Children's Processing of Ad-Hoc Implicatures
Across Different Paradigms

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Abstract

Language comprehenders routinely make pragmatic inferences that go beyond the literal meanings of utterances. If A said "I ate some of the cookies," B would probably infer that A ate 'some *but not all*' of the cookies. However, children often seem to fail to compute *scalar implicatures* (i.e., implicatures that depend on the knowledge of lexical alternatives) despite their early-emerging sensitivity to pragmatic cues. The current work sought to explore potential factors responsible for children's successes and failures in computing pragmatic inferences. In Experiment 1, we used an eye-tracking paradigm to test children's ability to compute *ad-hoc implicatures* (i.e., implicatures that depend on the knowledge of contextual alternatives). 4-5-year-old children were able to compute simplified implicatures, although these inferences are still harder and slower to generate than unambiguous interpretations for both children and adults. In Experiment 2, we explored the issue of inhibitory demands, a potential cause for younger children's failures on implicature tasks, and found preliminary evidence that differing saliencies of potential referents helps children's identification of semantically unambiguous targets but not ambiguous targets that require implicature computation.

Keywords: Pragmatic cues; implicatures; cognitive development

Introduction

Language comprehension involves not only interpreting the literal meanings of words in utterances, but also understanding the communicative intentions behind what is said. The literal content of one's utterance does not always fully express all that is intended; despite this limitation, speakers aptly choose utterances that could convey those intended meanings both explicitly and implicitly. Also, listeners take that assumption and make inferences about those implicit meanings given the utterance and context in which the utterance is produced. If people engaged in a conversation do not share the assumption that utterances may express intended meanings both explicitly and implicitly, fatal miscommunication could arise.

Consider the following situation: A says to B, "I bought delicious cookies and I put the box on your table. You're welcome! Oh, but I ate some of the cookies." Then B picks up the box, only to realize that the box is empty. B is expectedly surprised and gets upset at A for tricking him into thinking that the box would be filled with cookies; A then protests, claiming he did eat some, *and indeed all*, of the cookies, and he had never explicitly denied that the box was empty, so he never lied. Although it is true that A did not explicitly state

that he left a box filled with cookies on B's table, A's utterances somehow caused B to think that A intended to convey those meanings. B was operating under the assumption that A would make optimal utterances to convey his intended meanings, but A violated the expectation of being a cooperative speaker.

According to Grice (1975), language users tend to follow the *cooperative principle*: to make their contribution as required, when it is required, by the conversation in which they are engaged. The principle involves several maxims that cooperative speakers should follow, one of which is *Maxim of Quantity*: to be as informative as required. In the previously described situation, A did not follow Maxim of Quantity, as he was being under-informative: by saying that he ate some of the cookies when he in fact ate all. In other words, A failed to warn against the assumption that his utterances involved what Grice called *pragmatic implicatures*: speaker's implied meaning goes beyond the conventional meaning of the utterance.

Grice (1975) introduced two different types of implicatures: generalized (scalar) implicatures and particularized (ad-hoc) implicatures. *Generalized implicatures*, or also commonly known as *scalar implicatures* (*SI*'s from here on), are implicatures that involve scales built based on the knowledge of *lexical* alternatives. For example, the quantifier word 'all' is a stronger scalar alternative to the word 'some'; in the utterance "I ate some of the cookies," the use of the weaker term 'some' negates the stronger alternative 'all.' Besides quantifiers, SI's also include modals (e.g., might vs. must) and numerals (e.g., two vs. three; see Horn, 1984).

On the other hand, *particularized implicatures*, or *ad-hoc implicatures*, are implicatures that involve scales built based on the knowledge of *contextual* alternatives. For example, in the utterance "I put the box on the table," the lexical meaning of the word 'box' alone does not imply whether and with what it is filled. However, the context in which A says that he bought cookies and says "you're welcome" (suggesting a response of appreciation from B is expected) sets up the implicature that the box is filled with cookies, as compared to being empty, which is the less likely alternative created by the context of the utterance.

