The Inhibition versus Attribution Debate on Egocentric Bias in Visual Perspective-Taking

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Abstract

Egocentric bias is a significant contributor to social failure, yet its underlying mechanism remains controversial. Previous research has proposed two theoretical perspectives: the inhibitory selection model and the fluency misattribution account. The former posits that failure to inhibit one' s own perspective leads to egocentric bias, whereas the latter suggests that erroneously selecting information that is more fluent for oneself results in egocentric bias. To integrate these debates, we propose an inhibitory-attributional synergistic model, which posits that both inhibitory and attributional processes may jointly contribute to egocentric bias. Future research should employ sophisticated research paradigms and special participant populations to further validate this model.

Full Text

The Debate Between Inhibition and Attribution of Egocentric Bias in Visual Perspective Taking

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Abstract: Egocentric bias is a significant contributor to social interaction failures, yet its underlying mechanisms remain controversial. Previous research has proposed two theoretical accounts: the inhibitive selection model and fluency misattribution theory. The former suggests that egocentric bias stems from a failure to suppress one' s own perspective, while the latter argues that it arises from mistakenly selecting information that is more fluent in one' s own mind. To integrate these competing views, we propose an inhibition-attribution collaboration model, positing that both inhibitory and attributional processes may jointly produce egocentric bias. Future research should employ sophisticated paradigms and special participant populations to further validate this model.

Keywords: Egocentric Bias, Perspective Taking, Visual Perspective Taking, Social Interaction, Interpersonal Communication

Visual perspective taking refers to the ability to view the world from another person' s vantage point to understand what they see and how they see it (Michelon & Zacks, 2006; Samuel et al., 2019). As a fundamental aspect of cognitive development, this capacity enables individuals to comprehend others' perceptual experiences and serves as the foundation for social interaction. Accurately inferring another' s perspective requires understanding that different individuals have distinct perceptual experiences of the external world while simultaneously suppressing interference from inconsistent self-generated information. However, individuals inevitably experience interference from their own information during visual perspective taking, leading them to erroneously use their own experiences to evaluate others' perspectives. This perspective-taking bias caused by self-generated information is known as egocentric bias (also referred to as egocentric deviation or egocentric interference) (Samuel et al., 2019; Voyer et al., 2017). This bias represents a primary cause of social interaction failures and interpersonal communication barriers.

Current researchers have proposed two theoretical explanations for the emergence of egocentric bias: the inhibitive selection model and fluency misattribution theory (Birch et al., 2017; Frick & Baumeler, 2017; Todd et al., 2016). Leslie et al. (2005) introduced the inhibitive selection model, which posits that when reasoning about others' perspectives, individuals must inhibit their own viewpoint and manage conflicts between their own and others'perspectives. This inhibitory selection process is associated with executive functions, particularly inhibitory control. Building on this framework, numerous researchers have further argued that people struggle to completely ignore or suppress their own perspectives when inferring others' viewpoints. Moreover, individuals typically assume that others share the same information as themselves and consequently use their own perspective to understand others. When discrepancies arise between one' s own and another' s perspective information, this strategy becomes ineffective. At this point, people tend to suppress their own viewpoint while attempting to analyze and judge the other' s perspective. Failure in this suppression process results in egocentric bias (Nobusako et al., 2017).

In contrast, Birch et al. (2017) proposed fluency misattribution theory, which suggests that when reasoning about others' perspectives, people tend to misattribute their own more fluent and accessible thoughts as belonging to others. This theory maintains that egocentric bias does not originate from failed suppression of one's own perspective but rather from erroneous information selection. In visual perspective taking, information about others and oneself may be activated simultaneously, or self-perspective information may be activated first, awaiting selection. However, because self-perspective information is more salient, fluent, and easier to integrate, individuals mistakenly select this information, leading to egocentric bias (Bernstein et al., 2018; Birch et al., 2017).

