Ad-hoc pragmatic implicatures among Shipibo-Konibo children in the Peruvian Amazon

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Abstract: Pragmatic reasoning – the ability to infer the intended meaning of an utterance in context – is one of the core aspects of language comprehension. Children's ability to reason pragmatically increases across childhood in U.S. and European communities. In these communities, ad-hoc (contextual) implicatures tend to emerge around age four, but this pattern has not been studied across a broader range of contexts. We conducted a study of the development of ad-hoc implicatures in Shipibo-Konibo communities in the Peruvian Amazon. While 8–11-year-olds successfully made ad-hoc implicatures, younger children did not, despite successfully understanding control trials. These findings suggest that ad-hoc implicatures are available interpretations but that their development may be more protracted.

Keywords: Shipibo-Konibo; pragmatic development; implicature.

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Introduction

One of the most salient – and fascinating – aspects of human language is the ability of speakers to express a complex and subtle range of meanings that go beyond the literal semantics of their utterances. To take a classic example, a letter of recommendation that contains praise for penmanship and punctuality can still be damning based on its omission of certain important information (Grice, 1975). This kind of pragmatic reasoning – reasoning about a speaker's intended meaning in a particular context – allows the flexible, social use of language to accomplish a wide variety of different goals (Grice, 1975; Clark, 1996; Goodman & Frank, 2016).

In the current study, we use ad-hoc implicatures – a specific pragmatic phenomenon – as a case study of the broader process of contextual reasoning about language. For example, in the letter of recommendation case, the pragmatic implicature is that the candidate is *not* intelligent or hard-working. Because such implicatures can be constructed even in very simple contexts, they can be a useful tool for studying developmental change in pragmatic inferencing ability (e.g., Papafragou & Tantalou, 2004; Stiller et al., 2015; Horowitz et al., 2018). But to date this research has only been conducted in WEIRD – western, educated, industrialized, rich, democratic – contexts (Henrich et al., 2010). We extend this work by examining developmental change in ad-hoc implicatures in a non-WEIRD culture, the Shipibo-Konibo (SK) people of the Peruvian Amazon.[1]

In the remainder of this introduction, we introduce questions about the cross-cultural universality of pragmatic principles, the current state of the developmental evidence, and the specifics of our investigation.

Gricean Pragmatics Across Cultures

Grice's (1975, 1981) theory of pragmatics and implicatures is based on the idea that the meaning of a sentence derives from what the speaker intends to communicate. Despite its foundational impact in linguistics and psycholinguistics, the universal application of this intention-based approach has been criticized. For example, the "intentionalist" (or "mentalist") view of pragmatics may not apply in cultures in which the "opacity of mind" ideology prevails (Robbins & Rumsey, 2008). In such cultures,

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[1] Here we use the WEIRD/non-WEIRD distinction as a convenient characterization of the kinds of contexts in which research to date has been conducted, rather than a characterization of the contexts themselves. There is no underlying unity to "non-WEIRD" cultures, and we do not have any expectation that the development of pragmatic inference would be homogeneous across the range of cultures in the world. Our current study was intended to provide descriptive data on one culture — a first step in building data-driven expectations about the cross-cultural variability of pragmatic development.

people are reluctant to speculate about other people's intentions, and the mind is purported to be opaque and not easily readable. In Samoa, making pragmatic inferences has been described as less about understanding the speaker's intentions than looking at the social and material consequences of utterances. The role of invisible mental states is downplayed while that of the visible outcomes of speech acts is highlighted (Duranti, 1984, 2014). Similarly, Danziger (2006, 2010) has observed that the "opacity of mind" prevailing in the Mopan Maya culture of Belize undermines the very notions of intention and lie. Mopan Mayas do not seem to make any distinctions between a false sentence intending to deceive the listener and a false sentence whose falsehood is non-intentional. What really matters in their eyes is that a false sentence does not accurately depict the world, regardless of what the speaker's intention was.

Several investigators have also questioned whether the specific "maxims" of cooperative communication outlined by Grice (1975) are in operation consistently across cultures.[2] Drawing upon data collected in rural Madagascar, Ochs (1976) suggested that the maxim of informativeness is not used as extensively in other contexts as it is in Western culture. Similarly, Harris (1996) and Le Guen (2018) have pointed out that in rural Egypt and in Maya Yucatec culture, speakers are not generally expected to comply with truthfulness. On the contrary, Le Guen remarks that Yucatec Mayas' default expectation seems to be that lies and deception are pervasive.

