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TARGET ARTICLE

Reintegrating the Study of Accuracy Into Social Cognition Research

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Understanding the contents of other minds is a vital and ubiquitous task that humans perform with impressive skill. As such, it is surprising that the majority of social cognition research—whether behavioral or neuroscientific—focuses on the processes people use when attempting to understand each other while ignoring how well those attempts fare. Here we review historical reasons for the contemporary dominance of process-oriented research as well as the resurgence in the last decades of new approaches to studying interpersonal accuracy. Although in principle both the accuracy-oriented and process-oriented approaches study related aspects of the same phenomena, in practice they have made strikingly little contact with each other. We argue that integrating these approaches could expand our understanding of social cognition, both by suggesting new ways to synthesize extant data and generate novel predictions and lines of research, and by providing a framework for accomplishing such an integration. This integration can be especially useful in highlighting the deeply contextualized nature of the relationships between social cognitive processes, accuracy, and adaptive social behavior.

Introduction

One of human beings' most impressive accomplishments is our ability to understand what other people are intending, thinking, and feeling. This requires *perceivers* (individuals focusing on someone else) to translate the observable behaviors of social *targets* (individuals who are the focus of perceivers' attention) into inferences about those targets' physically invisible but psychologically real, internal states. Whether we're sniffing out the intentions of a used car salesman or figuring out the right thing to say to an upset friend, such inferences are critical to acting adaptively in social situations. Luckily, we are consummate experts at this task, accurately reading the internal mental states that guide other's behavior with an ease and skill that would be shocking if it wasn't so universal (Fiske, 1992; Swann, 1984).

For simplicity, we refer to this ability as *mind perception*, following Epley and Waytz (2009). Unlike global terms like "social cognition" or "person perception," which can refer to the whole host of faculties we bring to bear in understanding all manner of transient and enduring characteristics of other people, *mind* perception zeroes in on the specific task and accomplishment of understanding others' internal mental states. As such, for present purposes, it provides a convenient shorthand for referring specifically to this ability.

So how do perceivers draw inferences about targets' minds, and why are we so adept at it? Given the importance of these two questions, it is unsurprising that they have been a central focus of psychological research for the greater part of a century, and more recently have gained a great deal of attention in neuroscience. What is surprising, however, is the lopsided way this attention has been distributed, focusing almost entirely on answering the first—but not the second—of these questions. The lion's share of contemporary research focuses on characterizing the cognitive and neural processes perceivers engage when encountering other minds, while typically ignoring whether the engagement of these processes leads to accurate inferences about those minds. In other words, the majority of relevant research has focused on the question of *how* perceivers respond to other minds, but not *how well* they understand those minds. Although relatively neglected, this second question is of clear importance, as the goal of everyday social cognition is not to simply draw any type of inference about targets but to use accurate inferences to guide social behavior.

How did this state of affairs come to pass, what are its implications for the field, and should we do anything about it? To address these questions, the remainder of this article is divided into four main parts. In the first, we review the central role accuracy once played in social psychological research and the historical trends responsible for its abandonment in favor of a near monopoly of process-oriented research. Here we also briefly review the current understanding of mind perception processes gleaned from behavioral and neuroscientific research (for more comprehensive reviews, see Decety & Jackson, 2004; Fiske & Taylor, 2007; Gilbert, 1998; Keysers & Gazzola, 2007; Macrae & Bodenhausen, 2000; Mitchell, 2009a; Saxe, Carey, & Kanwisher, 2004) as well as the comparatively smaller number of research programs that have developed novel approaches to measuring interpersonal accuracy (again, for more comprehensive reviews, see Funder, 1995; Ickes, 1997; Jussim, 2005; Kenny & Albright, 1987; Kruglanski, 1989; Swann, 1984).

The second section builds on this historical foundation by arguing that a critical missing element in mind perception research is the integration of process-oriented and accuracy-oriented approaches within studies and research programs. The essential argument is that social cognition should reclaim its past tradition of thinking about accuracy and combine it with the current focus on processes. Here we motivate and describe a framework for integrating these usually independent approaches. This framework draws equally from neuroscientific and behavioral research to explain social cognitive phenomena at multiple levels of analysis, including neural systems, psychological processes, behavioral accuracy, and other outcomes such as social well-being and the social deficits that characterize many psychiatric disorders.

The third section highlights five kinds of novel insights and predictions that can emerge from focusing on the relationships between mind perception processes and accuracy—as opposed to either in isolation. First, an integrated view can help to dispel some incorrect, but pervasive, assumptions about mind perceivers' abilities to be accurate, or the sources thereof. Second, integrating processes and outcomes allows for an interactionist approach to understanding *when* a given social cognitive process contributes to accuracy about others. Third, an integrated approach enables researchers to connect social cognitive processes with their ostensive goals: Skillfully navigating the social world and maintaining positive interpersonal relationships. Fourth, this multilevel approach can offer new insights about parallels between the mechanisms underlying mind perception and other, seemingly disparate cognitive domains. Fifth, this approach offers novel ways to study the social cognitive deficits that characterize many psychiatric illnesses.

In the fourth and last section, we conclude by summarizing the central arguments of the article and touching on the ways an integrative approach can move beyond the specific examples of mind perception considered here and be applied to the study of other domains of social cognition and person perception, including prospection and dispositional inference.

Where Are We and How Did We Get Here?

The Rise and Fall of Accuracy Research

In important ways, the dominance of process-oriented approaches to mind perception research stems from a revolution older (and slightly less hostile) than Cuba's. In the first half of the 20th century, a central project of social psychology was determining the sources of accurate interpersonal inferences. Scores of studies were run with the goal of characterizing so-called good judges—that is, individuals naturally adept at understanding other minds—who could be tapped for jobs requiring interpersonal understanding, such as being judges or therapists. This work drew on a large, sometimes poorly organized, slew of criteria, both for defining and predicting accuracy. Depending on the study, accuracy was defined as a perceiver's ability to recognize emotional facial expressions in photographs, provide personality ratings of targets that agreed with expert opinions, group consensus, or targets' self ratings, or to predict the behavior of target individuals or groups. Predictors of accuracy varied just as broadly and included gender, socioeconomic status, training in psychology, number of siblings, general intelligence, and aesthetic sensibility. Perhaps unsurprisingly, this proliferation of independent and dependent variables led to an explosion of relationships being tested, and "good judges" often eluded capture behind a tangle of correlations and effect sizes. Nevertheless, accuracy continued to enjoy a privileged status among research topics; in summarizing more than 50 studies of "good judges" conducted by the mid-20th century, Taft (1955) remained confident that "the practical importance of [accuracy research] in psychology is obvious."

Writing a quarter century later, Schneider, Hastorf, and Ellsworth (1979) likely would have surprised Taft with their conclusion that, amidst the zeitgeist of social cognition research, "the accuracy issue [had] all but faded from view" (p. 222). What happened in the intervening years? Although there are many explanations, among the most salient are the arguments presented by Lee Cronbach and his colleagues (Cronbach, 1955; Gage & Cronbach, 1955) that were published only a few months after Taft's review. Cronbach presented a simple methodological criticism of the search for good judges: Quantifying accuracy as a subtraction between a perceiver's judgment and those of a target or group ignored a host of factors that could affect perceivers' apparent accuracy. For example, a perceiver with an accurate base rate for extraversion in the population could blindly apply that base rate to judge individuals she had never met and still appear to be a relatively "good judge." In other words, Cronbach asserted that accuracy researchers were not measuring what they thought they were measuring—accuracy—but instead were measuring the influence of other, potentially less interesting phenomena.

A close read of the publications by Cronbach, Nathaniel Gage, and others suggests that they did not intend for their criticism to upend accuracy research altogether. Instead, they hoped that more sophisticated methods could help clarify the sources of accuracy by decomposing them into a number of constituent parts. In fact, many of the factors they described as relevant to accuracy (e.g., the use of stereotypes, assumed similarity between perceivers and targets) are quite similar to mind perception processes studied now (see the Experience Sharing and Mental State Attribution sections). Gage and Cronbach presciently suggested that person perception research would be served best by modeling the relationship between these processes (which they referred to as "intermediary keys") and the accuracy or inaccuracy of resulting perceptions (Gage, Leavitt, & Cronbach, 1956). However, in lieu of taking up this challenge, accuracy researchers reacted by "crowding the exits" (Gilbert, 1998, p. 91), abandoning their endeavors almost completely for more than 25 years (Funder, 1987, 1995; Gilbert, 1998; Ickes, 1997; Ickes et al., 2000; Kenny & Albright, 1987).

Why did accuracy researchers so eagerly jump ship? Retellings of this historical trend converge on two points. First, the search for good judges suffered from a dearth of organizing principles and, as such, produced a jumble of loosely related findings, in which some factors predicted some types of accuracy some of the time (Dymond, 1949; Taft, 1955). Findings of any one study in this field were often idiosyncratic and irreproducible, and did not sum into programmatic, generative theoretical models. Second, no matter how organized accuracy researchers might have made their search for good judges, those judges—at least in the way researchers conceived of them—may have been more myth than reality. Early accuracy research staked much of its identity on isolating personality traits that would predict a perceiver's accurate inferences about targets' personality traits. In both cases, traits were defined as monolithic, stable qualities that should predict behavior across contexts. A good judge was considered to be someone who would accurately assess *all* social targets in *all* situations, and targets' self-reported personality traits were considered to be similarly constant. In the last 40 years, however, the idea of traits as invariant predictors of behavior has given way to an interactionist perspective, which describes behavior as fundamentally dependent on both individuals and the situations they encounter (Bandura, 1978; Mischel, 1968, 1973; Mischel & Shoda, 1995). This reconceptualization—and the fact that the majority of accuracy research preceded it—makes it unsurprising that the search for good judges was plagued by the low correlations and inconsistent relationships that also characterized many trait-based predictions of behavior.

