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# Early false-belief understanding in traditional non-Western societies

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The psychological capacity to recognize that others may hold and act on false beliefs has been proposed to reflect an evolved, species-typical adaptation for social reasoning in humans; however, controversy surrounds the developmental timing and universality of this trait. Cross-cultural studies using elicited-response tasks indicate that the age at which children begin to understand false beliefs ranges from 4 to 7 years across societies, whereas studies using spontaneous-response tasks with Western children indicate that false-belief understanding emerges much earlier, consistent with the hypothesis that false-belief understanding is a psychological adaptation that is universally present in early childhood. To evaluate this hypothesis, we used three spontaneous-response tasks that have revealed early false-belief understanding in the West to test young children in three traditional, non-Western societies: Salar (China), Shuar/Colono (Ecuador) and Yasawan (Fiji). Results were comparable with those from the West, supporting the hypothesis that false-belief understanding reflects an adaptation that is universally present early in development.

## 1. Introduction

Among the abilities that distinguish humans from our closest evolutionary relatives and all other animals is our capacity to represent and reason about the minds of our fellow humans. Some components of this ability, known as *theory of mind* or *psychological reasoning*, have evolutionary homologues in other species; for example, many animals are sensitive to cues of aggressive intent such as bared teeth, and cues of being seen such as gaze [1]. However, compared with other species, humans show an extraordinary facility with making inferences about the *beliefs* of others, and in particular, false beliefs [2,3]. The ability to track others' beliefs may yield significant fitness benefits in cooperation, competition, communication and cultural transmission [4–6]. For example, social learning in young children appears to gain a substantial boost from inferences about others' mental states [6,7]. However, despite hundreds of studies of false-belief understanding in children, controversy remains about just when and how this ability develops. Here, we present evidence




**Figure 1.** Maps showing the locations of the Salar (China), Shuar/Colono (Ecuador), and Yasawan (Fiji) field sites. (Online version in colour.)

from young children in three diverse, traditional, non-Western cultures which suggests that false-belief understanding emerges early in development as part of an evolved, species-typical adaptation for psychological reasoning.

The dominant view has been that false-belief understanding develops relatively late, at age 4 or 5 years, in Western populations. The primary evidence for this view derives from *elicited-response* tasks [8–13]. In these tasks, children are presented with a scene where an agent holds a false belief about some aspect of the scene, and they are asked a direct question about the agent's likely behaviour. For example [9], children listen to a story enacted with props: an agent hides her toy in one of two locations and leaves; in her absence, the toy is moved to the other location. Children are asked where the agent will look for her toy when she returns. At age 4 or 5, Western children typically answer correctly, pointing to the first location; by contrast, most 3-year-olds point to the second (current) location, suggesting that they do not yet understand that the agent will hold a false belief about her toy's location. Similar tasks with non-Western children have shown substantial cultural variability in development, with false-belief understanding emerging as late as 7 years of age in some societies [13–15]. Psychologists and anthropologists have suggested a variety of factors that might affect both the development of theory-of-mind abilities in childhood and their deployment in adulthood [16–18] (see the electronic supplementary material, §1). Taken together, this evidence suggests that false-belief understanding is acquired between about 4 and 7 years of age via culturally- or environmentally-driven domain-general learning processes.

However, recent evidence from *spontaneous-response* tasks in the West suggests that false-belief understanding may be present much earlier [19]. In these tasks, children are again presented with an agent with a false belief; instead of asking how the agent will act, however, investigators measure children's spontaneous responses to the unfolding scene. Many tasks focus on looking behaviours: for example, researchers measure *whether children look preferentially* at outcomes depicting the agent's likely actions (preferential-looking tasks), they record *where children look* as they anticipate which location the agent will approach (anticipatory-looking tasks) or they monitor *how long children look* when the agent's beliefs and actions are inconsistent (violation-of-expectation tasks). Positive results have been obtained using such tasks with Western children in the third [20–23], second [24–28] and even first [29,30] year of life. These results have led a number of researchers to question the dominant view and to propose that (i) false-belief understanding depends on evolved, domain-specific psychological-reasoning processes that emerge early in development [31,32], and (ii) compared with spontaneous-response tasks, elicited-response tasks are more challenging because they also involve executive functions, and so overwhelm young children's limited information-processing resources ([22,33]; for discussion and alternative interpretations, see [34–36]).