These pragmatic implicatures are common and efficient ways of implicitly expressing speakers' intended meanings;

thus, implicature computation is important for proficient language use, for both adults and children. For example, if a child asks a parent whether they could have cookies for snack, and a parent says: "you can have some of the cookies," the child should be able to infer that she should eat some but not all of the cookies.

Many studies have looked at the development of implicature understanding by testing adults' and children's ability to compute SI's, well-known examples of pragmatic inferences; most of them found that whereas adults readily compute SI's, children have difficulty with computing SI's (e.g., Noveck, 2001; Papafragou & Musolino, 2003; Huang & Snedeker, 2009; Barner, Chow, & Yang, 2009; Teresa Guasti et al., 2005). For example, Papafragou and Musolino (2003) presented adults and 5-year-old children with a context in which three out of three horses jumped over a fence. Then a puppet stated: e.g., "some of the horses jumped over the fence." When asked whether the puppet offered a good description of what happened, most of the adults denied it, whereas almost 90% of the children accepted it as an adequate description. Moreover, in a more recent study, Huang and Snedeker (2009) found that when adults and children are presented with a girl who has some (but not all) of the socks and another girl who has some and all of the soccer balls, and heard the sentence "point to the girl who has some of the soc..." adults looked more at the girl with socks after they heard the quantifier 'some', whereas children looked more at the girl with soccer balls until the disambiguation point when they heard 'socks.' Based on these two studies and others, children seem to have difficulty computing SI's.

What makes children's failures on SI computation surprising is that their early-emerging sensitivity to informativeness of others' and their own utterances: they adjust informativeness of their own expressions depending on the listeners' knowledge at 3 years of age (Matthews, Lieven, Theakston, & Tomasello, 2006); they provide more information when the distractor is more similar to the target and thus disambiguation is more difficult by 4 years (Matthews, Butcher, Lieven, & Tomasello, 2012); and they reward speakers based on the informativeness of their utterances by 5 years (Katsos & Bishop, 2011). Even at two years of age, when they are still too young to produce many utterances, children are able to assess informativeness of their own gestures (O'Neill & Topolovec, 2001). Thus, even young children seem to excel at assessing the informativeness of both their own and other people's utterances and communicative gestures, which suggests that lack of general pragmatic understanding is not the cause of children's failures on SI computation.

Among other potential factors causing children's difficulty with SI computation is whether children have access to lexical alternatives to the term offered. Implicature computation involves generating and negating alternatives to the given term. For example, upon hearing 'some,' the listener needs to generate a stronger alternative (in this case 'all') based on the lexical knowledge, and negate that alternative. One possi-

bility is that adults are better at generating these alternatives whereas children are less so.

Barner, Brooks, and Bale (2011) looked at children's ability to generate lexical alternatives for SI computation. In their study, 5-year-old children saw a context in which three out of three animals, a dog, cat, and cow, were sleeping. One group of children were asked, "are some of the animals sleeping" and as expected from failures on previous SI tasks, children agreed rather than reject based on the implicature 'some but not all.' Another group of children were asked a different question given the same context: "are only the cat and the cow sleeping?" If children knew what the word 'only' meant, they needed to reject this, because saying 'yes' to the question would unambiguously mean the cat and the cow are sleeping whereas the dog is not. Indeed, when the word 'only' was used and the alternative ('the dog') to the terms offered ('the cat' and 'the cow') was available in the context, children said 'no' to the question. Yet another group of children were asked another question about the same context: "are only some of the animals sleeping?" Because children knew that the word 'only' required the alternatives to the term offered to be negated, if children did have access to alternative to 'some' (i.e., 'all'), then children would say 'no.' However, children still said 'yes' to the 'only some'-question above chance, similar to how they answered the 'some'-question.

Based on these results, Barner et al. (2011) argued that the reason for children's failures on SI computation is their lack of access to lexical alternatives. When adults hear 'some,' they are able to generate the relevant scales and negate the stronger scalar alternative 'all' to the term 'some,' successfully computing implicatures; but for children, even though they know that there are alternatives to be negated, they may not be able to generate those relevant scalar alternatives. If access to lexical alternatives is at least one of the difficulties for children in implicature computation, they might succeed on implicature computation if the access to alternatives available to children in the context.