The general challenge to personality research issued by Mischel and others (Mischel, 1968, 1973; Mischel & Shoda, 1995) signaled a growing shift in attention toward the *processes* (or cognitive and affective "units") mediating the relationships between individuals and situations as input and behavior as output. A similar shift took place in psychology more broadly (Neisser, 1967) and in due time took over the troubled field of interpersonal perception research.

The Reign of Process

Focusing on social cognitive processes, as opposed to accuracy, has proven extremely generative, as it allowed researchers to "zoom in" on more tractable elements of mind perception, produced replicable findings and generated relatively simple and falsifiable theoretical claims (for fantastic reviews of the process approach and its major findings, see Chaiken & Trope, 1999; Gilbert, 1998). At its root, process research was strongly influenced by Heider (1958), who suggested parallels between mind perception and object perception. Gage and Cronbach alluded to these parallels as well, arguing that mind perception and visual perception both are "dominated far more by what the Judge brings to it than what he takes in during it" (Gage & Cronbach, 1955, p. 420).

Following the leads of Heider, Gage, and Cronbach, process-oriented researchers set their sights inside perceivers' heads. Instead of concerning themselves with the accuracy of perceivers' inferences about targets' reported states or observable behaviors—or even with actual social targets in any way—process models focused on a set of cognitive "tools" perceivers bring to bear when drawing inferences about targets in general. Although many such tools have been described (Ames, 2004; Chaiken & Trope, 1999; E. Smith & DeCoster, 2000), here we focus on two that have gained a great deal of attention in both psychological and neuroscience research: experience sharing and mental state attribution.

Experience Sharing

President Bill Clinton famously claimed to "feel the pain" of Americans suffering during tough economic times. Perceivers of all stripes share the intuition that they vicariously experience the internal states of others. This idea also is found in 18th-century moral philosophy (Smith, 1790/2002), aesthetic theory (Lipps, 1903), and contemporary models of motor cognition (Dijksterhuis & Bargh, 2001; Prinz, 1997). The common thread uniting these theories is that when observing targets experiencing an internal state, perceivers engage many of the cognitive and somatic processes they would engage while experiencing those states themselves (Preston & de Waal, 2002).[1] A link between the perception of others' states and the evocation of similar states in one's self is supported by various data, including demonstrations that perceivers often adopt the bodily postures (Chartrand & Bargh, 1999), facial expressions (Dimberg, Thunberg, & Elmehed, 2000), autonomic arousal (Vaughan & Lanzetta, 1980), and self-reported emotional states (Neumann & Strack, 2000) of targets.

In the last 15 years, neuroscience research has famously supported the idea of perception-action matching by identifying brain regions that demonstrate properties consistent with experience sharing. The common feature of these regions is that they become engaged both when perceivers experience an internal state themselves and when they observe targets experiencing those states. The specific regions demonstrating such shared activity for both self and other experiences depend on the type of internal state being shared (Decety & Jackson, 2004; Zaki & Ochsner, 2011b). For example, when both executing and observing motor acts, perceivers engage the so-called mirror neuron system, encompassing premotor, inferior frontal, and inferior parietal cortex (Iacoboni, 2009; Rizzolatti & Craighero, 2004; Rizzolatti & Sinigaglia, 2010). When experiencing and observing nonpainful touch, perceivers engage somatosensory cortex (Keysers, Kaas, & Gazzola, 2010; Keysers et al., 2004). When experiencing pain and observing (or knowing that) targets (are) in pain, perceivers also engage somatosensory cortex (Avenanti, Bueti, Galati, & Aglioti, 2005) and additionally recruit activity in regions related to the interoceptive and affective components of pain, including anterior insula and anterior cingulate cortex (Jackson, Meltzoff, & Decety, 2005; Morrison, Lloyd, di Pellegrino, & Roberts, 2004; Ochsner et al., 2008; Singer et al., 2004). The insula also is engaged both when perceivers feel disgust and observe it in others (Jabbi, Swart, & Keysers, 2007; Wicker et al., 2003), consistent with this region's role in processing information from the viscera (Craig, 2009; Lamm & Singer, 2010). Recent data suggest that even the hippocampus and posterior medial frontal cortex exhibit overlapping engagement during action observation and imitation (Mukamel, Ekstrom, Kaplan, Iacoboni, & Fried, 2010). For simplicity, hereafter we refer to all brain regions demonstrating this property as *experience sharing systems* (ESS), with the understanding that this is a functional definition and not one based on specific cytoarchitectonic properties or patterns of anatomical connectivity.

The general overlap between self and other experience instantiated in the ESS has generated a great deal of excitement, for at least two reasons. First, as noted earlier, the ESS has been put forward as the likely neural basis of perception-action matching. This claim is plausible and well supported, especially given demonstrations that overlapping neural activity in the ESS often correlates with self-report and online measures of experience sharing (Pfeifer, Iacoboni, Mazziotta, & Dapretto, 2008; Singer et al., 2004). Second, evidence about the neural bases of experience sharing has led to several claims that such sharing is the primary mechanism underlying interpersonal understanding (Gallese & Goldman, 1998; Gallese, Keysers, & Rizzolatti, 2004). This argument aligns much less well with existing data than the first. On one hand, it is true that shared experience provides a parsimonious, efficient way for perceivers to learn from and learn about others' motor intentions, affective states, and attitudes (Dijksterhuis & Bargh, 2001; Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005; Prinz, 1997; Schippers, Gazzola, Goebel, & Keysers, 2009; Schippers, Roebroeck, Renken, Nanetti, & Keysers, 2010). On the other hand, such sharing is a much less likely mediator of interpersonal understanding in other situations. This is because targets' "higher level" intentions and beliefs often are translated only ambiguously into motor or somatic states. For example, the identical motor program of pushing someone could signify the very different intentions of starting a fight or saving an inattentive commuter from an oncoming bus (Jacob & Jeannerod, 2005).

The utility of experience sharing becomes even blurrier when one considers that nonverbal expressions of intentions, beliefs, and emotions often fail to match the states targets are actually experiencing. In many cases, targets with no interest in being understood—because they are lying to, competing with, or attempting to produce a specific impression in targets—intentionally dissociate their nonverbal expressions

[1]In many ways, models of perception-action matching borrow from the more general idea of "embodied cognition," which posits that concepts related to physical states (including, presumably, those of other people) are processed through sensory and motor representations (Barsalou, 2008; Decety, 1996; Kosslyn, Thompson, & Alpert, 1997; Niedenthal, Barsalou, Ric, & Krauth-Gruber, 2005; E. R. Smith & Collins, 2009).

from their internal states (Ansfield, 2007; Ekman, Friesen, & O'Sullivan, 1988; Ybarra et al., 2010). The situation improves only slightly for more forthcoming targets: Even when earnestly expressing themselves, these targets often produce ambiguous nonverbal cues. This is especially prevalent in the domain of emotional expression. Although Ekman and colleagues famously demonstrated the ease with which posed facial expressions of canonical emotions are recognized (Ekman, Sorenson, & Friesen, 1969), such expressions rarely occur outside artificial contexts such as emotion studies and tourist photos: Even while experiencing powerful emotions, targets in naturalistic settings often produce subtle cues that leave perceivers puzzling over what those targets are feeling (Fernandez-Dols, Carrera, & Russell, 2002; Russell, Bachorowski, & Fernandez-Dols, 2003; Zaki, Bolger, & Ochsner, 2009). In such situations (and they are common), it is unclear how perceivers' use of experience sharing—by itself—could guide insightful inferences about target states.

Mental State Attribution

What is a perceiver to do, given the limitations of experience sharing? One alternative is to rely on contextually defined semantic information about targets' likely states, which is based on what perceivers know of the target and situation they are observing. By way of illustration, consider encountering a friend you know, who is grieving the recent death of a family member. This friend displays a neutral facial expression and occasionally even smiles at you while talking about the funeral and events since. If you were to make a judgment about his or her feelings based solely on sharing the internal states implied by these expressions, you may decide that your friend actually feels fine. However, it is more likely that your knowledge about your friend's situation will influence your judgments and lead you to the (probably correct) hypothesis that your friend's outward appearance belies a more negative internal experience.

Perceivers commonly create and test such hypotheses about targets' internal states. Although these hypotheses may be generated quickly and easily, they can typically be represented explicitly and propositionally within awareness as a perceiver effortfully deliberates about a target. We refer to this form of mind perception as *mental state attribution*[2] to describe the process by which perceivers tie together multiple strands of information in the service of nuanced, flexible inferences about targets' states and dispositions (Castelli, Happe, Frith, & Frith, 2000; Kelley, 1973; Saxe et al., 2004).

Like experience sharing, mental state attribution also has a relatively stable neural signature, involving multiple brain regions that support inferences about intentional states. Cognitive neuroscience research over the last 15 years has borrowed a number of paradigms from developmental and clinical traditions to study mental state attribution, usually by asking perceivers to draw inferences about the beliefs, knowledge, intentions, and emotions of others based on written vignettes, pictures, or cartoons. In a typical study, brain activity is compared between two conditions in which perceivers make judgments that differ only in their social or mental state content: For example, drawing inferences about the traits and states of intentional agents (e.g., "How dependable is Tracy?" "Is Kenneth's belief up to date?"), as opposed to inanimate objects that nonetheless have similar characteristics ("How dependable is Tracy's computer?" "Is Kenneth's photograph up to date?").