The present research sought to contribute new evidence to the ongoing debate over the developmental origins and universality of false-belief understanding by testing young children in non-Western societies with spontaneous-response tasks: until now, these tasks have been used exclusively with Western children. We reasoned that if performance in spontaneous-response tasks was cross-culturally variable, this would provide evidence that false-belief understanding is acquired via culturally- or environmentally-driven domain-general learning processes, with different societies showing different developmental trajectories. On the other hand, if children in traditional, non-Western societies succeeded at spontaneous-response tasks at the same early ages as Western children, this would provide evidence that false-belief understanding reflects an evolutionary adaptation for psychological reasoning that is universally present early in development.

We tested young children in three diverse, traditional, non-Western societies (figure 1): a Salar community in China, a Shuar/Colono community in Ecuador and a Yasawan community in Fiji (a fourth field site in Kenya produced no usable data, see the electronic supplementary material, §6). The Salar are a Turkic-speaking ethnic minority in rural north-west China who live in small, traditional settlements. The Shuar/Colono community is a mix of native Amazonians (Shuar), who were traditionally hunter-horticulturalists, and Ecuadorian immigrants from the Andes (Colono), both of whom now practice small-scale agriculture in the rural Amazon region. Our Fijian sample was from a small village in the Yasawa Island chain, separated from mainland Fijian society. Although these societies are very different in culture and language, they all diverge from the West along several dimensions that could be critical for cognitive development: they are small, rural, non-industrialized, non-wealthy communities, with low levels of formal education [37]. Given the vast disparities among these societies, and between them and the West, spontaneous-response tasks with young children in these societies provided a strong test between the two competing views above.

## 2. Methods and results

We adapted three spontaneous-response false-belief tasks developed at the University of Illinois Infant Cognition Laboratory: a verbal preferential-looking task [22], a verbal anticipatory-looking task [21] and a largely non-verbal violation-of-expectation task [25]. Children were tested in Salar (Salar), Spanish (Shuar/Colono) or the Fijian dialect of their village (Yasawan) (see the electronic supplementary material, §§3–5). Data for all three studies are available on the project website at http://www.philosophy.dept.shef.ac.uk/culture&mind/Data.

### (a) Verbal preferential-looking task

The verbal preferential-looking task [22] exploited children's well-established tendency to look preferentially at scenes that match the utterances they hear [38]. Children listened to a false-belief story involving two characters, C1 and C2 (for expository ease, all descriptions in this report involve females). In the story, C1 hid an object in one of two containers; in her absence, C2 moved the object to the other container. The story was accompanied by a picture book with 8–10 double-pages that presented photos of local actors and objects. The initial double-pages introduced the characters (*introduction* trials) and set up the story (*set-up* trials); in each set-up trial, one photo matched the storyline (matching picture) and one was irrelevant (non-matching picture). In the final double-page (*test* trial), one photo showed C1 searching for the object where she falsely believed it to be (initial-location picture), and the other showed C1 searching for the object in its current location (current-location picture). While viewing this double-page, children heard the final line of the story, which stated that C1 was looking for the object. If children represented C1's false belief, they should look longer at the initial-location picture than at the current-location picture. In the original Western sample, children looked reliably longer at the matching than at the non-matching picture during the set-up trials, and at the initial-location picture than at the current-location picture during the test trial (this last result reversed when C1 saw C2 move the object to its current location).

Children were tested in Salar ($n = 25$, range = 29–51 months, $M = 40$ months), Shuar/Colono, and Yasawan ($n = 11$, range = 26–43 months, $M = 33$ months) communities; the Shuar/Colono sample included a younger group ($n = 58$, range = 26–52 months, $M = 40$ months) and an older group ($n = 20$, range = 52–64 months, $M = 58$ months). Testing sessions were videotaped and coded frame-by-frame for where children looked during each set-up and test trial; after the double-page became visible, looking at each photo was coded for a *response period* of 8 s (set-up trials) or 4 s (test trial). All test trials were coded by a second, naive coder who agreed on 95 per cent of coded video frames.