Stiller, Goodman, and Frank (in press)[1] tested this prediction by looking at children's ability to compute, rather than SI's, ad-hoc implicatures, that depend on contextually-derived scales rather than lexically-derived ones. They presented 2- to 4-year-old children with pictures of three different faces, for instance: one wearing glasses and a top hat, another one wearing only glasses, and another wearing none of the two. Then a puppet said, "my friend has glasses," then asked children to pick out the correct referent.

Assuming that the puppet is a cooperative speaker, if he wanted to refer to the one wearing a top-hat and glasses, he could have said "my friend has a top-hat" to be maximally informative and distinguish it from the one wearing only glasses. Given this counterfactual scenario, only using

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[1]Papafragou and Tantalou (2004) also tried to look at children's processing of ad-hoc implicatures, but their findings were for an older and broader age group, and their design involved some other pragmatic factors that were potential confounds; see Sullivan, Davidson, and Barner (2011).

the term 'glasses' implicates the referent face has 'glasses but not a top-hat,' making the referent the face with only glasses.

This contextually-derived scale for ad-hoc implicature is similar to the scale derived for SI computation with 'some': the glasses-only face is analogous to a 'some-but-not-all' context, and face with top hat and glasses is analogous to an 'all'-context, which is negated by the implicature. But for children, these ad-hoc implicatures could be relatively easier to compute than SI, because the alternative is presented in the context. Hence, the listener has direct access to alternatives without the need to generate them on their own. Thus, if children were in fact able to make pragmatic inferences and yet previously failed on implicature computation due to the lack of access to alternatives, then children might succeed in choosing the pragmatically felicitous referent in this simpler, modified task.

Indeed, Stiller et al. (in press) found that children as young as 3.5 years of age chose the implicature-consistent, one-feature referent above chance when they heard utterances such as "my friend has glasses." This suggested that children are in fact able to compute implicatures, given the availability of inferential alternatives in the context, presumably because they are not yet good at spontaneously generating alternatives to the term that is offered.

Experiment 1 was designed to explore children's on-line processing of ad-hoc implicatures through the eye-tracking paradigm. We sought to address three main goals: first, confirm whether, as Stiller et al.'s findings suggest, children younger than 5 years can compute implicatures; second, look at children's real-time decision-making process, as opposed to one-time judgments, for implicature computation; and third, identify potential factors that contribute to the developmental differences in implicature computation performance.

Experiment 1

Method

Participants. Parents and their 2- to 5-year-old children visiting Children's Discovery Museum in San Jose, CA, were invited to participate in a short video study. The current sample comprised of children who were exposed to English at least 50% of the time as indicated by their parents; individual trials with more than 50% missing gaze data were excluded from analysis, and only those who completed at least 8 of 16 trials according to this criterion were included in the analysis. This left 93 out of initial 104 child participants whose data was analyzed: 24 2-year-olds (mean age = 2:6, range = 2:1-2:11, 10 female), 28 3-year-olds (mean age = 3:5, range = 3:1-3:11, 19 female), 24 4-year-olds (mean age = 4:6, range = 4:1-4:11, 13 female), 32 5-year-olds (mean age = 5:4, range = 5:1-5:9, 9 female). Children were given a sticker for participating in the study. 14 adult participants were undergraduate students recruited through Stanford Psychology credit pool.

Stimuli and Design. On each trial, participants saw two images: a target and distractor, which could either be an item with a single feature (e.g., a plate with only a carrot or only a banana), or an item with double features (e.g., a plate with a carrot and a banana). Each trial contained three phases: in the initial phase (8.5 seconds), two images were presented in silence for two seconds, then a pre-recorded voice said a sentence (e.g., "Look at these plates. Elmo's plate has a carrot."). Then, in the anticipatory phase (1.5 seconds), a chime sound played to induce participants' anticipatory gaze. In the following feedback phase (1.5 seconds), a character appeared next to the target with an amusing sound effect. This was to keep the task engaging for child participants.