Regardless of the type of judgment being made about others or the medium in which target cues are presented, such comparisons produce a strikingly consistent pattern of activation in a network that includes: Medial prefrontal cortex, temporoparietal junction, posterior cingulate cortex, and temporal poles. We refer to this set of regions as the *mental state attribution* system (MSAS), again with the understanding that this categorization is somewhat loose and functional (for more descriptions of the MSAS and its functions, see Baron-Cohen et al., 1999; Castelli, Frith, Happe, & Frith, 2002; Fletcher et al., 1995; Goel, Grafman, Sadato, & Hallett, 1995; J. P. Mitchell, Heatherton, & Macrae, 2002; Ochsner et al., 2004; Olsson & Ochsner, 2008; Peelen, Atkinson, & Vuilleumier, 2010; Saxe & Kanwisher, 2003). Notably, many regions within the MSAS have been tied to humans' more general ability to "project" themselves into distal scenarios or points of view (including the past, future, and uncertain or counterfactual concepts, as well as targets' nonobservable mental states; see Buckner, Andrews-Hanna, & Schacter, 2008; J. P. Mitchell, 2009b; Schacter, Addis, & Buckner, 2007; Spreng, Mar, & Kim, 2009). This putative role for the MSAS—in lifting oneself out of the cognitive "here and now" and simulating past and future perspectives and states—is intriguing because it is complementary to the assumed functional role of the ESS in providing a basis for vicariously experiencing the motor, sensory, and visceral states of targets. All this being said, it is important to note that the specific computations carried out by MSAS regions remain to be precisely specified, and whatever they turn out to be, they also play functional roles in behaviors not obviously related to mind perception (Corbetta, Patel, & Shulman, 2008; Daw, Niv, & Dayan, 2005; for more on this, see Amodio & Frith, 2006; Cavanna & Trimble,

[2]This type of inference has also been described in developmental and clinical research as, "theory of mind" or "mentalizing" (Baron-Cohen, Leslie, & Frith, 1985; Flavell, 1999; Leslie, Friedman, & German, 2004; Saxe et al., 2004), whereas inferences about more stable traits—as opposed to phasic internal states—are often grouped under the heading "person perception." We believe these terms refer to a highly overlapping set of computations and hence use one unifying term to refer to all of them.

2006; J. P. Mitchell, 2008a, 2009a; Olsson & Ochsner, 2008; Saxe, 2006; Saxe et al., 2004; Zaki & Ochsner, 2011b).

A Tale of Two Systems

Experience sharing and mental state attribution are functional cousins, serving the intimately related goals of sharing and appraising targets' internal states. As such, one might expect them to work together often in guiding mind perception. This makes the lack of family resemblance in these processes—between either their behavioral and neural correlates or the research programs that have explored them—all the more striking. Extant data have supported a picture of these mind perception processes as surprisingly dissociable, in at least two ways.

First, experience sharing and mental state attribution differ in the level of effort they seem to require, as reflected both in these processes' developmental trajectory and in the circumstances during which they are engaged. Developmentally, mental state attribution comes online concurrently with executive functions such as response inhibition (Carlson & Moses, 2001), and much later than behavioral signs of experience sharing (Flavell, 1999; Meltzoff & Decety, 2003; Meltzoff & Moore, 1977; Wellman, Cross, & Watson, 2001). Mental state attribution is most common when perceivers are given an incentive to make accurate or defensible judgments (Devine, Plant, Amodio, Harmon-Jones, & Vance, 2002; Kunda, 1990; Tetlock & Kim, 1987) and when they have the time and attentional firepower necessary to perform the necessary mental state calculus (Gilbert, Pelham, & Krull, 1989; Kruglanski & Freund, 1983). By contrast, sharing of targets' motor and emotional states often occurs outside of awareness (Dijksterhuis & Bargh, 2001; Neumann & Strack, 2000), and regions within the ESS—but not the MSAS—are engaged even when perceivers' attention to social targets is limited (Chong, Williams, Cunnington, & Mattingley, 2008; Spunt & Lieberman, 2011).

Second, as readers may have noticed, the brain regions making up the ESS and the MSAS are almost completely nonoverlapping. This dissociation holds up under meta-analytic scrutiny: Studies engaging one system rarely engage the other concurrently (Gobbini, Koralek, Bryan, Montgomery, & Haxby, 2007; van Overwalle & Baetens, 2009). Even more strikingly, the situations and task parameters that engage the MSAS often dampen activity in the ESS, and vice versa, leading to suggestions that these neural systems sometimes "compete" with each other for the guidance of behavior. For example, Brass, Ruby, and Spengler (2009) demonstrated that when participants were asked to refrain from imitating targets' movements, they demonstrated reduced engagement in the ESS and concurrently engaged areas within the MSAS. In another study, we (Zaki, Hennigan, Weber, & Ochsner, 2010) presented participants with nonverbal emotional expressions of targets combined with sentences describing the situational contexts to which targets were putatively reacting. In some cases, these two types of information suggested incongruent affective states (e.g., a happy-looking target paired with a contextual sentence stating that the target's dog just died). Perceivers then were asked to judge how they believed targets felt. As perceivers relied more on target nonverbal behavior when making judgments, they increased engagement of their ESS and dampened engagement of the MSAS; the opposite pattern emerged as perceivers relied more on contextual cues.

The impressive dissociations between the cognitive and neural signatures of experience sharing and mental state attribution have sometimes motivated an "either/or" approach to mind perception, in which researchers focus on one process while ignoring—or dismissing the importance of—the other. As we see next, this view proves an ill fit for existing and emerging data (Apperly, 2008; J. P. Mitchell, 2005), and reintegrating accuracy into the study of mind perception provides a way to move past such assumptions in favor of potentially richer questions about how mind perception operates.

Accuracy Returns

As just described, a process-oriented approach to mind perception has been both generative—in its ability to produce robust, replicable findings and relatively lean theoretical accounts of processes—and potentially limiting—in its tendency to isolate the study of single processes and ignore (or remain agnostic about) their relationship to behavioral outcomes such as accuracy. If process- and accuracy-related research programs are to make mutually beneficial contact, however, the question naturally arises as to what has become of accuracy research while the process-oriented approach has dominated research on mind perception, and on social cognition more broadly. After suffering a 25-year dry spell following the critiques of Cronbach and others, interpersonal accuracy research has regrouped and grown steadily over recent decades. Existing reviews provide excellent and detailed descriptions of current approaches to accuracy research (Funder, 1995; Ickes, 1997; Jussim, 2005; Kenny & Albright, 1987; Swann, 1984). As such, we describe only four of these very briefly, with the goal of laying out the basics of the most common approaches so that in later sections we can explore their integration with process-oriented work. The first three of these accuracy types (pragmatic, realistic, and componential) focus inferences about dispositions, whereas the fourth (empathic) directly addresses mind perception.

Pragmatic Accuracy

One approach to accuracy has overcome problems in measurement and validity by circumventing them entirely. Instead of attempting to establish a criterion representing the "true" state or trait of targets and measuring interpersonal accuracy as the ability of perceivers' inferences to approach that truth, the pragmatic approach focuses on the utility of social inferences for negotiating social relationships (Fiske, 1992, 1993; Jussim, 1991; E. R. Smith & Collins, 2009; Swann, 1984). Following Mischel's interactionist approach to personality, if targets' behavior varies stably across situations, then a perceiver's accuracy for a target need not (and potentially cannot) encompass all of that target's behavior. Rather, perceivers need only predict behavior relevant to domains in which they interact with a target (e.g., to successfully interact with John, his students need to accurately assess how hard a grader he is but not how much he loves banjo music). There is evidence that perceivers do achieve such "circumscribed accuracy" (Swann, 1984) and that they constrain their predictions about targets to situations relevant to their basis for judgment (Idson & Mischel, 2001; Noordewier & Stapel, 2009).

Realistic Accuracy

In contrast to pragmatic accuracy, the *realistic accuracy* approach takes as a starting point the idea that targets' dispositions (e.g., a target's level of extraversion) are real: that is, they exist independently of target and perceiver opinions. Thus, accuracy can be studied using methods used for construct validation by first identifying traits that are consensually perceived by others, predictive of behavior, and stable across time, and then examining how accurate perceivers are in perceiving such traits (Funder, 1995).

Componential Accuracy

Componential accuracy is embodied by Kenny and colleagues' work (Kenny & Albright, 1987; Malloy & Kenny, 2006), which statistically disentangles multiple potential sources of interpersonal consensus in a manner similar to that suggested by Cronbach's original critiques. Especially interesting for current purposes, component models provide behavioral cues about the processes that perceivers employ in drawing inferences about targets (e.g., projection or stereotyping). Unlike the realistic approach, however, component models remain agnostic about targets' "real" traits and instead focus on the mix of sources that influence interpersonal judgments.

