

# Psychological Inquiry

An International Journal for the Advancement of Psychological Theory

ISSN: 1047-840X (Print) 1532-7965 (Online) Journal homepage: <http://www.tandfonline.com/loi/hpli20>

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To cite this article: Y. Jenny Xiao, Géraldine Coppin & Jay J. Van Bavel (2016) Clarifying the Role of Perception in Intergroup Relations: Origins of Bias, Components of Perception, and Practical Implications, *Psychological Inquiry*, 27:4, 358-366, DOI: [10.1080/1047840X.2016.1237822](https://doi.org/10.1080/1047840X.2016.1237822)

To link to this article: <http://dx.doi.org/10.1080/1047840X.2016.1237822>



Published online: 24 Oct 2016.



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REPLY

## Clarifying the Role of Perception in Intergroup Relations: Origins of Bias, Components of Perception, and Practical Implications

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### Introduction

In our target article, we proposed the Perceptual Model of Intergroup Relations (PMIR) to conceptualize the role of perception in intergroup relations (Xiao, Coppin, & Van Bavel, this issue). According to the model, social identity can alter information processing across perceptual modalities (visual, auditory, tactile, olfactory, and gustatory perception) and this process can influence intergroup relations. Because the relationship between social group identification and intergroup relations has been well-established, we focused more on the effect of social identity on perception, with attention to implications for behavior. We also highlighted gaps in the existing literature and outlined areas for future research. The PMIR offers a broad set of guidelines for social psychologists to study perception as a function of social group dynamics and for perception researchers to consider social influences. Uncovering the role of perception in intergroup relations offers novel insights into the construction of shared reality and may help devise new and unique interventions targeted at the perceptual level. The current reply article expands on our target article by clarifying the origins of bias, components of perception, and practical implications of the PMIR.

We were amazed by the sheer number of scientists who have commented constructively on our target article; we are grateful for all 15 commentaries (and 32 authors)! We thank the brilliant people who have taken the time to engage with the PMIR. Many of the commentaries resonate with our own, often unstated, assumptions, and others force us to update our thinking. Collectively, the commentaries express a clear consensus regarding the major contributions of the PMIR. First, incorporating perception into a previously extensively studied domain of social identity and intergroup relations represents a theoretical contribution. Specifically, many commentators recognize the value of explicitly discussing multiple perceptual modalities, as previous research and theories in social psychology have focused almost exclusively on visual perception. Second, the PMIR has important practical applications for various real-world domains. We are grateful to the commentators for acknowledging these contributions.

Although there is a striking consensus regarding the theoretical and practical contributions of the PMIR, the commentaries

vary widely in their recommendations. We group the suggestions into three core themes, each of which we discuss in greater detail: origins of bias, components of perception, and practical implications. We are grateful for these suggestions and believe that addressing each theme has significantly clarified the PMIR.

### Origins of Bias

Research over the past half century has firmly established that people identify with groups, and this has significant consequences for intergroup relations (Tajfel, 1982). Indeed, the need to belong is widely considered one of the most fundamental human needs—behind only the need for safety and basic physical needs like air and water (Maslow, 1968). Classic experiments have demonstrated the ease with which people form social groups, as well as their powerful consequences (Campbell, 1965; Sherif & Sherif, 1953). Moving from an economic perspective of intergroup relations, social identity theory (Tajfel & Turner, 1979) was proposed to articulate the significance of belonging to and identifying with one's ingroup (also discussed in Ellemers, this issue; Reicher & Hopkins, this issue).

The idea that social categorization and identification can influence perceptual judgments is a classic concept in social psychology. Research from the social identity tradition has tested the idea that social categorization influences perception (Tajfel & Turner, 1979; Tajfel & Wilkes, 1963; also discussed in Ellemers, this issue, and Reicher & Hopkins, this issue). In the classic study, conducted by Tajfel and Wilkes following the proposal of social identity theory, categorization<sup>1</sup> accentuated between-category differences and within-category similarities in people's judgment of physical characteristics of stimuli (e.g., lengths of lines; Tajfel & Wilkes, 1963). Moreover, we agree with our colleagues that such perceptual biases are often shared among members of a particular group (Jetten & Haslam, this issue). In the following sections, we discuss the origins of these biases, including the role of contextual salience, evolution, and other proximal factors. Before we address these topics, we clarify several definitions (see Ferdenzi, Rouby, & Bensafi, this issue).

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<sup>1</sup>Or otherwise described in their original work as “classification.”