These two theories focus on different processing stages of visual perspective

taking, constructing fundamentally different theoretical frameworks. The inhibitive selection model primarily addresses how information conflict inhibition influences egocentric bias while neglecting the impact of information retrieval and integration processes (Amodio, 2019). Conversely, fluency misattribution theory focuses on the effects of erroneous information retrieval and integration while overlooking the role of information conflict inhibition. This theoretical divergence suggests that neither account may fully capture the mechanisms underlying egocentric bias. Despite their opposing nature, both theories can reasonably explain egocentric bias and have received substantial empirical support. In recent years, the debate between these two theoretical perspectives has become a prominent research focus in visual perspective taking and social interaction both domestically and internationally. However, previous studies have employed diverse paradigms, making cross-study comparisons difficult. Importantly, no existing research has systematically reviewed evidence supporting the inhibitive selection model and fluency misattribution theory according to experimental paradigms. Therefore, this article first reviews previous research by paradigm to examine the mechanisms underlying egocentric bias. Subsequently, by analyzing factors influencing inhibitory selection and misattribution, we explore the determinants of egocentric bias. Finally, we propose for the first time an inhibition-attribution collaboration model to bridge theoretical disputes in the literature, concluding with future research directions.

2 Experimental Paradigms for Egocentric Bias

The primary measure of egocentric bias involves observing how the match between participants' and others' perspectives influences performance in perspective-taking tasks. Consequently, measuring egocentric bias depends on assessing visual perspective taking. Based on the depth and complexity of perspective content, visual perspective taking is divided into Level-1 and Level-2 perspective taking. The former refers to understanding whether another person can see an object, while the latter involves understanding how the world appears from another' s perspective (Flavell et al., 1981; Gunia et al., 2021). Researchers have designed various paradigms to investigate the cognitive mechanisms underlying Level-1 and Level-2 perspective taking. The commonly used Level-1 task is the dot-probe paradigm, while Level-2 tasks include the own-body transformation task, director task, and ambiguous number paradigm.

2.1 Dot-Probe Paradigm

The dot-probe paradigm is frequently employed to test egocentric bias in Level-1 visual perspective taking (Qureshi et al., 2020; Santiesteban et al., 2017; Wang et al., 2019). In this paradigm, participants view an image of a room containing a virtual human facing one wall, with 0-3 dots randomly appearing on the walls. The virtual human' s perspective can be manipulated by changing their position. When all dots appear on the side the virtual human faces, the participant and

virtual human see the same number of dots (consistent condition). When dots appear on both sides of the virtual human, the participant and virtual human see different numbers of dots (inconsistent condition). In inconsistent conditions, participants are more susceptible to interference from their own information and experience greater difficulty judging the number of dots the virtual human sees —this constitutes egocentric bias (Samson et al., 2010).

Notably, the dot-probe paradigm also reveals altercentric interference (also called non-egocentric interference or reverse egocentric interference), which corresponds to egocentric bias. While egocentric bias refers to interference from one' s own perspective when understanding another' s viewpoint, altercentric interference occurs when information about another' s perspective interferes with understanding one' s own perspective (Samson et al., 2010; Santiesteban et al., 2017; Surtees & Apperly, 2012). These two types of interference show dissociable patterns across different populations. For instance, researchers have examined performance on the dot-probe task among healthy participants, psychiatric patients, and individuals with autism. The results indicate that psychiatric patients and individuals with autism, like healthy participants, show similar egocentric bias when reasoning about others' perspectives, as they are all influenced by self-generated information. However, when understanding their own perspective, these clinical populations consider others'perspectives less than healthy participants, exhibiting reduced altercentric interference (Drayton et al., 2018; Schwarzkopf et al., 2014).

Researchers have also verified that the dot-probe paradigm measures visual perspective taking related to understanding others' mental states rather than unrelated processing. Furlanetto et al. (2016) presented participants with three types of virtual humans in the dot-probe paradigm: those without glasses, those with transparent glasses, and those with opaque glasses. Participants showed significant egocentric bias when judging the number of dots seen by virtual humans without glasses or with transparent glasses, but not when judging those with opaque glasses. This demonstrates that the dot-probe paradigm indeed measures egocentric bias in visual perspective taking.

Findings from this paradigm primarily support the inhibitive selection model, which posits that inhibition is a crucial factor underlying performance differences in perspective taking. In inconsistent conditions, participants automatically process the virtual human' s perspective, creating a conflict between their own and the other' s viewpoint. Resolving this conflict requires inhibiting one' s own perspective, and failure to do so produces egocentric bias.

