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The face-mind link: Why we see minds behind faces, and how others' minds change how we see their face

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Abstract

Understanding others' minds has puzzled philosophers for centuries. Psychologists, too, have recently begun asking questions about what causes us to see another person as having complex or simple mental faculties. Here, we review recent evidence linking how we perceive others' *faces* with how we perceive others' *minds*—the face-mind link. We first discuss research demonstrating a face-to-mind effect, showing that both certain facial features (e.g., eyes) and face perception processes (e.g., configural processing) can trigger the perception that a face has a mind. We then discuss recent evidence demonstrating a mind-to-face effect, showing that believing a person is inhumane (i.e., their mind) leads their face to be processed less like a face and more like an object. Finally, we consider both the consequences of this bidirectional face-mind link, and what the next steps may be in understanding how and why we infer minds from faces, and how and why beliefs about others' minds affects how we see their face.

1 | INTRODUCTION

How do we really know what the inner life of others is like? You know that *you* think and feel, love and hate, reflect and revel, but how can you know that *I* do? What about the inner life of your neighbors' dog? How do we know what she experiences, or how she thinks? This is the core of the so-called "problem of other minds," which has long vexed philosophers (Wittgenstein & Anscombe, 1958). Psychologists have come to this question a bit later but have been hard at work on it as well. But whereas a philosopher might consider *whether* other people (or animals) have minds, psychologists tend to focus on what causes us to ascribe more and less sophisticated minds to others.

Mind perception is a fundamental cognitive skill, with real implications for everyday life (Dennet, 1996). Ascribing sophisticated minds to others brings them into the moral community where norms of fair treatment and mutual respect are expected (Gray, Young, & Waytz, 2012). If we see a being as having a sophisticated human-like mind, it seems unfair to hurt it or to unduly restrict its freedoms. Yet people can and do deny others their cognitive, emotional, and/or experiential capacities (see Haslam & Loughnan, 2014; Waytz, Gray, Epley, & Wegner, 2010). We often call

such denial of mind to others *dehumanization*, and when we do this, it can undermine empathy for others' pain and can potentiate violence and aggression (Haslam, 2014; Kteily, Bruneau, Waytz, & Cotterill, 2015).

A lengthy review of what it means to "perceive a mind" in humans is beyond the scope of the current work; however, there is some consistency in how scholars from multiple research traditions—including the infrahumanization (e.g., Leyens et al., 2000; Leyens, Demoulin, Vaes, Gaunt, & Paladino, 2007), dehumanization (e.g., Haslam, 2006, 2014), and mind perception (e.g., Waytz et al., 2010) literatures—explain ascriptions of mind (see Bain, Vaes, & Leyens, 2014 for a review). Each of these prominent perspectives focus on how humans are seen as possessing *sophisticated capacities* that are distinct from other animals, while having an emotional responsiveness and *experiential capacities* that makes humans distinct from inanimate objects, such as automata, machines, and robots (see Haslam, 2014). Although people believe that non-human animals (e.g., dogs and frogs) are able to experience the world and simple emotional states, they are seen as having limited cognitive and agentic abilities. Conversely, non-human agents (e.g., robots and automata) are perceived to have the ability to cogitate and act upon the world yet are seen as lacking inner experience (Gray, Gray, & Wegner, 2007). This distinction between "unthinking" animals and "unfeeling" machines is reflected in how people are denied mind (Haslam, 2006, 2014; Loughnan & Haslam, 2007). Humans who lack rationality, morality, and civility are seen as animal-like (i.e., animalistic dehumanization) whereas humans who are judged as lacking in emotional responsiveness and interpersonal warmth are seen as machine-like (i.e., mechanistic dehumanization).[i]

Although research has focused quite a bit on the consequences of denying mind to others, understanding *when* we see others as having sophisticated or simplistic minds (or not having minds at all) is a much newer topic of research (see Bain et al., 2014). Importantly, recent research has shown that these perceptions of others' minds are malleable and depend on a variety of perceiver characteristics or motives (Epley, Waytz, & Cacioppo, 2007; Waytz et al., 2010). When targets become likeable, when perceivers desire predictive capacity, or when perceivers come to desire a sense of control or social connection, targets are more likely to be ascribed sophisticated mental capacities (Epley et al., 2007). For example, a dog seems to have a more sophisticated inner life when we are lonely—all the better to fulfill the role of friend for us. Relatedly, when perceivers wish to derogate or distance themselves from social outgroups, due to intergroup conflict (e.g., Cortes, Demoulin, Rodriguez, Rodriguez, & Leyens, 2005) or status differences (e.g., Leyens et al., 2001; Vaes & Paladino, 2010), perceivers may be motivated to not see their fellow humans as having sophisticated minds. It feels easier to cause harm to a simple creature than to a complex one. Conversely, when outgroups become relevant and interdependent with an ingroup, perceivers may be motivated to perceive mind (e.g., Capozza, Trifiletti, Vezzali, & Favara, 2013; see also Leyens et al., 2007 for a review). We need to understand the minds of those with whom we will interact (see also Khalid, Deska, & Hugenberg, 2016).