## Definitions

In the PMIR, we borrow our definition of “social identity” and “social group” from classic social identity theory and research (e.g., Tajfel & Turner, 1979; also discussed in Ellemers, this issue, and Reicher & Hopkins, this issue). Tajfel and Turner originally described intergroup interactions as one extreme of a continuum consisting of “interactions between two or more individuals (or groups of individuals) which are fully determined by their respective memberships in various social groups or categories, and not at all affected by the interindividual personal relationships between the people involved” (Tajfel & Turner, 1979, p. 34). The other extreme of the continuum involves purely interpersonal interactions. Minimal groups, for instance, exemplify “mere group membership” in the purest sense, absent conflicts over resources or historical hostility between groups (Tajfel, Billig, Bundy, & Flament, 1971). As such, “intergroup relations” is defined as how people think about and act toward people from another social group. We are grateful for the commentaries that help clarify these definitional issues from classic theories (e.g., Ellemers, this issue; Reynolds & Subasic, this issue; Reicher & Hopkins, this issue). Regarding the origins of bias in the PMIR, we focus our discussion on three main aspects of social identity.

## Evolutionary Sources

Regarding the source of biases originating from social identities, Keller and Cesario (this issue) provide an evolutionary account. Humans are social beings, and we agree that there is something deeply rooted about the human propensity to form and favor groups (Brewer & Caporael, 2006). This notion would also suggest that features of the human perceptual and cognitive systems may have been selected because forming and favoring group-based interactions conferred an evolutionary advantage (Cikara & Van Bavel, 2014). Just as Keller and Cesario point out, adding a consideration of an evolutionary framework gains an understanding into *why* our social identities and social belonging motives should shape perception.

More specifically, adopting an evolutionary framework as an ultimate explanation can help the PMIR make *specific* predictions concerning the effects of social identity on perception. For example, “individuals who perceive themselves to be highly vulnerable to diseases should have more negative attitudes of groups they see as foreign” (Keller & Cesario, this issue, p. 326). Indeed, recent work has provided experimental evidence of the role of disgust in mediating the relationship between group identity and avoidance (Reicher, Templeton, Neville, Ferrari, & Drury, 2016). Specifically, in this research, after smelling a sweaty T-shirt, disgust—measured by either self-report or an unobtrusive measure of walking time to wash hands or number of pumps of hand sanitizer used—was lower when participants believed the T-shirt was owned by a member of their own group. Even more relevant to the PMIR, perceived disgust mediated the relationship between group identity (ingroup vs. outgroup) and willingness to interact with the owner of the T-shirt (Reicher et al., 2016). In short, the perception of disgust appears to play a role in social group identity and the avoidance of outgroup members.

In terms of making specific predictions, one example from our own lab builds on research from evolutionary models of biological threat responses to predict specific effects on intergroup perceptual judgments. According to biologists, it is usually more adaptive for organisms to respond to potential threats as if they are truly threatening than to fail to respond (Bradley, Codispoti, Cuthbert, & Lang, 2001). Error management theory (Haselton & Buss, 2000) proposes that when judgments are made under uncertainty, natural selection has favored decisions biased toward committing errors that are less evolutionarily costly. As such, it may be adaptive to represent a potential threat as physically closer or more imminent, triggering the cascade of reactions that prepare the body for appropriate action (Blanchard & Blanchard, 1989; Lang, Bradley, & Cuthbert, 1997). Indeed, spider phobics tend to report that spiders are physically larger and moving more quickly toward them, compared to people who are less fearful of spiders (Leibovich, Cohen, & Henik, 2016; Riskind, Moore, & Bowley, 1995; Shiban et al., 2016; Vasey et al., 2012). Moreover, anxiety-prone people represent negative emotional stimuli as if seen from a closer perspective (Mathews & Mackintosh, 2004). Collectively, these theorizing and findings point to an evolutionary rationale for exaggerated perception of threatening objects, animals, and people.

Consistent with the argument that incorporating evolutionary biology in the PMIR enhances its ability to specific predictions (Keller & Cesario, this issue), these reactions to biological threats help make predictions regarding threats of a social nature (Roelofs, Hagenaaars, & Stins, 2010). We have found parallel threat-induced effects with distance and size perception, such that a threatening group (e.g., Mexican immigrants) was estimated as not only physically closer but also larger in population size (Xiao & Van Bavel, 2012; Xiao, Wohl, & Van Bavel, 2016). Similarly, members of majority groups tend to overestimate the population size of minority groups and the rate at which minority groups are growing (Alba, Rumbaut, & Marotz, 2005; Outten, Schmitt, Miller, & Garcia, 2012). Collectively these effects point to a physical looming effect of intergroup threat, such that threatening outgroups and their group members may be perceived to be closer, larger, and moving faster toward the perceiver. However, important to note, such bias can be reduced when people are surrounded by their ingroup members (Cesario & Navarrete, 2013). This work is highly consistent with an evolutionary explanation of social identity on perception, and future work could benefit from such an approach.