Empathic Accuracy

Pragmatic, realistic, and componential approaches to accuracy all share a focus on perceivers' ability to gauge targets' stable dispositions, but often, perceivers are more concerned with a target's transient states (How does Frank feel right now? Is Jenna flirting with me?). Work on *empathic accuracy* examines interpersonal consensus about such states using paradigms in which perceivers' rating of targets' thoughts and feelings are compared with targets' reports on their own states (Ickes, 1997; Ickes, Stinson, Bissonnette, & Garcia, 1990; Levenson & Ruef, 1992). Such paradigms have been used to examine the situational and individual-difference predictors of accuracy for emotions (Klein & Hodges, 2001; Pickett, Gardner, & Knowles, 2004; Simpson, Ickes, & Blackstone, 1995; Simpson, Orina, & Ickes, 2003; Stinson & Ickes, 1992). Similar approaches in nonverbal behavior also have examined the types of emotional cues (e.g., visual, prosodic) that predict accuracy, and in which circumstances they do so (Costanzo & Archer, 1989; Hall & Schmid Mast, 2007; Nowicki & Duke, 1994; Rosenthal, Hall, DiMatteo, Rogers, & Archer, 1979; Russell et al., 2003).

Where Do We Go From Here? Integrating Process and Accuracy

The process- and accuracy-oriented approaches described here ostensibly study two sides of the same social cognitive coin: How people go about attempting to understand each other and how well their attempts fare. As such, the relative lack of crosstalk between these approaches is at least somewhat surprising. In some cases, this disconnect may stem from perceptions that processes and accuracy are orthogonal and do not impact each other in lawful ways. If this were true, it would be unclear *how* single studies or research programs could meaningfully tie these phenomena together. In other cases, researchers may believe that processes and accuracy are related but that the structure of these relationships is obvious (e.g., the more a perceiver applies a given process, the more accurate their inferences will be), and therefore the explicit study of their connection offers little new insight about mind perception. If this were true, it would be unclear *why* examining process–accuracy relationships is a meaningful endeavor. In this section we address the first of these issues (how processes and outcomes can be brought together). In the third section we address the second (why bringing these phenomena together is important to the future of mind perception research).

A Framework for Integration

A Social Cognitive Neuroscience Approach

In building a framework for integrating research on process and accuracy, it should be highlighted that we adopt a social cognitive neuroscience (SCN) approach (Lieberman, 2007; J. P. Mitchell, 2006; Ochsner, 2007; Ochsner & Lieberman, 2001) that combines the theory and methods of cognitive neuroscience and social psychology. Two key ideas are embodied by this approach. The first idea is that behavior can be explained usefully at multiple levels of analysis, including (a) the social level describing behaviors and experience in their interpersonal context, (b) the cognitive level specifying underlying information processing mechanisms, and (c) the neural level specifying the neural systems that implement these processes. Whereas social psychology traditionally has been concerned primarily with the first two of these levels, and cognitive neuroscience primarily concerned with the latter two, SCN (or social neuroscience more broadly; see Cacioppo & Bernston, 1992) seeks to connect all three.

The second idea concerns the way in which we draw inferences about the relationships between these levels. In any given experiment we can manipulate and/or measure variables at the social (e.g., accurate vs. inaccurate inference) and neural (e.g., activity in specific brain systems) levels. By contrast, cognitive processes such as experience sharing and mental state attribution cannot be directly measured; their operation must be inferred from patterns we observe in social- and neural-level variables. For this reason, the SCN approach emphasizes the use of converging evidence from the social and neural levels to triangulate on psychological processes. This can provide greater leverage for testing psychological theories than approaches that emphasize only the social and cognitive, or cognitive and neural levels, respectively.

Applying SCN to Process-Accuracy Relationships

The SCN approach can be used to build a framework that uses behavioral (including self-report) and neuroscientific measures to draw inferences about how interpersonal accuracy is related to the underlying processes of experience sharing and mental state attribution. Although no one technique taken alone is sufficient to document the presence of a given cognitive process—or its effect on accuracy—the hope is that combining data from varying levels of analysis will afford us more traction in examining mind perception in a way that speaks to multiple domains of research.

Figure 1 illustrates this framework, using experience sharing as an example process. Cognitive/process-level phenomena—for example, a perceiver's deployment of experience sharing—are impossible to observe directly. Even defining them requires wading into murky phenomenological terrain (e.g., "How can we really *know* what emotion a target is experiencing?"). However, each of these phenomena involves multiple measurable variables at the social/behavioral and neural levels. By way of comparison, consider that the study of affective experience (the leftmost phenomenon in Figure 1) has been well served by seeking out converging evidence from self-report, neural activity, and other domains (Barrett, 2009; Barrett, Mesquita, Ochsner, & Gross, 2007; Kober et al., 2008; Lindquist & Barrett, 2008). Similarly, we believe that the operation of mind perception processes and their effect on accuracy can be inferred best from the many measurable signs that these cognitive-level phenomena leave in their wake. These include activity in relevant neural systems, convergence between targets' and perceivers' reports of their own affect (a social/behavioral level sign of experience sharing), convergence between targets' and perceivers' reports on targets' affect (a social/behavioral level sign of interpersonal accuracy), and correlations between target and perceiver neural or physiological activity over time (Marci & Orr, 2006; Schippers et al., 2009; Stephens, Silbert, & Hasson, 2010; Vaughan & Lanzetta, 1980). It is important to note that connections *between* phenomena can also be effectively interrogated by sampling evidence at multiple levels of observation. For example, a strong case for

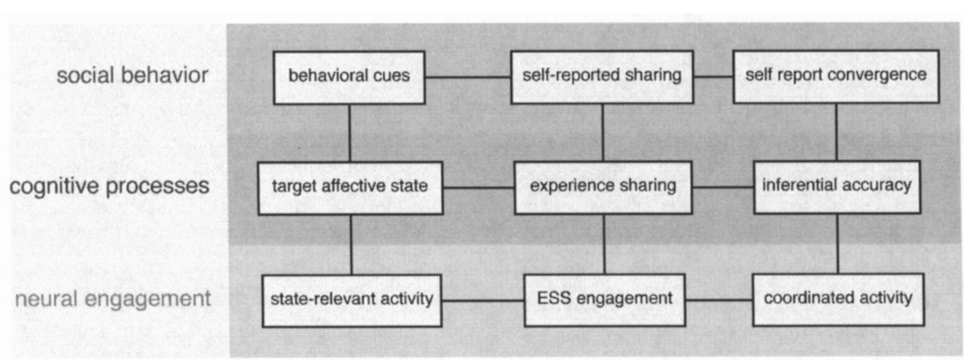

Figure 1. A framework for combining neural and behavioral observations to gain traction on how and when mind perception processes produce accurate inferences. *Note.* ESS = experience sharing systems.

the idea that experience sharing contributes to interpersonal accuracy can be made by marshalling evidence that these phenomena are related at behavioral, experiential, and neural levels (Cacioppo & Bernston, 1992; Ochsner & Lieberman, 2001).

Modeling Context Dependency

As Lieberman (2005) pointed out, if a social psychologist was stranded on a desert island and given the choice of one idea to bring with her, a likely candidate would be "the power of the situation." The SCN approach expands this "situationalist" focus to neuroscience research as well. Does Jack's high score on a conscientiousness scale mean he won't be found playing air guitar while standing precariously on a barstool this weekend? Will viewing a surprised face engage participants' amygdala or not? The likely answer to these (and myriad other questions) is, It depends on the contexts in which behaviors and brain activity are embedded. Our own work and our examination of others' work suggest that process-outcome relationships in mind perception are no exception to this trend. That is, asking *whether* experience sharing or mental state attribution (or any other mind perception process) produces accuracy is a conceptual nonstarter. Instead, researchers should focus on *when* these processes produce accuracy. This requires "zooming out" from a focus on processes or accuracy in isolation, to achieve a broader focus on contextual factors that determine their connection to each other.

Figure 2 displays such a broad view of accuracy, with an emphasis on the many moving parts that determine the course of a mind perception episode. In this model, both the cues produced by a target and those received by a perceiver constrain (a) the likelihood that a perceiver will engage a given mind perception process, and (b) the effect that process can be expected to have on accuracy. Zooming out also makes clear that neither cognitive processes nor accuracy are mind perception's endgame. Both of these phenomena serve the more "downstream" goal of supporting adaptive social behavior and fostering positive social ties. Researchers often labor under the assumption that mind perception processes and interpersonal accuracy allow perceivers to "navigate," "maneuver," or otherwise locomote adeptly through their social world. However, there are likely cases in which a given process, or even accuracy, are not social interaction's power steering. Processes and accuracy sometimes have no effect on social well-being, and can even reduce perceivers' ability to connect fruitfully with others. Our approach emphasizes the need to model situational factors that determine when a process (or accuracy) helps—and when it harms—perceivers' social interactions.

Thus, central to this model is a focus on two ways in which the relationship between cognitive processes and later outcomes are mediated by other factors. First, there is an emphasis on understanding the situational factors that determine whether a given process will produce accurate inferences. Second, there is an emphasis on understanding how accuracy itself can serve as a mediator between the use of a mind perception process and adaptive social outcomes.