Although we strongly agree that these findings linking motivations and mind perception are convincing and important, in the current work, we have a different focus. We instead focus on how what we see in others faces influences our beliefs about their minds, and conversely, what we believe about others' minds influences how we see their faces. This face-mind link may not be immediately obvious in everyday life, but we think that considering others' minds as a product of what we see in their faces is a novel way of thinking about how (and when) we see others as mindful or mindless. Research from diverse fields—cognitive science, perception, and social cognition—has begun demonstrating how everyday processes associated with perceiving faces can be both cause and consequence of mind perception. In the current work, we review this growing scientific literature on the face-mind link. We begin by discussing recent research showing that seeing faces can lead us to infer minds. Both specific *features* in faces and certain face-typical *processes* can influence how we infer others' minds. We next review recent research demonstrating that beliefs about others' minds can influence how we process others' faces. Thus, faces can influence how we see others' minds, but minds can also change how we see others' faces. Finally, we consider new directions for future research. Across each area of the review, our goal is to focus both on the strengths of the existing evidence and to suggest areas where additional research is needed. Thus, we seek to highlight a novel and theoretically generative link between face perception and mind perception.

2 | MINDS FROM FACES

Human faces can be considered to have two cardinal characteristics. First, faces have regularized *features*, such as eyes, a nose, and a mouth. Second, those features are organized in a regularized eyes-over-nose-over-mouth *configuration*. It turns out that both features and configurations are critically important when processing others' faces, and we spontaneously use both when viewing and recognizing others' faces (e.g., Cabeza & Kato, 2000; Tanaka & Gordon, 2011). Your face would not really be yours without both its features and their configuration. However, recent research has demonstrated that the face-mind link—the tendency to infer a mind from a face—is influenced both by the features of human faces and by the eyes-over-nose-over-mouth configurations of faces. Here, we review evidence for these facial feature-to-mind and these facial configuration-to-mind effects.

2.1 | Facial features

Human faces differ both from one another (e.g., you and I appear different because our facial structures differ) and from themselves (e.g., your face looks different when you smile than when you frown). And these differences matter. By having different facial features, we can easily tell who is who, and by having different expressions, we can easily tell who is likely to do what (e.g., Fridlund, 1994; Frijda & Tcherkassof, 1997; Sacco, Wirth, Hugenberg, Chen, & Williams, 2011).

Beyond using these facial differences to decode others' identity and intention, we also use them (often unwittingly) to infer who has what sort of mind. Researchers have recently begun documenting how *features of faces* can lead to the ascription and denial of mind. Human-like features (and eyes in particular) play a pivotal role in deciding when a target has a mind. In recent research, Looser and Wheatley (2010) showed participants a series of faces that were morphed on a continuum from a doll face to a human face (see Figure 1). Participants were asked to decide the extent to which they believed a target had a mind. As stimuli included a greater proportion of human features relative to doll features, participants were more likely to believe that the face was alive and had a mind. In some ways, these data are quite intuitive: Morphed faces with more "humanness" in them are judged as more likely to have minds. However, Looser and Wheatley (2010) also found some key patterns of data that tell us quite a bit about how faces can signal (or fail to signal) the presence of mind. First, the increase in animacy as faces became objectively more human was nonlinear. Instead, there was a sharp uptick in categorization of faces as animate at around the 60% human/40% doll morph. This pattern of data indicates that animacy appears to be an "all or nothing" proposition. Either a face spontaneously appears to be animate or it does not—we do not spontaneously see faces as somewhat animate. Second, and equally important, is that Looser and Wheatley (2010) found that the eyes of the target faces played an outsized role in judgments of whether faces were animate or not.

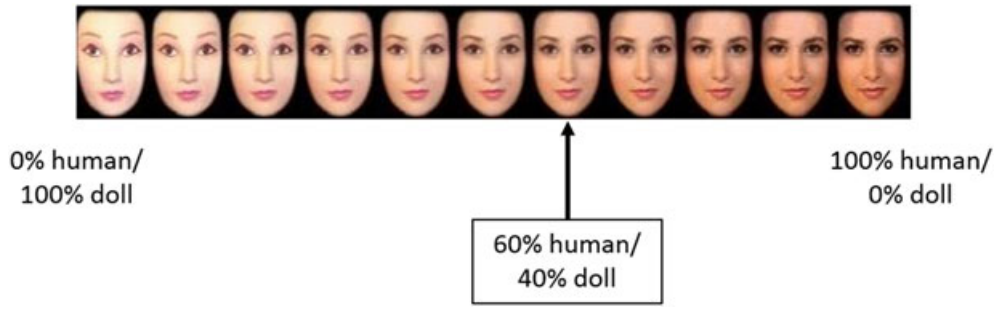

FIGURE 1 Stimuli morphed between human and doll. Perceivers typically see faces as animate (i.e., having a mind) when they contain at least 60% human features relative to doll features (Adapted from Looser & Wheatley, 2010). However, this threshold can be shifted by perceiver desires (e.g., social connection or ingroup/outgroup distinctions; see Powers, Worsham, Freeman, Wheatley, & Heatherton, 2014; Hackel, Looser, & Van Bavel, 2014)

Indeed, when it comes to perceiving mind, the eyes have it. Put simply, eyes appear to signal minds. For instance, in recent work from our lab (Khalid et al., 2016), we demonstrated that perceivers attributed more agentic minds (e.g., minds capable of self-control and with an understanding of morality) to faces who were making direct eye contact with them, as compared to faces that were averting their eyes (see Figure 2). In other words, when someone locks eyes with you, they seem to have a more sophisticated inner life than when they look away. Further, this effect was due, at least in part, to perceivers believing that targets making eye contact were more interested in future social interaction than those averting their gaze (see also Wirth, Sacco, Hugenberg, & Williams, 2010). In other words, we begin to mentally prepare for future social interactions by computing the minds of others when we believe social interaction may be imminent. Consistent with this, we found that eye gaze did not influence the ascription of mind to targets that were clearly inanimate; after all, dolls (even dolls who seem to look at us) cannot provide meaningful social interaction.