When anthropologists and linguists question the purported universality of Gricean accounts, however, they are not claiming that the people they have studied on the field *never* comply with cooperative norms. The claim is rather that *in some situations* in which we would expect compliance with these norms in a Western context, no such compliance is to be found. Yet despite this general interest in pragmatic norms across cultures, and the importance of measuring the degree of compliance with Gricean accounts, relatively little work in the cross-cultural context has made use of new experimental paradigms designed to study pragmatic behaviors in the lab (e.g., Noveck & Reboul, 2008). In particular, experimental measurement might help researchers understand the degree to which patterns of reasoning are truly infelicitous vs. simply less common.

Pragmatic Development

The development of pragmatic abilities in childhood has been the focus of a deep literature. This work has examined a wide range of topics including the use of contextual, social, and discourse information (see e.g., Clark & Amaral, 2010) and the construction of common ground in word learning (for a review, see Tomasello, 2000). A

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[2] Although this critique is posed in specifically Gricean language, we believe it applies equally to neo-Gricean accounts (e.g., Goodman & Frank, 2016).

particular focal point – with important implications for our study here – has been the question of the degree to which children make Gricean implicatures (e.g., Noveck, 2000; Papafragou & Tantalou, 2004; Barner et al., 2011; Frank & Goodman, 2014). One line of this work has examined performance in lexical scales such as quantifiers (e.g., "*some* of the cookies" implicates "*not all* of the cookies"; Noveck, 2000).[3] There is an emerging consensus that developmental issues in making such implicatures are related at least in part to knowledge of the individual scale members and their relationship to one another as alternatives (e.g., Barner et al., 2011; Horowitz et al., 2018).

In contrast, an alternative line of work has tried to measure children's performance in tasks where the relevant pragmatic implicature is created from contextual alternatives (e.g., Papafragou & Tantalou, 2004; Stiller et al., 2015). These tasks have the advantage of using situations that are easily accessible to children, offering the possibility of capturing developmental changes in the ability to make pragmatic inference. In Stiller et al. (2015), children were shown arrays containing three images, for example: [(1) a man], [(2) a man + glasses], [(3) a man + glasses + a hat]. They were then asked to help a puppet who said "My friend has glasses. Which one is my friend?". While the statement is literally true of both (2) and (3), on Gricean and other related accounts, an informative speaker would probably have said "hat" (or "hat and glasses") to describe (3). Thus, the puppet implicates pragmatically that (2) is his friend. In that study, children around 3.5 years old showed evidence of choosing (2) over the – presumably more interesting and salient – alternative (3).

Evidence from this study converges with data from a wide range of similar "ad-hoc" (contextually created) implicature tasks that show evidence of success around four years of age (Horowitz et al., 2018; Barner et al., 2011; Papafragou & Tantalou, 2004). While there has been some variation in the languages in which these tasks have been carried out (e.g., English, Greek), all of these studies have been conducted exclusively with Western populations, using convenience samples that typically reflect children recruited in WEIRD regions. Despite the simplicity of such tasks, and hence their suitability for translation across cultures and populations, little work has been done using them to investigate cross-population or cross-cultural differences in pragmatic inference.[4]

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[3] An alternative perspective on implicature is the grammatical view, in which some – or all – implicatures are generated by the presence of a covert grammatical operator with the meaning "only", e.g. "only some of the cookies…" (Chierchia et al., 2012). This idea has received support in the literature on adults' scalar implicature (e.g., Franke & Bergen, 2020), but its application to children's pragmatic development is less accepted based on the successes of neo-Gricean models (e.g., Bohn et al., 2021).

[4] This pattern stands in contrast to work on quantification, which has made substantial progress cross-linguistically (Katsos et al., 2016).

The Current Study

The current study adapts the task described above from Stiller et al. (2015) to investigate cultural variation in pragmatic development, specifically in the Shipibo-Konibo (SK) people. The SK are an indigenous group living in the Peruvian Amazon, along the Ucayali River and its tributaries. They are mainly horticulturalists and fishermen (as well as occasional hunters), but are being increasingly integrated into the national Peruvian market economy. Although interactions with the Peruvian mestizo world – and even the Western world – are regular, SK culture remains very lively and still displays a strong identity. Although the SK language is well-studied from a linguistic perspective (e.g., Valenzuela, 2003), to our knowledge there is no specific evidence on SK pragmatics or related constructs (e.g., attitudes toward intention reading).