During the set-up trials (figure 2), children easily followed the story, looking reliably longer at the matching picture across trials: Salar, $t_{24} = 9.63$, $p < 0.001$; Shuar/Colono-young, $t_{57} = 16.06$, $p < 0.001$; Shuar/Colono-old, $t_{19} = 9.82$, $p < 0.001$; and Yasawan, $t_{10} = 4.67$, $p = 0.001$ (all tests two-tailed). During the test trial, in all populations, children looked reliably longer at the initial-location picture: Salar, $t_{24} = 2.59$, $p = 0.016$; Shuar/Colono-young, $t_{57} = 3.16$, $p = 0.003$; Shuar/Colono-old, $t_{19} = 2.36$, $p = 0.029$; and Yasawan, $t_{10} = 2.26$, $p = 0.047$ (for additional tests, see the electronic supplementary material, §3). No effects of age were found. These results suggest that, like the Western children, the non-Western children understood that C1 held a false belief and expected her to search for the object in its initial location.

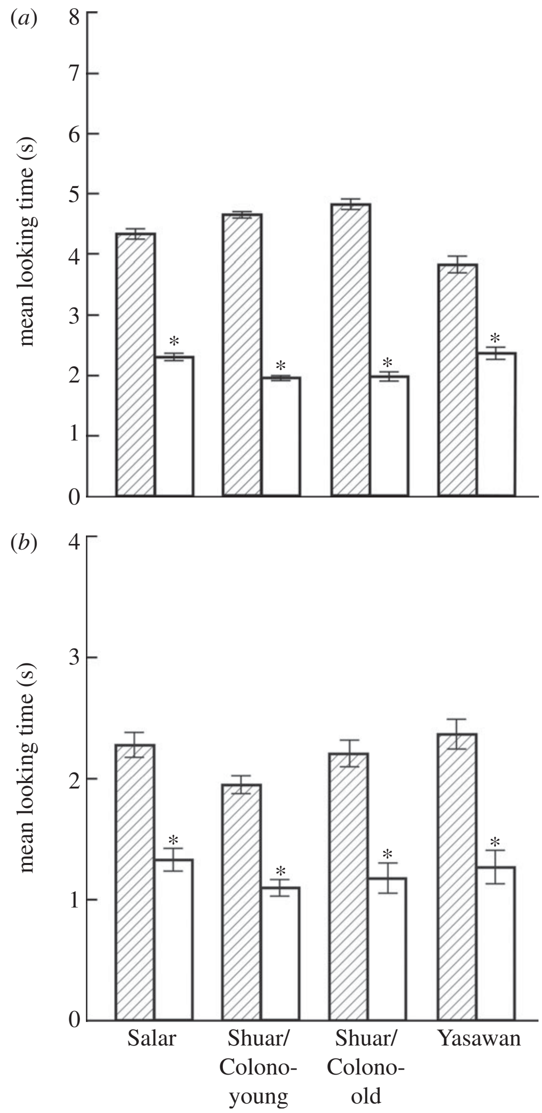


**Figure 2.** Verbal preferential-looking false-belief task. (*a*) Set-up trials (striped bars represent matching picture and unstriped bars represent non-matching picture) and (*b*) test trial (striped bars represent initial-location picture and unstriped bars represent current-location picture). Bars show mean looking times, error bars show standard errors of the mean, and asterisks denote significant differences between two bars ($p < 0.05$, two-tailed).

