

# In the Mood to Get Over Yourself: Mood Affects Theory-of-Mind Use

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Understanding others' behavior often involves attributing mental states to them by using one's "theory of mind." We argue that using theory of mind to recognize differences between one's own perspective and another's perspective is a deliberate process of inference that may be influenced by incidental mood. Because sadness is associated with more systematic and deliberate processing whereas happiness is associated with more heuristic processing, we predicted that theory-of-mind use would be facilitated by sadness compared with happiness. Two experiments supported this prediction, demonstrating that participants were more likely to utilize knowledge about others to make inferences about their mental states when they were induced to feel sad than when they were induced to feel happy. These results provide both theoretical insight into the psychological mechanisms that govern theory of mind as well as practical insight into a common source of variability in its use.

*Keywords:* egocentrism, theory of mind, perspective-taking, mood, heuristics

Reasoning about others' mental states is an inescapable feature of everyday life. An ambiguous joke following a manuscript rejection can leave one wondering whether a colleague meant to be light hearted or vindictive. A date's raised eyebrows can leave one wondering whether a new outfit is shockingly attractive or just shocking. Such mental state inferences occur across a wide spectrum of affective experiences. Dejected academics and giddy romantics alike infer the mental states of their colleagues and companions. Being emotional does not excuse one from making inferences about other minds. We argue that it does, however, alter *how* people make these inferences.

## Theory of Mind and Mental Effort

Attributing beliefs, desires, and intentions to others requires distinguishing between one's own and others' mental states. To do so, one must construct a representation of another's mental states that avoids relying on unshared, egocentric knowledge. Such theory-of-mind use is pervasive and often efficient, prompting scholars to suggest that it is governed by a universal mental module (Fodor, 1985; Friedman & Leslie, 2004; Sperber & Wilson, 2002; cf., Apperly, Samson, & Humphreys, 2005) that allows for rapid and automatic reasoning about other minds without effortful attention (Stone, Baron-Cohen, & Knight, 1998).

Experimental evidence, however, calls this automaticity hypothesis into question. For instance, people respond slower to questions that require theory-of-mind use than to questions that do not (Apperly, Riggs, Simpson, Samson, & Chiavarino, 2006), and use knowledge about others' beliefs to understand spoken communication only after adjusting an initial egocentric interpretation (Epley, Morewedge, & Keysar, 2004; Keysar & Barr, 2002). Consequently, people who are distracted or asked to respond quickly are less likely to use what they know about others to make mental state inferences (Epley, Keysar, Van Boven, & Gilovich, 2004; Lin, Keysar, & Epley, 2008).

The apparent resource dependence of reconciling one's own perspective with another's perspective is inconsistent with purely automatic accounts of belief reasoning.<sup>1</sup> It suggests instead that constructing inferences about others' mental states requires effortful reasoning to inhibit and correct an initial, often egocentric, default (Epley, Keysar, et al., 2004; Keysar & Barr, 2002). This is consistent with various dual-process accounts of judgment in which an automatic default inference must be overcome by deliberate processing (e.g., Chaiken & Trope, 1999; Kahneman, 2003; Sloman, 1996).

## Mood and Cognitive Processing

Incidental mood could provide insight into the psychological mechanisms that govern theory-of-mind use. Research demonstrates that happiness diminishes the likelihood of engaging in deliberate processing (e.g., Bless & Igou, 2005; Bodenhausen, Mussweiler, Gabriel, & Moreno, 2001; Forgas, 1995), and hinders executive control (Oaksford, Morris, Grainger, & Williams, 1996; Phillips, Bull, Adams, & Fraser, 2002). If employing one's theory of mind requires deliberate processing, then happy people should

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<sup>1</sup> Although automaticity is a central component of modularity, demonstrations of deliberate components of theory-of-mind use do not preclude all modular accounts. Some specify a two-step process that is not necessarily inconsistent with our proposal (e.g., Friedman & Leslie, 2004).

employ their theory of mind less than should sad people. That is, happy people should be less likely to use what they know about others' beliefs to make mental-state inferences. Such mood effects would be inconsistent with a purely automatic account of theory-of-mind use, but would be consistent with dual-process accounts of theory-of-mind use.

### Experiment 1

One hallmark of a developed theory of mind is the ability to distinguish between what one knows and what others know. The false-belief task (Wimmer & Perner, 1983) is the most common test for this ability in children, and a modified version demonstrates that even adults have difficulty completely disregarding private knowledge when reasoning about false beliefs (Birch & Bloom, 2007).