We conducted a variant of the ad-hoc pragmatic inference task described above with a group of SK children (4–11-year-olds). In general, SK children have a routine that is a mix between more traditional activities and educational activities. They tend to spend about 3 to 4 hours a day at school (every morning). Teaching at school is bilingual and this is how they are first exposed to Spanish language, but they do not master the basics of Spanish before early adolescence. When they are not at school, children spend their time playing with peers, without being monitored by adults. They are also quite involved in the daily tasks of their household (caring for younger siblings, gardening in the family *chacra*, fishing, cooking, etc.). Doing so, they learn a great deal of skills. As in many other indigenous cultures, learning occurs simply "by observing and pitching in" (Rogoff, 2014) and without any formal teaching (Lancy, 2016). As a result, SK children seem mature and autonomous compared to the average Western child.

In a pilot study, we tested SK children using the Stiller, Goodman, & Frank (2015) three-object paradigm described above. This paradigm proved to be difficult for young children, however (based on low performance even on control trials). As a consequence, in the present study, we used a simplified version of the paradigm that was designed for younger U.S. children and that involves computation of implicatures over two – instead of three – images (Yoon & Frank, 2019). Example stimuli are shown in Figure 1.

Figure 1. Example stimulus for a pragmatic inference (where the utterance would be "rice," with correct answer on the left) / control-double trial (where the utterance would be "fish," with correct answer on the right).

Methods

Participants

Children were recruited in two SK neighbourhoods of Yarinacocha, in the Pucallpa region of Peru, as well as in Bawanisho, a native community settled along the Ucayali River, 4 hours south of Pucallpa. Children were recruited either through their parents or through local schools. Data were collected from a total of 84 children, but 6 had no reliable age data associated and were excluded on this basis. The remaining 78 children were between the ages of 4 and 11 years old. Age of children was recorded as it was indicated by their DNI (Peruvian identity document). The 78 children in the final sample were split post-hoc into three approximately two-year age groups for descriptive and visualization purposes. Sample composition is shown in Table 1. Female children were more likely to participate because male children tended to be away from the village slightly more often.

Table 1. Sample composition

Age Group	Age (SD)	N	Male
4 – 6-year-olds	5.4 (.49)	11	3 (27%)
6 – 8-year-olds	7.1 (.50)	30	16 (53%)
8 – 11-year-olds	9.1 (.67)	37	14 (39%)

Stimuli

Our study had four trial types: *warm-up, control-single, pragmatic inference,* and *control-double*. Based on our earlier pilot study, we created a set of stimuli that were locally appropriate and that we believed would be easy for SK children to name (see Materials Availability, below).

Warm-up trials consisted of 4 consecutive trials where a participant needed to choose between 2 images. Although the pair belonged to the same superordinate category, they did not share any highly salient features. Warm-up trials were a *flower* vs. a *hat* (baseball cap), a *dog* vs. a *chicken*, a *chair* vs. a *ball*, and a *jaguar* vs. a *peccary* (local wild pig).

The main block of trials in the experiment consisted of two control-single trials, two pragmatic inference trials, and two control-double trials. Control-single trials were, like warm-up trials, choices between two different images, but this time more closely matched (images from the same basic-level category that differed on some property). The control-single trials were a *black-and-white kene* (fabric square) vs. a *colourful kene*, and a *gringo* couple (pair of Caucasian adults) vs. a *Shipibo-Konibo* couple (pair of SK adults).

In contrast, the base stimulus for both pragmatic inference and control-double trials was a pair of "containers" (e.g., *plate;* see Figure 1). Both containers shared one item (e.g., *rice* on the plate) and one had a unique item as well (e.g., *fish*). Items were *plates* with *fish* and *rice, motocarros* (vehicles) with *men* and *baskets, malocas* (traditional circular houses) with *trees* and *outhouses,* and *tables* with *plantains* and *aguaje* (moriche palm fruit). On pragmatic inference trials, the target word was the shared item (e.g., *rice*), with the intended referent being the container with only that item (e.g., the plate with *only rice*). On control-double trials, the target word was the unique feature (e.g., *fish*), with the intended referent being the container with both items.

We created four stimulus orders. Warm-up trials were given in a constant order, but trial type was counterbalanced for order in the six main trials. Target side was counterbalanced within each trial type. In addition, target item was counterbalanced across orders for the pragmatic inference and test trials (so that, e.g., *fish* was sometimes the shared item and sometimes the unique item). Similarly, the target word for warm-up and control-single trials was counterbalanced across orders.