## Contextually Determined Social Identities

In addition to considering the evolutionary roots of social groups, it is essential to recognize the situational aspects of social identity (Balciis, Stern, & Cole, this issue; Reicher & Hopkins, this issue; Reynolds & Subasic, this issue). Humans all belong to multiple social groups, and not all group memberships are equally salient to our core self-concept at all times (Turner, Hogg, Oakes, Reicher, & Wetherell, 1987). Depending on the current context and motivation, different social identities may become more or less relevant. As Reynolds and Subasic (this issue) note, the PMIR

moves beyond the idea that it is necessary to travel to some distant land or to identify an atypical set of individuals with certain peculiarities to demonstrate that people can think and judge stimuli differently. The central idea of the paper is that people have a capacity to vary their self-definition. (p. 349)

In our view, this is one of the central insights that social psychology has given the study of human cognition (Packer & Van Bavel, 2014).

Our own research frequently capitalizes on situations where certain social identities are made particularly salient, such as a sports arena where one's identity as a fan of a sports team is made most salient (e.g., Xiao & Van Bavel, 2012). Even in classic minimal group paradigms, where the groups are created on an arbitrary basis, these trivial social identities can override the effects of more entrenched groups and identities, like race (see Van Bavel & Cunningham, 2009). Therefore, all the predictions in the PMIR are contingent upon situationally salient and motivationally relevant social identities. The idea that our self-definitions can vary flexibly depending on the current salient context is a well-established tenet of self-categorization theory (Turner et al., 1987). Yet this flexible construction of the self offers novel insights into the nature of perception and how it mediates intergroup relations.

### **Hierarchy and Other Proximal Factors**

We completely agree with several commentaries that groups very rarely exist in their most pure and theoretical form and that it is crucial to consider the structural context in which they are situated (Kteily & Richeson, this issue). Many, if not all, groups in our society exist within hierarchical structures. Indeed, hierarchy of social groups has been the focus of dominant theories in the field of social psychology (e.g., see Jost & Hunyady, 2003; Sidanius & Pratto, 2001, for system justification theory and social dominance orientation, respectively). Racial groups, for instance, come with a long history of hierarchy and stereotypes. Cultural stereotypes of racial groups have important consequences for perception of physical characteristics. Defining and isolating the effects of mere group membership in no way contradicts the importance of studying groups in their historical and societal contexts. Indeed, the PMIR allows proximal factors to moderate intergroup effects.

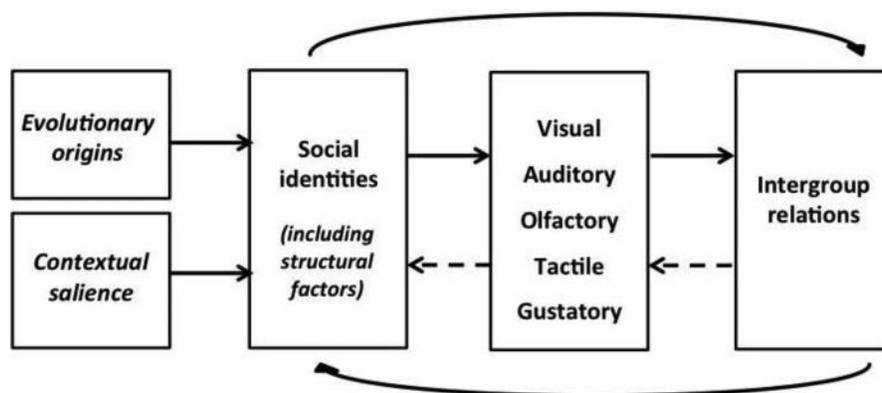
Structural factors can dominate perception because they are often chronically salient, deeply ingrained, and impossible to escape. For instance, when it comes to racial relations in the United States, "there is very little that can be done *psychologically* to reduce this association without changing the social reality first" (Reynolds & Subasic, this issue, p. 350). Thus, the impact of countervailing identities might be fleeting. Moreover, structural inequalities between groups might be perpetuated and maintained through perception (Blair, Judd, & Chapleau, 2004; Eberhardt, Davies, Purdie-Vaughns, & Johnson, 2006; Eberhardt, Goff, Purdie, & Davies, 2004; Hetey & Eberhardt, 2014).

