<table>
<thead>
<tr>
<th>Title</th>
<th>Early false-belief understanding in traditional non-Western societies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Author(s)</td>
<td>Barrett, H. Clark; Broesch, Tanya; Scott, Rose M.; He, Zijing; Baillargeon, Renée; Wu, Di; Bolz, Matthias; Henrich, Joseph; Setoh, Peipei; Wang, Jianxin; Laurence, Stephen</td>
</tr>
<tr>
<td>Date</td>
<td>2013</td>
</tr>
<tr>
<td>URL</td>
<td><a href="http://hdl.handle.net/10220/25367">http://hdl.handle.net/10220/25367</a></td>
</tr>
<tr>
<td>Rights</td>
<td>© 2013 The Authors. This is the author created version of a work that has been peer reviewed and accepted for publication in Proceedings of the Royal Society B, published by The Royal Society on behalf of The Authors. It incorporates referee’s comments but changes resulting from the publishing process, such as copyediting, structural formatting, may not be reflected in this document. The published version is available at: [Article DOI: <a href="http://dx.doi.org/10.1098/rspb.2012.2654">http://dx.doi.org/10.1098/rspb.2012.2654</a>].</td>
</tr>
</tbody>
</table>
Early false-belief understanding in traditional non-Western societies

Journal: Proceedings B

Manuscript ID: RSPB-2012-2654

Article Type: Research

Date Submitted by the Author: 08-Nov-2012

Complete List of Authors: Barrett, H.; University of California, Los Angeles (UCLA), Anthropology
Broesch, Tanya; Simon Fraser University, Department of Psychology
Scott, Rose; University of California Merced, School of Social Sciences, Humanities, and Arts
He, Zijing; Sun Yat-sen University, Department of Psychology
Baillargeon, Renée; University of Illinois, Department of Psychology
Wu, Di; Cedarville University, Department of Psychology
Bolz, Matthias; Max Planck Institute for Human Cognitive and Brain Sciences, Department of Social Neuroscience
Henrich, Joseph; University of British Columbia, Psychology
Setoh, Peipei; University of Illinois, Department of Psychology
Wang, Jianxin; Lanzhou University, Center for Studies of Ethnic Minorities in Northwest China
Laurence, Stephen; University of Sheffield, Department of Philosophy

Subject: Cognition < BIOLOGY, Evolution < BIOLOGY, Behaviour < BIOLOGY

Keywords: Theory of Mind, Evolutionary Psychology, Development, Cognition

Proceedings B category: Behaviour
Early false-belief understanding in traditional non-Western societies

Authors: H. Clark Barrett¹*, Tanya Broesch², Rose M. Scott³, Zijing He⁴, Renée Baillargeon⁵, Di Wu⁶, Matthias Bolz⁷, Joseph Henrich⁸, Peipei Setoh⁵, Jianxin Wang⁹, Stephen Laurence¹⁰

Affiliations:

¹UCLA Department of Anthropology, 341 Haines Hall Box 951552, Los Angeles, CA 90095, USA.
²Department of Psychology, Simon Fraser University, 8888 University Drive, Burnaby, British Columbia V5A 1S6, Canada.
³School of Social Sciences, Humanities, and Arts, University of California Merced, 5200 North Lake Road, Merced CA 95343, USA.
⁴Department of Psychology, Sun Yat-sen University, 135 Xingangxi Road, Guangzhou, Guangdong 510275, China.
⁵Department of Psychology, University of Illinois, 603 East Daniel Street, Champaign, IL 61820, USA.
⁶Psychology Department, Cedarville University, 251 N. Main St., Cedarville, OH 45314, USA.
⁷Department of Social Neuroscience, Max Planck Institute for Human Cognitive and Brain Sciences, 04103 Leipzig, Germany.
⁸Departments of Psychology and Economics, University of British Columbia, 2136 West Mall, Vancouver, British Columbia V6T 1Z4, Canada.
Summary: The psychological capacity to understand others’ 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 to those from the West, supporting the hypothesis that false-belief understanding reflects an adaptation that is universally present early in development.

Key Index Words / Phrases: Theory of Mind, false-belief understanding, social cognition, human universals, evolutionary psychology.
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 homologs 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 to 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 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, in Western populations. The primary evidence for this 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 behavior. 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; in 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 ESM). Taken together, this
evidence suggests that false-belief understanding may be acquired via culturally- or
environmentally-driven domain-general learning processes.

However, evidence from spontaneous-response tasks in the West suggests that false-
belief understanding is 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
behaviors: 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.