Procedure

Children sat in front of the experimenter, whose hand was painted to look like a puppet. They were introduced to a fictional character called "Juanito" (the puppet) and were told that Juanito went for a walk and encountered different objects and people

on his way. Juanito would next ask children if they could help him locate these objects on the two images displayed in front of them. For example, the experimenter would say: "Juanito encountered a plate."[5] The puppet standing for Juanito would then ask: "this plate has rice; can you show me the plate?"[6] Children would have to point either to the [plate + rice] picture or to the [plate + rice + fish] picture. In this case, the pragmatically correct response was [plate + rice].

Children were first presented with four warm-up stimuli: i.e., stimuli very easy to discriminate (e.g., [jaguar] vs. [peccary]), to familiarize them with the task. They were then tested in a counterbalanced order on: two "control-single" trials (e.g., [coloured traditional fabric] vs. [black and white traditional fabric]); two "control-double" trials (e.g., [table + plantains] vs. [table + plantains + moriche palm fruit], after having been told that Juanito saw a table that has both plantains and moriche palm fruits); and two test trials (e.g., [table + plantains] vs. [table + plantains + moriche palm fruit], after having been told that Juanito saw a table that has plantains – implicating *only* plantains). The structure of the prompt was identical on all trials.

The instructions were translated into SK by a certified translator and the translation was subsequently revised by two SK bilinguals who are used to working with children; the whole experiment was performed in SK. Two sample videos are shared via Databrary (see Data Availability, below).

Results

Children's performance by age group across all trial types is shown in Figure 2. Across all age groups, children were at ceiling for warm-up and control-double trials, showing that they understood the task and were able to indicate the appropriate reference to the puppet. Both control-single and pragmatic inference trial performances were substantially lower, and close to chance except in the oldest age group.

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[5] SK original version: "Juanitonin merai westiora rato."

[6] SK original version: "Nato rato riki arrozya; ¿Minki ea rato oinmati atipana?" The SK Research Assistant who performed the experiment introduced a slight procedural variation. Consistently with the procedure as just described, with some children, she used the puppet (i.e., she gestured with her painted hand as if the puppet was speaking) only to utter the final question: "can you show me the plate?" With some other children, on the other hand, the puppet was used both for the penultimate sentence "this plate has rice" and for the final question "can you show me the plate?" This slight procedural variation can be seen by comparing the two videos included in the Supplementary Materials. Importantly, what remained constant across children was that the first sentence ("Juanito encountered a plate") was always uttered by the experimenter and the last one ("can you show me the plate?") by Juanito.
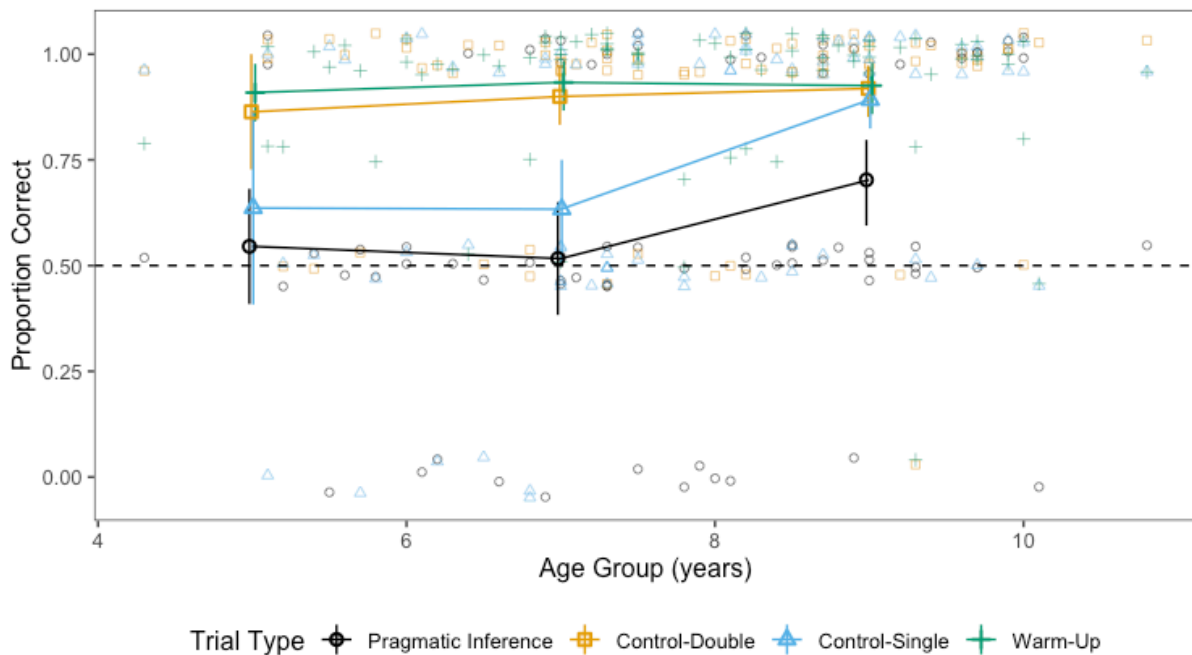
Figure 2. Proportion of correct (or pragmatically consistent, in the case of pragmatic inference trials) responses, plotted by age group. Error bars show 95% confidence intervals, computed by non-parametric bootstrap.