2.2 Own-Body Transformation Task

Researchers also frequently use the own-body transformation task (OBT) to investigate the mechanisms underlying egocentric bias in Level-2 visual perspective taking (Gardner et al., 2017; Jansen et al., 2020; van Elk et al., 2017). In this paradigm, participants view an image of a human figure with outstretched

limbs rotated at various angles and must determine whether a specific marker or target object appears on the figure' s left or right hand. As the rotation angle increases, the discrepancy between the figure' s perspective and the participant' s perspective grows, making it more difficult for participants to mentally rotate and imagine themselves in the other' s position. This increased difficulty in perspective inference manifests as more pronounced egocentric bias (Zacks & Tversky, 2005).

To examine the temporal dynamics of self- and other-perspective activation, van Elk et al. (2017) employed the OBT paradigm, requiring participants to judge whether a red bracelet appeared on the virtual human' s left or right wrist. Results showed that as the figure rotated 60°, 120°, and 180° around the Y-axis, participants' reasoning time gradually increased. In these cases, participants used their own perspective as an anchor and mentally rotated to infer the other' s viewpoint. When participants' own perspective was more salient and the mental rotation angle was large, they were more likely to erroneously attribute their own perspective to the other, producing egocentric bias. These findings indicate that in the OBT paradigm, self-perspective information is activated first.

Consequently, results from this paradigm primarily support fluency misattribution theory, which maintains that egocentric bias arises from the misattribution of information during cognitive processing. Under inconsistent conditions, participants' own perspective is more salient, fluent, and activated earlier, leading them to incorrectly attribute self-perspective information as belonging to the other.

2.3 Director Task

Researchers using the director task have also found that participants readily exhibit egocentric bias when adopting others' perspectives (Apperly et al., 2010; Legg et al., 2017; Samuel et al., 2019). In this task, participants and the experimenter sit on opposite sides of a shelf containing various objects, some of which are occluded from the experimenter' s view by opaque barriers, creating discrepant visual information between participant and experimenter. Participants must move objects according to the experimenter' s instructions. For example, in Wang et al.' s (2019) study, two balls were placed on the shelf, but the smaller ball was not visible to the experimenter. When the experimenter instructed "move the small ball left," participants often ignored the fact that the experimenter could only see the larger ball and moved the smaller ball instead. These results demonstrate that participants frequently rely on their own visual information without considering the experimenter' s perspective, thereby exhibiting egocentric bias.

Some researchers argue that findings from this paradigm support the inhibitive selection model. Samuel et al. (2019) contend that in the director task, the cost of shifting from one's own perspective to another's is asymmetric with the reverse

shift, with the former requiring greater cognitive effort. When participants must inhibit their more salient perspective to adopt another' s, this inhibitory process makes reasoning more difficult.

However, other researchers maintain that the director task results support fluency misattribution theory. Pile et al. (2017) used the director task to examine whether social anxiety affects the accuracy of perspective taking. They found that young adults with high social anxiety showed greater egocentric bias. This occurs because high social anxiety involves a negative bias toward social situations, reducing motivation for active social engagement and making self-generated information more salient, thereby increasing susceptibility to fluency misattribution (Creswell et al., 2014).

2.4 Ambiguous Number Paradigm

Researchers using the ambiguous number paradigm have found that people are susceptible to their own perspective during Level-2 visual perspective taking (Millett et al., 2020; Surtees et al., 2013; Surtees et al., 2016). In this paradigm, participants must determine whether a virtual human sees a number as 6 or 9. In consistent conditions, the number is presented vertically, so both participant and virtual human see the same digit (either 6 or 9). In inconsistent conditions, the number is presented horizontally, creating different percepts (when the participant sees 6, the virtual human sees 9, and vice versa). Results show that participants have greater difficulty judging the number seen by the virtual human in inconsistent conditions, demonstrating egocentric bias.

Some researchers argue that findings from this paradigm support the inhibitive selection model. Elekes et al. (2016) propose that in the ambiguous number paradigm, participants can activate available information based on current contextual cues (e.g., the virtual human' s different viewing angle). This activated information includes both self-perspective and other-perspective information. When reasoning about the other' s perspective, participants must inhibit their already-activated self-perspective that conflicts with the other' s view. Insufficient or failed inhibition produces egocentric bias.