However, these effects of eyes can influence us even when eyes are on non-human agents. Broadly, research finds that the presence of human-like facial features on non-human agents can lead to the perception that these agents have mind and shape behavior accordingly (e.g., DiSalvo, Gemperle, Forlizzi, & Kiesler, 2002). In one study, Ahn, Kim, and Aggarwal (2014) showed that adding human-like facial features to non-human cartoons made participants treat them more like a person. Near a light switch, researchers surreptitiously placed a poster of a lightbulb encouraging people to save energy by turning off the lights. In one condition, the lightbulb poster had eyes, a nose, and a mouth. In another condition, the poster lacked these facial features. Remarkably, just adding human-like features to a clearly non-human object led to less energy consumption and more dimmed lights. In a subsequent study, participants put significantly less non-food waste into a compost bin when an accompanying poster had an image of a compost bin with human-like facial features compared to no facial features. The authors suggest these effects are due to feelings of guilt engendered by the anthropomorphized objects—perceiving mind in a non-human agent (see also Bateson, Nettle, & Roberts, 2006). In related research, Aggarwal and McGill (2007) demonstrated that participants have a tendency to ascribe mind to automobiles when their grilles are made to resemble smiles or frowns. Likewise, Windhager et al. (2008) demonstrated that people make inferences about an automobile's friendliness and aggressiveness depending on whether the shape and position of its grill and headlights mimics human facial dominance or sociability. Similarly, adding eyes to an inanimate object creates the illusion of animacy. In one creative display, Gao, McCarthy, and Scholl (2010) showed participants a series of randomly moving geometric shapes on a computer screen and added eyes to many of the shapes. These eyes all tracked the movement of another shape. This immediately created the illusion of a "wolfpack" with the eyes of the predator shapes tracking and corralling the looked-at shape. In other words, eyes created the illusion of a mind, even for randomly moving objects (cf. Balas &

FIGURE 2 Perceivers ascribe more sophisticated minds to direct-gaze than to averted-gaze faces (Khalid et al., 2016)

Horski, 2012). Automobiles, compost bins, light switches, and geometric shapes are neither happy, angry, nor particularly judgmental. And they resemble humans in only the most schematic of ways. Yet the simple presence of human-like facial features is sufficient to create human-like attributions in the minds of perceivers.

Although the presence of human-like facial features in non-human agents can be sufficient to create human-like attributions, it can also be unnerving. Indeed, the so-called *uncanny valley*—the tendency for increasingly human-like entities to be liked up until a point at which they appear creepy—may be related to the presence of human-like features on non-human agents. Although quite a bit of research has investigated the existence of the uncanny valley (i.e., what makes a face creepy), less work has linked this feeling of unease toward very human-like dolls or robots to perceptions of animacy or mind. That said, several studies have demonstrated that unease for human-like inanimate targets is maximized when artificial-looking faces have realistic eyes (e.g., MacDorman, Green, Ho, & Koch, 2009; Seyama & Nagayama, 2007). Indeed, some hypothesize that the signal of mind that arises from the perception of human-like facial features while knowing that a target is inanimate produces this sense of unease. Supporting this, Gray and Wegner (2012) found that robots with a more human-like appearance were attributed more experiential mental capacities (e.g., the capacity to feel fear and pain). Moreover, uncanny valley effects for human-like robots appeared to maximally occur when they were ascribed human-like characteristics. Notably, both human-like and mechanical robots were ascribed similar agentic capacities (e.g., the capacity to plan actions and exhibit self-control), suggesting that uncanniness may be specifically driven by the sense that non-human agents cannot just think, but can *feel*. Ultimately, more work is needed to better understand how the relationship between face perception and mind perception can give rise to non-human agents being seen as friendly as compared to creepy. However, what evidence there is suggests that adding human-like facial features not only produces more perception of mind but that sometimes this perception of mind can make a non-human target appear uncanny or eerie.

If adding human-like facial features to non-human agents can make them be seen as more human or treated in more human ways, what happens when we *remove* human features from otherwise human faces? In one study from our lab, we (Almaraz, Deska, & Hugenberg, 2017) used digital manipulation software to carefully remove facial features—either the eyes, the nose, or the mouth—smoothing over the missing feature with naturalistic looking skin. Although less sophisticated minds were ascribed to the faces with their nose and mouth removed relative to the unmodified face, faces missing their eyes were seen as particularly mindless. In related work, Schein and Gray (2015) showed participants images of a face that was either intact or had its eyes or nose obscured with a white circle. Mirroring our findings, as compared to the intact face and the face without a nose, the face without eyes was ascribed less mind and was judged as less likely to have a soul. Together, these results indicate that the presence or absence of facial features (especially eyes) is an important cue used by perceivers to judge whether a face harbors a mind.