It is worth noting that connections between mind perception phenomena are bidirectional and that the left–right direction in Figure 2 is not a timeline demarcating sequentially completed steps. Perceivers do not encounter targets, deploy a mind perception process, draw an (in)accurate inference, produce a socially (mal)adaptive behavior, and call it a day. Instead, social interactions are dynamic and dense with feedback loops (Freeman & Ambady, 2011; Kunda & Thagard, 1996). For example, learning that she is

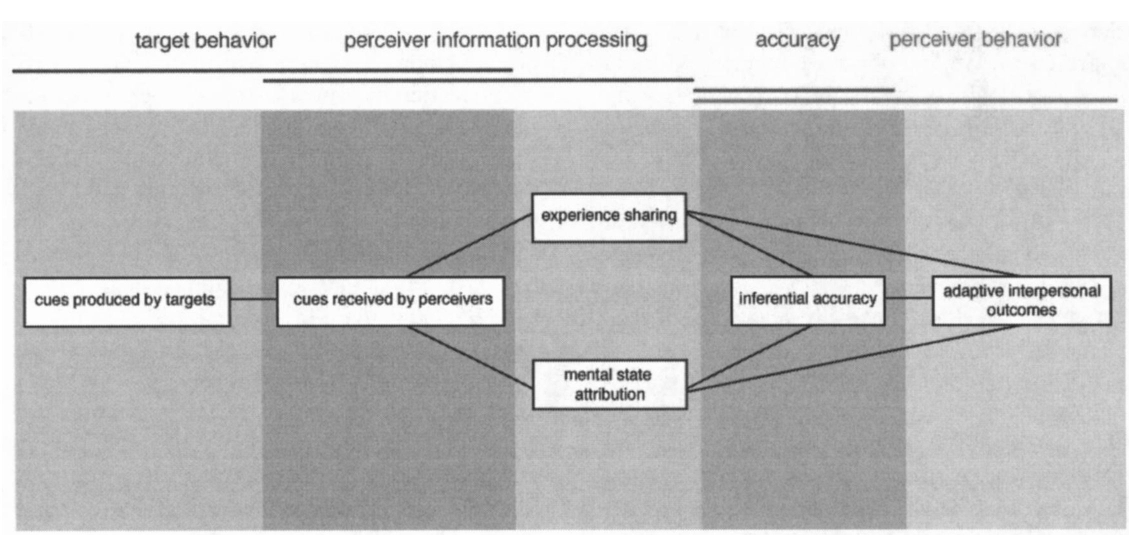

Figure 2. An illustration of some of the many contextual factors constraining the relationship between mind perception phenomena.

mistaken or has behaved inappropriately, a perceiver may alter the way she engages during subsequent interactions with a target. Perceivers can shift their mind perception in multiple ways, including changing the *content* that they focus on when employing mental state attribution (such as the level at which they construe a target's behavior; see Spunt, Satpute, & Lieberman, 2010; Vallacher & Wegner, 1987), or altogether changing the *process* they employ in perceiving that target (e.g., "turning up" one's shared experience through perspective taking; see Batson, 1991; Lamm, Batson, & Decety, 2007). These adaptations can, in turn, serve perceivers' goals of better understanding targets (Eyal & Epley, 2010). Such feedback processes are not limited to perceivers' information processing; targets also may change the social cues they produce to clarify their internal states after learning that a perceiver has misjudged them (Swann & Ely, 1984; Swann, Hixon, Stein-Seroussi, & Gilbert, 1990), or (even more interesting) may change their self-view to match a perceiver's initially erroneous judgment of them (Turner, 1991). The role of such feedback loops in mind perception is an emerging topic of enormous interest. However, because relatively little is known about how such feedback works—and to constrain the scope of this article—we focus predominantly on "left to right" relationships between the phenomena in Figure 2.

What Does This Buy Us? The (Basic and Applied) Fruits of Integration

Thus far, we have outlined a framework for integrating processes and accuracy in the study of mind perception. We now broaden our focus to suggest ways in which this integrative approach can foster novel insights and influence the way observations are made in behavioral, neuroscientific, and clinical mind perception research. We describe separately the potential advances that could be made for our understanding of mind perception in each of these domains, but we emphasize at the outset that a major advantage of integrating the study of processes and accuracy emerges specifically from bridging data gleaned from different approaches (e.g., neural and clinical) that too often are isolated from each other.

Specifically, we discuss five advantages an integration of process and accuracy have over the study of either in isolation: (a) overturning incorrect but pervasive assumptions about mind perception, (b) delineating the situation-specific relationships between processes and accuracy, (c) tying data about information processing more directly to evidence about social well-being, (d) drawing parallels between mind perception and other domains of cognition, and (e) mapping the domains in which social cognitive abnormalities in psychiatric disorders lead to functional impairments.

As previously mentioned, the majority of examples we discuss focus on mind perception accuracy for transient affective states (i.e., empathic accuracy) and not on inferences about other aspects of individuals, such as their stable dispositions. Beyond the pragmatic limitations of space, this narrowing of scope is motivated by two principled factors. First, empathic accuracy paradigms enjoy some psychometric strengths that obviate some of the early concerns leveled against accuracy research more generally. Historically, accuracy has been calculated as the simple difference between a perceiver's rating of a target state or trait relative to some criterion measure (e.g., the target's self-report). This approach is intended to index accuracy about the overall level of some attribute, has been common to many forms of accuracy research, and has been roundly criticized as statistically problematic (see earlier and see Cronbach, 1955; Kenny, 1991). By contrast, contemporary empathic accuracy paradigms record perceivers' inferences, as well as targets' self-report, at multiple timepoints. This allows researchers to compute a measure of accuracy for the *time-varying dynamics* of a target's state, not just the overall average level of that state. For example, one can calculate the correlation between a perceiver's inferences about a target's affect and a target's self-rating as they both vary across time. The resulting correlations reflect target–perceiver agreement about *when* a target felt relatively negative. It is important to note that such correlations are independent of the overall level of some state that perceivers infer that targets are experiencing and that targets assign to themselves. As such, dynamic measures are robust to many of the biases—including stereotype application, assumed similarity, or scale usage tendencies—that can inflate empathic accuracy measures defined as the difference between two global assessments.

Second, for reasons explained above (see Where Do We Go From Here?), we are especially interested in connecting measures of cognitive processes such as shared experience and mental state attribution to measures/correlates of interpersonal accuracy at the behavioral and neuroscientific levels. Because almost all neuroscience research on process use concerns the sharing and inferring of transient states (beliefs, emotions, intentions), and not static traits, empathic accuracy is a natural candidate for exploring process-accuracy relationships across multiple levels of analysis. This does not mean that this measure of accuracy is the *only* one that can be used to examine the connections we describe next. In fact, it is our hope that future researchers will be motivated to explore similar connections—at both the neural and behavioral levels—between mind perception processes and other forms of accuracy.

Contributions to Behavioral Approaches

Perceivers' Mind Perception Abilities: Half Full or Half Empty?

Imagine an extraterrestrial preparing to make first contact with Earth. In advance of meeting humans, she decides to do research on our behavior, taps into PsycINFO, and reads all the work she can find on mind perception. She is disappointed to learn that people are, by and large, inept at understanding each other: They ascribe traits to each other based on demonstrably nondiagnostic behaviors (Gilbert & Malone, 1995; Jones & Harris, 1967); erroneously impute their knowledge, beliefs, and preferences onto others (Epley et al., 2004; Gilovich, Medvec, & Savitsky, 2000; Gilovich, Savitsky, & Medvec, 1998; Ross, Greene, & House, 1977); and carelessly apply stereotypes (Fiske, 1998). They can correct these mistakes, but only through slow, labor-intensive application of rules, and in the absence of such efforts, they "default" to error and bias (Devine, 1989; Devine et al., 2002; Gilbert, Pinel, Wilson, Blumberg, & Wheatley, 1989).

Why has existing research equipped our interplanetary traveler with such underwhelming expectations? Because accuracy is hard to define, and the faults and foibles of mind perception have proved comparatively easier to uncover and eye-catching to boot, the process-oriented approach tends toward a potentially disheartening view of mind perceivers as "faulty computers," running mind perception software that is often situation inappropriate (Higgins & Bargh, 1987; Krueger & Funder, 2004). This outlook gains further momentum from its contact with a historically popular view of decision making, which suggests that people—instead of optimizing their decisions based on all the information available to them—rely on simple judgmental heuristics that lead them toward a host of incorrect decisions about the outside world (Kahneman & Tversky, 1996; Tversky & Kahneman, 1974), the sources of their own behaviors and abilities (Nisbett & Wilson, 1977), and even the nature of those behaviors and abilities (Kruger, 1999; Kruger & Dunning, 1999).[3]

Is such a pessimistic attitude about mind perception warranted? Granted, perceivers can be induced into committing lawful, compelling errors when judging targets' states and traits. However, studies of these effects often use statistically perfect judgments as a criterion against which to define social cognitive error (e.g., completely discounting nondiagnostic information when making preference judgments, see Jones & Harris, 1967). Further, studies of social cognitive error typically use highly superficial and nonnaturalistic tasks that—in a manner analogous to visual illusions—are designed to create the errors they document (Funder, 1987) and may overlook the ways these errors actually reflect generally adaptive processing. These factors result in a "half-empty glass" view of perceivers who are seen in light of their errors and not their accomplishments (Krueger & Funder, 2004).

Traditionally, accuracy research has taken a much different tack: Comparing judgments made in more naturalistic settings (i.e., judgments made about actual social targets on the basis of complex behavior) to targets' own self-perceptions. Further, accuracy in these studies is typically measured against a baseline of chance, as opposed to an assumption of perfect (and often perfectly rational) performance. This approach produces a more optimistic view of mind perceivers, who are shown to excel in a number of ways. First, perceivers largely agree with each other and establish impressive consensus about the states and traits of social targets, even when they have access only to "thin slices" of target behavior (Ambady & Rosenthal, 1992, 1993; but see also Ames, Kammrath, Suppes, & Bolger, 2010), or impoverished target cues (North, Todorov, & Osherson, 2010; Zaki, Bolger, et al., 2009). Second, perceivers' inferences are impressive predictors of target behavior (Funder, 1991; Moskowitz & Schwarz, 1982), even decades after perceivers' from their initial impressions (Nave, Sherman, Funder, Hampson, & Goldberg, 2010). Third, perceivers achieve consensus with targets themselves (Ickes, 1997; Kenny & Albright, 1987; Levenson & Ruef, 1992; Zaki, Bolger, & Ochsner, 2008). Finally, emerging evidence suggests that, at least in certain situations, perceivers have a well-calibrated understanding of when they are likely to be accurate, versus inaccurate, about target states (Kelly & Metcalfe, in press).

