

# Culture, attribution and automaticity: a social cognitive neuroscience view

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**A fundamental challenge facing social perceivers is identifying the cause underlying other people's behavior. Evidence indicates that East Asian perceivers are more likely than Western perceivers to reference the social context when attributing a cause to a target person's actions. One outstanding question is whether this reflects a culture's influence on automatic or on controlled components of causal attribution. After reviewing behavioral evidence that culture can shape automatic mental processes as well as controlled reasoning, we discuss the evidence in favor of cultural differences in automatic and controlled components of causal attribution more specifically. We contend that insights emerging from social cognitive neuroscience research can inform this debate. After introducing an attribution framework popular among social neuroscientists, we consider findings relevant to the automaticity of attribution, before speculating how one could use a social neuroscience approach to clarify whether culture affects automatic, controlled or both types of attribution processes.**

**Keywords:** cultural neuroscience; attribution; social perception; social neuroscience; social cognition; causal reasoning

Social psychologists study the causal attributions people assign to others' behavior because these attributions are pivotal in interpersonal interactions. Subjective judgments about the reasons for others' behavior determine how people interpret the behavior, how they respond to it and what they expect from these individuals in the future (Heider, 1958). Perhaps the most central phenomenon in this literature is the tendency of perceivers to causally attribute others' behavior to their enduring internal characteristics, such as traits, attitudes and aptitudes, while underestimating the role of the situation or social context in which the behavior emerges (Ichheiser, 1949; Ross, 1977).

Many contributing sources have been suggested for this bias toward personal dispositions, otherwise known as the 'fundamental attribution error' (Ross and Nisbett, 1991) or 'correspondence bias' (Gilbert and Malone, 1995). Heider (1958) associated this bias with Gestalt processes of unit formation; that is, in the perceiver's visual field the person is figural against the ground of the context. In addition to considering how these low-level perceptual processes contribute to the dispositionist bias, Heider also emphasized how perceivers' belief structures or implicit theories guide their reasoning about properties of persons and situations as causes of behavior. Different streams of early empirical research on attribution biases found support for the role of perceptual processes (Jones and Nisbett, 1972) and for the role of more deliberate reasoning processes (Kelley, 1972).

Eventually these insights were integrated in stage models proposing that perceivers reach their causal conclusions through a series of qualitatively different inference processes that vary in automaticity. In these models, initial spontaneous perception-like inferences are subsequently refined through more conscious deliberations (Quattrone, 1982; Trope, 1986; Gilbert and Malone, 1995). The automaticity of mechanisms for the dispositionist bias is an important issue, as it underpins strategies for reducing the bias and its problematic consequences in interpersonal interactions.

Another development in attribution research has been the renewed discovery of cultural differences (Miller, 1984). Increasing evidence indicates that East Asians are less prone than Westerners to focus on a target person's dispositions and more likely to reference factors in the social context (Morris and Peng, 1994; Lee, Hallahan and Herzog, 1996; Morris, Menon and Ames, 2001; Choi *et al.*, 2003). These cultural differences challenge the premise that attributional dispositionism is fundamental to human perception mechanisms and suggest that it may largely reflect belief structures, habits or norms distinctive to the highly individualistic Anglophone nations suffused with Western cultural traditions, where virtually all classic social psychology studies were conducted (Sampson, 1977).

Although automaticity and cultural differences are both major themes in recent attribution research, the question of whether cultural differences arise in automatic *vs* controlled processes is not well understood. In the current article, we review theory and evidence relevant to this question. Cross-cultural psychologists have explored the automaticity of attribution in the context of stage models, yet as we shall see, no definitive answers have emerged. At the same time, a more complex picture of the automatic and controlled

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processes involved in social judgment has emerged from social neuroscience research (Satpute and Lieberman, 2006). We sketch this framework by describing the few preliminary studies that have linked social perception tasks to particular neural mechanisms, and we propose how such research might be extended to explore the degree to which cultural differences appear in early-stage automatic processes or later-stage controlled processes.

### CULTURE IN AUTOMATIC AND CONTROLLED PROCESSES

Before we consider attribution in particular, let us first establish that generally culture can shape preconscious, spontaneous, automatic mental processes as well as conscious, deliberate, controlled reasoning. To illustrate, consider two individuals who conform their behavior to the customs of American culture—a rural Iowa farmer who has lived his whole life within 50 miles of his birthplace, and a New York City-based nurse, recently immigrated from the Philippines and highly motivated to Americanize. For the farmer, the frameworks of American culture (individualism, egalitarianism) are taken for granted. In his social experience, these patterns are universal and consensual; they seem less like subjective premises and more like features of the natural world. Immersed in Americana, the farmer is no more aware of the cultural assumptions guiding his inferences than fish are aware of water. The nurse, in contrast, is more self-conscious of how the frameworks shape her attributions. For the cosmopolitan immigrant, adhering to the culture's categories most likely occurs through vigilant effort and continual self-correction. The contrast between these 'settled' and 'unsettled' lives illustrates two distinct ways in which cultural patterns can enter a person's thinking (Swidler, 1986).

The present question is whether the influence of culture on the dispositionist bias arises in automatic components of attributional processing, controlled components or both. In addition to clarifying how culture influences interpretations of behavior, an answer to this question will engender a more sophisticated understanding of the general attribution process and provide traction on the question of how best to manage unwarranted attributional inferences. Cultural psychologists have amassed evidence that bears upon the automaticity question through two general approaches: measuring inferences in tasks assumed to tap spontaneous rather than deliberate processing and measuring patterns of inferences as conditions assumed to increase (e.g. need for closure) or decrease (e.g. attentional load) deliberate components of processing are manipulated.

### SOCIAL PSYCHOLOGICAL EVIDENCE ABOUT CULTURE AND ATTRIBUTION

There has been longstanding evidence for cultural differences in the biases of people's everyday explanations for behavior (Miller, 1984), yet until recently little evidence probative of

the automaticity question. Initial tests that cultural differences arise in spontaneous or automatic causal judgments came from visual perception tasks. Morris and Peng (1994) modified the classic causal paradigm of Heider and Simmel (1944) by developing animated displays with attributionally ambiguous events involving a fish swimming in the vicinity of other fish. For example, one set of displays was based on leading/chasing ambiguity; a fish swimming in front of a group of fish could be interpreted either as acting on internal preferences—and leading the group—or as responding to situational pressure—being chased by the group. In comparisons between Chinese (PRC) and American (US) participants, Chinese perceivers showed a greater bias toward attributing the individual's behavior to its social situation, influence of the group of fish. Hong *et al.* (2000) extended this finding by demonstrating that bicultural Hong Kong (HK) students who were primed with either Western or Chinese iconic images (e.g. Mickey Mouse *vs* The Stone Monkey) shifted toward more dispositional or more contextual attribution tendencies.