Consider the issue of law enforcement's relationship with African Americans in the United States. African Americans are often associated with the cultural stereotype of being threatening, aggressive, and criminal (Brigham, 1971; Devine, 1989; Devine & Elliot, 1995; Duncan, 1976; Johnson, Trawalter, & Dovidio, 2000). Given the combination of racial stereotypes and the frequency of

interracial contact in policing, it is unsurprising that young Black males, compared to their White counterparts, are more likely to be shot fatally by police (Gabrielson, Jones, & Sagara, 2014; Lowery, 2016; Ross, 2015; Swaine, Laughland, & Lartey, 2015). Racial biases in police shootings have inspired researchers to study the factors that contribute to African Americans being disproportionately targeted and shot by police officers (e.g., Correll, Park, Judd, & Wittenbrink, 2002; Correll et al., 2007; Fyfe, 1982; Greenwald, Oakes, & Hoffman, 2003; Payne, 2001; Plant, Peruche, & Butz, 2005). The majority of this work has focused on whether police officers (and other subject populations) can accurately detect the presence (and absence) of a weapon and the role of weapon perception in their ultimate shooting decisions. However, the PMIR, past research on intergroup threat, and anecdotal evidence from real-world police shootings would collectively suggest that distance perception may play a critical role in police officer's decision to shoot.

In August 2014, for instance, St. Louis police shot and killed 25-year-old Kajieme Powell. Fewer than 20 s elapsed between the time the police arrived on the scene to arrest Mr. Powell for allegedly shoplifting two soft drinks and donuts and the time they fired several shots at him. Although the police alleged that Mr. Powell had a knife and was "within 2 or 3 feet of the officers" (Friedersdorf, 2014, para. 3), a cell phone video of the incident showed that Powell was much farther away. Indeed, distance perception is critical in this context. In the law enforcement community, the "21-Foot Rule" has become a police doctrine and is still being taught during police officer firearms and deadly force training throughout the United States (Martinelli, 2014). According to the "21-Foot Rule," an average person charging at a police officer with a knife (or other stabbing weapon) can cover a distance of 21 feet during the time it takes an average officer to recognize the threat, pull out his gun, and shoot the target (Tueller, 2004). The implication therefore is that police officers should be able to accurately estimate the distance between a knife-carrying suspect and themselves in order to make the correct decision on whether to shoot. This is rather difficult to achieve in split-second fashion due to a speed-accuracy trade-off (Wickelgren, 1977). The PMIR predicts that threatening outgroups, like African Americans, might be perceived as closer in distance to police officers, which could influence police decisions to shoot.

Other factors such as the cooperative/competitive nature of groups, ideology of group members, system justification motives, and sociohistorical contexts are important to consider as well. For instance, Kteily and Richeson (this issue) discuss motivations to justify the hierarchical structure of the society. An abundance of research from studying system justification motivation has provided ample evidence that people are willing and motivated to justify and support even unequal and unfair social systems (Jost, Banaji, & Nosek, 2004; Jost & Hunyady, 2003). Perception could play a role in justifying the system (Stern, Balcetis, Cole, West, & Caruso, 2016). Similarly, Jetten and Haslam suggest that high-status versus low-status group members may strategically manage their perception in ways to serve their group-level motivations. For instance, although high-status group members may typically emphasize perceptions that help maintain their group status, low-status group members may reject such perceptions or emphasize differences to cultivate a distinct social identity (Jetten & Haslam, this issue). We agree fully that incorporating such



**Figure 1.** A (updated) perceptual model of intergroup relations. *Note.* Solid arrows indicate existing empirical work, and dotted arrows indicate that very little, if any, empirical work exists to date. Italicized text indicates updates to the original perceptual model of intergroup relations given the insights and recommendations from commentaries.

considerations into the PMIR will greatly enrich the scope of the model, and we welcome research on this functional aspect of group-based perception.

Needless to say, we have benefited greatly from the commentaries in clarifying and elaborating on issues regarding the component of social identity in the PMIR. In addition to making our definitions more explicit, we have also elaborated on “social groups” as grounded in evolutionary biology and the current social context (see [Figure 1](#)). Adding these considerations to the PMIR has enriched the power of the model to make more specific predictions and made it more explicit *why* such predictions are made.