The modified task for adults was originally designed to investigate a specific *curse-of-knowledge* bias (Nickerson, 1999) by comparing conditions of knowledge with conditions of naivety (Birch & Bloom, 2007). We modified it further to detect more general variation in theory-of-mind use. Adults read one of two versions of a short scene and then predicted a protagonist's behavior. In our task, the protagonist had the same knowledge in both versions but participants received different privileged knowledge. Diminished theory-of-mind use would be reflected by an increased reliance on one's own private knowledge. We predicted that happy participants would be less likely to employ theory of mind, and therefore be more influenced by their own private knowledge, than would sad participants.

### Method

#### Participants

One hundred University of Chicago students participated in exchange for \$4.

#### Procedure

This  $2 \times 2$  between-subjects experiment included a mood induction and a false-belief task, presented as two unrelated studies.

**Mood induction.** As part of an "audio equipment evaluation," participants first evaluated the quality of a pair of headphones. Participants in the happy condition picked one song from a list of five "happy" songs. Participants in the sad condition picked one song from a list of five "sad" songs. Song lists were preselected to invoke the desired mood, based on informal pretesting. Participants then answered two headphone-evaluation questions, and an abbreviated Positive and Negative Affect Schedule (PANAS) scale as a manipulation check (*calm, happy, angry, sad, excited, and anxious*; Watson, Clark, & Tellegen, 1988).

**False-belief task.** Participants then moved to another cubicle for an ostensibly unrelated "second study" and received materials showing two panels of a scene (see Figure 1). All participants saw Panel 1 and read, "This is Vicki. She finishes playing her violin and puts it in the blue container. Then she goes outside to play." Participants then saw one of two randomly assigned versions of Panel 2, which manipulated their knowledge of the box that contained the violin. Participants in the blue-box condition read: "While Vicki is outside

playing, her sister, Denise, comes into the room." Participants in the red-box condition read: "While Vicki is outside playing, her sister, Denise, moves the violin to the red container." All participants then read: "Then, Denise rearranges the containers in the room until the room looks like the picture below." The picture depicts Denise in the room, with the boxes rearranged. Critically, the red box in Panel 2 sits where the blue box was in Panel 1, making it plausible that Vicki might look in the red box.

All participants read, "When Vicki returns, she wants to play her violin. What are the chances Vicki will first look for her violin in each of the above containers?" Participants wrote their percentage likelihood estimates in the spaces beneath each box.

The critical dependent variable was participants' estimated likelihood that Vicki will look in the red box. Absolute predictions about Vicki's behavior can be influenced by countless factors (e.g., Will she notice the boxes have been moved?), but the important measure for our hypothesis is the difference in estimates between the two private-knowledge conditions. If likelihood-of-looking estimates are higher for those who know it is in the red box than for those who know it is in the blue box, this would reflect egocentrism. To the extent that theory of mind is used to consider only what Vicki believes, the influence of private knowledge will be decreased. We predict less deliberate reasoning when participants are happy than when sad, and therefore greater private-knowledge use when happy than when sad.

### Results and Discussion

Three participants whose false-belief-task responses were more than 3 *SDs* from the overall mean were removed from all analyses.

#### Mood Manipulation Checks

Participants reported being happier in the happy condition ( $M = 3.65$ ,  $SD = 0.72$ ) than in the sad condition ( $M = 2.29$ ,  $SD = 0.90$ ),  $t(95) = 8.23$ ,  $p < .001$ , and reported being sadder in the sad condition ( $M = 2.54$ ,  $SD = 0.99$ ) than in the happy condition ( $M = 1.37$ ,  $SD = 0.67$ ),  $t(95) = 6.87$ ,  $p < .001$ . Participants also reported being significantly more excited in the happy condition ( $M = 2.49$ ,  $SD = 1.04$ ) than in the sad condition ( $M = 1.48$ ,  $SD = 0.65$ ),  $t(95) = 5.71$ ,  $p < .001$ . There were no other between-condition mood differences,  $t_s < 1$ .