Extending beyond specific features, facial appearance more broadly can serve as a cue for the ascription and denial of mind. For instance, faces that appear phenotypically Black are routinely denied mind. Research has demonstrated that many American Whites have a stereotypic association between Black people and apes, which reflects a profound misunderstanding of Blacks as less evolved than comparable Whites. As one example of this association, Goff, Eberhardt, Williams, and Jackson (2008) have shown White or Black faces as primes immediately before participants were tasked with finding images of animals in pixelated visual scenes. Compared to participants who were primed with White faces or no faces, those primed with Black faces were quicker to identify ape images in those blurry scenes (Goff et al., 2008; see also Eberhardt, Goff, Purdie, & Davies, 2004). In a similar vein, research has demonstrated that perceivers believe that Black individuals experience less pain than White individuals (Trawalter, Hoffman, & Waytz, 2012). Further investigations have linked this bias to erroneous beliefs linking Black people with supernatural qualities such as toughness and mysticism (Waytz, Hoffman, & Trawalter, 2014) and erroneous beliefs about the biological differences between Black and White people (Hoffman, Trawalter, Axt, & Oliver, 2016). Although perceiving Black people as experiencing less pain than White people might not seem like a process related to mind perception, work by Gray et al. (2007) identifies the capability to feel pain as a core component of the *experience* dimension of mind. Denying others the sensory experience of pain denies them the experiential component of their

mind. Moreover, this pattern of mind denial strips individuals of their "moral patiency"—the ability to be seen as a victim who is harmed (either physically, as in the above case, or in the broader sense of being morally wronged).

Other facial characteristics too, such as facial structure, can influence mind perception. Recent work demonstrates that targets' *facial width-to-height ratio* influences the extent to which they are ascribed or denied sophisticated mental capacities (Deska, Lloyd, & Hugenberg, 2017). Although past work shows that perceivers judge individuals with relatively greater facial width-to-height ratio as relatively more dominant and threatening (Geniole, Denson, Dixson, Carré, & McCormick, 2015), recent work from our lab has extended this link to perceptions of mind (see Figure 3). Using a variety of measures, we demonstrated that individuals with high facial width-to-height ratio (i.e., relatively wide and short faces) were ascribed less sophisticated minds than were individuals with low facial width-to-height ratio (i.e., relatively longer and narrower faces). In particular, perceivers tended to believe that targets higher in facial width-to-height ratio had less capacity for intentional action, self-regulation, and complex emotions, a pattern consistent with an animalistic form of dehumanization. Additionally, these biases in mind perception had a number of downstream consequences. Compared to individuals with low facial width-to-height ratio, perceivers believed that targets with high facial width-to-height ratio were more likely to be convicted of a brutish crime (i.e., assault) but not a sophisticated crime (i.e., embezzlement) and were valued for their physical, but not intellectual, acumen. Moreover, preliminary evidence suggests that these effects occurred across the lines of target race and sex, underscoring the importance of face structure as a rich signal of humanity.

It may seem surprising or even counter-intuitive that facial characteristics can lead to both human and non-human targets being ascribed more or less sophisticated minds than others. Yet this array of findings shows that facial features, appearances, and structures can influence mind perception. However, research has also demonstrated that minds are not signaled uniquely by the features in the face. Rather, the way in which others' faces are *processed* also has implications for how much mind they are ascribed as well.

2.2 | Face processing

Faces, it seems, are special. Unlike the vast majority of objects that we see and perceptually process every day, human faces elicit a type of perceptual processing—called *configural processing*—that occurs primarily for faces (Maurer, Le Grand, & Mondloch, 2002).[ii] Rather than being processed only on a feature-by-feature basis, human faces are typically processed as a single, integrated Gestalt. For instance, when we see a car, we process the wheels, the doors, and the roof separately. Yet when we see a face, we see eyes and the nose, and the mouth, but we also integrate the eyes, the nose, and the mouth together into a single perceptual unit. This is part of why we can easily tell thousands of human

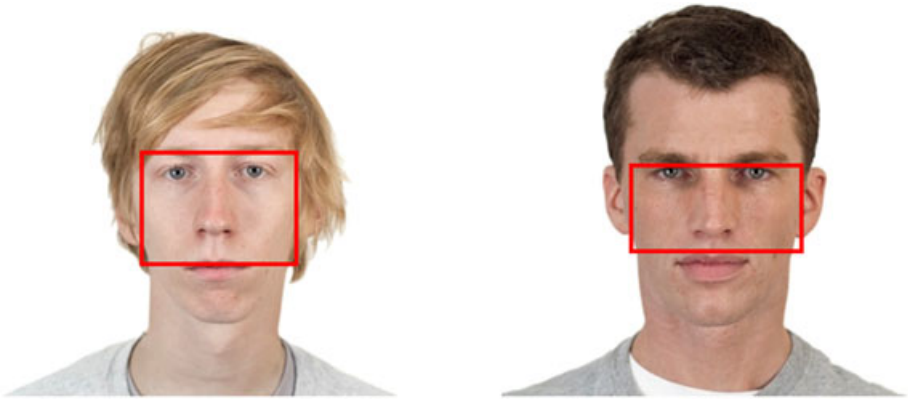

FIGURE 3 Individuals with relatively greater facial width-to-height ratio (i.e., wider and shorter faces, such as the man on the right) are ascribed less sophisticated minds (Deska, Lloyd, & Hugenberg, 2017)