An integration of processes and accuracy can combine the strengths of each of these approaches in balancing views about perceivers' skills in understanding targets. Specifically, not only can we document that perceivers fare pretty well in their endeavors (the conclusion of extant accuracy research) or that a given process sometimes fails them (the conclusion of extant process research), but we can more specifically chart the landscape of process-accuracy relationships to describe *when* a given process supports accuracy. We turn to this issue now.

Processes' Situation-Specific Utility

When humans are equipped with more than one tool for completing a single task, a few questions naturally arise. One could ask which tool is better for completing that task (e.g., "Should I use the hammer or screwdriver for hanging this painting?"). However, a deeper question may be, *Why* would nature equip us with more than one tool for a single task? The answer is often that what appears to be a single task (e.g., hanging a painting), upon closer inspection, ends up splintering

[3]Nonetheless, heuristics offer efficient decisions that are often as accurate—and sometimes more accurate—than exhaustive problem-solving strategies (Gigerenzer, 1999; Rieskamp & Otto, 2006).

into multiple, independent tasks each suited to different tools (e.g., hanging frames held up by screws vs. nails).

Perceivers' repertoire of mind perception processes suggests just such a state of affairs: Shared experience, mental state attribution, and other processes likely exist in tandem because they each support accurate interpersonal understanding under differing circumstances. This perspective can clear up confusion in the extant literature on the process-accuracy relationship.

Consider the age-old search for the "good perceiver." Popular intuition has long held that some individuals—specifically, those who tend to share others' experiences— also should be adept at understanding those experiences (Allport & Allport, 1921). However, attempts to relate accuracy and experience sharing have fared surprisingly poorly (Hall, 1979; Ickes et al., 1990; Levenson & Ruef, 1992), leading modern accuracy research to largely abandon the search for "good perceivers" (Ickes et al., 2000). The model described in the Modeling Context Dependency section suggests a way out of this counterintuitive null finding: Lawful features of social situations may determine *when* experience sharing will come in handy to mind perceivers.

Following this logic, we recently tested the idea that a critical feature of a perceiver's situation is the type of target they encounter. Our premise was that mind perception, as a fundamentally interpersonal process, should depend both on a perceiver's tendencies to deploy specific kinds of processes—such as experience sharing—and features of targets that influence how easily they can be perceived—such as their trait levels of emotional expressivity (Gross & John, 1997; Zaki, Bolger, et al., 2009). Specifically, we predicted that perceivers high on the tendency to use experience sharing would be more accurate in judging the emotions of a target to the extent that the target sends strong expressive signals to their internal emotional state that the perceivers could share. In line with this prediction, we found that perceivers' trait-level experience sharing predicted accuracy as a function of a target's tendency to be emotionally expressive (Zaki et al., 2008). Findings like this both flesh out situation-specific utility of mind perception processes and highlight the importance of moving beyond the "perceiver-centric" view that has dominated process-oriented research for half a century.

Linking Processes to Social Well-Being and Dysfunction

Whereas the proximal goal of mind perception processes is forming an accurate impression of targets, the ultimate goal of such processes is to allow perceivers to function adaptively in the social world, by forming and maintaining social bonds with others. Positive social relationships are a central human need (Baumeister & Leary, 1995) that provides both psychological and physical protection against environmental stressors (Bolger & Eckenrode, 1991; Cohen, Doyle, Skoner, Rabin, & Gwaltney, 1997; Hawkley, Burleson, Berntson, & Cacioppo, 2003). Indeed, discussions of mind perception often begin with the idea that processes such as experience sharing and mental state attribution are important because those processes support adaptive social behavior.

But do they? Perhaps only sometimes. On one hand, individual differences in experience sharing sometimes are associated with adaptive social behaviors, such as cooperation, altruism (Eisenberg & Miller, 1987; Johnson, 1975), or some measures of social skills (Bailey, Henry, & Von Hippel, 2008; Pfeifer et al., 2008; Riggio, Tucker, & Coffaro, 1989), and individual differences in the tendency to employ mental state attribution may track with accommodating behavior during conflict in close relationships (Arriaga & Rusbult, 1998; Long & Andrews, 1990). On the other hand, some studies have found no relationship between these processes and social skills, adjustment, or integration (Cliffordson, 2002; McWirther, Besett-Alesch, Horibata, & Gat, 2002).

The integrative approach we advocate suggests a novel prediction: Accuracy may serve as a "middleman" mediating the relationship between deployment of a process and its ultimate adaptive goal of promoting social well-being. Support for this comes from the finding that interpersonal accuracy (especially concerning transient states such as thoughts and emotions) predicts adaptive relationship behavior, such as skillful social support (Verhofstadt, Buysse, Ickes, Davis, & Devoldre, 2008); lower relationship abuse (Clements, Holtzworth-Munroe, Schweinle, & Ickes, 2007); and social adjustment in adolescents (Edwards, Manstead, & MacDonald, 1984; Gleason, Jensen-Campbell, & Ickes, 2009; Spence, 1987), college students (Carton, Kessler, & Pape, 1999; Zaki & Ochsner, 2011a), and adults (Bartz et al., 2010).

Of course, the idea that accuracy supports adaptive social function is nothing new (for a review of nearly 100 studies on this topic, see Hall, Andrzejewski, & Yopchick, 2009) and was, in fact, part of the impetus for the original accuracy movement described earlier. Today, well-known theories incorporate decoding of others' states into larger constructs, such as emotional intelligence (Lopes, Grewal, Kadis, Gall, & Salovey, 2006; Mayer, DiPaolo, & Salovey, 1990; Mayer, Salovey, & Caruso, 2008; Mayer, Salovey, Caruso, & Sitarenios, 2001) or affective social competence (Halberstadt, Denham, & Dunsmore, 2001). However, these frameworks often view accuracy as a precursor, or "lower level, fundamental skill" (Mayer et al., 2008, p. 506) that combines with other skills such as affect management and communication ability to produce a higher level set of abilities that support social function.

In contrast, mind perception researchers view accuracy itself as a complex outcome dependent on a suite of flexibly deployed cognitive processes. As such, research tying health and well-being to accuracy often makes little contact with work on the cognitive processes that produce accuracy. This is unfortunate, given that social cognitive work has begun to suggest that empathic accuracy does not always promote adaptive behavior. In fact, in some cases accuracy can be maladaptive, as when perceivers correctly intuit a target's negative or relationship-damaging thoughts and feelings (Simpson et al., 1995; Simpson et al., 2003) or when accuracy prevents the application of (presumably adaptive) positive biases in self-perception that are characteristic of most individuals (Taylor & Brown, 1988).

Integrating processes and outcomes suggests ways to address these seemingly conflicting relationships between mind perception processes, accuracy, and adaptive social behavior by reframing the questions we ask. Instead of asking whether a given mind perception process promotes adaptive behavior, we might ask *when* its use is adaptive by virtue of producing accurate inferences, and *when* does that process motivate adaptive behaviors irrespective of (or even by reducing) accuracy?

Following a social cognitive neuroscience approach, both behavioral and neural correlates of mind perception processes and accuracy can be brought to bear in answering such questions, and testing models in which accuracy mediates the relationship between mind perception processes and social function. The use of brain activity to predict outcomes in the field is only now taking hold (cf. the "brain as predictor" model employed by Berkman, Falk, & Lieberman, 2011; Falk, Berkman, Mann, Harrison, & Lieberman, 2010) and stands to make headway in linking information processing to adaptive behavior in the social domain.

Contributions to Neuroscientific Approaches

Fleshing Out Single-Process Models

Dissociations between the neural systems supporting experience sharing and mental state attribution have prompted a curious debate among neuroscientists about *which* system is primarily responsible for mind perceivers' abilities (Apperly, 2008). Some, following so-called simulation theory (Heal, 1996), have cited the role of the ESS as evidence that shared experience is the royal road to interpersonal understanding (e.g., Gallese & Goldman, 1998; Gallese et al., 2004). Others, following the tongue-twistingly named "theory theory" (Gopnik & Wellman, 1992), argue that mental state attribution, supported by the MSAS, is central to understanding targets (e.g., Saxe, 2005).

We believed such theories lack two features critical to forming a more complete theory of mind perception's neural bases. First, in focusing on single neural systems, it is easy to forget that processing the complex social cues perceivers most often encounter in daily life typically draws on both the MSAS and ESS (among other regions). Second, MSAS and ESS-based theories of interpersonal understanding have proceeded largely in the absence of *direct evidence* about whether either neural system supports accuracy about actual social targets. This is because tasks engaging the ESS rarely require perceivers to infer targets' internal states, and tasks tapping the MSAS typically employ extremely easy, simplified social tasks that produce ceiling effects. In each case, the ability to directly measure the neural systems supporting accurate, as opposed to inaccurate, social inferences is limited at best (Zaki & Ochsner, 2009). We now discuss each of these weaknesses in the literature—and how we believe they can be overcome—in turn.

