface). A recent study used a similar experimental procedure to investigate development of human body perception (Slaughter, Heron, & Sim, 2002). Infants between the ages of 12 and 18 months were shown typical and scrambled images of human bodies (see Fig. 1) as well as facelike stimuli, and their looking preferences were measured. The data indicated differences in the way infants responded to faces and bodies. Infants younger than 18 months of age did not show a preference for typical or scrambled body pictures, suggesting that they did not notice the differences between them, yet these young infants clearly preferred the typical face to the scrambled face. By 18 months of age, infants looked longer at the scrambled than at the typical body pictures, presumably because they found the scrambled images novel or surprising. These developmental data indicate that infants' perceptual expectations about typical human faces develop much earlier than their expectations about human bodies.

Adults also show a dissociation between face and body detection. In recent fMRI studies, distinct brain regions were activated when participants viewed pictures of faces, bodies, or body parts. Detection of faces consistently correlated with activation in the fusiform face area, located in the ventral temporal

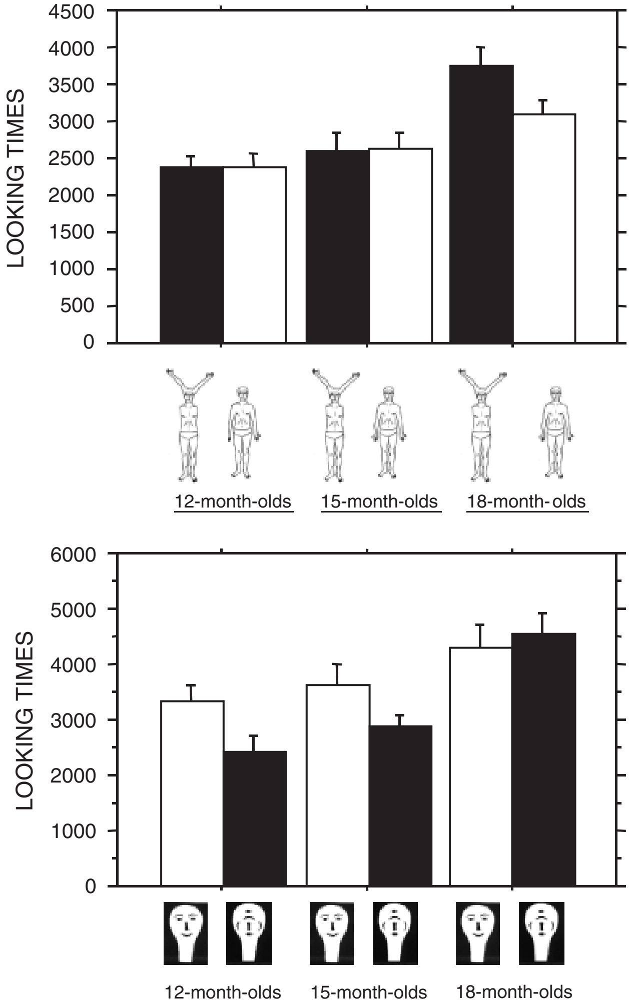


**Fig. 1.** Mean looking times (in milliseconds) to images of human bodies (top) and facelike stimuli (bottom) with typical (white bars) and scrambled (black bars) arrangements of parts. Results are presented separately for 12-, 15-, and 18-month-olds. From Slaughter, Heron, and Sim (2002).

lobe (the underneath surface of the brain toward the back; Kanwisher, McDermott, & Chun, 1997). In contrast, the extrastriate body area, located in the lateral occipitotemporal cortex (the lower left or right outside surface of the brain toward the back), was active only when participants were shown images of the human body or body parts (Downing, Jiang, Shuman, & Kanwisher, 2001). The extrastriate body area does not respond to images of faces.

Thus, both in infancy and in adulthood, there are demonstrated differences in basic perceptual detection of human faces and bodies.

### Recognition of Faces and Bodies

In contrast to the data on detection, data on face and body recognition reveal some similarity in how adults process faces and bodies. Without explicit training, people should be experts at recognizing both individual faces and individual body postures, because of their ubiquity in everyday life. If perceptual expertise means that visual recognition relies on configural processing, then one would expect that both faces and bodies would be most easily recognized by the spatial arrangement of their component parts. The inversion effect, in which recognition of objects is disrupted by turning them upside down, is traditionally considered an indicator of configural processing because inverting a familiar object makes it more difficult to recognize relations between the parts. The inversion effect has been demonstrated for faces and also for other objects when viewed by experts (e.g., dog breeders, car experts). A recent study (Reed, Stone, Bozova, & Tanaka, 2003) demonstrated that adults show similar inversion effects for faces and body postures: Both faces and bodies are more difficult to recognize when presented upside down than when presented right side up, but the same is not true of other complex stimuli, such as houses (see Fig. 2). It appears that both face and body-posture recognition depend on mentally representing the spatial configuration of stimulus parts.