To investigate the strength of the evidence that children were above chance on the pragmatic trials, we computed default Bayesian *t*-tests using the BayesFactor package (Rouder et al., 2009) comparing children's mean responses to the null hypothesis of responding at chance. A first *t*-test revealed positive but relatively weak evidence for overall above-chance reporting across all children (BF_{10} = 4.25), but evidence was quite strong for 8–11-year-olds specifically (BF_{10} = 58.75).[7] These tests therefore support the conclusion of above chance pragmatic responding in the oldest children.

Children showed a similar pattern of performance for control-single trials, with BFs < 3 for the younger two groups, but very strong evidence for 8–11-year-olds specifically (BF_{10} > 10^{10}).[8] Why were children substantially weaker on control-single trials than control-double trials? We speculate that the items chosen ([Shipibo-Konibo cou-

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[7] Note that the choice of this age group for follow-up analysis is post-hoc and reflects the division of the data into discrete age groups after data collection was complete.

[8] In all cases, qualitative conclusions were identical using frequentist *t*-tests (all BFs < 3 were non-significant at *p* > .05, and all BFs > 3 were significant at *p* < .05.

ple] vs. [Gringo couple] and [colourful traditional fabric] vs. [black and white traditional fabric]) must have been more difficult for children given that the trials are uncomplicated comparisons (but we do not have independent evidence on this question). But by design, our key comparison is control-double trials, which use the same materials as pragmatic inference trials but ask about the unique feature, rather than the repeated feature. In contrast to the control-single trials, the evidence from these trials was clear: only the oldest children were able to perform the pragmatic inference, but all children performed well on the control-double trials that used the same stimulus items (see Figure 3).
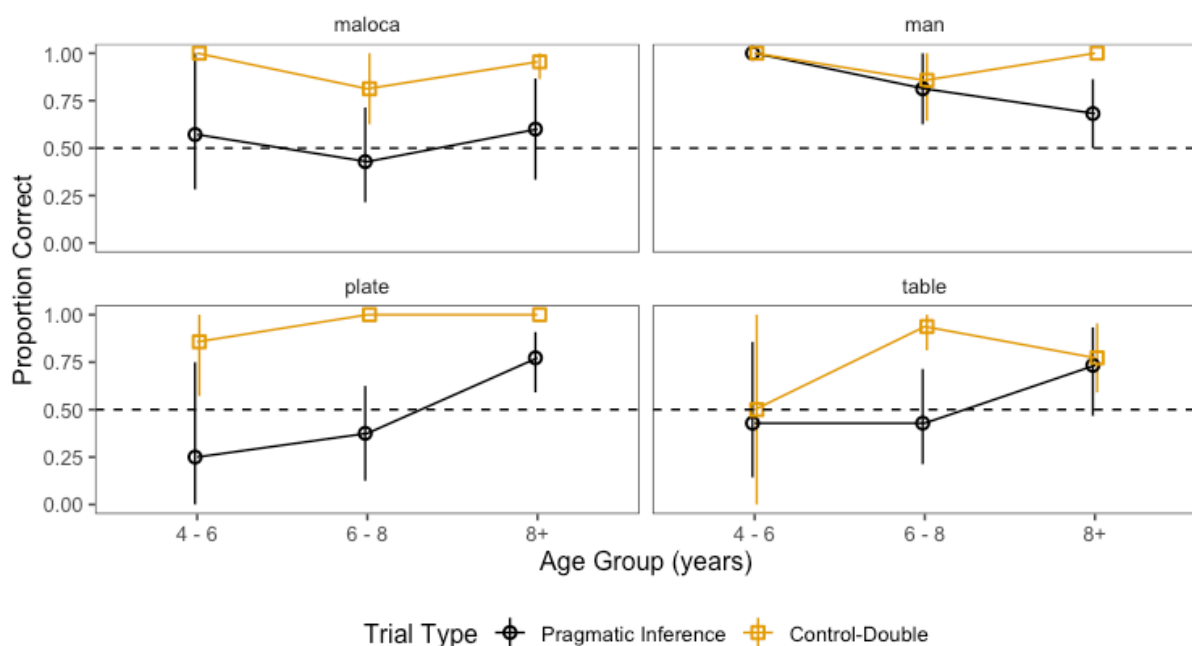
Figure 3. Proportion correct (or pragmatically consistent, in the case of pragmatic inference trials) responses, plotted by age group and experimental stimulus item. Error bars show 95% confidence intervals, computed by non-parametric bootstrap.