Moving from single to multiple-process models. In our view, nominating single processes or neural systems as supporting interpersonal understanding likely reflects a lack of contact between cognitive neuroscientific and behavioral approaches to mind perception. A major aim of cognitive neuroscience is using brain activity as a guide for interpreting multiple cognitive processes as either distinct (based on separable neural circuitry) or functionally related (based on overlapping neural circuitry; see Henson, 2005). This approach has helped to resolve a number debates about cognition, for example, providing evidence that visual imagery and visual perception are highly similar (Kosslyn et al., 1997), or that declarative and procedural memory are not (Buckner et al., 1995; Schacter, 1997).

However, such an approach also encourages researchers to emphasize single patches of neural real estate and to focus on tasks that excite their particular neural neighborhood. For example, a researcher examining the role of the ESS may be more interested in tasks tapping the ESS, such as perceivers' sharing of targets motor intentions, disgust, or pain, and may pay less attention to false belief tasks that do not engage the ESS. Similarly, such a researcher may pay more attention to data demonstrating that damage to the ESS impairs emotion perception (Adolphs, Damasio, Tranel, Cooper, & Damasio, 2000; Shamay-Tsoory, Tomer, Berger, Goldsher, & Aharon-Peretz, 2005) than to similar lesion data suggesting that the MSAS is necessary for making judgments about many forms of beliefs and intentions (Shamay-Tsoory, Aharon-Peretz, & Perry, 2009).

Nonetheless, the fact that neural systems *can be* dissociated does not imply that they are *necessarily* or even *usually* dissociated during social inferences, especially those based on the kinds of complex social information that we encounter in everyday situations (Keysers & Gazzola, 2007; Shamay-Tsoory, 2010;

Singer, 2006; Uddin, Iacoboni, Lange, & Keenan, 2007; Zaki & Ochsner, 2009). Consistent with this, both the ESS and MSAS are concurrently engaged by "naturalistic" mind perception tasks, such as viewing videos of complex social cues (Brass, Schmitt, Spengler, & Gergely, 2007; de Lange, Spronk, Willems, Toni, & Bekkering, 2008; Spunt et al., 2010; Wolf, Dziobek, & Heekeren, 2010).

The second weakness in the cognitive neuroscience literature on mind perception is the absence of direct data on the neural sources of accuracy, which renders any claim about the neural bases of interpersonal understanding more speculative than is typically recognized. In some ways, this is similar to the state of memory research in the mid-1990s. At that time, a few key brain regions had been linked to memory performance through lesion studies, and in the first wave of neuroimaging studies of memory these same regions were engaged during encoding tasks. The extent to which any given region was critical for *successful* encoding was not yet known, however, because the issue had yet to be assessed directly. This changed with the advent of the *subsequent memory paradigm*, in which brain activity during a given encoding trial was related to veridical recollection of a memorandum on a later test. This approach confirmed that activity in the medial temporal lobe and inferior frontal gyrus was related to later performance, cemented their functional importance to memory formation, and provided a critical methodological tool for probing the neural correlates of memory more generally (Brewer, Zhao, Desmond, Glover, & Gabrieli, 1998; Wagner et al., 1998).

We believe that integrating a focus on accuracy into neuroimaging studies of mind perception can play a similar role, by providing novel, direct evidence about the role of the ESS and MSAS in producing interpersonal accuracy. To take a step in that direction, we identified brain regions the activity of which increased as perceivers became more accurate about the emotions expressed by targets shown on videotapes talking about autobiographical emotional experiences. This analysis revealed that activity in several regions within both the MSAS and ESS (especially the putative mirror neuron system engaged by observing and performing actions; see Zaki, Weber, Bolger, & Ochsner, 2009) predicted accuracy. Dovetailing with this initial finding, a subsequent study demonstrated that functional coupling between target brain activity and perceiver brain activity in both ESS and MSAS predicts perceivers' comprehension of stories told by targets (Stephens et al., 2010).

This type of data is critical in that it can help move past the prevalent yet ultimately unproductive debate as to whether interpersonal understanding is supported by the MSAS *or* ESS, by demonstrating that both systems—and, it stands to reason, their related cognitive processes—support accuracy.

The suggestion here is that future work could move toward asking more nuanced questions about *when* a given system is most important to fostering accuracy. Again, consider memory research, where the neural bases of successful encoding have been shown to differ critically depending on the type of information being encoded (e.g., social vs. nonsocial; see Macrae, Moran, Heatherton, Banfield, & Kelley, 2004; J. P. Mitchell, Macrae, & Banaji, 2004). In like fashion, the MSAS and ESS may turn out to be variably useful in producing accurate inferences, depending on types of social cues perceivers encounter and the inferences they are asked to make. Specifically—although direct evidence is still lacking—extant data suggest that the MSAS may support accurate inferences about complex, contextualized internal states (i.e., those that require understanding the source of a belief or emotion), whereas the ESS may support accuracy about states with more prominent bodily components, such as disgust or pain (Keysers & Gazzola, 2009; Lamm & Singer, 2010; Saarela et al., 2007; Zaki, Davis, & Ochsner, 2011; Zaki et al., 2010). Future work should investigate such possibilities.

Drawing Parallels With Other Phenomena

As previously described, a major aim of cognitive neuroscience is to "carve nature at its joints" by using imaging data to inform questions about the distinct or overlapping processing systems underlying various behaviors. In this regard, imaging data have proven to be particular useful in addressing particular kinds of questions about processing mechanisms. One question ideally suited for imaging data is whether two different behavioral phenomena depend on common or distinct processing systems. By determining whether the two behaviors recruit similar or different neural systems one gains purchase on this question.

In the last decade, this approach has been applied to the study of social cognition to demonstrate that encountering, drawing inferences about, and responding to social information recruits brain regions largely distinct from those supporting processing of nonsocial information. Consider the example of cognitive control. Tasks requiring the engagement of control processes such as response inhibition or working memory engage lateral prefrontal and cingulate regions but seldom if ever activate regions within the MSAS (Botvinick, Braver, Barch, Carter, & Cohen, 2001; Wager, Jonides, & Reading, 2004). In fact, cognitively demanding tasks *deactivate* several MSAS regions, and activity in regions associated with social and nonsocial task types demonstrates negative, reciprocal relationships (Drevets & Raichle, 1998; Fox et al., 2005). At first these findings were taken to mean that thinking about animate agents requires a discrete form of information processing unique to the social domain (J. P. Mitchell, 2008b) and that cognition and socioemotional processes might be antagonistic to one another (Drevets & Raichle, 1998). More recent models have focused on the specific computations that may differentiate the demands of social versus nonsocial inference (Buckner & Carroll, 2007; J. P. Mitchell, 2009b).

Although useful for clarifying the boundaries between social and nonsocial cognition, a strong focus on dissociating their underlying processing systems may miss ways in which the two kinds of systems collaborate in everyday social interactions that demand more than one kind of process come into play. This bears on the previous discussion of cognitive control. Behavioral work suggests that mind perception—and specifically mental state attribution—is highly demanding, and succeeding in it depends on the availability of executive control resources (Apperly & Butterfill, 2009; Carlson & Moses, 2001). At first blush, this finding seems to clash with evidence that executive control and social cognition rely on different neural systems. This confusion is partially cleared up, however, when we consider that neuroimaging studies of mind perception often employ social tasks with limited or no executive demands (e.g., passive viewing of social targets), and when they do employ more difficult social tasks (e.g., some studies of mental state attribution), cognitive control demands are typically equated across the critical mind perception and baseline control conditions so as to isolate the neural correlates of mental state attribution.

As such, distinctions between neural systems involved in social and nonsocial information processing may not reflect "deep" dissociations between the computations underlying these phenomena. Instead, they may reflect the simple fact that, to date, extant work has largely focused on a particular question: Is mind perception different from other cognitive abilities? This question is addressed by attempting to isolate neural systems preferentially engaged by the presentation of, and judgments about, social cues. Typically, this is accomplished by stripping away the complexities of everyday social interaction to devise tasks simple enough that they depend most critically on only the specific mind perception process(es) of interest in a given study.

Asking a different question—for example, What do social and nonsocial information processing have in common?— suggests focusing on tasks that more closely match the complex processing demands of "everyday" social cognition where cognitive control processes might be important. For example, targets often produce unclear or contradictory feedback about their internal states, which perceivers must sort through or choose between in order to be accurate. In such cases, drawing accurate interpersonal inferences requires adjudication between multiple sources of social information (e.g., a target who looks sad but sounds happy). It is likely that these requirements functionally resemble other forms of response conflict that engage executive control centers in the brain. Studies of the neural correlates of perceiving conflicting social cues bear out this parallel by showing engagement of domain general control systems (Decety & Chaminade, 2003; R. L. Mitchell, 2006; Wittfoth et al., 2009) that interact with regions in the ESS and MSAS to guide attention to the cues that perceivers find most relevant to deciding how targets feel (Zaki et al., 2010).

Thus, although the neural systems involved in mind perception and nonsocial cognition can be dissociated, exploring their common reliance on domain-general control systems can illuminate some of their similarities as well. Future work employing naturalistic social tasks in combination with measures of accuracy may serve to further characterize the links between mind perception processes and other cognitive abilities.

Contributions to Clinical Approaches

Finally, an integration of processes and accuracy has the potential to reframe thinking about clinical disorders characterized by social cognitive deficits. As with the study of healthy perceivers, this approach allows for a shift away from viewing these disorders as representing disruptions of single processes that invariably cause social symptoms and toward a focus on (a) seeing disorders as arising from abnormal profiles of function in multiple processes and their interrelationships and (b) examining the situation-specific effects of these processing abnormalities on social symptoms. Here we consider autism spectrum disorders (ASD) as an example case.