Further testing the role of spontaneous processes, Masuda and Nisbett (2001) varied this procedure by simply assessing memory for details of the central fish *vs* the peripheral context. Japanese perceivers had better memory for contextual details, while Americans (by some measures) had better memory for the central figure. Still further, Chua *et al.* (2005) replicated this design while measuring participants' eye movements. The results indicated that Chinese made more saccadic (rapid nonfocused) eye movements toward the periphery than did North Americans, whereas North Americans looked at the object earlier and had longer fixations on the focal fish than did the Chinese.<sup>1</sup>

Other evidence for cultural differences in spontaneous inferences comes from responses to linguistic stimuli. Uleman and colleagues (Winter and Uleman, 1984) proposed that perceivers spontaneously infer traits (e.g. helpful) when reading sentences about trait-implying behaviors (e.g. 'Brad helped the lost tourists') based on findings that participants erroneously recall having seen the trait words when tested for their memory of the sentences. Many studies in Western contexts find that participants spontaneously infer personality traits from behavioral information more than they infer contextualized behaviors from personality trait information. However, in East Asian contexts, the opposite is true; East Asians have a stronger tendency to spontaneously infer contextualized behaviors (Maass *et al.*, 2006).

<sup>1</sup>These studies suggest that the difference may be a domain-general tendency to attend centrally as opposed to broadly and not a bias specific to processing an individual's behaviour. However, other studies suggest that the dispositional *vs* contextual biases are not general across different kinds of stimulus targets. Findings from a number of tasks indicate that the East–West difference in dispositionalism reverses when explaining the behaviour of groups, organizations or other collectivities. East Asians, who see groups as wielding greater causal power and exhibiting more stability, are more likely than Westerners to attribute behaviours by collectivities to their enduring internal properties (Menon *et al.*, 1999; Kashima *et al.* 2005; Friedman *et al.*, 2007; Zemba *et al.*, 2006).

Asian–Western bicultural individuals can be induced to shift between these two inferential mindsets by manipulations of cultural primes or language of instruction. More recent evidence suggests that different attribution biases can be induced within a single perceiver by priming the relevant cultural mindset (A. Mok and M.W. Morris, unpublished data).

Of course, it is certainly possible that cultural differences reflect both spontaneous implicit processes and deliberate processing of explicit propositional beliefs. Norenzayan *et al.* (1998) compared students' explicit beliefs in dispositionism and situationism, finding that the former did not differ and the latter was endorsed slightly more by Koreans than Americans. Whether such beliefs actually mediate cultural differences in attribution, however, was not tested. Zou *et al.* (2009) investigated this in a series of studies comparing US and HK participants on several social cognition tasks that elicit East/West differences. They also measured students' perceptions of the extent to which dispositionism and situationism are consensual beliefs in their culture. Across several studies results showed that it is perceptions of culturally consensual beliefs—and not personal beliefs—that differ dramatically between Western and Eastern societies and mediate national differences in social judgment outcomes. Zou *et al.* (2009) suggest that cultural patterns are reproduced through people's nonconscious adherence to commonsense, rather than through deliberate reasoning from one's personal values and beliefs.

Another important attribution literature involves the person perception task of attributing attitudes from a speech or essay produced under situational constraint (Jones and Harris, 1967). Several studies have found no cultural difference between American and East Asian groups in attributions of essay-correspondent attitudes when the situation constrained the target individual (i.e. when the speaker was instructed to promote a position or given 'no choice'; Choi and Nisbett, 1998; Krull *et al.*, 1999). However, recent research on this classic paradigm finds participants assume that experimenter instructions (the situational constraint) would not be sufficient to induce a target person to produce a compelling speech in a counternormative direction (e.g. pro-Castro) unless the target person were already privately partisan in that direction (Morris and Larrick, 1995). Miyamoto and Kitayama (2002) found that when the essay was made less compelling (and hence more believably the result of a situational force) dispositional inferences decreased among Japanese perceivers but not American perceivers. Choi and Nisbett (1998) found that when the strength of the evidence for situational causation increased (the essay closely echoed suggestions in the experimenter's instructions) Koreans' correspondence bias decreased whereas Americans' did not. Similarly, Masuda and Kitayama (2004) found that whereas the standard 'no choice' condition evoked attitude attributions by both American and Japanese perceivers, a strong situational

force condition (the target person merely read an essay pre-written by the experimenter) evoked attitude attributions by Americans but not by Japanese. These findings highlight that East–West attitude attributions are elicited when the behavioral stimuli contain clear evidence of situational influence.

Attitude attribution studies have been central to stage models of dispositional and situational inference. Researchers have posited that perceivers initially anchor on properties of the person acting as an explanation and subsequently adjust to take into account situational determinants. The adjustment tends, however, to insufficiently correct for the available situational evidence. Stage models offer a way to analyze where in the process perceivers from different cultures diverge. One account within the stage model framework is the Choi *et al.* (1999) argument that cultures differ not in the first stage but solely in the second stage. That is, all perceivers anchor on dispositional causes but Easterners adjust for situational evidence more adequately than do Westerners.

With important exceptions (Kruglanski, 1980; Read and Miller, 1993), most social inference researchers agree that the two stages differ in automaticity: automatic anchoring followed by more deliberate adjustment (e.g. Trope, 1986; Gilbert and Malone, 1995). Winter *et al.* (1985) provided evidence for the automaticity of dispositional inferences by demonstrating that perceivers make them even when they cannot engage in deliberate processing of the target (i.e. when under high attentional load). Recall of sentences about trait-diagnostic behaviors was facilitated by the associated trait terms more than by other associated words.

Attentional load manipulations have been used to garner evidence that, in contrast to initial attribution stages, the inference corrections purported to occur in later stages are not automatic. Gilbert *et al.* (1988) tested the dependence of situational correction on attentional resources in two influential studies. In Study 1, participants watched a silent videotape of a woman who fidgeted anxiously during an interview. Immediately afterwards, they judged the woman's disposition, specifically her level of trait anxiety. Situational constraint on the target person was manipulated by informing half the participants that the interview involved stressful topics (e.g. sexual experiences) and half that it involved nonstressful topics (e.g. favorite vacations). Rationally, assuming multiple sufficient causes, information about the stressful situation warrants less imputation of trait anxiety, whereas information about the nonstressful situation warrants more imputation of the trait (the discounting and augmenting principles; Kelley 1973). Attentional load was manipulated by preoccupying half of the participants with concern about an upcoming task. Consistent with predictions, the situational manipulation affected attributions more when perceivers had more attentional resources available. Study 2 used the situationally constrained essay paradigm, in which participants listen to a speech by a fellow

student who was assigned his or her topic, and then judge the speaker's private attitude on the topic. Again, attentional load was manipulated by worrying half of the participants about a subsequent task. Participants were more dispositional under high attentional load; they were likely to attribute to the speaker an attitude corresponding to the speech topic. Gilbert *et al.*, conclude that the oft-documented dispositional bias in attribution reflects in part the ubiquitous busyness of social perceivers who lack the attentional resources to engage in situational correction of their initial spontaneous dispositional inferences. This suggests a second account of the cultural difference, which is that the second stage of situational correction may be more automatized for East Asians, given how strongly these cultures reinforce the need for situation- and role-appropriate behavior.