There were three types of test trials. In an *inference* trial, the target item had a single feature (e.g., a carrot), and the distractor item had two features, one that was common with the target (e.g., a carrot) and the other feature that was unique (e.g., a banana). The test sentence named the feature that was common to the target and distractor. Thus, if participants understood that "Elmo's plate has a carrot" implicates "Elmo's plate has a carrot *but not a banana*" given the context, they should look more toward the target than the distractor; otherwise, they should look equally to both.

There were two additional trial types, with semantically unambiguous targets: *control-double* trials looked identical to inference trials, but the target and distractor were switched, such that the double-feature item was the target and the single-feature item was the distractor, and the test sentence named the unique feature on the target. *control-single* trials presented two items that each had a unique single feature, and either could be the target. Children saw 4 inference, 4 control-double, and 4 control-single trials; adults saw 6 inference, 6 control-double, and 12 control-single trials.

There were six sets of item and feature types, and the features were named with nouns found in MacArthur-Bates CDI. Two orders of the test trials were created, such that trial types and item types were counterbalanced and trial order was pseudo-randomized across the two orders.

Procedure. Participants sat in a booster seat, approximately 60 cm away from the monitor of an SMI RED 120 Hz binocular remote eye-tracker. Participants were introduced to the task as watching a short video. The video began with a short Elmo video clip that lasted for 1-2 minutes, during which any necessary adjustments to the eye-tracker and participants' chair positions were made. The eye-tracker was then calibrated for each participant, using a 2-point calibration and validation of the calibration points. After calibration, participants were introduced to Sesame Street characters and were told 'Today, [they] will show us lots of fun things. Are you ready? Let's go!'

Following the introduction, participants saw two gaze-contingent practice trials, with unambiguous targets that differed from the test items. Then children watched 16 test trials and adults watched 24 test trials, as well as 4 filler photos

of children playing and 2 Elmo video clips, presented at a pseudo-random points between test trials. The video lasted approximately 8 minutes.

Results.

For control trials, participants of all age groups looked toward the targets in both control-double and control-single trials reliably above chance (50%; see Figure 1). This shows that after they heard the unambiguous targets being named, children were able to correctly identify the targets. Some interesting patterns were found: first, there were age differences in the speed of looking at the target and the proportion of correct looking overall; these data are extension of the findings by Fernald, Pinto, Swingley, Weinbergy, and McRoberts (1998), who found that children's efficiency of familiar word recognition over the second year; the current data show these gains in the efficiency seem to continue to increase through the childhood. Second, child participants looked more toward the target above chance even before the target word was produced. One plausible cause of this bias is the saliency of the target relative to the distractor: the target in a control-double trial was always visually more salient than the distractor, which might have attracted children's attention even before they heard it being named (see further discussion about the saliency effect in inference trials below).

For inference trials, children older than 3 years showed robust looking to inferential targets. For example, upon hearing "Bert's plate has a carrot," older children were able to identify the plate with only a carrot as the referent rather than the plate with a carrot and a banana. These results replicate Stiller et al.'s findings and suggest that children's inferential ability might have been obscured in previous SI tasks due to the unavailability of lexical alternatives to offered terms.

Also, there were clear developmental trajectories looking to the inferential target increased with age. A linear mixed-effects model analyzed the effects of trial type, age group (as continuous), and time window (early: 1 s before noun onset - 1 s after noun onset; late: 1 s - 3 s after noun onset) on the proportion of children looking to the target (see Table1). Results of this model indicate a significant interaction between the inference trial type and time window, such that children looked more toward the inferential target during the late window than during the early window. Also, there was a significant interaction between the inference trial type, age group, and time window, such that older children looked more toward the inferential target during the late window compared to younger children.

One possible factor besides implicature computation that could have affected children's judgments is learning effect: participants might have learned to locate the inferential targets from the feedback that showed them the target. If so, there should have been an order effect and participants should have improved in later trials, especially for inference trials if children failed to compute implicatures and had to rely on the feedback to figure out the referents; however, analyses revealed no order effect for any of the trial types ($t = .3$).