### (b) Verbal anticipatory-looking task

In the verbal anticipatory-looking task [21], adapted from prior research [39], children interacted sequentially with two experimenters, E1 and E2. E1 stood across from the child at a table in a testing room; on the table were two containers, with a pair of scissors hidden in one of them (target container). E1 introduced a sheet of stickers and asked the child to choose one. E1 then said she would need her scissors to cut out the sticker; she opened the non-target container, showed the child it was empty, then opened the target container and retrieved her scissors. After cutting out the sticker, E1 asked the child to select a second sticker. Before she could cut it out, E2 arrived, announced that someone was looking for E1, and stepped out of the room. E1 then replaced her scissors in the target container, told the child she would cut out the sticker when she returned, and, as she was leaving, asked E2 to remain with the child. E2 took E1's place across the table, opened the non-target and target containers in turn, discovered the scissors, and placed them in her pocket. Next, E2 looked away from the child, assumed a thoughtful pose, and uttered the self-addressed anticipatory prompt, 'When [E1's name] comes back, she is going to need her scissors again...where will she think they are?' During the following *response period*, E2 paused for several seconds, repeated the prompt, and then paused again while maintaining her thoughtful pose. If children represented E1's false belief, they should expect her to look for her scissors in the target container. In the original Western sample, children looked reliably longer at the target than at the non-target container (this did not occur when E1 saw E2 place the scissors in her pocket before E1 left the room).

Children were tested in Salar ($n = 13$, range = 29–51 months, $M = 39$ months), Shuar/Colono ($n = 29$, range = 29–52 months, $M = 40$ months), and Yasawan ($n = 7$, range = 30–43 months, $M = 36$ months) communities. Testing sessions were videotaped and coded frame-by-frame for where children looked during the response period. All response periods were coded by a second, naive coder who agreed on 93 per cent of coded video frames.

One-sample *t*-tests against chance (0) were used to evaluate target advantage (looking time at target minus non-target container). Children in all three populations looked reliably longer at the target container during the response period (figure 3): Salar, $t_{12} = 2.94$, $p = 0.012$; Shuar/Colono, $t_{28} = 3.27$, $p = 0.003$; and Yasawan, $t_6 = 2.85$, $p = 0.029$. No effects of age were found. These results suggest that, like the Western children, the non-Western children understood that E1 would hold a false belief and anticipated that she would look for her scissors in the target container.

## (c) Non-verbal violation-of-expectation task

The non-verbal violation-of-expectation task [25] exploited infants' well-established tendency to look longer at events that violate, as opposed to confirm, their expectations; it also capitalized on the fact that infants generally expect similar, but not dissimilar, objects to share non-obvious properties [40]. Children watched live events involving two experimenters, E1 and E2. To start, E2 was absent from the testing room; E1 sat on one side of a table, and in front of her was a bright-coloured object (E1's object). At the back of the table, across from the child, were two additional objects: one that was identical to E1's object (identical object) and one that differed in pattern and colour (different object). E1 first shook her object, demonstrating that it rattled. Next, she shook the different object, which also rattled, and then she shook the identical object, which made no noise. E1 repeated this sequence several times, shaking all three objects in turn, to help children learn the objects' properties. Next, E2 arrived and sat across from the child, behind the identical and different objects. E1 turned to E2, said, 'Look!', and shook her object, demonstrating that it rattled. E1 then asked E2, 'Can you do it?'. E2 grasped either the identical (identical-object event) or the different (different-object event) object and paused; children watched this *paused scene* until they

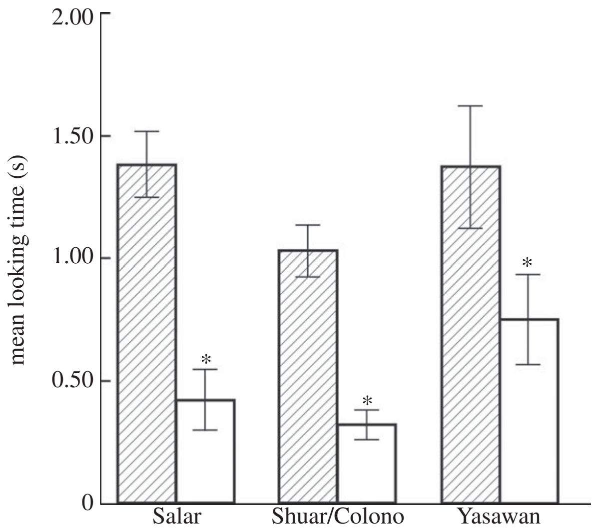


**Figure 3.** Verbal anticipatory-looking false-belief task. Bars show mean looking times, error bars show standard errors of the mean, and asterisks denote significant differences between two bars ($p < 0.05$, two-tailed). Striped bars represent target container and unstriped bars represent non-target container.