Although much evidence supports the assumption that perceivers automatically anchor on dispositional inferences, other research suggests that anchoring inferences are not always dispositional. Using the assigned essay paradigm, Quattrone (1982) showed that when the task is explicitly framed for participants as situation perception ('try to learn what you can about this situation from what you observe') rather than person perception ('try to learn what you can about this person from what you observe'), participants attributed the essay to the situation rather than to the person's attitude. Unfortunately, it was unclear whether this result reflected a changed initial inference or simply strengthened situational correction. More insight comes from the research of Krull (1993) who manipulated participants' inferential goals as well as attentional load. A key finding was that perceivers with a situational inference goal failed to discount for dispositional information when under attentional load. This suggests that regardless of the direction of the initial anchoring inference, corrective processing follows only if attentional resources are available. In this view, the sequence of person anchoring followed by situational adjustment merely reflects that participants primarily have a default mindset or goal of person inference. It suggests another account for the difference, which is that Easterners may be more likely than Westerners to bring a situation inference goal to a social perception task. If East Asians chronically hold a situational inference goal (e.g. 'what can I learn about this situation from watching the target person?'), they may launch into spontaneous situational inferences upon observing a behavior and only secondarily consider what the behavior might reflect about the target person's traits.

In sum, stage models yield at least three distinct accounts of how culture might influence dispositional attribution. As illustrated in Figure 1, East Asians may differ from Westerners in having (i) greater situational correction, (ii) more automatized situational correction and (iii) greater likelihood of anchoring on situational causes. These three points of influence are not mutually exclusive. Indeed, to the extent that dispositional explanation and situational

	Processing Stage		
	Anchoring		Adjustment
Situational Adjustment More <i>Responsive</i>	Westerners Easterners	Person Person	Situation correction effortful Situation correction sufficient
Situational Adjustment More <i>Automatized</i>	Easterners	Person	Situation correction automatic
Situational Anchoring More <i>Likely</i>	Easterners	Situation	Disposition correction automatic

**Fig. 1** Three accounts of how East Asians differ from Westerners within a two-stage process of attributional inference: situational adjustment more adequately responsive to evidence, situational adjustment that operates more automatically, and a greater likelihood of anchoring initially on situational causes rather than personal dispositions.

explanation are perceived social norms in Western and Eastern societies (Zou *et al.*, 2009), we might expect a pull toward these attributional outcomes at multiple points in the inferential process.

Several research programs have investigated these accounts by varying attentional load in person perception experiments across cultures. Knowles *et al.* (2001) conducted a cross-cultural comparative study using the political speech paradigm. Matched samples of student participants in the US and HK listened to a speech, purportedly by a fellow student, endorsing an unpopular political position. Participants' instructed goal was to figure out the speaker's private attitude about the issue. Attentional load was manipulated with a memory task while students listened to the tape-recorded speech. A crossed manipulation was information about the situational constraints under which the speech was written. In the constraint condition the speaker was purportedly instructed by his professor to defend the view expressed in the speech, whereas in the choice condition the speaker was instructed to choose a position for or against this view. Results from the high constraint condition are most relevant. Under high load, US perceivers showed a strong dispositionist bias—imputing a speech-correspondent attitude to the speaker despite the situational constraint—whereas HK perceivers did not; under low load US and HK perceivers alike showed little dispositionist bias. In the low constraint condition, the speech was attributed to corresponding attitudes by both US and HK perceivers. In other words, when attentional resources were low, US perceivers failed to take into account the level of situational constraint whereas HK perceivers did take into account the level of situational constraint. The fact that HK perceivers' situational correction was not disrupted by load is consistent with the account that situational adjustment is automatized for East Asian perceivers.

Lieberman *et al.* (2005) conducted comparisons of US students and East Asian foreign students at US universities. Using the 'anxious interview' paradigm, Lieberman *et al.*, varied across studies the inferential goal that participants were assigned. Perhaps the clearest result came when

participants were given a situational inference goal: inferring the topic of the interview questions reflected by the anxious behavior in the silent video. Under load, US and East Asian foreign student participants showed similar moderate tendencies to impute stressful interview topics (sexual fantasies) as opposed to nonstressful (favorite hobbies). However, under low load, the cultural groups diverged; US students became less confident in their situational attribution whereas East Asians became more confident. Given that this cultural difference appears in the low load condition, Lieberman *et al.*, conclude that it reflects the second stage of adjustment rather than the first stage of anchoring. Whereas Americans adjusted away from the situational attribution, East Asians adjusted toward increased situational attribution. Lieberman *et al.*, suggest that East Asians may have a heuristic of adjusting in the direction of situational attribution and do so even when it is not warranted by the situational evidence.

Briley and Aaker (2006) manipulated attentional load in a comparison of US and HK participants. Attentional load was manipulated by showing participants an 8-digit number and asking them to remember it by continually rehearsing it without copying it down. Then they were presented with a case about a pizza delivery that arrived late in the context of an extremely busy evening for the delivery business. Participants were asked to judge whether the lateness was 'due to the delivery person' vs 'due to situational factors.' Results showed an interaction of culture and attentional load: Under high load, US perceivers were more dispositional than HK perceivers, while under low load their attributions were alike. This pattern is consistent with the previously posited mechanism of East Asian automatized situational correction. However, another aspect of the findings differed from the previous studies. The least dispositional and most situational attributions occurred with East Asian perceivers under high load. This is consistent with the suggestion that East Asians automatically anchor on situational attributions when they have a situational inference goal and therefore spontaneously construct situational attributions. Whereas the prior studies controlled the perceivers' inferential goal, Briley and Aaker left it free to vary and thereby may have tapped an additional way that culture affects automatic processes.

In sum, comparative studies varying attentional load suggest several points where cultures may differ in the steps of attributional inference. When the task involves a clear person-inference goal, all perceivers may anchor on personal dispositions. In the subsequent step of factoring in situational constraints, East Asian perceivers may respond to situational evidence more adequately or more automatically. Under conditions where the inference goals are unspecified, however, East Asians may be more inclined to bring a situational inference goal and anchor on a situational explanation. Unfortunately, the existing evidence comes almost entirely from perceivers' final attribution judgments. There is no convincing process evidence to corroborate the

assumption that two distinct components of inference are involved, that one temporally follows the other, and that one is higher in automaticity. While the two-stage framework has been heuristically useful, the evidence for it is remarkably thin.