Table 1: Coefficient estimates from mixed-effects models predicting proportion of looks to target

|	Coeff.	Std. Err.	t-value	Sig.	
(Intercept)	0.43	0.04	10.07	$p < .01$	**
Trial type (Control-double)	0.17	0.07	2.6	$p < .01$	**
Trial type (Inference)	-0.1	0.07	-1.44	$p = .15$	
Age (Continuous)	0.04	0.01	3.17	$p < .01$	**
Window (Late)	0.18	0.05	3.32	$p < .01$	**
Trial type (Control-double) × Age	-0.02	0.02	-0.85	$p = .40$	
Trial type (Inference) × Age	-0.02	0.02	-1.17	$p = .24$	
Trial type (Control-double) × Window	0.02	0.09	0.17	$p = .86$	
Trial type (Inference) × Window	-0.21	0.09	-2.28	$p < .03$	*
Age × Window	0.005	0.02	0.32	$p = .75$	
Trial type (Control-double) × Age ×Window	-0.03	0.03	-1.15	$p = .25$	
Trial type (Inference) × Age ×Window	0.05	0.03	1.95	$p = .05$	.
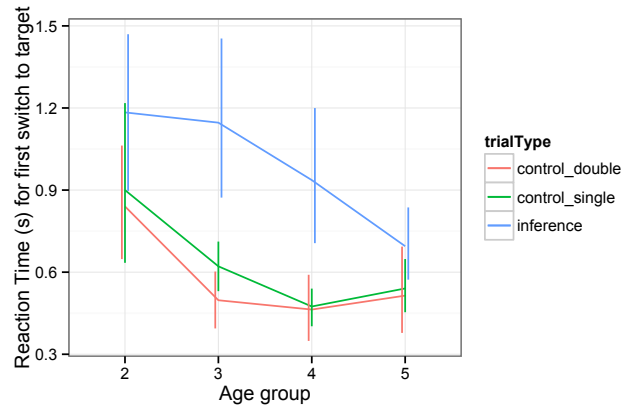
Figure 2: Average reaction times for first switches to target in trials in which participants were looking at the distractor (and not the target) at the target word onset.

There were two additional interesting patterns revealed in the data: first, looks to the target were slower and overall lower in proportion in inference trials compared to both control trial types across all age groups. switches to targets from initial looks to distractors were slower for inferential than control targets (Figure 2). This suggests that implicatures are generally slower and harder to process compared to the unambiguous semantic meanings, regardless of the participants' age. Second, the two-year-olds' looking at the target was below chance, rather than at chance, which means they were looking significantly more at distractors than targets. Hence, two-year-olds did not seem to consider both the inferential targets and distractors as equally likely referents based on the literal meaning of the utterance; rather, the distractors attracted children's attention away from the target.