faces apart even though they differ by only millimeters. Imagine walking through a parking lot containing cars of the same make and model that differ only in millimeters; you would never be able to find your car! Compare that experience to trying to pick out the face of someone you know well (e.g., your mother; your romantic partner) from a crowd. It may take a few seconds, but by comparison, it is easily done. This tendency to process faces in a special manner affords us, in part, this remarkable ability to tell who is who nearly effortlessly.

Importantly, recent research has also investigated the extent to which this configural processing—typically reserved for human faces—is also implicated in perceiving targets as having human-like minds. Indeed, perhaps the close association of configural processing with humanness (we typically process humans configurally but not objects) has made configural face processing a cue that sophisticated minds are present. Conversely, it is possible that when we fail to process faces configurally (i.e., we fail to use face-typical processing for a human face), we will fail to spontaneously recognize that the face is harboring a sophisticated mind. Consistent with this logic, recent research has begun documenting how experimentally impairing the use of configural processing leads to the perception of less sophisticated minds and how targets that are dehumanized are afforded less configural (i.e., face-typical) processing.

As noted above, the presence of human eyes on a face seems to disproportionately signal (relative to other facial features) that there is a human-like mind behind them. Even human eyes alone can signal the presence of a mind. Yet the presentation of a *full face* is a substantially stronger signal than the eyes or any other facial feature alone (Looser & Wheatley, 2010). The presentation of an entire upright face most readily affords configural processing, and this processing may be what alerts perceivers that the target has a mind. Even though, logically, we know the eyes belong to a face, there is something about the presentation of the full configuration of features that strongly signals a sophisticated human mind. Indeed, recent work from our lab has reliably demonstrated that configural face processing is associated with mind perception. Specifically, Hugenberg et al. (2016) demonstrated that when perceivers' ability to processes faces configurally is experimentally disrupted, faces are ascribed less sophisticated minds than when configural processing is not disrupted. Here, Hugenberg and colleagues relied on *face inversion* to disrupt configural processing. Part of what makes faces unique is the regular eyes-over-nose-over-mouth configuration. When we disrupt this configuration (even just by inverting a face; Yin, 1969; cf. Sekuler, Gaspar, Gold, & Bennett, 2004), this disrupts perceivers' ability to integrate the features of the face into a single perceptual unit (see Figure 4). Inversion

FIGURE 4 Inverting faces disrupts the ability for perceivers to process them configurally and triggers dehumanizing responses

forces us to rely more on features than we typically would otherwise. Relying on this, Hugenberg and colleagues found that participants were slower to recognize words associated with humanity (e.g., soul) after being exposed to inverted faces, as compared to upright faces. Thus, whereas human faces normally bring human-related words to mind, inverted faces failed to do so. In an additional study, Hugenberg et al. (2016) demonstrated that inverted faces were ascribed lower levels of uniquely human mental characteristics (e.g., thoughtful, empathetic) than upright faces. In similar work, Deska, Almaraz, and Hugenberg (2017) provided additional evidence for the link between configural processing and mind perception. In two studies, perceivers were less likely to ascribe minds to morphed targets when inverted than when upright. Importantly, disrupting configural processing only reduced mind ascription for faces that shared strong featural similarity to human faces (i.e., disrupting configural processing didn't have any effect on faces that were clearly dolls), suggesting that perceiving mind in a face might require that the face both has human features *and* elicits configural processing.

Recent work by Cassidy et al. (2017) further extends this configural processing-to-mind link while also considering the effects of race. Whereas above, we reviewed evidence suggesting that phenotypically Black faces are ascribed less sophisticated minds, what happens when the human-like *configuration* is disrupted as well? Specifically, Cassidy and colleagues replicated the upright versus inverted face procedure of previous work, while also showing White participants the faces of White, Black, and Asian targets. Although Cassidy and colleagues found that inverting targets' faces did tend to lead perceivers to ascribe less sophisticated minds to all targets, this was especially true for Black targets. When presented inverted, Black faces were not only ascribed less sophisticated minds but they were also judged to be acutely untrustworthy and were seen as highly interchangeable with one another. Why does inverting Black faces lead to this especially strong mind-denying response in Whites? Although more research needs to be done, there is reason to believe that this response was the product of two simultaneous effects. First, past research has reliably shown that Whites often deny mind to Black targets and dehumanize Black individuals (e.g., Goff et al., 2008). However, it is possible that this denial of mind targeted at Blacks may be offset by the signal of humanness that comes from configural face processing. If there is a stereotypic association of Blacks as mentally unsophisticated, but an association between upright faces and humanness, perhaps these two countervailing forces at least partially offset one another. However, inversion may "unleash" the otherwise partially restrained tendency for Whites to deny minds to Blacks.