Some further evidence suggesting that cultural differences affect initial automatic inferences comes from research on individual-difference moderators of deliberate reasoning. Need for cognitive closure (NFCC; Kruglanski *et al.*, 1993) refers to the state of desiring simple and clearly justifiable answers rather than complex and hard-to-explain solutions. Chiu *et al.* (2000) proposed that high NFCC predisposes perceivers to adhere to their perceived culturally consensual response tendencies as default strategies (Festinger, 1950; Kruglanski *et al.*, 2006; Fu *et al.*, 2007). Chiu and colleagues presented US and HK participants with vignettes featuring action either by an individual or by a group target actor, building on the research of Menon *et al.* (1999) who found that while Easterners refrain from dispositional attributions about individual actors they are inclined toward dispositional attributions about group actors. Consistent with predictions, in the US higher chronic NFCC perceivers exhibited greater dispositional bias for individual targets but not group targets, whereas in HK they exhibited greater dispositional bias for group targets but not individual targets. Chiu *et al.* also conducted an experiment that situationally induced high NFCC through time pressure. As expected, among US participants high time pressure increased dispositional bias for individual targets and not group targets, whereas in HK it did so for group targets but not individual targets. This effect—time pressure manipulations increasing cultural conformity—has also been demonstrated with other kinds of judgments, such as susceptibility to different kinds of persuasion appeals (Briley and Aaker, 2006, Study 3).<sup>2</sup>

## SOCIAL COGNITIVE NEUROSCIENCE VIEW OF ATTRIBUTION

In recent years, researchers have begun to examine attribution using neuroimaging methods. Consistent with dual-stage models, this research has found that attribution tasks involve cortical areas implicated in spontaneous pre-conscious processing as well as those that support deliberate conscious reasoning. However, as insights about component processes accumulate, the traditional dual-stage models of social inference are being supplanted by models that posit

<sup>2</sup>Similar to situational inductions of NFCC are studies that have manipulated the task context to draw out more spontaneous or more deliberate processing. In their studies of cultural differences in persuasion, Briley and Aaker (2006, Study 1) primed either automatic or deliberate processing. They found that US vs HK cultural differences appeared more strongly when spontaneous rather than deliberative processing was induced. Conversely, in studies of compromise decisions, Briley *et al.* (2000) found that requiring participants to provide explicit reasons before making consumer decisions increased East/West cultural differences. The requirement for reasons led participants to draw upon their cultures' stocks of decision principles, encoded in proverbs. In sum, while cultural differences in decision making may be generally associated with spontaneous processing, some forms of deliberate processing may also induce cultural differences by bringing culturally conferred knowledge structures to the fore.

multiple steps of automatic unconscious inference, multiple steps of controlled inference and interactions between the automatic and controlled systems of inference. As we shall see, findings about attributional bias that have been traditionally interpreted in terms of two serial stages can be re-interpreted in terms of the interaction among cortical regions with functions that trigger automatically, regions that signal the need for conscious deliberation and regions that support conscious, explicit processing and control. Before reviewing the existing neuroscience findings that speak to the automaticity of cultural attribution differences, we provide an overview of the social neuroscience framework invoked to understand how people ascribe causes to behavior.

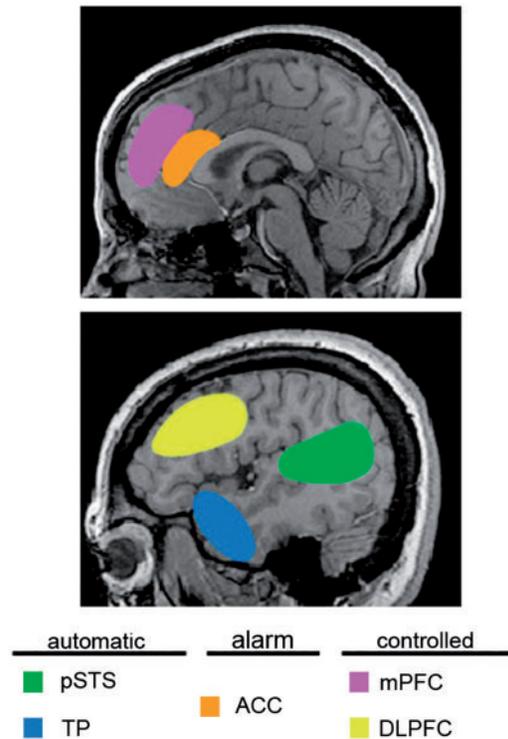
### Brain regions that support automatic processing

Neuroscience methods enable a more complex and nuanced picture of the early stages of perception, including social perception. Visual stimulus information passes from the eyes to the primary visual cortex and then to the visual association cortices by way of two pathways—the dorsal and ventral visual streams (Ungerleider and Mishkin, 1982). The ventral pathway identifies ‘what’ the stimulus is, while the dorsal pathway determines ‘where’ it is and ‘how’ it is moving. These ‘what’ and ‘where/how’ streams come together in the first region central to social perception, the superior temporal sulcus (STS; see Figure 2). At this early point in the processing stream, the biological motion of animate entities is distinguished from the mechanical movements of inanimate entities (Castelli *et al.*, 2000; Grossman and Blake, 2002; Blakemore *et al.*, 2003; Heberlein *et al.*, 2004). In fact, evidence suggests that a posterior aspect of this region (pSTS) detects stimulus features that distinctively signal intentional movement,<sup>3,4</sup> including contingent movements of two targets (Blakemore *et al.*, 2003; Schultz *et al.*, 2003), particularly those featuring eye and mouth movements consistent with mutual attention and interaction (Hoffman and Haxby, 2000), hand movements toward an object *vs* toward empty space (Grezes *et al.*, 2003), changes of trajectory to avoid an obstacle *vs* swerving for no reason (Saxe *et al.*, 2004) and hands lifting *vs* being pushed upwards (Morris *et al.*, 2008). These pSTS responses occur spontaneously, without requiring that participants are asked to interpret or categorize the stimulus (Grossman, *et al.*, 2000; Grossman and Blake, 2002; Hasson *et al.*, 2004).<sup>5</sup>

<sup>3</sup>It should be noted that many social neuroscience researchers discuss these findings in the context of the temporoparietal junction (TPJ), a region that incorporates the pSTS. For simplicity sake, we refer to it as the pSTS.

<sup>4</sup>How humans understand others’ actions remains controversial. In contrast to the position promoted in this review, the mirror-neuron theory posits intention recognition by means of simulation by aspects of the motor system and the inferior frontal gyrus (Gallese & Goldman, 1998; Rizzolatti & Craighero, 2004).

<sup>5</sup>It should be noted that despite overwhelming evidence that mechanisms of the pSTS are bottom-up driven, the magnitude of the pSTS signal increases when participants are asked to explicitly attend to the information and is sensitive to both movement features indicative of intentionality and to cues in the social context in which the movement occurs (see Pelphrey and Morris, 2006). It may be that the pSTS is activated not only by elemental trajectory features of incoming sensory information but also by the backflow of excitation from detection of more abstract higher order cues to intentional action.