Despite this similarity in the recognition of faces and bodies, there are suggestions of differences in recognition processes as well. Evidence from neuropsychological patients indicates a dissociation between face and body recognition. In prosopagnosia, patients are unable to recognize individual faces—a recognition problem that can be independent from difficulties with recognition of other objects. This pattern of visual recognition problems suggests that these patients have damage to a specialized face-processing area in the brain. The disorder autotopagnosia (or somatotopagnosia) affects patients' ability to recognize, point to, or name specific body parts within the context of a whole body, although these patients have no difficulty naming parts of other complex objects (e.g., Ogden, 1985). Though each of these disorders is distinct from general object recognition problems, prosopagnosia and autotopagnosia do not typically occur together. The existence of these two distinct neuropsychological disorders, one affecting face recognition and the other body-part recognition, suggests that recognition of faces and recognition of bodies involve some distinct processes.

## CONCLUSIONS

The studies reviewed here provide evidence for both similarities and differences in the way we perceive faces and bodies. Detection tasks have demonstrated mostly differences: developmental differences in responses to typical and scrambled faces versus bodies, and activation of different brain areas for face versus body processing in adults. Recognition tasks have shown similarity between perception of faces and perception of bodies, in the effects of expertise and inversion. But there are also some differences in face and body recognition: Prosopagnosia and autotopagnosia reveal independent deficits for recognition of faces and bodies and do not co-occur.