Discussion

How does pragmatic reasoning ability develop in children growing up in an indigenous Amazonian (and hence, non-WEIRD) culture? We used a simple ad-hoc implicature task adapted from previous work on pragmatic development to address this question in SK children. Although the younger children in our sample understood the task, they did not show the same patterns on the key pragmatic inference trials as has been observed in U.S. samples. In contrast, 8–11-year-olds showed relatively robust above-chance performance. Pragmatic inferences in our study were found substantially later in development relative to studies of children in the U.S. and Europe, where

three-year-olds show above chance performance in some tasks and four-year-olds are typically relatively accurate (e.g., Barner et al., 2011; Katsos & Bishop, 2011; Papafragou & Tantalou, 2004; Stiller et al., 2015; Yoon et al., 2018). Our findings nevertheless provide some new support for the idea that ad-hoc pragmatic inferences occur in a wide variety of cultural contexts.

The developmental differences we observed may relate to differences in children's language experiences. For example, SK children might experience fewer examples of pragmatic language use because more of their day-to-day language input is likely to come from peers rather than adults (Schneidman et al., 2012; Cristia et al., 2018). Young children overall tend to produce under-informative and egocentric language much more frequently than adults, even though they are in principle capable of reasoning about others' perspectives (see e.g., Nadig & Sedivy, 2002 for review). Such differences in input would result in differential familiarity with implicature and could create a more protracted developmental course. Many details in this hypothesis are underspecified, however. Even in U.S. contexts, the dependence of children's pragmatic inferencing on specifics of their language input is not completely understood, and this is even more true in the SK context.

The present design has several limitations that call for caution in the interpretation of our data and highlight the difficulty of cross-cultural research. First, in our paradigm, a fictional character (a puppet) was uttering sentences and asking children to compute implicatures. While U.S. children are comfortable with this type of setting, it must be stressed that interactions with fictional characters are virtually non-existent in SK culture and this feature likely rendered the paradigm more confusing. Performance in warm-up and control-double trials suggest that even younger children were able to answer simple questions, but they might still have struggled with the more complex and ambiguous test trials. Finally, the interpretation of our findings might differ depending on the correct account of implicature behaviour. It might be the case that ad-hoc implicatures are generated via a grammatical mechanism (following Chierchia, Fox, & Spector, 2012), and so our results might bear more directly on the availability of a grammatical operator (e.g., a covert "only") rather than – or in addition to – a pragmatic inference (Franke & Bergen, 2020).

Cross-cultural research should use a variety of paradigms and designs, not just one. Our results show that SK children's ability to compute ad-hoc implicatures is somewhat delayed as compared to U.S. and European children, but the generality of this result to other paradigms and methods of assessment is unknown. This question can only be answered by future research with both populations. As suggested by early critics of Grice, cross-cultural diversity in pragmatic inferences is never absolute: it is restricted to specific situations. The only way to test such subtle cross-cultural variations is to implement the richness of real-life pragmatic situations in a variety of experimental tasks.

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Data, Code, and Materials Availability Statement

All data, code, and experimental materials are available at https://github.com/langcog/amazon_pragmatics. Example videos are available at

Ethics Statement

Our protocol received ethical approval from Pontificia Universidad Católica del Perú's Institutional Review Board. When recruited at school, consent for participation was collected from both the teachers and the parents; otherwise, only consent from the parents was collected. Although all children were eager to participate in the experiment, we could not test all of them, because some parents feared that we might be *pishtacos* (organ and blood thieves) and were thus reluctant to have their children involved.

Authorship and Contributorship Statement

MF, DK, MFF, and MCF designed research; MF collected data; DK and MCF analyzed data; MF and MCF drafted the initial paper; MF, DK, MFF, and MCF provided edits to the paper.

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