### Components of Perception

Several commentators have raised questions regarding whether the PMIR is similar to New Look type models/theories, or whether it is a novel stand-alone model (e.g., Correll, Cloutier, & Mellinger, this issue; Deska, Lloyd, & Hugenberg, this issue; Fincher & Morris, this issue). Our research and theory have been inspired by insights from New Look-type models that predominate modern psychology, but the PMIR also goes beyond this approach in several important ways. As Reynolds and Subasic (this issue) note, “What is new and where there is significant advancement is the finding that a perceiver can have different perception experiences of the same stimuli depending on his or her current self-definition” (p. 348). The fluid nature of the self is central to the PMIR and missing from many previous discussions of social vision. In addition to focusing on social identity concerns, the PMIR also shifts the focus from a modular view of social vision to multiple components of perception that cut across modalities. We avoided this discussion in our original target article to focus on the breadth of our approach, but we are grateful to the commentaries for giving us the opportunity to delve deeper into the components of perception in the PMIR. Moreover, in this section we also address a problem that has been observed more generally in our field as a whole—referred to as the “toothbrush problem” by Walter Mischel (2008).

### Overcoming the “Toothbrush Problem”

First, Balcetis et al. (this issue) present two separate models that focused specifically on skin tone perception and distance

perception, as well as the relevant literature supporting each model. Both models provide an impressive degree of specificity, as they each focus on a specific domain. These models overlap with our current model in many ways, but the PMIR would encapsulate the different dimensions of perception (e.g., distance perception, skin tone perception), insofar as they are shaped by social identity concerns. In our view, the parsimony of a singular broad framework offers several advantages (as well as disadvantages) over minitheories tailored for every possible dimension and modality of perception. Consider for a moment the challenges of developing models for intergroup size perception, distance perception, color perception, volume perception, taste perception, haptic perception, and so on.

Although there might be mini-applications of the PMIR to specific domains, the general constructs outlined in the PMIR apply to many domains of intergroup perception. In our view, this is a strength of the model. Walter Mischel famously observed that there was an overabundance of minitheories in the field of psychology—which he termed the “toothbrush problem.” In his view, “psychologists treat other peoples’ [*sic*] theories like toothbrushes—no self-respecting person wants to use anyone else’s” (Mischel, 2008, para. 3). The PMIR is an active attempt to circumvent this problem by identifying commonalities across identities, perceptual modalities, and intergroup outcomes. Cutting across seemingly disparate phenomena and numerous minitheories reveals that several core constructs are common across these models. Looking at the forest instead of the trees can not only guide us in a specific domain (e.g., by applying lessons from other modalities or domains) but also open our eyes to other potentially less prevalent domains (e.g., studying the role of olfaction in intergroup relations). That said, we certainly appreciate the merit in producing minitheories that are very narrow in scope but concrete in their applications. We invite future scholars to take the general principles from the PMIR to specific areas of inquiry—a topic we address in more detail next.

### Dynamic Processing

In addition to encompassing multiple modalities of perception, the PMIR is also distinct from the New Look because our thinking has been heavily inspired by dynamic processing and predictive coding models (Clark, 2013; Cunningham, Zelazo,

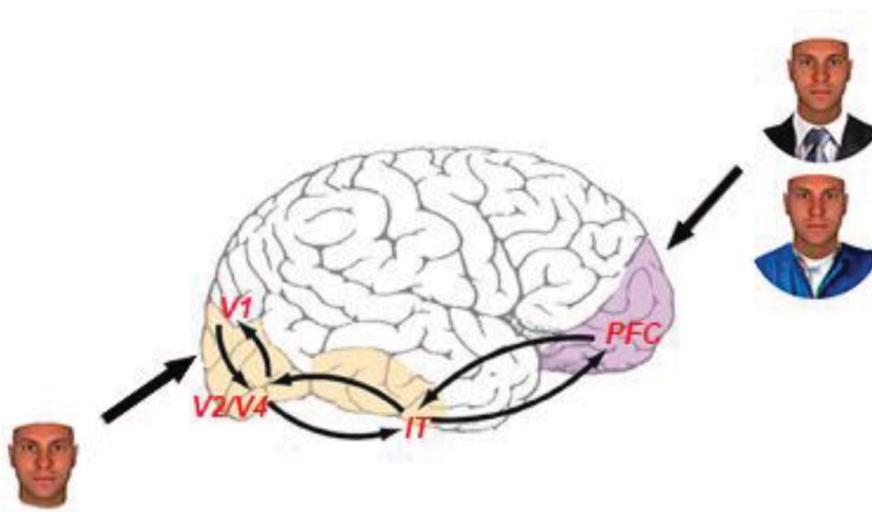
Packer, & Van Bavel, 2007; Freeman & Ambady, 2011; O'Reilly, Wyatte, Herd, Mingus, & Jilk, 2013; Scherer, 1984). During this time, work from cognitive science has shown that the term *perception* can be decomposed into several component processes, which range from very early processes such as edge detection and color encoding in V1 and V4 to higher level perceptual processes like face and place perception in the occipitotemporal cortex to action encoding in high-order regions (Goldstein, 2014; Haxby, Hoffman, & Gobbini, 2000). This perceptual processing hierarchy is far more complex than many models of motivated perception have acknowledged, and yet it is still a vast oversimplification from decades of work in vision science.