Processes and Accuracy in Autism

Individuals with ASD famously fail to engage in typical forms of interpersonal interactions (Lord et al., 1997; Lord, Rutter, & Le Couteur, 1994; Wing & Gould, 1979) and to normatively deploy mental state attribution and experience sharing or engage the neural systems underlying these processes (Baron-Cohen et al., 1985; Dapretto et al., 2006; Kennedy, Redcay, & Courchesne, 2006; Oberman, Ramachandran, & Pineda, 2008; Rogers, Hepburn, Stackhouse, & Wehner, 2003). The observed covariance between a specific kind of processing dysfunction (e.g., experience sharing) and abnormal social function in ASD is sometimes used as evidence that abnormalities in single mind perception processes underlie social deficits in autism (Baron-Cohen, 1994; Oberman & Ramachandran, 2007). On this view, abnormalities in either mental state attribution or experience sharing lead, more or less directly, to the complex social symptoms evinced by ASD.

Although processes such as those supporting experience sharing no doubt play some role in ASD, single process models fail to square with several lines of evidence (Happe, Ronald, & Plomin, 2006). For example, not all studies of ASD document problems in mind perception tasks or their neural bases (Bird et al., 2010; Bowler, 1992; Castelli, 2005; Fan, Decety, Yang, Liu, & Cheng, 2010). Further, the few studies attempting to directly link deficits in mind perception processes with social symptom severity have yielded inconsistent results (Dapretto et al., 2006; Fombonne, Siddons, Achard, Frith, & Happe, 1994; Lombardo, Barnes, Wheelwright, & Baron-Cohen, 2007; Rogers et al., 2003; Tager-Flusberg, 2007). What's more, interventions aimed at encouraging the use of mind perception processes (e.g., training in recognizing photographed emotional faces) often produce improvements *on these tasks* without causing any parallel improvements in clinically assessed social deficits (Gevers, Clifford, Mager, & Boer, 2006; Golan & Baron-Cohen, 2006; Hadwin, Baron-Cohen, Howlin, & Hill, 1996, 1997; Ozonoff & Miller, 1995). These disparities underscore the gap between successfully deploying a particular cognitive process and successfully interacting with others.

The model we are advocating here suggests that two conceptual shifts could better link information processing to social function in ASD. First is the proposition that adaptive social functioning depends on the simultaneous and concerted use of multiple processes to support accurate understanding of the complex social cues perceivers typically encounter. Extant tasks used to assess impairments in ASD (such as motor imitation or emotion identification using pictures) are ill suited to capturing such deficits, because they are aimed at assessing the deployment of single processes using highly simplified stimuli. Second, abnormalities in the operation of mind perception processes likely interact with features of a situation (e.g., the target to which a perceiver is paying attention), affecting social function more in some situations and less so or not at all in others. As such, moving beyond a "perceiver-centric" take on mind perception could allow for mapping the specific contextual domains in which the processing deficits characterizing ASD are most damaging to patients.

Although there are only three extant studies of empathic accuracy in ASD, they provide promising initial support for the more nuanced view we are advocating here. For example, individuals with ASD demonstrate more consistent impairments in empathic accuracy than in simpler, more canonical theory of mind tasks (Demurie, De Corel, & Roeyers, 2011; Roeyers, Buysse, Ponnet, & Pichal, 2001). Second, the one study examining contextual effects on accuracy deficits suggests that ASD individuals' social cognitive problems are indeed selective and related to the types of cues they encounter. Specifically, ASD status predicted reduced accuracy when perceivers observed unstructured interactions between targets but not when they observed targets interviewing each other in a structured format (asking each other questions, such as "What do you like to do in your spare time?"; see Ponnet, Buysse, Roeyers, & De Clercq, 2008). These data suggest that examining context-dependent deficits in accuracy can help researchers map the domains in which individuals with ASD are likely to be more or less impaired and how these impairments evolve out of mind perception processes that support greater or lesser accuracy. Such an approach also suggests potential novel interventions based not on erasing cognitive deficits but rather on placing individuals in contexts/situations where those cognitive deficits are less likely to matter.

Consider anecdotal reports (Grandin & Barron, 2004) and empirical studies (Baron-Cohen, 2009; Baron-Cohen, Richler, Bisarya, Gurunathan, & Wheelwright, 2003) suggesting that individuals with ASD often compensate for mind perception deficits by using systemized rules to elaboratively "work out" the likely experiences of social targets. Such a compensatory strategy could be most useful when targets are producing clear and structured cues about their internal states (as in the interview condition previously described) of the type produced by emotionally expressive targets (Zaki et al., 2008; Zaki, Bolger, et al., 2009). This suggests a form of intervention in which caregivers and family members of individuals with ASD could restructure their behavior to provide clear, readable cues about their internal states, thereby rendering the information-processing issues inherent to ASD less debilitating.

Although speculative, ideas like this one highlight a broader point: Integrating measures of mind perception processes, accuracy, and adaptive functioning can produce novel predictions about the domains in which information-processing deficits lead to clinical dysfunction, and suggest situation-specific interventions to alleviate such dysfunction.

Conclusions

Mind perception research has a long and sometimes rocky past. The early years were defined by the hunt for accuracy. This hunt never captured its quarry, which led researchers to focus almost exclusively on the information-processing steps underpinning social cognition—independent of accuracy. This shift has been enormously successful in characterizing the separable mechanisms through which perceivers try to understand targets, and recent work identifying neural signatures of these processes has made the endeavor even more compelling.

We have argued that mind perception research—in focusing almost exclusively on process—has often chosen to ignore its past, and as a consequence has been limited in some important ways. The majority of current mind perception research is concerned with determining whether and when a given cognitive processes is in play—and neural correlates of these processes are—in many cases without reference to whether or to what extent one's resulting understanding of another person is accurate. Or put another way, we know a lot about what processes people engage when they *try* to make sense of others minds but less about what determines whether they are accurate. This matters because in actual social encounters, a perceiver's goal is not simply to draw any old inference about their social partners but (usually) to draw an accurate one.

There seem to be two main reasons that the process approach has failed to make contact with the accuracy approach. First, researchers may believe that accuracy is too difficult to quantify. Luckily, this concern is outdated. Following a 25-year hibernation, accuracy research has surged, producing a novel and varied approaches to quantifying accuracy and identifying its predictors. Second, even if process-oriented researchers believe that accuracy can be quantified, they may not believe doing so is relevant to their work. Here, we hope to have shown that this view may be shortsighted insofar as integration can provide several novel insights, predictions, and lines of research. Following the framework previously outlined, the strength of this approach comes from directly linking (either behavioral or neural) signs that a process has been deployed with signs that a perceiver has accurately decoded a target's internal states, and in turn relating both of these constructs to adaptive outcomes in the social world. Critical to all of these connections is identifying first the contextual boundaries that determine when a process supports accuracy and, second, when accuracy predicts social well-being.

In elaborating this approach, we have purposefully constrained our focus to two processes—mental state attribution and experience sharing—and on one form of accuracy—the ability to correctly judge a target's dynamic emotional experience—because we considered a limited focus to be necessary for fully fleshing out and illustrating the value of a process-accuracy integration in a single article. However, we hope that future work will port this approach to the study of other processes, such as stereotyping and projection (Hoch, 1987; Judd & Park, 1993; Jussim, 1991; Neyer, Banse, & Asendorpf, 1999); other forms of accuracy, such as predictions of one's own future experiences (Gilbert et al., 1998; Kermer, Driver-Linn, Wilson, & Gilbert, 2006; Wilson, Wheatley, Meyers, Gilbert, & Axsom, 2000); and other forms of adaptive behavior, such as successful negotiation, cooperation, and accurate prediction about others' actions (Coricelli & Nagel, 2009; Galinsky, Maddux, Gilin, & White, 2008; Hampton, Bossaerts, & O'Doherty, 2008; Valdesolo, Ouyang, & DeSteno, 2010).

Overall, we believe that this approach can reframe current data concerning mind perception processes, prompt richer questions about how people understand each other, and suggest new ways of testing these questions. The sorts of changes motivated by this approach will vary depending on the phenomenon being studied and level of analysis being employed. In some cases, questions will be refined from the categorical ("Which process leads to accuracy?") to the conditional ("When will this process produce accuracy?). In other cases, neuroscientists could shift away from characterizing single systems ("What processing steps are instantiated in the MSAS or ESS?") and toward more holistically viewing these systems' role in naturalistic situations ("How do the MSAS and ESS interact with each other and with other systems—like those involve in domain general cognitive control—to produce accurate inferences?"). Finally, in clinical settings, this could mean moving beyond characterizing psychiatric disorders as arising from deficits in single processes ("Do individuals with ASD fail to normatively employ mental state inference?") to examining profiles of information-processing abnormalities across multiple processes in a broader social-cognitive context ("Under which situations will failing to employ mental state attribution most affect an ASD individual's abilities to interact with others, and is there a way to attenuate this effect?").

Let us end by saying that in no way do we wish to suggest that the current, process-focused approach dominating social cognition should be *replaced* by the one described here. That would be as counterproductive as the screeching halt of accuracy research half a century ago. Instead, we are making the simple point that—as so often is the case when two approaches provide different angles on the same, complex question—joining forces can be beneficial to everyone.

Note

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