Finally, recent evidence has also indicated that perceivers' ability to agree whether a face has more or less human-like traits can rely on configural processing as well. Wilson, Young, Rule, and Hugenberg (2018) have found that disrupting the ability to configurally processes faces appears to more greatly inhibit perceivers' ability to make judgments about traits related to humanness (i.e., trustworthiness) than traits more closely related to animals (i.e., dominance). Across a series of studies, Wilson and colleagues replicate the tendency for perceivers to show strong consensus for both trustworthiness and dominance ratings for upright faces. This likely is not a surprise—most of us would agree that Tom Hank's face looks more trustworthy than Steve Buscemi's face. Similarly, it is likely easy to get agreement that Russell Crowe's face looks more dominant than Justin Timberlake's face. However, disrupting configural face processing via face inversion affects consensus for trustworthiness judgments (a trait that appears unique to humans) more so than for dominance judgments (a trait that seems more animalistic). Here, we again see that when the ability to process human faces using face-typical processing (i.e., by violating configurality), the ability to infer human-like mental traits is disrupted.

This evidence suggests that perceiving another human's mind is determined, at least in part, by the extent to which face-typical processing is engaged. When otherwise human faces fail to elicit configural processing (i.e., they are processed in a manner more typical of non-human objects) they are ascribed lower levels of human-like characteristics. Indeed, in situations like this, human-typical traits (e.g., soul) do not easily come to mind. Taken together, these studies implicate how we process faces in how we perceive minds. When the configural face processing typical of face perception is present, it allows us to see others as having fully human faculties and can even constrain otherwise dehumanizing responses (Cassidy et al., 2017). However, when face-typical processing is disrupted, so too is the ability to infer sophisticated, human-like minds from others' faces.

3 | FACES FROM MINDS

As we outlined above, faces may not be attributed sophisticated minds when they lack human-like facial features or when configural processing is disrupted. However, recent research indicates that this relationship is bidirectional: Perceiving faces can trigger beliefs about others' minds, but so too can beliefs about others' minds influence how faces are perceived. In short, faces are seen as harboring minds when it suits our purposes to do so. For example, desiring social connection with others influences the extent to which faces require human-specific features to be judged as having mind. In one study, Powers et al. (2014) adopted the doll-to-human face-morph paradigm outlined previously (i.e., Looser & Wheatley, 2010; see Figure 1) and measured the extent to which participants felt a strong chronic desire for social connection. Participants who desired more social connection more easily saw minds in faces. In a second study, Powers and colleagues manipulated social rejection to make some people desire social affiliation. Just like those with the chronic desire for connection, those with an acute desire to connect to others more easily see minds in faces. Even relatively doll-like faces seem to harbor minds for lonely perceivers.

Believing that a target belongs to an "us" rather than a "them" can have a similar effect, shifting the threshold for deciding when a face harbors a mind. Using those same doll-to-human morphs, Hackel et al. (2014) found that participants had a higher threshold for perceiving mind (i.e., required more humanness in the faces) in faces that belonged to outgroups, as compared to ingroups. This was true even when the groups were so-called "minimal" groups; groups that were just made up for that study. However, in a follow-up study, Hackel and colleagues found that when participants felt *threatened* by the outgroup, this actually made relatively doll-like outgroup members seem mindful. Threatening outgroups required *fewer* human-specific features for mind to be perceived. Generally speaking, it is often useful to try to understand the mind of a person or group who may be threatening to us (e.g., What are they going to do to us? How can we stop them?). This way, one can better understand its intentions in order to best alleviate or circumvent the threat. Thus, although the intergroup context can influence whether a face seems to harbor a mind, it appears important not just to consider whether the group is an "us" or a "them" but what the relationship between us and them actually is.

If perceiver's motives can change the threshold for human-like *features* to seem like human faces, could such motives also change how faces are *processed*? Recently, Fincher and Tetlock (2016) investigated just this issue. They hypothesized that beliefs that we have about others can influence how we process others' faces. In this work, participants learned that some faces they would see belonged to serious norm violators (e.g., murderers and rapists), the exact sort of people we often think perform inhuman (or at least inhumane) acts. Using a variety of measures across several studies, they demonstrated that participants used less configural processing for the faces of norm violators than for faces of people who follow societal rules. In other words, learning that others have acted in inhumane ways changes how we process the faces of those inhumane people. The faces of inhumane actors were processed more like objects and less like people, a phenomenon they call "perceptual dehumanization." Here, we actually *see* their faces in a more object-like manner. In a subsequent series of studies, Fincher and Tetlock (2016) demonstrated that the reduction of configural processing for norm violators has real consequences: It helps us punish those whom we believe have acted inhumanely. This disruption of configural face processing allows participants to more readily assign harsh punishments to those serious norm violators. This pattern of data is consistent with previous work showing how the denying mind to others can facilitate punishment (Viki, Fullerton, Raggett, Tait, & Wiltshire, 2012), torture (Viki, Osgood, & Phillips, 2013), and even execution (Osofsky, Bandura, & Zimbardo, 2005).

