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Brief article

Anxiety impairs spontaneous perspective calculation: Evidence from a level-1 visual perspective-taking task

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ABSTRACT

Reasoning about other people's mental states is central to social life. Yet, even neuro-typical adults sometimes have perspective-taking difficulties, particularly when another's perspective conflicts with their own. In two experiments, we examined the cognitive mechanisms underlying an affective factor known to hinder perspective taking in adults: anxiety. Using a level-1 visual perspective-taking task, we found that incidentally experiencing anxiety, relative to neutral feelings and anger, impaired the spontaneous calculation of what another social agent can see. Feeling anxious did not, however, impede perspective calculation with a non-social entity, suggesting that anxiety's disruptive effects may be particularly pronounced for social aspects of cognition. These findings help elucidate the mechanisms underlying the effects of incidental emotions on perspective taking and inform debates about "implicit" forms of mentalizing.

1. Introduction

Reasoning about the content of other people's minds – often called mentalizing or perspective taking – is central to managing most aspects of social life. Yet, at times, even neuro-typical adults err in such endeavors, particularly if others' perspectives conflict with their own (Birch & Bloom, 2004; Nickerson, 1999). When might these mentalizing difficulties be exacerbated? Recent evidence suggests that particular emotions can hinder perspective taking (e.g., Bukowski & Samson, 2016; Converse, Lin, Keysar, & Epley, 2008). In one set of experiments, for example, anxiety – a high-arousal emotion triggered by situations that are novel, threatening, or otherwise have the potential for adverse outcomes (Brooks & Schweitzer, 2011) – impeded adults' ability to infer others' spatial perspectives and beliefs (Todd, Forstmann, Burgmer, Brooks, & Galinsky, 2015). Our aim here was to shed light on the mechanisms underlying these anxiety-induced perspective-taking difficulties.

Abundant research has sought to elucidate the cognitive processes underlying mentalizing (see Apperly, 2010, for a review). On one notable view, ascribing mental states to oneself and others involves two distinct processes: an implicit *calculation* of candidate mental contents (e.g., what a person sees, knows, or wants) and an explicit *selection* of the most plausible among these candidates while inhibiting competitors (Leslie, Friedman, & German, 2004; Leslie, German, & Polizzi, 2005; see also Apperly & Butterfill, 2009). Because most mentalizing tasks, including those used by Todd et al. (2015), assess both the calculation and selection of another person's perspective while inhibiting one's own perspective, they necessarily conflate these processes (Ramsey, Hansen, Apperly, & Samson, 2013). With the rise of indirect measures of perspective taking that monitor eye gaze (e.g., Rubio-Fernández, 2013; Schneider, Bayliss, Becker, & Dux, 2012) and other spontaneous behaviors (e.g., Cohen & German, 2009; Kovács, Téglás, & Endress, 2010), however, distinguishing among these processes is possible.

Samson, Apperly, Braithwaite, Andrews, and Bodley Scott (2010) recently introduced one such measure: a level-1 visual perspective-taking (hereafter, L1-VPT) task[1] wherein adults view a human avatar in a room with dots on the walls. On some trials, the avatar and participants can see the same number of dots; on other trials, the avatar cannot see some of the dots that are visible to participants. Two interference effects commonly emerge in this task: First, responding from the avatar's perspective is more difficult when it conflicts with what participants themselves can see. This *egocentric* intrusion resembles other egocentric biases commonly found on tasks requiring explicit judgments of others' perspectives (e.g., Epley, Keysar, Van Boven, & Gilovich, 2004; Keysar, Lin, & Barr,

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[1] Level-1 VPT entails understanding *what* someone sees; this can be contrasted with level-2 VPT, which entails understanding *how* someone sees something (Flavell, Everett, Croft, & Flavell, 1981).

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2003; Todd, Hanko, Galinsky, & Mussweiler, 2011). Second, reporting one's own perspective is more difficult when it conflicts with what the avatar can see. This *altercentric* intrusion is thought to reflect a rapid and efficient consideration of the avatar's visual perspective and thus provides an indirect measure of spontaneous perspective calculation (e.g., Qureshi, Apperly, & Samson, 2010; Ramsey et al., 2013; Smith & Mackie, in press). We used this L1-VPT task in the current work to examine the effects of incidental experiences of anxiety (i.e., anxiety triggered in an unrelated prior context; Bodenhausen, 1993) on processes of perspective calculation and perspective selection.

How might feeling anxious affect these processes? Based on prior findings suggesting that anxiety increases egocentric biases in explicit forms of mentalizing (Todd et al., 2015), we anticipated that experiencing anxiety would increase the relative difficulty of judging the avatar's perspective when it conflicts with one's own perspective versus when self and other perspectives are aligned (i.e., anxiety should increase egocentric intrusion). Insofar as these anxiety-induced deficits in explicit mentalizing are accompanied by, or even rooted in, complementary changes in implicit cognitive processes (see Gawronski & Bodenhausen, 2006), moreover, anxiety might also be expected to weaken spontaneous tendencies to calculate others' perspectives. This proposition accords with evidence of comparable effects of incidental emotions on explicit and implicit social judgments (e.g., Bodenhausen, Sheppard, & Kramer, 1994; DeSteno, Dasgupta, Bartlett, & Cajdric, 2004). On this *perspective-calculation* account, feeling anxious, despite increasing egocentric intrusion, should *decrease* altercentric intrusion. Note that anxiety-impaired perspective calculation could also be revealed by an increased difficulty in judging the avatar's perspective even when it aligns with one's own perspective. An effect here where there is no perspective conflict to resolve—and thus little need to recruit effortful processes—may also reflect deficiencies in a rapid and efficient form of perspective calculation (Ramsey et al., 2013; Samson et al., 2010).