Being able to incorporate and learn from advances in cognition neuroscience allows us to theoretically and empirically decompose perception, as well as disentangle it from judgmental processes that are driven more by self-presentational concerns (see Fincher & Morris, this issue; Lick & Johnson, this issue). Moreover, it allows us to go well beyond simple distinctions between selection and perception (as discussed in Fincher & Morris, this issue; Lick & Johnson, this issue), because each of these psychological constructs can themselves be decomposed much further. For instance, selection can occur through the pathway from attention to visual input, or through the internal selection of goal-relevant representations in the absence of attentional differences. Unfortunately, many tasks and measures in the field of social psychology to date do not allow researchers to dissociate between these different component processes (also discussed in Stoler & Freeman, this issue). Thus, the application of a component process approach to intergroup relations remains largely speculative.

Of importance, the component process approach is not a simple feed-forward model. We describe how higher order systems, such as the Orbitofrontal Cortex, has tuned lower order visual systems through reentrant processing. Specifically, the primary visual cortex (V1) responds primarily to visual stimuli and has been shown to be responsible for perception of basic characteristics such as color, shape, movement, and patterns, from where there are pathways to and from other regions in

the visual cortex such as V2/V4 and the inferior temporal cortex (Goldstein, 2014; Haxby et al., 2000). Thus bottom-up perceptual input and higher order systems iteratively process information until arriving at a conscious percept and action sequence (see also Cunningham et al., 2007). The role of reentrant processing between higher order and lower order regions occurs throughout the perceptual-processing hierarchy (Wyatte, Jilk, & O'Reilly, 2014). We have created an example from the visual perceptual modality (see Figure 2), but we expect similar processing in other sensory modalities specified in the PMIR (also see Ferdenzi, Rouby, & Bensafi, this issue, on olfactory perception). Computational models with similar properties have already been applied fruitfully to the role of person perception (Freeman & Ambady, 2011).

Understanding the component processes is critical to understanding exactly where in the processing stream identity might exert an influence. In the context of face processing, for instance, people tend to engage in deeper encoding for in-group members, which is mediated by the fusiform face area (FFA; Van Bavel, Packer, & Cunningham, 2011). This approach can also be used to arbitrate between competing theoretical explanations. For instance, biased judgments of skin tone (e.g., Caruso, Mead, & Balcetis, 2009) could be mediated by color perception in V1, face perception in the fusiform, memory in the hippocampus, or categorization decisions in the prefrontal cortex. Only the first two patterns of activation would implicate perception, and the theoretical conclusions would differ fairly dramatically if the behavior was driven by V1 as opposed to the fusiform. These subtle theoretical differences are central to a component process approach. This approach not only is useful for inferring that “perception” was changed but also provides a guideline for the future. In our view, the most interesting theoretical question facing the field is not *whether* perception has been altered, it is *how* perception has been altered. Understanding the role of perceptual biases will provide a foundation for designing interventions to reduce bias and improve intergroup relations. Reducing biased judgments in the courtroom



**Figure 2.** Social contextual information (e.g., status cues) exerts top-down influences on perception (e.g., of racially ambiguous faces; figure adapted from Freeman, Penner, Saperstein, Scheutz, & Ambady, 2011, and Wyatte et al., 2014). *Note.* Although this example illustrates visual perception, we expect similar processing in other sensory modalities specified in the perceptual model of intergroup relations.

can be a very different matter depending on whether biases hinge on holistic face processing or visual attention.