**Fig. 2** Brain areas that support automatic, alarm and controlled phases of causal attribution.

In addition to detecting cues of animacy and intentionality in stimulus displays, the pSTS also plays a role in identifying or recognizing low-level action goals. Single-cell recording studies with nonhuman primate perceivers have identified populations of neurons in the pSTS that respond selectively to basic actions toward objects (e.g. reaching, lifting, pushing etc; Perrett *et al.*, 1989; Jellema and Perrett, 2006). Cell firing rates in this area depend not only on the target’s movements but also on the visible presence of the object of the action (Jellema *et al.*, 2000) and on signs of the target person’s awareness of the object (i.e. gaze directed at the object; Perrett *et al.*, 1989). Evidence suggests that different movements directed toward attaining the same goal elicit nearly identical firing patterns in this region, whereas similar movements with diverging goals elicit distinct firing patterns (Jellema and Perrett, 2003, 2006; Zacks *et al.*, 2001). Based on these results, neuroscience researchers believe that the mechanisms of the pSTS are specialized for rapidly recognizing behavior of other people and identifying what basic actions are taking place.

While pattern-matching computations performed by the pSTS provide recognition of *what* a target person is doing, perceivers often want to know *why*—they want to attribute the behavior to its cause in order learn something more about the person or the situation. Social cognition research suggests that perceivers rely on different strategies for attributing routine behavior *vs* novel or unexpected behavior (Rumelhart, 1980; Fiske and Taylor, 1991). Actions in

routine situations (e.g. a waiter brings menus to the table) are pattern matched to scripts. The restaurant script enables the perceiver to recognize a customer ordering a meal from the waiter is situationally determined and indicates nothing special about the person. Social neuroscience evidence implicates the *temporal poles* (TP; see Figure 2) in script-based processing (Fletcher *et al.*, 1995; Frith and Frith, 2003; Gallagher and Frith, 2003; Vollm *et al.*, 2006). In addition to exhibiting increased recruitment during tasks that involve causal attribution, strong activity is observed in this region when participants listen to or read coherent narratives relative to nonsense (Mazoyer *et al.*, 1993), unrelated sentence strings (Fletcher *et al.*, 1995) and incoherent narratives (Maguire *et al.*, 1999). Furthermore, atrophy of the TP region is associated with the loss of knowledge about all but the simplest and most concrete scripts (Funnell, 2001). Although social neuroscience researchers have not directly tested whether the process by which scripts and other schemas are retrieved and applied is automatic, compelling evidence from research by social and cognitive psychologists suggests that this is indeed the case (Schank and Abelson, 1977; Cantor *et al.*, 1982).

### Brain regions that detect inconsistencies and signal the need for deliberation

Not all social inferences can be accomplished effortlessly and in the absence of conscious control. Two topics that have received little attention from social psychologists are precisely how perceivers recognize the need for deliberation and how the cascade of events that culminates in controlled reasoning is triggered by stimulus information. In contrast, cognitive neuroscientists have made headway in elucidating the process by which controlled processing is initiated. A large body of evidence suggests that the *anterior cingulate cortex* (ACC) plays a critical role in detecting conflict and signaling the need for top-down control (Kerns *et al.*, 2004). Although the mechanisms employed by these regions are central to causal attribution, it is important to highlight that, unlike the mechanisms of the pSTS, those of the ACC are not social-specific but play a more general cognitive function.

The ACC has been described as an *alarm system* that alerts the need for conscious analytic processing (see Botvinick *et al.*, 2001; Lieberman, 2003, 2006). This alarm is sensitive to the presence of various forms of conflict. Activity in the ACC increases when people detect discrepancies (e.g. Botvinick *et al.*, 2001) or when their expectations are somehow violated (e.g. Carter *et al.*, 1998). The blood oxygen level-dependent (BOLD) signal in this region increases when people are confronted by problems that lack obvious solutions (e.g. there is more than one potential answer; Petersen *et al.*, 1988), when a relatively automatic but inappropriate response needs to be overridden (Pardo *et al.*, 1990; Carter *et al.*, 1995), and when people encounter evidence that is inconsistent with an existing causal theory (Fugelsang and Dunbar, 2004). In the context of social

inferences, the ACC likely signals the need for deliberation, thereby preventing automatic processes from having free reign over our social sensemaking.

### Brain regions that support deliberate processing

By itself, an alarm is of little use. When the ACC detects conflict or inconsistency, it signals the dorsolateral prefrontal cortex (DLPFC; Brodmann areas 9 and 46) to draw inferences through conscious deliberation. The DLPFC, which is heavily interconnected with the ACC (Fuster, 1980) and one of the last human brain areas to develop (i.e. myelinate; Gotay, 2004), is believed to support executive processing. As such, the DLPFC enables the conscious maintenance and manipulation of information that is no longer present in the sensory environment (e.g. memories, knowledge, etc). Simply put, the DLPFC is required to consciously reflect on specific information that is not immediately detectable through our senses (Lieberman *et al.*, 2002). Any form of symbolic thinking such as propositional reasoning (Waltz *et al.*, 1999; Goel and Dolan, 2000), causal inferences (Lieberman *et al.*, 2002), and hypothesis formation (Christoff and Gabrieli, 2000) depend on the DLPFC's integrity and availability. It is important to note that the DLPFC works in concert with sensory, motor, memory and language systems (Duncan *et al.*, 1996) to jointly meet the conscious reasoning demands of a task. Evidence suggests that as tasks become automated, task-relevant neural pathways are strengthened and can therefore be engaged independently of the DLPFC (Asaad, Rainer and Miller, 1998). In sum, the DLPFC supports explicit attempts by perceivers to collect and integrate information to understand behavior and is critical to the metacognitive aspect of attributional analysis.

The effortful ascription of traits and motivations to behavior involves a distinct cortical region, one with mechanisms that are argued to play a uniquely social function. In the case of novel or ambiguous actions for which they lack schemata, social perceivers are purported to engage in a different process of *mindreading*—imputing the target's inner intentions, beliefs and desires to generate a narrative. Results of the work on this topic by cognitive neuroscientists indicate that this mentalizing strategy recruits an anterior cortical region, the *medial prefrontal cortex* (mPFC). In contrast to the script matching purported to unfold in the temporal poles, mindreading is commonly conceived of as an effortful, conscious process, dependent on the availability of attentional resources.

Mindreading begins with imputing the proximal mental states behind an action—intentions, beliefs, desires—and often results in inferences about more enduring distinctive properties of particular persons, which add to the social perceivers' map of the social environment, beyond the schematic knowledge about typical types of persons and situations. Compared with TP schema-matching processes, mPFC mechanisms are employed when social perceivers interpret

at a more abstract level—when they explain why a target person performed a notable or unexpected behavior, why a target actor conducted an extended sequence of actions or why an actor has shown a pattern of behaviors over time. Unlike displays of simple goal-directed movement, which elicit activity confined to the pSTS region (Blakemore *et al.*, 2003; Schultz *et al.*, 2004), displays of more complex intentional movement patterns give rise to activity in *both* the STS and the mPFC (see Castelli *et al.*, 2000; Frith and Frith, 2003; Schultz *et al.*, 2003).