An alternative hypothesis derives from research linking anxiety to decrements in executive functioning (Eysenck, Derakshan, Santos, & Calvo, 2007; Shields, Moons, Tewell, & Yonelinas, in press). In line with theoretical claims that perspective selection (but not perspective calculation) is cognitively demanding (e.g., Apperly & Butterfill, 2009; Leslie et al., 2004, 2005), one study found that taxing participants' executive resources (via a dual-task procedure) increased the difficulty of responding when the avatar's perspective was in conflict with one's own, regardless of whose perspective was under consideration (Qureshi et al., 2010). On this *perspective-selection* account, the executive deficits that typically accompany anxiety should impair the ability to select among competing perspectives. In this case, then, feeling anxious would be expected to increase the difficulty of responding whenever there is a self–other perspective conflict to resolve, thereby producing increases in both egocentric intrusion and altercentric intrusion.

We tested these different predictions in three experiments wherein participants underwent an emotion induction, after which they completed Samson et al.'s (2010) L1-VPT task. In Experiment 1, we compared anxiety with neutral feelings. In Experiment 2, we compared anxiety with anger. Additionally, in Experiment 2b, we tested whether any observed effects of anxiety on L1-VPT could be accounted for by more domain-general cognitive processes rather than processes that are specific to social cognition.

2. Experiment 1

2.1. Method

2.1.1. Participants

Native English-speaking undergraduates ($N = 152$) participated for course credit. We excluded data from 1 participant who did not complete the emotion induction and 4 participants who made errors on >30% of trials on the L1-VPT task (Samson et al., 2010), leaving a final sample of 147 (82 women, 62 men, 3 unreported).

2.1.2. Procedure

2.1.2.1. Emotion induction. Participants first underwent an emotion induction. They described in detail a time when they felt very *anxious* (instructions adapted from Cataldo & Cohen, 2015) or, in a *neutral-emotion* condition, what they did the previous day. Prior research has found that this type of autobiographical recall task is a valid means of inducing specific incidental emotions, including anxiety-related states (Lench, Flores, & Bench, 2011).

2.1.2.2. L1-VPT task. Next, participants completed an L1-VPT task (Samson et al., 2010). They saw a room with dots on the left and right walls. A human avatar stood in the center of the room facing left or right. On *other* trials, participants responded from the avatar's perspective; on *self* trials, participants responded from their own perspective. Additionally, on *consistent* trials, the number of dots visible to the avatar was identical to the number visible to participants; on *inconsistent* trials, the avatar could not see some of the dots that were visible to participants. Each trial began with a fixation cross (500 ms), followed by a cue ("YOU" or "HE") indicating whose perspective to respond from (750 ms), and then another cue (0–3) indicating the number of dots to verify (750 ms). Finally, the room appeared (on screen until participants responded). Participants' objective was to verify if the number of dots on the wall matched or mismatch the given number by pressing one of two response keys as quickly and accurately as possible. Match and mismatch trials occurred with equal frequency, but only match trials were analyzed (Fig. 1 displays the different types of match trials[2]). If participants did not respond within a response deadline (2000 ms), a message ("Please try to respond faster!") appeared (1000 ms), after which the next trial began. Incorrect responses triggered a red "X" (1000 ms), after which the next trial began. Participants completed four equivalent blocks of 52 experimental trials; within-block trial order was pseudo-randomized (see Samson et al., 2010, for details). Sixteen practice trials preceded the first block of experimental trials.

2.1.2.3. Manipulation check. Finally, participants indicated how much the event they described made them feel several specific emotions (1 = *not at all*, 7 = *very much so*). We averaged the anxiety (*anxious*, *fearful*, *nervous*; $\alpha = 0.85$) and neutral (*calm*, *neutral*, *unemotional*; $\alpha = 0.69$) items.

2.2. Results

2.2.1. Manipulation check

Experienced anxiety was higher, whereas experienced neutrality was lower, in the anxiety versus the neutral-emotion condition, ($ps < 0.001$, Hedges' $gs > 1.24$). Furthermore, participants in the anxiety condition reported greater anxiety than neutral feelings, whereas participants in the neutral condition reported greater neutral feelings than anxiety ($ps < 0.001$, $gs > 0.79$). Table 1 displays descriptive statistics for all experiments; additional content analyses of the emotion-induction essays appear in the Supplemental Material.

2.2.2. L1-VPT

We excluded mismatch trials because of systematic differences across trial types (see Samson et al., 2010, for details). We also

[2] For interpretation of color in Fig. 1, the reader is referred to the web version of this article.