#### False-Belief Task

We predicted that participants in the happy condition would be more influenced by their privileged location knowledge when estimating the likelihood that Vicki would look in the red box than would participants in the sad condition. A  $2$  (mood: happy vs. sad)  $\times 2$  (location knowledge: red box vs. blue box) between-subjects analysis of variance (ANOVA) yielded a significant main effect of location knowledge,  $F(1, 93) = 5.53$ ,  $p = .02$ , qualified by the predicted interaction,  $F(1, 93) = 4.25$ ,  $p < .05$ . Participants in the happy condition predicted that Vicki was more likely to look in the red box when they knew the violin was in the red box ( $M = 21.01$ ,  $SD = 18.49$ ) than when they knew it was in the blue box ( $M = 7.71$ ,  $SD = 8.88$ ),  $t(47) = 3.19$ ,  $p < .01$ . Estimates in the sad condition, however, did not differ between participants who knew the violin was in the red box ( $M = 16.46$ ,  $SD = 17.30$ ) and those

[Panel 1] This is Vicki. She finishes playing her violin and puts it in the blue container. Then she goes outside to play.



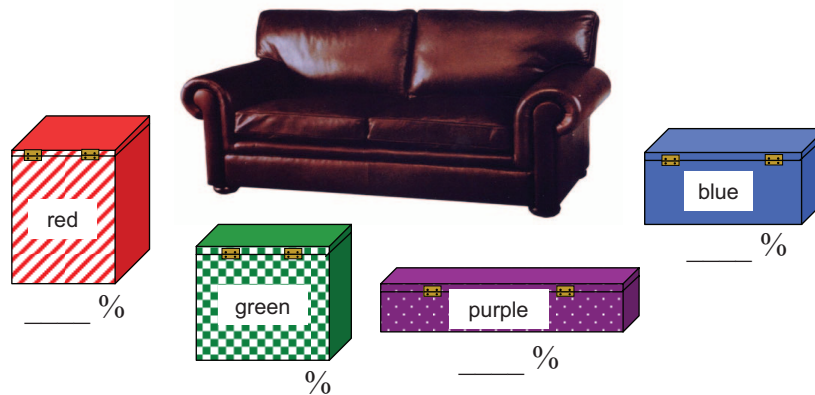
[Panel 2] While Vicki is outside playing, her sister, Denise, ...



[blue box condition] ... comes into the room.

[red box condition] ... moves the violin to the red container.

Then, Denise rearranges the containers in the room until the room looks like the picture below.



When Vicki returns, she wants to play her violin. What are the chances Vicki will first look for her violin in each of the above containers? Write your answers in the percentages in the spaces provided under each container.

*Note:* All participants saw Panel 1. Participants saw either the *blue-box* version or the *red-box* version of Panel 2. Color labels did not appear in the actual stimuli.

Figure 1. Modified false-belief task used in Experiment 1.

who knew it was in the blue box ( $M = 15.58$ ,  $SD = 12.48$ ),  $t(46) < 1$ , *ns*. These data suggest that participants were less likely to employ their theory of mind in the happy condition than in the sad condition.

We designed Experiment 2 to expand on these findings by examining a different context (communication), using a different mood induction (films), and utilizing more unobtrusive and online theory-of-mind measures (behavioral observation and eye-movement).

## Experiment 2

Language is inherently ambiguous. To communicate effectively, a listener may need to consider a speaker's knowledge or beliefs.

A date's comment about one's "fancy outfit," for instance, could be either sincere or sarcastic. Interpreting communication accurately often requires employing one's theory of mind to consider the speaker's beliefs, knowledge, or intentions.

We investigated how mood may influence the interpretation of communication by inducing happy or sad moods in participants playing a communication game. The participant and a confederate "director" sat on opposite sides of an array of objects. The participant followed the director's instructions to move some of these objects. Eleven of the 16 slots in the array were mutually visible, whereas the other 5 were visible to the participant but occluded from the director. This created a critical difference in perspective.

Egocentrism would be evident if participants thought that the director was talking about objects that were visible only to them (Keysar & Barr, 2002). For instance, the director might ask a participant to “move the candle.” On critical trials, a competitor object (e.g., a second candle) was included in the grid but occluded from the director. Relying on an egocentric default in this case would lead to confusion because there are two possible referents. To overcome egocentrism and find the director’s intended object, participants must use their theory of mind and rely only on what the director can see.

We evaluated egocentric interference in two ways, as well as the ability to recover from egocentric interference. First, we counted behavioral manifestations of egocentrism, such as reaching for the occluded object or asking for clarification. Second, we measured the time taken to identify the target object when a competitor was present versus absent. A longer delay, or more interference, indicates diminished theory-of-mind use. We indexed the ability to recover from initial egocentric processing by considering all trials in which participants fixated on competitors. When people look at an object, they may be considering it as a potential referent (Keysar, Barr, Balin, & Brauner, 2000; Spivey & Tanenhaus, 1998). When participants fixated on competitors but did not reach for them or ask for clarification, we considered it a case of recovery.