To look more closely participants' eye gaze shift patterns in the inference trials, participants' switches in looking were examined (a method first introduced by Fernald, Zangl, Portillo, and Marchman (2008); see Figure 3). For each age group, trials were divided into two groups: trials in which participants were initially looking at the distractor at the noun onset, and trials in which participants were initially looking at the target. If participants computed the implicature, then
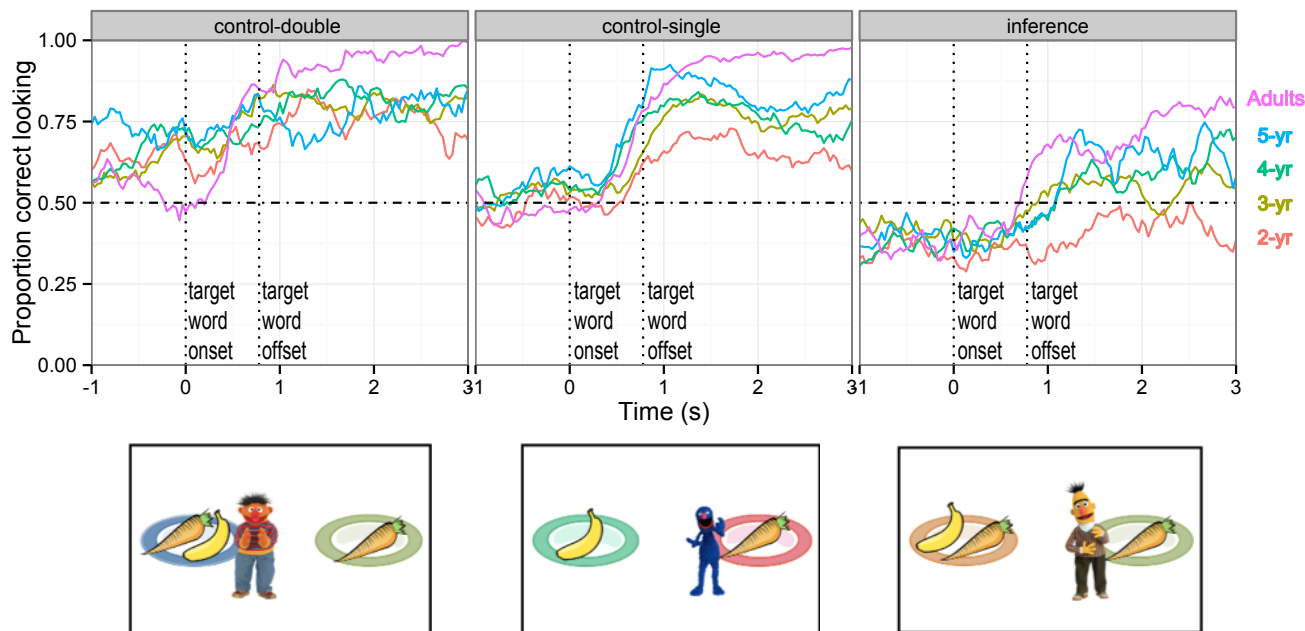
Figure 1: Proportion of 2- to 5-year-old children and adults looking to the target image as the utterance unfolds. Time 0 represents the target noun onset. Proportion correct looking is defined by looks to the target divided by the total looks to both the target and the distractor.
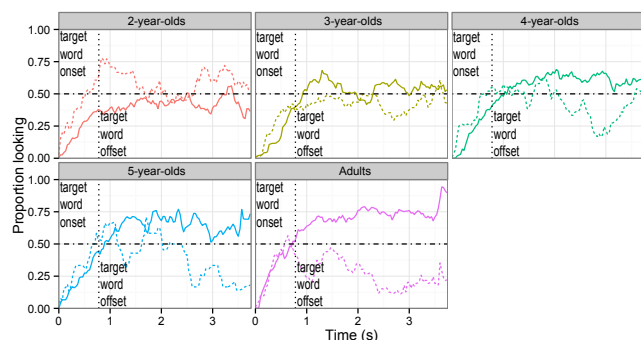

Figure 3: Looking to the target as a proportion of looking to the target and distractor across trial types. Children heard a sentence like ?Elmo?s plate has a carrot (target word)? then received feedback indicating the correct referent (i.e., characters? appearance next to the target item) 4 seconds after the target word onset.

distractor-initial group should increase their looking to the target, whereas target-initial group should continue to remain looking to the target.

Current findings show that adults and children of 3 years and above follow these predictions: switch looks to the target after initial look at the distractor shoot up above chance after the target word has been produced. However, 2-year-olds actually show the opposite pattern: those who initially look at the target tend to switch and look at the distractor, whereas those who initially look at the distractor fail to switch to the target above chance.

One possible cause of this pattern is the differential saliency of the target and distractor, except in inference trials the relative saliency is switched between the target and distractor: the distractor is always perceptually and conceptually more salient, because it contains an extra item. Thus, the listener has to overcome the greater saliency of the distractor and devote more attention to the target based on the pragmatic inference, requiring his or her inhibitory control.

Inhibitory control is difficult for children and continues to develop through childhood, as shown in the literature on executive control (Davidson, Amso, Anderson, & Diamond, 2006; Gerardi-Caulton, 2000). A number of studies also found that children's lack of inhibitory control might affect recognition of newly learned words (Yurovsky & Frank, 2014) and processing of negative utterances (Nordmeyer & Frank, 2013). It is plausible that similar inhibitory control constraints hindered younger children's correct looking to the inferential targets on the current work.