Evidence from vision science and computational models suggests that top-down influences are most likely to occur under conditions of perceptual ambiguity. Unambiguous sensory input places a reality constraint on perception and limits motivated perception. It is only when there is sufficient ambiguity that one should observe the influence of social identities on perception. As Stolier and Freeman (this issue) note, “persistent and stable perceptual bias may be less plausible than temporary impacts upon processing given the abundance of bottom-up information available” (p. 354). Accordingly, these authors have discussed advances in behavioral methods that can help us tap into temporal processing of top-down modulation (motion-tracking methods; Stolier & Freeman, this issue), in addition to modern methods such as electroencephalography and functional magnetic resonance imaging, which we discuss more in detail in the next section.

### **Contribution of Modern Methods**

Perception can be rather automatic and unconscious, or strategic and goal directed (Jetten & Haslam, this issue). In their commentary, Jetten and Haslam note that perceptions are often “created,” “cultivated,” “invented,” “managed strategically and creatively (e.g., directed, focused, and framed),” “agentically, selectively, and often passionately” by group members to serve specific group goals (p. 320). This was clearly missing from the PMIR, but we fully agree that perception can be both passive (in the sense that it occurs automatically) and active (or strategically managed). Do people *intentionally* perceive the political candidate (e.g., Barack Obama) to be darker or lighter in order to justify certain downstream decisions and/or behaviors? Or are these biases simply a reflection of genuine perceptual distortions that occurred without any conscious or strategic manipulations? It is an important distinction to draw and a point that has been missing from the literature.

The core issue at the heart of these ambiguities is that much of the literature is not well suited for isolating perception and teasing apart components of the perceptual process. For instance, Stolier and Freeman (this issue) point out that theorizing on skin tone judgments has focused on top-down influences on perceptual experience and judgment. But this work has been largely “agnostic to the functional nature and level of processing at which top-down perceptual influences occur within these systems (e.g., visual cortex, olfactory cortex, association cortex)” and “the temporal dynamics of top-down modulations” (Stolier & Freeman, this issue, p. 352). We agree completely with this assessment and think this is an important issue going forward with this research. Likewise, we opened our target article by talking about the classic case study in which football fans from Dartmouth and Princeton misperceive the transgressions of the other team. This work has long been cast as an effect of perception, but no published work has systematically interrogated all elements of the perceptual process (e.g., attention, selection, judgment) or disentangled them from other processes (e.g., memory, strategic reporting). Until then, the interpretation of the results will remain ambiguous.

Thankfully, new methods have emerged that are starting to allow researchers to dig deeper and pinpoint where and when (how early) in the processing stream effects of social identity could occur (Ellemers, this issue; Stolier & Freeman, this issue). Research in this literature allows us to generate precise insights about the conditions when higher order concerns about identity will shape perception and action (see also Van Bavel, Hackel, & Xiao, 2014). Because the PMIR integrates psychology and neuroscience, it allows for predictions about the effects of temporary or permanent brain damage on perception. It also encourages investigation of these processes using tools from cognitive neuroscience, such as electroencephalography, magnetoencephalography, or functional magnetic resonance imaging, to tease apart theoretically distinct explanations for different behavioral phenomenon. Each of these tools offers unique insights into the spatial (where in the brain) and temporal (when in the brain) responses associated with social identity.

Several articles demonstrate the utility of these methods for studying the relationship between identity and perception. As we noted earlier, members of an experimentally created ingroup preferentially recruited the FFA area compared to outgroup members. In addition, individual differences in FFA activity for ingroup versus outgroup faces were correlated with recognition memory differences for ingroup versus outgroup faces (Van Bavel, Packer, & Cunningham, 2008; Van Bavel et al., 2011). Important to note, this study was able to dissociate the effects of group membership on the FFA from early visual processing in the primary visual cortex, suggesting that these results were specific to face perception rather than attention. Also important, this study provides evidence that social identity can exert a top-down influence on FFA function and may be involved in subordinate level (vs. superordinate level) encoding of faces (see also Ratner, Kaul, & Van Bavel, 2013). Findings such as these point to perceptual biases to explain patterns of behavior and distinguish perceptual biases from simple attentional biases.

The temporal dynamics of top-down perceptual effects are often overlooked in the field of social psychology (Stolier & Freeman, this issue). Following the work on fusiform activity, Ratner and Amodio (2013) found that mere group categorization and identification shaped N170 magnitude to perceiving faces, showing that these minimal group identities can exert an influence on face perception very quickly. There is evidence that social groups can influence social perception even faster—perhaps as early as 100 ms after seeing a face (Cunningham, Van Bavel, Arbuckle, Packer, & Waggoner, 2012). Although this study does not test social identity per se, it offers valuable insight into when in the processing stream biases in race perception can take place.