We expected that participants induced to feel happy would again be less likely to employ theory of mind and would therefore be more prone to egocentric interference. Experiment 2 also included a no-mood-induction control condition as an exploratory test of whether the results are produced primarily by the induction of happiness, of sadness, or both.

### Method

#### Participants

Fifty-three University of Chicago students participated in exchange for \$12. Data from 5 participants were discarded due to miscalibrated equipment (3) or early termination due to discomfort from the eye-tracker (2).

#### Apparatus

An SMI eye-tracker (SensoMotoric Instruments; Boston, MA) recorded participants’ eye movements. Participants wore a helmet with a small camera lens and a magnetic head-tracker that allowed for natural movement. A computer integrated eye and head position information to determine the gaze position and eye-fixation coordinates.

#### Procedure

**Training.** The director received a picture of the grid that illustrated, from her perspective, the desired final location of objects. The pair’s goal was to collaborate in moving objects around the grid to match the picture. Only the director could see the picture, but only the participant could touch the objects. The director therefore instructed the participant. A trained female confederate played the director, whom participants believed was a naïve participant. To ensure that participants understood the visual occlusions, the experimenter reiterated the director’s ignorance of

objects in the occluded slots, and participants experienced the director’s partially obstructed view by switching roles for one practice round.

**Mood induction.** Participants next watched one randomly assigned movie clip known to induce happiness (*When Harry Met Sally*; Reiner, 1989), sadness (*The Champ*; Zeffirelli, 1979), or neither (*Chicago Loop*; WTTW, 1996). We borrowed the first two from Gross and Levenson (1995), and validated all three in a separate pretest. To refresh mood states during the communication game, participants paused halfway through and spent 3 min thinking of events that corresponded with the mood in the movie. Participants in the neutral condition recalled the last items they purchased from the grocery store.

**Communication game.** Participants next played eight rounds of the communication game. For each round, there was a target object in one of the 11 mutually visible slots. Before receiving instructions, participants fixated on the center of the grid. Participants were free to move their eyes as soon as the director began the instructions. The director’s instructions for half of the trials were potentially confusing because a competitor object was present in one of the occluded slots (“competitor present”). There was no competitor present in the other trials (“competitor absent”). Target objects were presented in random order, except that no more than two target objects from the same condition appeared consecutively.

**Measures.** The behavioral index of egocentric interference was the number of trials in which each participant (a) reached for or moved the competitor or (b) asked the director for clarification. The latency to identify the target object was indexed by the participant’s final fixation on it before reaching. Eye fixations were coded within a temporal window that began at the noun phrase (e.g., the “c” in “candle”), and ended when the participant finally identified the target. In the few cases when participants did not fixate on the target, the hand touch was considered the end of the window. We counted a fixation on an object if the eye gaze remained in its slot for at least 100 ms consecutively. The delay caused by the presence of the competitor objects, measured by the time increase in competitor-present trials relative to competitor-absent trials, constituted our second measure of egocentric interference. The measure of recovery was the conditional probability, given fixation on the competitor, of resolving the interference without asking for clarification or reaching for the competitor.

### Results and Discussion

#### Egocentric Interference

**Egocentric behavior.** Without the competitor, participants showed no egocentric behavior. The presence of the competitor, however, resulted in significantly different levels of egocentric behavior in the three mood conditions,  $F(2, 45) = 4.98, p = .01$ . A planned comparison demonstrates that those in the happy condition behaved more egocentrically ( $M = 1.8, SD = 1.2$ ), across the four competitor-present trials than did those in the sad condition ( $M = 0.7, SD = 0.8$ ),  $t(30) = 2.89, p < .01$ . Participants in the happy condition also behaved more egocentrically than those in the neutral condition ( $M = 0.8, SD = 1.1$ ),  $t(30) = 2.39, p = .02$ . The sad and neutral conditions did not differ,  $t(30) < 1, ns$ .



**Delay.** To avoid inflating the effects with long latencies, we truncated them at 3 SDs from the mean. The presence of the competitor slowed final fixation on the target object more in the happy condition than in the sad condition (see Figure 2). We submitted the final-fixation times to a 3 (mood: happy, sad, neutral)  $\times$  2 (competitor: present vs. absent) mixed-model ANOVA, with competitor as a within-participants factor. This yielded a main effect for competitor,  $F(1, 45) = 34.24, p < .01$ , qualified by the predicted interaction,  $F(1, 45) = 4.69, p < .05$ . A planned 2 (mood: happy vs. sad)  $\times$  2 (competitor: present vs. absent) mixed-model ANOVA demonstrates that the delay in final fixations caused by the competitor was significantly larger in the happy than the sad condition,  $F(1, 30) = 5.68, p < .05$ . Exploratory 2  $\times$  2 ANOVAs demonstrated that the delay in the happy condition was also significantly greater than the delay in the neutral condition,  $F(1, 30) = 7.03, p < .05$ , but the sad and neutral conditions did not differ,  $F < 1$ .