Given this potential issue with inhibitory control for younger children, the current results have at least two different interpretations, both of which posit that older children have good pragmatic understanding and they are also better at inhibitory control than younger children, but make different predictions about younger children's pragmatic understanding: younger children might have poorer pragmatic understanding compared to older children, and they theoretically

consider both objects as equally likely referents, but pay more attention to the more salient object. On the other hand, in another interpretation, both younger and older children might have good pragmatic skills, but younger children's attention to the more salient object is caused by their lack of inhibitory control.

In Experiment 2 we looked more closely at the effect of saliency gap between target and distractor in inference and control-double trials. In addition to trials in which single-feature and double-feature items were presented together, we added trials that presented single-feature and triple-feature items side-by-side. If inhibitory demands are present and affect implicature processing, we should see greater performance gap between control trials and inference trials in the newly added trials.

Another issue that we were interested in exploring was the discrepancies in children's performances as captured by different methodologies. Even though we replicated Stiller et al. (in press)'s findings that children of 4 years and above successfully compute implicatures, 4-year-olds in Stiller et al. (in press) identified the pragmatically correct referent with close to 75% accuracy rate, even though their paradigm had an additional foil besides a distractor, whereas 4-year-olds in our Experiment 1 had accuracy rate closer to 60%. If the new paradigm is valid, this difference should arise not from linguistic phenomena of our interest but due to the different natures of the task: explicit choice-making paradigm such as the one used by Stiller et al. (in press) should yield higher accuracy rates compared to implicit eye-tracking measure, during which participants make more spontaneous and unintended shifts in gazes. Experiment 2 addresses this concern by using forced-choice selection paradigm, in which participants mark their response explicitly; if our assumption about the validity of the measure is correct, Experiment 2 should yield results that are overall closer to Stiller et al. (in press)'s findings; but at the same time, we predict some differences due to the varying saliency gap between items.

Experiment 2

Method

Participants. Participants were recruited from Children's Discovery museum in San Jose as in Experiment 1, and from the Bing Nursery School at Stanford University. For Experiment 2, we recruited 3- to 5-year-old children. The final sample consisted of X 3-year olds (X female), X 4-year olds (x female), and X 5-year olds (x female).

Stimuli and Design. Stimuli for test and practice trials were identical to those in Experiment 1, except in the following ways: the images of target and distractor were presented on an iPad tablet as cropped images on a black background. Once participants indicate their choice by touching one of the two images on screen, the image became outlined in green, and the images faded and disappeared, after which the images for the next trial showed up. There were no video clip or introduction video at the beginning, and no filler trials in between.

Procedure. Participants sat at a table at approximately 20 cm distance from the iPad tablet. First they were introduced to the touch screen with a simple task of touching dots and smiley faces on screen to make them transform. Then the experimenter introduced a new "game" and explained the test trials that would follow. For the two following practice trials, experimenter scaffolded if the participant needed assistance; once test trials started, experimenter maintained minimal interaction with the participant. Participants saw 16 test trials: 4 inference and 4 control-double trials, half of which presented triple-feature items instead of double-feature items; and 8 control-single trials, half of which presented two double-feature items (the second feature was an extra common feature across both items) instead of two single-feature items.

Results and Discussion.

As for comparing different trial types, similar to what we found in Experiment 1, inference trials yielded lower accuracy rate compared to control trials.

Age differences in responses were also replicated: 5-year-olds had higher accuracy rates than 3-year-olds for inference trials.

This Experiment also provided a measure of methodological validity of the current paradigm. Results were closer to Stiller et al. (in press) in that accuracy rates were much higher compared to eye-tracking. In fact 3-year-olds seem to perform better in this paradigm compared to Stiller et al. (in press), plausibly because the current task is easier with two instead of three items, and more engaging with touch-contingent visual and audio stimuli.

For the main question of interest for this Experiment: did varying the number of features have an effect on children's accuracy rate or reaction time to inference or control trials?

As for accuracy rate: yes, different number of features seem to affect target identification. But it is not the accuracy rate for inference trials that changes (decreases as saliency gap increases, as expected); it is the accuracy rate for control-double trials that *increases* as their targets gain saliency. Thus, the relative performance gap between control-double trials and inference trials seem to be driven by more attentional resources being spent on the distractor, not by reduced attention to inferential target.