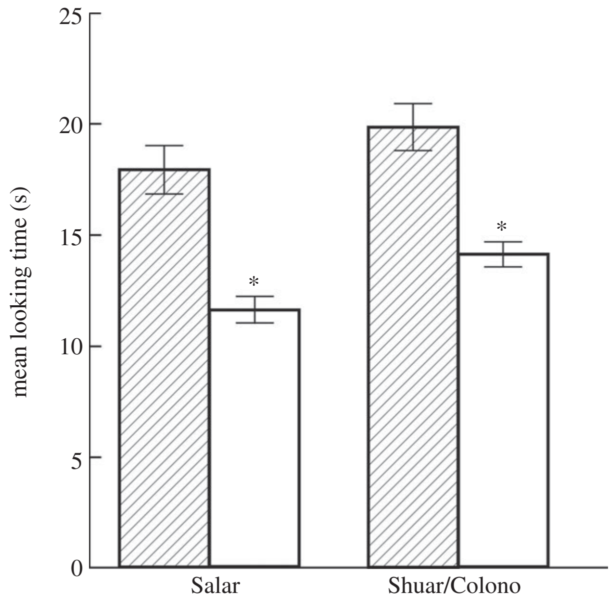


**Figure 4.** Non-verbal violation-of-expectation false-belief task. Bars show mean looking times, error bars show standard errors of the mean, and asterisks denote significant differences between two bars ($p < 0.05$, two-tailed). Striped bars represent different-object event and unstriped bars represent identical-object event.

looked away and the testing session ended. If children attributed to E2 the false belief that the identical object would rattle (because perceptually identical objects typically share non-obvious properties), they should expect her to reach for the identical object. In the Western sample, children looked reliably longer at the paused scene if shown the different-object event as opposed to the identical-object event (this effect reversed when E2 was present throughout the testing session and thus knew which objects rattled).

Children were tested in Salar ($n = 19$, range = 16–30 months, $M = 23$ months) and Shuar/Colono ($n = 19$, range = 17–30 months, $M = 22$ months) communities (tests in Fiji produced no usable data, see the electronic supplementary material, §5). Testing sessions were videotaped and coded frame-by-frame for how long children looked at the paused scene. All paused scenes were coded by a second, naive coder who agreed on 94 per cent of coded video frames.

In both populations (figure 4), children looked reliably longer at the paused scene if shown the different-object event, as opposed to the identical-object event: Salar $t_{17} = 2.25$, $p = 0.038$; and Shuar/Colono $t_{17} = 2.13$, $p = 0.048$. No effects of age were found. These results suggest that, like the Western children, the non-Western children expected E2 to hold a false belief about the identical object's properties.

## 3. Conclusions

In summary, young children from three diverse, traditional, non-Western societies (Salar, Shuar/Colono, and Yasawan) were tested with three spontaneous-response false-belief tasks that had previously yielded positive results with Western children [21,22,25]. These tasks differed in several respects: two were verbal and one was largely non-verbal; two tapped a false belief about an object's location and one tapped a false belief about an object's non-obvious properties; two used live events and one used a picture-book story; and each of the three used a different looking measure. The performance of the non-Western children was comparable with that of Western children: across tasks, 1- to 4-year-olds gave reliable evidence that they could represent others' false beliefs, pointing to a remarkable degree of convergence between early false-belief understanding in Western and non-Western populations. These findings cast doubt on the long-standing view that false-belief understanding is not achieved until ages 4 to 7, and provide strong evidence that such understanding emerges early in development, as part of an evolutionary adaptation for psychological reasoning.

Our results also pave the way for further developmental cross-cultural research. Given the sensitive nature of looking-time measures, it was unclear at the outset whether they could be used in extremely challenging field conditions. These subtle measures might easily have been swamped by the sheer novelty of the testing procedure or by the many factors competing for children's attention in field conditions. Our study demonstrates that the barriers to using such experimental paradigms in traditional societies can be overcome, promising richer data on human universals than have hitherto been available.

The study was approved by the institutional review boards of the institutions participating in the research: Emory University, the University of Illinois, Sun Yat-sen University, and UCLA.

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