Consistent with these data are a range of findings suggesting that groups that tend to be chronically denied mind often fail to elicit configural processing. Among the most frequent targets of explicit dehumanization are racial outgroups. Indeed, racial outgroups frequently elicit less configural processing than racial ingroup members (Michel, Rossion, Han, Chung, & Caldara, 2006; Rhodes, Hayward, & Winkler, 2006; Tanaka, Kiefer, & Bukach, 2004). Similarly, neurological data reveal that people are better able to decode the mental states (as measured by the ability to infer emotional states from images of the eye region) of same-race compared to other-race targets (Adams et al., 2010); and, as noted above, disrupting Whites' ability to configurally process Black faces yields particularly negative

outcomes (Cassidy et al., 2017). Similar effects are observed for sexualized women. Sexualized women tend to elicit less configural processing (Bernard, Gervais, Allen, Campomizzi, & Klein, 2012) and are seen as relatively interchangeable (Gervais, Vescio, & Allen, 2012). Holding race and sex constant, perceivers also tend to better remember the faces of low-status group members compared to the faces high-status group members (Shriver, Young, Hugenberg, Bernstein, & Lanter, 2008); indeed, the ability to remember faces is itself associated with configural processing (e.g., Richler, Cheung, & Gauthier, 2011). Even mere social categorization can influence the extent to which perceivers employ configural processing. Michel, Corneille, and Rossion (2007) show that racially ambiguous stimuli elicit less configural processing when labelled as outgroup compared to ingroup members (see also Pauker et al., 2009). Similarly, otherwise identical faces belonging to minimal outgroups (e.g., students at a different university, people with different contrived personality types) are impaired in memory and elicit less configural processing than those assigned to minimal ingroups (Bernstein, Young, & Hugenberg, 2007; Hugenberg & Corneille, 2009).

Together, these findings underscore the bidirectional nature of how faces can suggest minds, and how minds can influence how we see faces. In particular, these data showcase that perceiver beliefs and motivations (e.g., desire for social connection), as well as characteristics about targets (e.g., social group membership) can influence how faces are perceived (see also Deska, Lloyd, & Hugenberg, 2016; Xiao, Coppin, & Van Bavel, 2016). Further, these processing effects have real consequences: When faces get less configural processing they get more punishment (Fincher & Tetlock, 2016).

4 | WHAT NEXT?

Perceiving faces and perceiving minds are intertwined. What we see in a face (and how we see it) influences the sort of mind we believe exists behind its eyes. And the sort of mind we believe a face harbors influences how we perceive and judge that face. Yet our understanding of this face-mind link is still quite new, leaving many exciting avenues open for future research. In this final section, we outline several areas where important and unanswered yet questions still await research.

First, although the research clearly shows that perceiving minds and perceiving faces are linked, it is yet unclear *why*. One plausible possibility is mere associations. Perhaps we simply come to associate certain facial features (or certain facial processing styles) with minds. For instance, consider eyes. Perhaps we associate eyes with minds because, in our overwhelming experience, targets with eyes have minds. In all likelihood, your experience is that things that think tend to have eyes, so you have learned that "eyes = mind." This proposed associative link between eyes and minds likely requires little cognitive elaboration. However, other potential face-mind links may be driven more by deliberative, motivated reasoning. For instance, the down-regulation of configural face processing to norm-violators shown by Fincher and Tetlock (2016) is likely a motivated process. Without the knowledge that a man is a murderer, for instance, perceivers would have little reason to not process his face like they do other faces. Yet upon learning that a man is a murderer, the motivated down-regulation of configural processing helps to facilitate punishing him. Thus, considering the extent to which the face-mind link (or perhaps specific face-mind links shown in the literature) is associative versus deliberative, or occur above or below the threshold of consciousness, may provide exciting and fruitful avenues for new ways of thinking about how and why faces and minds are linked.

Second, here we have reviewed work suggesting that configural processing and mind perception are linked. When the ability to process faces configurally is disrupted, perceivers ascribe targets less sophisticated minds. Although configural processing is quite typical for human faces (and piecemeal, feature based processing is more typical of non-face objects), it is also true that configural processing is not *unique* to human faces. Indeed, we can learn to process other non-face objects in a configural manner. For example, car experts and bird experts become more likely to use configural processing for targets of their expertise (cars and birds, respectively; Bukach, Gauthier, & Tarr,

2006; Gauthier, Skudlarski, Gore, & Anderson, 2000). This opens a variety of exciting lines of future research. For instance, one possibility is that perceivers use less configural processing for outgroup faces than for ingroup faces in part because perceivers often have less experience processing the faces of outgroup members (e.g., Chiroro & Valentine, 1995, Walker, Silvert, Hewstone, & Nobre, 2007; Walker & Tanaka, 2003). This differential expertise with ingroup and outgroup faces could help explain why outgroup members are denied mind relative to ingroup members. Alternatively, perhaps coming to see an entity as having a mind can facilitate learning the configuration of its face. We know from past research that part of gaining reading fluency is learning to process letters configurally (e.g., Wong et al., 2011). Perhaps Sesame Street is so successful at teaching children the configuration of letters because they first convince children that the letters are animate and mindful (by having eyes, singing and dancing, and having other characteristics of mindful entities), which facilitates the learning of configurations. Relatedly, numerous researchers have demonstrated that processing fluency or the subjective ease of processing a stimulus influences the extent to which a face is evaluated positively (e.g., Reber, Schwarz, & Winkielman, 2004). It may be the case that the ease with which a face is processed (perhaps in part because of our experience processing familiar faces) influences the extent to which it is ascribed sophisticated mental faculties. In support of this, recent research suggests that ambiguously human targets (e.g., life-like robots) are difficult to categorize and this relative disfluency in turn predicts judgments of those targets as unlikeable and weird (Carr, Hofree, Sheldon, Saygin, & Winkielman, 2017). Yet to our knowledge, no work has directly tested an association between processing fluency and attribution of mind.