A wealth of experimental evidence links mPFC activity to the simulation of others' mental states. The mPFC is recruited in tasks that involve reasoning about the intentions of characters in cartoons and vignettes (Brunet *et al.*, 2000; Gallagher *et al.*, 2000; Amodio and Frith, 2006); tasks that require judgments about whether another person performs particular actions (e.g. 'run' or 'lick'), which invite thoughts about their motive (Mason *et al.*, 2004); and tasks that require reasoning about others' knowledge ('would Christopher Columbus know how to use a video home system (VHS)?'; Goel *et al.*, 1995) and others' false beliefs (e.g. 'Sally purchased a train ticket because she believed the subway was running when it is actually shut down for the weekend'; Saxe and Kanwisher, 2003). Strong activity in the MPFC is observed during tasks that require participants to explicitly strategize about another person's hidden intent, such as a game of 'rock, paper, scissors' (McCabe *et al.*, 2001; Gallagher *et al.*, 2002), or cooperate when there are mixed motives, such as in the Prisoners' Dilemma (Rilling *et al.*, 2004).

A handful of studies have taken the further step of linking mPFC activity not only to processing of targets' mental states but also to inferences about their *traits* or dispositions. The evidence discussed thus far, implicates the mPFC in one particular strategy or process of causal attribution—interpreting behavior by consciously and deliberately imputing mental states and dispositions. While obviously central to the question at hand, this is but one of many strategies for attribution. Attribution theory has amassed considerable evidence that perceivers use covariation of the behavior with different alternative causes as a strategy for inducing causality. Perceivers reflect on a target's past behavior, the target's behavior in other situations and the behavior of other actors in the present situation—does the target always behave this way when in this setting? Does the target behave this way in altogether different settings? Do other actors also behave this way in the present situation? (Kelley, 1967, 1973). This raises the question of whether dispositional inferences that follow from covariational evidence are also subserved by the mPFC? This particular attribution task is designed to identify the locus of causation—person or situation—based on information about past events, presented as objective and external knowledge. When the covariational evidence points to a person locus, however, perceivers may spontaneously take the next step of 'getting inside the target's mind',

inferring a particular disposition to explain the given behavior.

To explore this matter, Harris *et al.* (2005) scanned participants—all American—while performing MacArthur's (1972) attribution task. They observed changes in the pSTS and mPFC across the three attribution criteria. Consistent with the view that activity in the pSTS responds to behavioral stimuli and the mPFC is recruited when participants strategize about underlying mental and dispositional causes, the authors report finding strongest activity in these regions in stimulus problems where the target behaved consistently over time in the given situation, where the target behaved in a similar way in altogether different situations and where other actors did not behave this way in the given situation. Under this configuration of covariational evidence, participants almost always attribute the behavior to the person's dispositions. Consistent with evidence that Western perceivers are relatively insensitive to social consensus evidence—information about how most people behave in the situation—mPFC activity remained high even when this piece of the covariational evidence was missing, when the behavior was depicted as a consensual response in the situation. These findings dovetail well with the social neuroscience literature on mentalizing by implicating both the pSTS and the mPFC in deliberate causal attribution.<sup>6</sup> Cha and Nam (1985) found that Korean perceivers, compared with MacArthur's (1972) Americans, were twice as sensitive to consensus information, reducing their attributions to the target person's dispositions when informed that many other people had behaved similarly in the same situation. This finding aligns with evidence from other paradigms that strong evidence for situational causation is more likely to be taken into account by East Asian perceivers. It would be valuable to replicate the Harris *et al.*, study with East Asian participants to see whether their mPFC processing is more sensitive to consensus information, which would suggest that their attention to consensus information reduces their tendency to process person causes when they are unwarranted.

To date, few researchers have focused explicitly on the process by which perceivers assign stable dispositions to others' behavior. Mitchell *et al.* (2004) attempted this by measuring BOLD activity while perceivers performed various tasks involving sentences with trait-diagnostic behavior. Relative to the task of putting the sentences into sequence, explicitly forming impressions of the target persons from the sentences was associated with increased mPFC recruitment. Critically, mPFC involvement is specific to forming an impression of social entities and does not extend to forming impressions of inanimate objects (Mitchell *et al.*, 2005a). Furthermore, the mPFC is distinctively recruited when

<sup>6</sup>A puzzling feature of the Harris *et al.* findings is that the behavioral measure of person attribution correlated more closely with STS than mPFC activation. It may be that perceivers process the background covariational information by imagining the behaviors described and this mental imaging of other people's behavior engages STS activation just as does perception of the target's behavior.

judging internal psychological dispositions of a target person compared to judging internal physical characteristics that are unobservable (Mitchell *et al.*, 2005b). This implies that the mPFC is specialized for processing information about other people's psychological interiors—both their ever-changing beliefs, desires and intentions and their more enduring stable attitudes, aptitudes and traits—and not for thinking about people more generally.

While the vast majority of studies implicate the mPFC in controlled attribution, it is worth highlighting the results of a recent study that challenge the notion that the mPFC activates solely in deliberative processing. In a direct test of the automaticity of mPFC mechanisms, Mitchell *et al.* (2006) measured mPFC activity in Western participants during processing of behavioral sentences, varying the task and the kind of sentence. The dorsal mPFC was recruited when participants were directed to form impressions of the targets from these sentences, relative to when they were directed to remember the sentence sequence. When participants were given this explicit person inference goal, there was no difference in mPFC activity elicited by sentences strongly diagnostic of traits compared to those less diagnostic. However, when participants performed the sequencing task (i.e. in the absence of a person inference goal), a substantial effect of sentence diagnosticity emerged in both the TPs and the mPFC. These results are consistent with the claim that the TPs support the spontaneous retrieval of knowledge in the form of schemata or scripts. Furthermore, this finding suggests that while the mPFC is associated with controlled deliberate processing, certain stimulus features (such as behavior that is consistent for the target across occasions and situations) may spontaneously trigger mPFC inference mechanisms (see Uleman *et al.*, 2005). It would be interesting to test whether spontaneous mPFC activation occurs for Eastern perceivers as much as it does for Western perceivers. Perhaps Western perceivers, for whom dispositional inference is cultural commonsense, are more likely to bring a person inference goal to their social perception opportunities and accordingly to spontaneously infer dispositions through mPFC mechanisms.