Nevertheless, some researchers contend that this paradigm's results also support fluency misattribution theory. Todd et al. (2019) combined the ambiguous number paradigm with response deadline techniques and found that when response time was limited, participants' inferences about the virtual human' s perspective decreased significantly. Under time pressure, participants' own perspective information became more comprehensive, salient, and easier to integrate.

3 Factors Influencing Egocentric Bias

Since egocentric bias may result from both inhibitive selection and fluency misattribution, factors affecting these two processing mechanisms also influence the emergence and magnitude of egocentric bias. Based on previous research, the physiological and social similarity between participants and perspective-taking

targets, participants' developmental stage, and cultural background all affect inhibitive selection and fluency misattribution. The following sections examine the primary factors influencing egocentric bias.

3.1 Physiological Similarity of Cues

Existing research indicates that greater differences in external features between the perspective-taking target and the participant make it more difficult for participants to understand the target' s perspective, thereby increasing egocentric bias (Ganesh et al., 2015; Muto et al., 2018). For example, Kessler and Thomson (2010) asked participants to judge whether objects on a table were to the left or right of a perspective-taking target. When the target changed from a cartoon character to an empty chair, participants' egocentric bias increased significantly. Compared to cartoon characters, chairs lack human features, making it more difficult for participants to inhibit interference from self-generated information when taking their perspective.

Ganesh et al. (2015) further investigated the influence of perspective-taking targets by examining their relationship to the self. Results showed that participants performed better when the perspective-taking target was their own photograph compared to another person' s photograph. This suggests that people have difficulty understanding perspectives of dissimilar individuals. When attempting to understand dissimilar others' perspectives, inhibiting self-generated information consumes substantial cognitive resources, resulting in greater egocentric bias. These findings support the inhibitive selection model.

3.2 Social Relevance of Cues

Higher social similarity between perspective-taking targets and participants leads participants to more readily adopt their own perspective, resulting in greater egocentric bias (Cakal et al., 2021; Simpson & Todd, 2017). For instance, Simpson and Todd (2017) asked university students from two schools to take the perspectives of symbols representing each school. Results showed that when taking the perspective of their own school' s symbol, participants were more likely to use their own perceptual information to reason about the symbol' s perspective, exhibiting greater egocentric bias.

Abbate et al. (2019) asked participants to adopt the perspective of outgroup members (people from other countries) to complete dialogues and imagine how others would view certain issues. Results indicated that participants relied more on group knowledge (e.g., stereotypes) to infer others' mental states and less on their own understanding, making them less susceptible to egocentric bias interference. Klimecki (2019) similarly found that during perspective taking, participants were more likely to believe that ingroup members shared their own perspective compared to outgroup members, leading to erroneous use of their own perspective and producing egocentric bias. These results support fluency misattribution theory.

3.3 Age and Individual Development

Individuals' inhibitory control abilities strengthen with age, leading to a reduction in egocentric bias across development, though this bias never completely disappears (Martin et al., 2019; Zhao et al., 2018). Zhao et al. (2018) administered the director task to 8- and 10-year-old children and found that 10-year-olds demonstrated superior perspective-taking abilities compared to 8-year-olds, indicating that egocentric bias decreases significantly with age.

Adopting a lifespan developmental perspective, Bernstein et al. (2011) measured perspective-taking abilities in participants aged 3 to 95 years and discovered for the first time that egocentric bias follows a U-shaped trajectory across the lifespan—it emerges at age 3, declines by age 5, stabilizes and persists throughout adulthood, and increases again in older age. The enhanced egocentric bias in older adults may result from memory decline, causing them to forget their initial predictions about others and reconstruct their inferences using outcome information. Alternatively, it may stem from declines in inhibitory control, making it difficult for them to suppress their own perspective. This interpretation supports the inhibitive selection model.