### Recovery

The proportion of competitor-present trials that included fixation on a competitor was nearly identical across the three mood conditions (67%, 66%, 61%, for happy, sad, and neutral, respectively). Among those trials, recovery rates were lower in the happy condition (44%) than in the sad (76%),  $\chi^2(1, N = 85) = 9.07, p < .01$ , or neutral conditions (74%),  $\chi^2(1, N = 82) = 7.67, p < .01$ .

The three measures thus converge to show that participants in a happy mood are more prone to egocentric interference and less likely to recover from it than those in a sad mood. We also found that theory-of-mind use was disrupted by happiness more than it was facilitated by sadness compared to a neutral condition. We doubt this second finding is a systematic feature of judgment, but suspect that it is a product of this particular paradigm in which there may be relatively little room for improvement in performance relative to the baseline condition but considerable room for decrements in performance. Further research would be necessary to address this conclusively.

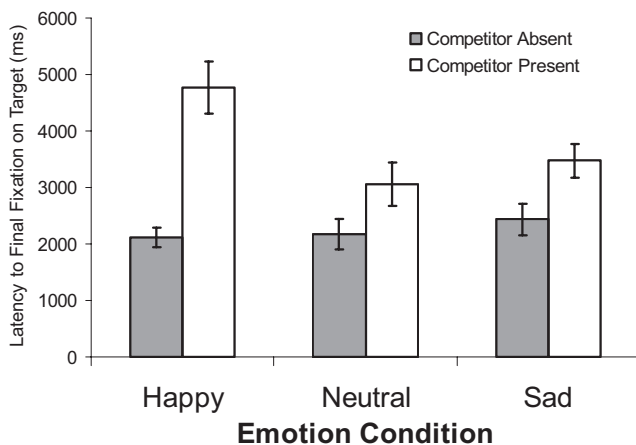


Figure 2. Latency to final fixation on target object (ms) as a function of mood (Experiment 2). Bars represent standard errors.

### General Discussion

People make inferences about others' mental states in a wide variety of moods. Our experiments suggest that these mood states have important consequences for mental-state inferences, such that those in a happy mood may be less likely to utilize their theory of mind than those in a sad mood. These results are important not only for the practical insights they provide into what affects everyday theory-of-mind use, but also for the theoretical insights into how people make mental state inferences in the first place. In particular, these results suggest that theory of mind requires deliberative processing to inhibit an egocentric assessment that is often more readily accessible than is specific knowledge about others. Happy people tend to rely on this egocentric default, whereas sad people incorporate knowledge about others more deliberately. These differential effects of mood are inconsistent with a purely automatic account of theory-of-mind use.

It is important to clarify that these results do not demonstrate that happiness will always increase egocentric bias, nor that egocentric bias will necessarily decrease accuracy. First, accuracy depends on the structure of the situation. Research often relies on tasks where one's own perspective differs from another's perspective. An egocentric process under these circumstances leads to mistaken inferences, but when perspectives overlap, egocentric reasoning should produce more accurate judgments (Hoch, 1987). Second, mental-state inferences need not always begin with an egocentric default, but may instead evoke rapidly accessible stereotypes when others appear to be very different from the self (Ames, 2004; Clement & Krueger, 2002). Happiness, compared with a neutral state (and presumably sadness as well), tends to increase stereotype use in judgment (e.g., Bodenhausen, Kramer, & Süsner, 1994). The general principle governing these findings is that happiness increases reliance on readily accessible defaults in judgment, whereas sadness diminishes reliance on such defaults (for a review, see Clore & Huntsinger, 2007). In mental-state inferences, happiness increases reliance on these defaults—be they stereotypes or egocentric knowledge—whereas sadness promotes the elaboration of individuating information about others' mental states through deliberate theory-of-mind use.

More practically speaking, these results provide insight into an important source of systematic variability in theory-of-mind use. In both of our experiments, people utilized their knowledge about others' knowledge when they were feeling sad and this made their inferences less biased. To the extent that individuals' mental states are discrepant, then, happy mind readers may find themselves sadly mistaken.

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