In sum, we have reviewed evidence for the neural correlates of automatic processes, alarm systems and controlled processes. Automatic processing is triggered immediately by incoming stimulus information as it is matched with memory patterns to identify actions and recognize events. Social neuroscientists generally agree that spontaneous pSTS activation plays a role in interpreting what a target is doing whereas TP activation functions to interpret why a highly familiar action is being performed. Provided perceptual input can be matched to familiar patterns in memory, each of these steps will occur with the perceiver on intuitive autopilot. When the behavior is ambiguous, complex or when it is inconsistent with a schema invoked to interpret a social interaction, the ACC alarms the DLPFC that careful deliberation is required to resolve the intent and meaning of the

behavioral stimulus. Through the generalized mechanisms of the DLPFC, perceivers explicitly gather and integrate information, which they can then bring to bear on their causal judgments. It is the mechanisms of the mPFC, however, that are engaged to intuit the internal drivers—both fleeting and stable—of a target to understand their behavior. Finally, while the vast majority of evidence suggests that the mind-reading mechanisms of the mPFC are deliberative, recent work by Mitchell *et al.* (2006) provides initial evidence that these mechanisms can be triggered independently of the DLPFC and ACC in perceivers with person inference goals.

### POTENTIAL NEUROSCIENCE EVIDENCE ABOUT CULTURE AND ATTRIBUTION

The primary aim of this manuscript was to review behavioral and social neuroscience findings that provide clues to culture's impact on automatic and controlled attribution processes. Cultural psychologists have garnered behavioral evidence for the automaticity of culture on attribution by demonstrating that East–West differences emerge with perception and memory tasks that tap automatic processing (not just in people's explicit verbal explanations) and emerge under conditions inhibiting conscious deliberation (e.g. high attentional load). In addition to bolstering this view that culture permeates into automatic, unconscious processing of attributions, neuroscience research has the potential to provide a more complete account of the mechanisms underlying cultural differences. We now review the existing neuroscience evidence that speaks to the automaticity question and highlight ways that neuroscience approaches could be further developed in future research. We propose that several kinds of neuroscience evidence could elucidate unanswered questions about cultural influence on attribution processes, including (i) differential activation of areas early in the processing stream that support automatic functions (e.g. schema matching by the TP), (ii) differential ACC alarm sensitivities, (iii) differential cortical activity observed under conditions of attentional load (i.e. when the DLPFC resources are occupied) and (iv) differential triggers of mPFC activity.

Before we discuss findings directly relevant to attribution, we first highlight preliminary neuroscience evidence that culture shapes preconscious, spontaneous, automatic mental processes as well as conscious, deliberate, controlled reasoning. Recent work by Gutchess *et al.* (2006) suggests that cultural differences are detectable early in the cognitive processing stream, manifesting in basic perceptual processes such as how perceivers allocate attention to their surrounding environment (see also Hedden *et al.*, 2008). As discussed, the available behavioral evidence suggests that Westerners focus on figural objects in a scene at the expense of contextual detail. In contrast, East Asians tend to employ a relatively broader scope of attention, noticing and processing more information in the periphery (Witkin and Berry, 1975;

Masuda and Nisbett, 2006; Kitayama *et al.*, 2007). Gutchess *et al.* (2006) report that Americans confronted by target objects exhibit greater activity in brain areas that are involved in figural object recognition (e.g. bilateral middle temporal gyri) than Chinese participants. These results are interpreted as reflecting an increase in attention on the part of their American participants to the focally presented object. These reflexive orienting differences may contribute to the cultural discrepancy in performance on covariation detection tasks (Ji *et al.*, 2000), and explain why East Asians are not only more likely to draw on features of the situation to explain behavior, but more likely to notice meaningful contextual patterns in the first place.

### Differential involvement of automatic attribution regions

Neuroscience research implicates pSTS mechanisms in the automatic processing of cues, especially those signaling intentionality. If culture impacts the initial anchoring phase of attribution, this might manifest as greater pSTS activity among Western perceivers. While some pSTS processing may occur in the parsing of actions even for perceivers with situation-inference goals, Western perceivers with stronger person-inference goals would show more pSTS processing of a target person's actions. Consistent with this possibility, Kobayashi, Glover and Temple (2007) report finding that relative to their Japanese counterparts, American participants exhibit greater right pSTS activity during mental state attribution tasks. This difference is consistent with arguments that Westerners are more likely to interpret behavior in terms of individual goals and dispositions.

Conversely, to the extent that East Asian perceivers come to behaviors with situation-inference goals, they should exhibit more activation in regions involved in automatic processing of situational causes. To the extent that East Asians rely on situational scripts to interpret other's behaviors, they should exhibit stronger TP activity during attribution tasks than Westerners. In a second study, Kobayashi *et al.* (2006) report that American and Japanese participants recruit the ACC, DLPFC and the mPFC to an equal extent during mental state attribution tasks but that the Japanese exhibit greater activity in the temporal poles than American perceivers. Taken together, these findings suggest that culturally distinctive biases in attribution have correlates in differential activation of automatic neural mechanisms.

### Differential sensitivity of the ACC alarm

As discussed, the social neuroscience view of attribution posits that when perceivers detect an inconsistency, the ACC alarm signals the need for deliberative processing, which is implemented by the DLPFC (in concert with other brain regions). It is certainly reasonable to expect that perceivers from East Asian and Western cultures exhibit qualitatively different ACC alarm sensitivities. Evidence

suggests that East Asians have a heightened sensitivity to situational evidence (Choi *et al.*, 1999; Kitayama *et al.*, 2007). At the systems neuroscience level, this might manifest as an ACC alarm that is sensitized to detecting relevant situational information, especially when this evidence is inconsistent with an alternative causal account.

To the best of our knowledge, cultural neuroscience has yet to explore the conditions under which the ACC alarm of Eastern vs Western participants is triggered. This is unfortunate. A more complete characterization of the ACC's response to dispositional and situational inconsistencies in Westerners and East Asians has great potential to isolate the three different accounts of cultural differences in attribution (see Figure 1). As discussed, there is currently little process evidence against which to judge existing models of cultural differences in attribution—claims are based entirely on the pattern of attributional outcome judgments that emerge under varying conditions.

Imagine a stimulus for which East Asians and Westerners both draw a dispositional inference (e.g. '*Jennifer is helpful*') from evidence they have been provided (e.g. '*Jennifer volunteered to take orphans to the zoo*'). With traditional social psychology methods, it is impossible to determine whether this identical behavioral outcome reflects the same underlying sequence of inferences or different sequences (see Figure 1). According to the same-sequence accounts, which posit that both Easterners and Westerners alike begin with dispositional inferences but that Easterners more accurately or more effortlessly correct for relevant situational evidence, no ACC differences should emerge during the attribution judgment. In contrast, according to the different-sequence account that East Asians anchor on situational inferences and then make effortful dispositional corrections, the dispositional conclusion should be associated with ACC and DLPFC activity in East Asian but not Western participants as it could only occur through considerable corrective activity.

Some support for this logic comes from a recent cultural study outside of the social perception domain. In a task that captures cultural differences in capacity for contextualized vs decontextualized judgments, Hedden *et al.* (2008) found that participants making judgments under conditions that conflict with their culturally-reinforced approach exhibited more activation of controlled processing areas (e.g. the DLPFC), whereas participants making judgments under conditions that favored their culturally reinforced approach did not show activation in deliberative reasoning regions.