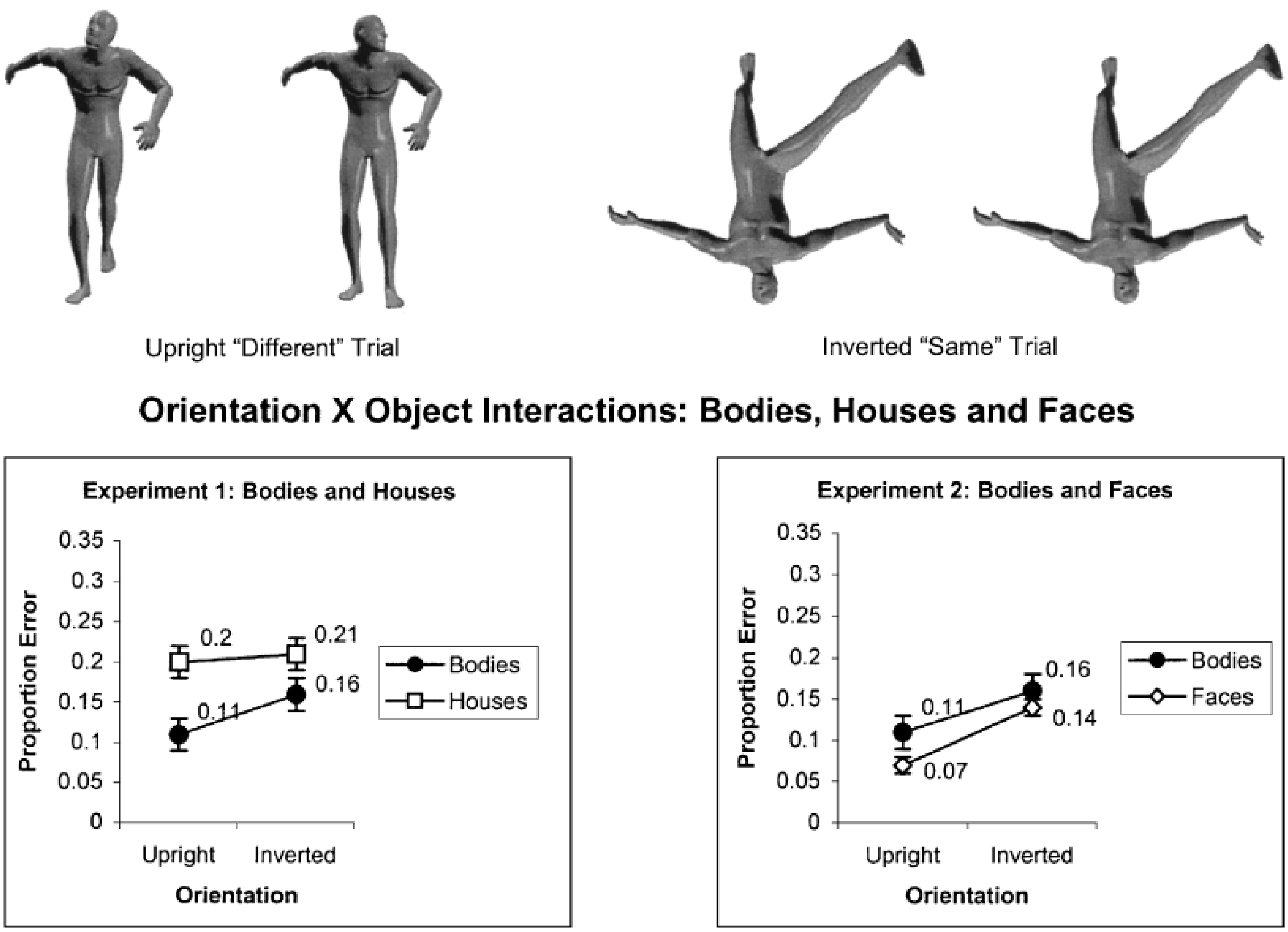


**Fig. 2.** Examples of stimuli and results from a study on ability to recognize upright and inverted stimuli. On each trial, two stimuli, which could be either the same or different, were presented in either upright or inverted orientation. The task was to indicate whether the stimuli were identical. The graphs show the percentage of trials on which participants responded incorrectly. From Reed, Stone, Bozova, and Tanaka (2003).

This complex pattern may be explained in terms of the levels of processing involved. Detection tasks appear to tap into relatively basic visual categorization processes, possibly processes depending on simple spatial properties. Thus, the evidence from such tasks suggests the initial identification of faces and bodies as such occurs in distinct areas of the brain. Recognition tasks, in contrast, may recruit several different complex processes that analyze configural properties, identify individuals, and assign meaning. Some processing, such as the configural processing affected by expertise, may operate similarly for faces and bodies. Other recognition processing (e.g., how parts are represented relative to the whole or how the motion of parts is represented) may operate differently for faces and bodies.

## DIRECTIONS FOR FUTURE RESEARCH

Understanding the extent to which faces and bodies are treated similarly in visual processing will require more work that explicitly contrasts responses to faces, bodies, and other complex objects. Furthermore, it will be important for such work to define carefully the level of processing being tested. Detection paradigms involve differentiating faces and bodies from other objects or scrambled stimuli. The developmental work to date has focused on body detection, but can be expanded to explore the development of body recognition. At what stage of development would infants recognize individual, meaningful body postures?

Recognition encompasses a variety of processes, depending on what about the face or body is being represented in the mind. Inversion and discrimination studies, for example, test whether participants are sensitive to relatively small changes in configuration, and performance in these studies thus may not depend on representing the whole object. Paradigms that test how well parts are recognized within the whole or individually (e.g., tests used with autotopagnosics) may tap into a different level of processing, at which the structure of the whole object and the relationship of parts to that whole are represented. Processing of bodies and processing of faces may therefore be similar in some recognition tasks, but different in others, depending on the level of processing involved. Detailed work testing recognition at different levels of processing can help clarify the levels at which bodies and faces share processing and mental representations and the levels at which they do not.

Finally, further work on this topic should consider the importance of motion. The studies reviewed here all involved detection or recognition of static human faces and bodies. However, static and dynamic information are arguably weighted differently in face and body processing; as noted, static information is more meaningful in faces, whereas dynamic information is more crucial to body perception. For example, static images easily afford recognition of individual faces, but recognition of individual bodies probably has less to do with body shape than with characteristic motion patterns. Prosopagnosics report using motion patterns to recognize familiar people. Recent evidence suggests that facial information is processed by two distinct cognitive streams: a ventral stream (through the lower parts of the temporal lobes, corresponding to brain areas below the ears) that recognizes individuals by static features and a dorsal stream (through the upper parts of the parietal lobes, corresponding to brain areas above the ears) that processes dynamic information (O'Toole, Roark, & Abdi, 2002). Different brain areas are activated by static versus dynamic displays of facial expressions. The brain also responds differently to displays of the biomechanical motion of human bodies than to static human bodies, but this may not be a dorsal-ventral differentiation (Vaina, Solomon, Chowdhury, Sinha, & Belliveau, 2001). Thus, perhaps one of the most important future directions for research in this area is the exploration of how visual processes involved in the perception of faces and bodies depend on dynamic information.

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