3.4 East-West Cultural Characteristics

Culture profoundly influences the ability to overcome egocentric bias, though the findings are complex (Wang et al., 2021; Zhai et al., 2021). Markus and Kitayama (1991) found that Western cultures typically emphasize self-focus, while East Asian cultures emphasize other-focus and group orientation. Consequently, individuals from East Asian cultural backgrounds show less erroneous information selection during perspective taking and are less disturbed by egocentric bias compared to those influenced by Western cultures. Chopik et al. (2017) asked participants from 63 countries to infer others' thoughts in specific situations and found that participants from individualistic countries performed worse on perspective-taking tasks than those from collectivistic countries. This suggests that individualism makes one' s own perspective more salient and fluent during perspective taking, increasing susceptibility to egocentric bias.

However, Wang et al. (2019) used the dot-probe paradigm and director task to compare university students from the United Kingdom and Taiwan, finding that both groups exhibited similar egocentric bias across both tasks. This finding diverges from previous research. Whether East-West cultural differences lead to different patterns of egocentric bias and how cultural factors influence egocentric bias through inhibitive selection or fluency misattribution require further investigation.

4 Inhibition-Attribution Collaboration Model

The debate between the inhibitive selection model and fluency misattribution theory has intensified in recent years, with each theoretical perspective receiving

substantial empirical support. Moreover, findings from paradigms such as the director task and ambiguous number paradigm can be interpreted by both theories. Based on previous research, we hypothesize that the inhibitive selection model, which emphasizes inhibitory processes, and fluency misattribution theory, which emphasizes integration processes, may not be mutually exclusive but rather work collaboratively to produce egocentric bias. Therefore, we propose an integrative framework to bridge these theoretical disputes.

FeldmanHall and Shenhav (2019) proposed a three-stage model of automatic reasoning and perspective taking to reduce social uncertainty. This model suggests that interacting with others is one of humanity's most inherently uncertain behaviors. People are motivated to engage in social interaction by external incentives and interact with others in ways that reduce uncertainty. Specifically, reasoning about others' perspectives involves three stages: (1) an automatic reasoning process, where individuals rapidly narrow their inferences about others using past knowledge and current contextual cues, reflecting the rapid integration of prior knowledge and most accessible environmental information; (2) a controlled reasoning process, where individuals attempt to understand the current environment from others' perspectives and judge their likely behaviors and emotional responses, thereby refining their inferences by perceiving others' thoughts and viewpoints; and (3) a feedback-based learning process, where individuals update their predictions based on new knowledge or feedback about others' behaviors to better infer others' perspectives. Stages (1) and (2) are not entirely separate but occur largely simultaneously. However, this model focuses on explaining the process of reasoning about others and cannot account for the mechanisms underlying egocentric bias.

Drawing on FeldmanHall and Shenhav's (2019) model, we propose the inhibition-attribution collaboration model (see Figure 1 [Figure 1: see original paper]). Specifically, when encountering highly uncertain perspectives from others, people struggle to accurately infer others' viewpoints in a given situation. At this point, the inhibitive selection model and fluency misattribution may produce egocentric bias through three processing pathways:

(1) Individuals make initial judgments about the environment using prior knowledge and current information. This reasoning process is automatic, rapid, but low in accuracy because individuals primarily consider problems from their own perspective. When inferring others' perspectives, individuals must first inhibit their own viewpoint. If self-perspective inhibition is successful, uncertainty in judgment is significantly reduced, enabling correct understanding of others' perspectives. For example, in the dot-probe paradigm, participants can typically inhibit their own perspective successfully, consider problems from others' viewpoints, and respond correctly (Francois & Rossetti, 2020; Santiesteban et al., 2017; Surtees & Apperly, 2012).

(2) When individuals cannot inhibit self-generated information, they must process conflicts between their own and others' perspectives during per-

spective taking. At this point, uncertainty remains high when reasoning about others' perspectives. If individuals can make correct choices between these conflicting perspectives—that is, correctly attribute others' viewpoints—uncertainty in visual perspective taking decreases. Individuals can successfully complete visual perspective taking without exhibiting egocentric bias. Research has found that when inferring outgroup members' beliefs, participants' own information is more fluent and salient, and inhibiting self-generated information consumes substantial cognitive resources. However, because outgroup members' beliefs differ substantially from their own, participants can still correctly attribute outgroup members' perspectives, thereby avoiding egocentric bias interference (Abbate et al., 2019; Klimecki, 2019).