Finally, it is worth highlighting that individual differences in cognitive style, such as NFCC, might be associated with chronic differences in the sensitivity of the ACC alarm. High NFCC individuals are more likely to adhere to culturally reinforced answers even when the evidence is ambiguous. As a consequence, they should show less ACC activation when resolving a causal solution. To date, research has linked the ACC to obsessive-compulsive disorder (OCD).

Evidence suggests, for example, that the unusual sensitivity to discrepancies exhibited by individuals who suffer from OCD is associated with a hyperactive ACC (Gehring *et al.*, 2000).

### Differential activity during attentional load

Another research strategy for uncovering the processes through which culture affects attribution processes is measuring BOLD activity in participants making judgments while under attentional load. Attentional load manipulations interfere with central executive functioning and therefore diminish people's ability to consciously reflect on and consciously adjust their initial judgments. In the context of attributional inferences, these manipulations prevent people from engaging deliberate correctional processes despite existing flaws in their solution. The cortical regions recruited during a given load manipulation depend partly on the nature of the task—loads that require verbal processing require language areas, for example—but by definition, they are supported by mechanisms subserved by the DLPFC (Mason *et al.*, 2007). Importantly, the most frequently implemented load manipulations involve the DLPFC and not the other brain regions that play a fundamental role in the attribution process. Hence, it is not the case that the activation associated with conducting the attentional load task would obscure the change in activation expected from the decrease in deliberative attributional processing. Thus, it is theoretically possible to measure the differential involvement of the pSTS, TP, the ACC (and possibly the mPFC) under conditions where people are prevented from reaching a causal solution via deliberation and to relate the observed pattern of activity to convergent and divergent attributional outcomes. This would be valuable not only in distinguishing different points of cultural influence but also for corroborating some of the basic assumptions made when attentional load manipulations are used in attribution research.

### Differential mPFC triggering

Recent evidence by Mitchell and colleagues (2006) suggests that behavioral stimuli highly diagnostic of traits spontaneously trigger mPFC mentalizing processes. As we have noted, it would be interesting to test whether the effect Mitchell *et al.* (2006) observed would emerge in East Asian participants, who may be less trigger happy in their dispositional inferences on account of different chronic social inference goals related to different cultural outlooks. It would also be interesting to ask whether there are certain conditions (e.g. when a perceiver has knowledge about a target's past behavior) under which these stimuli would trigger mPFC mechanisms even in East Asian perceivers?

While current evidence suggests a clear role for mPFC mindreading processes as a means toward inference of personal traits, it is also possible that mindreading plays a similar role in the construction of situational attributions. Although it makes intuitive sense to predict that

Westerners more consistently exhibit mPFC recruitment when considering attributionally ambiguous behaviors—those that could be construed in terms of either situational or dispositional determinants—this prediction might be overly simplistic. Much of the available evidence indicates that East Asians are more likely to consider how situational factors influence mental states—wants, beliefs, desires, etc—which in turn give rise to behavior (Malle, 2004). If East Asians make situationist attributions in this way then attributionally ambiguous behaviors should elicit common mPFC recruitment in both East Asians and Westerner perceivers, even though their attributional conclusions diverge. Future research is needed to clarify whether the consideration of situational causes is also processed by mPFC mechanisms. One way to determine this would be to measure mPFC activity while people are directed to make situational explanations (e.g. 'what aspects of the social context shaped this response?'). If perceivers envision the mental states through which the target is affected by a situation (e.g. the teenager committed vandalism because he wanted acceptance into the gang) then their deliberate processes of reaching situational attributions may also recruit mPFC mechanisms.<sup>7</sup>

### SUMMARY

A burgeoning literature documents that people's biases in attributing behavior to causes vary across cultures, with Westerners favoring explanations that reference situational constraints. We reviewed the relevant behavioral literature and suggested that a more fine grained model of attribution could be constructed by considering the results emerging from social cognitive neuroscience (SCN). Finally, we speculated on ways that neuroscientific approaches might continue to be a source of valuable evidence moving forward. As this review highlighted, cultural neuroscientists are only just beginning to accumulate evidence relevant to the automaticity question. Absent in the social neuroscience literature, for example, are attempts to identify brain regions recruited when participants deliberately explain behavior in terms of situational constraints. We suspect that a clearer understanding of the attribution process will emerge as social neuroscience researchers consider relevant social psychological findings and incorporate the paradigms and frameworks used by traditional attribution researchers into their work.

While we have emphasized evidence that culture affects automatic components of the attribution process, we have argued that it is likely that cultural inferences involve both automatic and controlled components. To demonstrate that cultural influence operates in controlled processes, researchers must adopt a slightly more complicated approach—they must show that brain areas involved in controlled processing are equally active in both cultures under low attributional

<sup>7</sup>It is certainly possible that a distinct mPFC subregion supports inferences about stable traits as opposed to temporary states of mind. If so, cultural differences would be expected to emerge in the former region.

load conditions but that this common brain activity results in diverging conclusions. Compelling evidence that culture impacts attribution via controlled processes would be strong BOLD activity in the mPFC and the DLPFC in perceivers from both cultures accompanied by a very specific pattern of behavioral results—westerners invoking dispositional explanations and Easterners situational ones. It should be noted that the strength of the argument for cultural effects through controlled mechanisms from these results hinges on an *absence* of BOLD differences in the pSTS and the temporal poles. If differences emerged in these areas, it would be difficult to rule out the possibility that the behavioral results were driven by concurrently engaged spontaneous mechanisms—the pSTS mechanisms detecting cues to intentionality or the TP mechanisms matching the stimuli to scripts or schemas.

While certainly not a suitable tool for exploring all cross-culture differences, brain imaging and cognitive neuroscience methods have three notable strengths that are worth briefly reviewing. First, these techniques allow for the exploration of differences without relying on participants' introspective capabilities, which are known to be subject to bias (Nisbett and Wilson, 1978). Even when participants can accurately report on the content of their thoughts or the means by which they arrived at a solution, drawing participants' attention to their cognitions potentially alters them in a fundamental way. The second strength is that these techniques complement existing social psychology approaches by providing insight into underlying mechanisms and processes. Third, these techniques can reveal differences that go undetected using traditional behavioral measures. One might expect that certain culturally invariant behaviors are supported by diverging strategies. Research by Chiao and colleagues (2008), for example, confirms that while East Asians and Western participants perform equally well on emotion recognition tasks, the solution is arrived at by the two cultures through qualitatively different approaches (see Gutchess *et al.*, 2006; Chiao and Ambady, 2007, p. 246; Chiao *et al.*, 2008). We hope others share our enthusiasm for using social neuroscience approaches to explore the impact of culture on attribution, as we seek more insight into cross cultural differences in causal inferences.

#### Conflict of Interest

None declared.

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