Proponents of spontaneous-response tasks argue that (1) results on such tasks suggest that
false-belief understanding depends on evolved, domain-specific psychological-reasoning
processes that emerge early in development (31,32), and (2) elicited-response tasks are more
challenging because they also involve executive functions and so overwhelm young children’s
limited information-processing resources (22,33). To bolster these conclusions, evidence is
needed from spontaneous-response tasks with young children in non-Western societies: until now, these tasks have been used exclusively with Western children. If performance in spontaneous-response tasks is 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 succeed at spontaneous-response tasks at the same early ages as Western children, this would provide strong 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 ESM). The Salar are a Turkic-speaking ethnic minority in rural central 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 (34). Given the
vast disparities among these societies, and between them and the West, spontaneous-response
tasks with young children in these societies provide a strong test between the two competing
hypotheses above.

2. METHODS AND RESULTS

We adapted three spontaneous-response 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 ESM for details).

(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 (35). 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 (setup trials); in
each setup 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
doouble-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- 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 setup trials and at the initial- 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 setup and test trial.
All test trials were coded by a second, naive coder who agreed on 95% of coded video frames.

During the setup trials (Figure 2), children easily followed the story, looking reliably
longer at the matching picture across trials: Salar, t(24) = 9.63, p < .001; Shuar/Colono-young,
t(57) = 16.06, p < .001; Shuar/Colono-old, t(19) = 9.82, p < .001; and Yasawan, t(10) = 4.67, p =
.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 = .016; Shuar/Colono-young, t(57) = 3.16, p
= .003; Shuar/Colono-old, t(19) = 2.36, p = .029; and Yasawan, t(10) = 2.26, p = .047 (for
additional tests, see ESM). 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.

(b) Verbal anticipatory-looking task

http://mc.manuscriptcentral.com/prsb
In the verbal anticipatory-looking task (21), adapted from prior research (36), 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% 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) (Figure 3). Children in all three populations looked reliably longer at the target container during the response period (Figure 2): Salar, $t(12) = 2.94, p = .012$; Shuar/Colono, $t(28) = 3.27, p = .003$; and Yasawan, $t(6) = 2.85, p = .029$. 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 (37). 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 brightly-colored 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 color (different object). E1 first shook her object, demonstrating that it rattled. Next, she shook the different object, which also rattled, and then 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 looked away and the testing session ended. If children attributed to E2 the false belief that the identical object would rattle (since 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- 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 ESM). 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% of coded video frames.

In both populations (Figure 4), children looked reliably longer at the paused scene if shown the different- as opposed to the identical-object event: Salar $t(17) = 2.25, p = .038$; and Shuar/Colono $t(17) = 2.13, p = .048$. 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 employed a different looking measure. The performance of the non-Western children was comparable to 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 age 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 employing...
such experimental paradigms in traditional societies can be overcome, promising richer data on
human universals than have hitherto been available.

Acknowledgments: Funding for this research was provided by a grant from the UK’s Arts and
Humanities Research Council (for the AHRC Culture and the Mind project) and from the
Hang Seng Centre for Cognitive Studies, University of Sheffield.

References:

   of who was watching when. *Science* 312, 1662-1665.

2. Call, J., Tomasello, M. 2008 Does the chimpanzee have a theory of mind? 30 years later.

   represent others’ knowledge but not their beliefs. *Dev. Sci.* 14, 1406-1416.

   belief understanding and why it matters: The social-acting hypothesis. In *Navigating the
   social world: What infants, children, and other species can teach us* (eds. M. R. Banaji &
   S. Gelman), New York: Oxford University Press.

   Oxford, ed. 2).

   have evolved specialized skills of social cognition: The cultural intelligence hypothesis.
   *Science* 317, 1360-1366.


31. Scott, R.M., Baillargeon, R. 2009 Which penguin is this? Attributing false beliefs about identity at 18 months. *Child Dev.* 80, 1172-1196.


**Figure captions**

**Fig. 1.** Field sites: Salar (China), Shuar / Colono (Ecuador), and Yasawa (Fiji).

**Fig. 2.** Verbal Preferential-Looking False Belief Task. Bars show mean looking times, and error bars show standard errors of the mean.

**Fig. 3.** Verbal Anticipatory-Looking False Belief Task. Bars show mean looking times, and error bars show standard errors of the mean.

**Fig. 4.** Non-Verbal Violation-of-Expectation False Belief Task. Bars show mean looking times, and error bars show standard errors of the mean.
Field sites: Salar (China), Shuar / Colono (Ecuador), and Yasawa (Fiji).
Verbal Preferential-looking False Belief Task. Bars show mean looking times, and error bars show standard errors of the mean.

136x335mm (600 x 600 DPI)
Verbal Anticipatory-looking False-belief Task. Bars show mean looking times, and error bars show standard errors of the mean.
Non-verbal Violation-of-expectation False-belief Task.

Bars show mean looking times, and error bars show standard errors of the mean.