(3) When individuals cannot inhibit self-generated information and make attribution errors, egocentric bias emerges. In this situation, self-generated information is more salient and fluent, making it difficult for individuals to inhibit. Moreover, under high uncertainty, individuals struggle to make correct choices between conflicting self- and other-perspectives, leading them to misattribute their own perspective as belonging to others, ultimately producing egocentric bias. For example, previous research has found that when virtual humans are replaced with non-social objects such as chairs or arrows, participants have greater difficulty inhibiting interference from their own perspective and are more likely to exhibit egocentric bias (Kessler & Thomson, 2010; Wilson et al., 2017).

Inhibitive selection and fluency misattribution jointly constrain people' s inferences about others'perspectives, thereby reducing uncertainty about others'viewpoints. This reasoning process also depends on learned predictions about others' potential perspectives. For instance, people make predictions based on others'social group membership (Abbate et al., 2019; Klimecki, 2019). These predictions can provide feedback through two pathways to update visual perspective-taking processes in real time: (1) direct observation of others' perspectives and behaviors in specific situations, and (2) updating of prior knowledge about others (Debiec & Olsson, 2017; Frith & Frith, 2006). Through these pathways, individuals combine new evidence with prior reasoning to update predictions about others' viewpoints and perspectives, thereby achieving accurate inference.

Figure 1. The Inhibition-Attribution Collaboration Model

5 Summary and Outlook

Research on egocentric bias reveals limitations in human visual perspective-taking abilities and provides an important entry point for understanding human social interaction. Previous studies have examined egocentric bias using numerous experimental paradigms and identified several key influencing factors. However, debate continues regarding whether egocentric bias originates from the inhibitive selection model or fluency misattribution theory. Based on our

review and synthesis of relevant research, we propose that future studies on egocentric bias could advance in three main directions:

First, researchers should explore the roles of domain-general versus domain-specific interference in egocentric bias. The inhibitive selection model suggests that perspective-taking findings do not support domain-general memory interference but rather reflect engagement in domain-specific social behaviors (e.g., reasoning about others' perspectives). Specifically, participants can consider both their own and others' perspectives simultaneously but must inhibit their own perspective; otherwise, egocentric bias emerges during visual perspective taking (Surian & Franchin, 2020). Fluency misattribution theory implies that domain-general attentional processes modulate visual perspective-taking performance—when participants fail to attend to others' perspectives, they are more likely to use self-generated information and make erroneous judgments (Santiesteban et al., 2017). However, the boundaries between domain-general and domain-specific interference effects on egocentric bias remain unclear. Therefore, future research attempting to dissociate the inhibitive selection model and fluency misattribution theory should also examine the contributions of these two factors.

Second, research should investigate egocentric bias within Chinese cultural contexts. How cultural factors influence egocentric bias through inhibitive selection or fluency misattribution remains unclear. Moreover, most current research has focused on Western countries, with relatively few studies conducted in China. Future research should adopt big-data, multi-center approaches to deeply examine egocentric bias in Chinese cultural contexts and conduct cross-cultural comparisons with Western samples. For example, traditional Chinese group consciousness and conformity mentality, compared to Western independent consciousness and individualism, represent deeper psychological factors more stable than cultural frameworks (Chopik et al., 2017). Given the important role of visual perspective taking in daily social communication, future research should reveal different manifestations of egocentric bias across cultural and social environments. Such research will provide guidance from broader and more representative dimensions for understanding how cultural factors influence egocentric bias.

Third, researchers should explore how reducing egocentric bias can promote social interaction. Since egocentric bias hinders visual perspective-taking processes, can interventions reduce egocentric bias and thereby facilitate social interaction? Preliminary research supports this hypothesis. For example, Van Mier (2019) found that in a haptic parallelity task, the egocentric reference frame is primarily hand-centered. When participants grasped a handrail, their egocentric bias decreased significantly compared to when they placed their hand flat on the handrail. However, such studies on overcoming egocentric bias remain relatively scarce. Future research should explore methods to reduce or overcome egocentric bias to promote social interaction.

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Note: Figure translations are in progress. See original paper for figures.