This approach is particularly helpful because the majority of the research to date on motivated social perception has employed behavioral measures of perception that are prone to self-report biases. As such, the conclusions from these studies have been questioned by cognitive scientists (Firestone & Scholl, 2015). Because any behavior—even something as simple as a button press—is the product of multiple component processes, we strongly advocate for more neuroscience or implicit measures to identify the underlying perceptual process. The PMIR leverages theories and methods from cognitive

neuroscience to interrogate the underlying perceptual processes that drive social behavior. Bridging these levels of analysis has the added scientific value of building a consilient theory, which is more likely to stand the test of time than theories that operate only a single level of analysis (Wilson, 1998).

### Practical Implications and Social Change

“While the very ‘basic’ nature of perception processes at play here makes the evidence for the role of social identity utterly compelling in academic terms, it also begs the question ‘why should we, as a society, care?’ (Reynolds & Subasic, this issue, p. 349). This question points to another significant contribution of the PMIR—societal implications. These authors and others express an interest in seeing more elaboration on the relationship between perception and intergroup consequences: How can perception affect social change? We are grateful for several commentaries that outline a number of lines of work that can be encompassed within the PMIR. We speculated that the general principles from our PMIR may have important implications for a wide range of intergroup domains and are delighted to see that several commentaries extend the PMIR (or parallel work) to a number of exciting domains.

First, the principles from the PMIR apply nicely to the politically contentious issue of climate change (Hahnel & Brosch, this issue). Similar to our conclusions, Hahnel and Brosch observe that much previous research focused mainly on the relationship between political identity and climate change *judgments* and *decisions* without considering perceptual processes. Of importance, the authors “conceptually distinguish situational perception from more abstract climate change beliefs and concerns. As the global concept of climate change is not perceptually accessible, local, proximal events serve as indicators of this latent concept” (Hahnel & Brosch, this issue, p. 311).

Second, Balcetis, Stern, and Cole (this issue) develop a model within another domain—motivated distance perception. Specifically, this model encapsulates an abundance of recent evidence (some of which is cited in our target article) on the effects of motivational and situational factors on perception of physical distance. This model is particularly interesting because it overlaps with the PMIR, but each model has its own domain of application. Specifically, the model of motivated distance perception and the PMIR can both predict and explain effects of social belonging needs on perceptions of physical distance. The model of motivated distance perception also encompasses relationships between other motivational factors that are not related to social identity concerns, such as hunger, thirst, and so on. On the other hand, the PMIR encompasses perception of characteristics other than physical distance.

Third, the PMIR has been applied to political behavior in particular (Enos, this issue). Specifically, Enos (this issue) cites evidence in voting behaviors that White voters in heavily Black counties are likely to favor segregation. Important to note, it was pointed out that “the mechanism underlying this relationship has remained obscure, with a range of alternatives offered” (p. 296). Enos concludes that a perceptual model such as the one proposed in our target article would offer the possible mechanism for these trends in voting behaviors that better fits the situation than many others found in the literature. This is a

case where perception might offer novel insight into a longstanding theoretical debate about intergroup relations.

In applying the PMIR to specific intergroup domains (e.g., climate change, race, political behaviors, etc.), it is crucial to take into consideration the specific factors that underlie that intergroup relationship in the immediate social context (Kteily & Richeson, this issue). “Changing identities is a powerful way to change societies” (Reynolds & Subasic, this issue, p. 350). Even economists have argued that choosing an identity might be one of the most important economic decisions one makes (Akerlof & Kranton, 2000). Basic research bridging intergroup relations and perception can have profound implications for understanding societal issues and affecting social change.

### Conclusion

We are grateful to hear the immense enthusiasm for integrating perception and intergroup relations. It is obvious from the commentaries that there is excitement about this area of work, but much is still to be accomplished. In our view, the most interesting theoretical questions going forward are not about whether social constructs (identity) influence perception but about where in the perceptual-processing stream these biases are occurring. This will give us guidance about where and how to intervene. For instance, to take advantage of work on malleability of race or skin tone perception, we need to further understand where and when in the processing stream such effects could occur. Do we need to change perception, how people construe others, memories they draw upon of Black people, or something else? Although these are all possible interpretations based on evidence we have thus far from the literature, they would involve very different interventions. Scientists in this area will need to combine theoretical and methodological advances to answer these questions. We are excited to perceive a common identity emerging among scientists who intend to take this approach to understanding intergroup relations.

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