Third, the current work focuses exclusively on faces. This was intentional—much of the recent work on how perceiving others interfaces with perceiving minds has focused on faces. However, it is possible that the face-mind link is a subset of a broader phenomenon involving *embodied minds*. We know from existing research that people make all sorts of inferences about others' characteristics based on how they move, including sex (e.g., Johnson & Tassinary, 2005), sexual orientation (Johnson, Gill, Reichman, & Tassinary, 2007), and even race (Lick, Golay, & Johnson, 2014). A variety of bodily cues (e.g., height, weight, waist-to-hip ratio) and movement cues (e.g., speed, shoulder positioning) may signal whether or not another person's mind is worth considering. As one example of this, recent work by Schroeder and Epley (2015) suggests that the presence of human-like voice influences mind perception, with people ascribing more sophisticated minds to targets when they hear them speak as opposed to when they merely read the transcript of the same speech (see also Schroeder & Epley, 2016). The natural tonal variations in human voices trigger inferences that the target has a sophisticated human-like mind. More generally, whereas the current work has focused on faces, we think it is exciting to consider how other signals may, alone or in conjunction, be used to infer others' minds.

Fourth, moving forward in this research, it will be important to understand how contexts interact with faces (or other cues) to influence mind perception. Indeed, some face-mind linkages may be context-dependent, sometimes making stimuli seem like they have *more* mind, and sometimes making stimuli seem like they have *less* mind. For example, whereas the presence of eyes often signals the presence of a mind (Gao et al., 2010), not all eyes successfully signal minds (Balas & Horski, 2012). One cannot simply morph human eyes onto the face of a doll and make the doll seem human. Relatedly, sometimes threatening targets are denied mind (e.g., Deska et al., 2017), but sometimes threatening targets are ascribed mind (Hackel et al., 2014). Exactly how and why threats sometimes trigger the inference of sophisticated minds and sometimes trigger the inference of simplistic minds is as yet unclear. One likely explanation could be the differential interdependence of the threatened groups (see Capozza et al., 2013). Perhaps groups who compete in an ebb-and-flow relationship (e.g., Democrats and Republicans in the U.S. political system; Hackel et al., 2014) require more mind perception than those in an all-or-nothing competition. More generally, if there is one thing we know about humans, it is that we are highly sensitive to contexts, and understanding the context in which faces are seen will be a critical component of understanding the face-mind linkage. Related to this context-dependency, much of this extant research has been done with so-called WEIRD participants (i.e., participants from Western, Educated, Industrialized, Rich, and Democratic cultures; Henrich, Heine, & Norenzayan, 2010). We know that people across the globe perceive faces somewhat differently (e.g., Blais, Jack, Scheepers, Fiset, & Caldara,

2008) and that conceptions of mind can differ across cultures as well (e.g., Bain, Vaes, Kashima, Haslam, & Guan, 2012). It will be important in future research to understand whether, and if so how, similar effects occur across the lines of participants' race, ethnicity, and culture.

Finally, we are excited to see more work explore the consequences of the face-mind link. Although work by Fincher and Tetlock (2016) demonstrates that one outcome of failing to process a face in a face-like manner is the facilitation of punishment, more research is needed to understand real-world outcomes. For example, it is plausible that the dehumanizing treatment experienced by people with facial stigma that may disrupt face configurations (e.g., cleft palates) may be due in part to this link between face and mind perception. Future research could benefit from understanding how these effects that we have seen in the lab may influence how people experience stigma in the world.

5 | CONCLUSION

This review explores the early, but exciting, findings at the intersection of face perception and mind perception. Here, we focused on how processes related to everyday face perception can serve as cues to mind perception, and how beliefs about others' minds can influence how we perceive and judge others' faces. In particular, this review demonstrates that although this literature is relatively new, there is already a great deal of evidence supporting the role of face perception and processing in attributions of mind to others. Perhaps most importantly, we hope the present synthesis can help scholars across disciplines understand how mind perception can be cause and consequence of everyday face perception.

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Endnotes

[i] Although we highlight similarities between these models of infrahumanization, dehumanization, and mind perception (as well as related work investigating anthropomorphism or animacy), we also recognize that real differences exist as well in terms of conceptual definitions, research focus, and empirical predictions (see Bain et al., 2014 for a review).

[ii] Maurer et al. (2002) note that configural processing has been used to refer to sensitivity to first-order relations (i.e., the general organization of eyes above a mouth), sensitivity to second-order relations (i.e., the distances between facial features), and holistic processing (i.e., processing a face as a gestalt, without decomposing the target into specific features). We adopt the same convention here and discuss holistic processing as a subset of configural processing.

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