Comparison of reaction times: surprisingly, we don't see expected higher reaction time for inference trials, especially for young 3-year-olds (Figure 5) Interestingly, reaction times for control-double trials seem to go up with more features for every age group, whereas reaction times for inference trials tend to stay (Figure 6)

Rethinking unit of saliency: 'more' does not necessarily always draw more or quicker attention, 'less' can stand out as well, especially for identification purpose
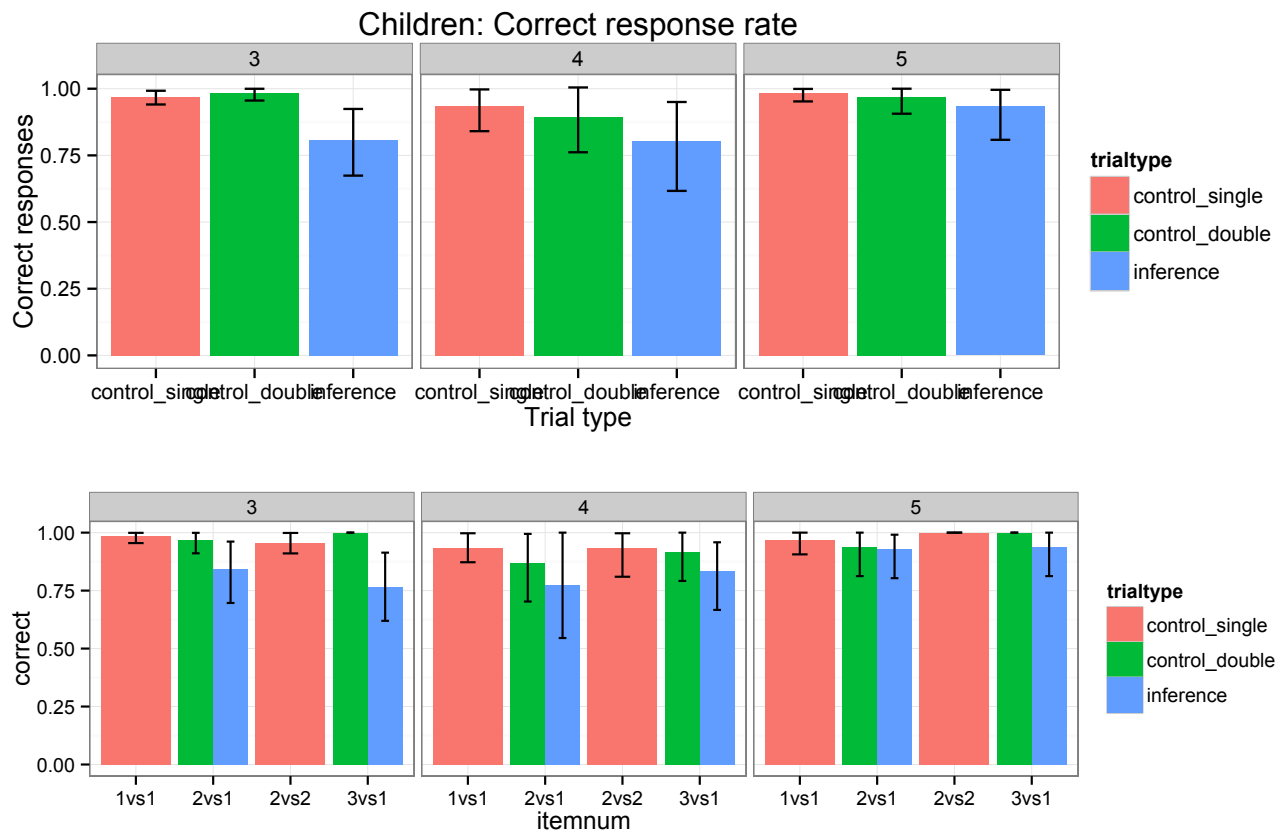
Figure 4: Top: Accurate response rates for trial types and age groups. Bottom: Accurate response rates for trial types, number of features present and age groups.
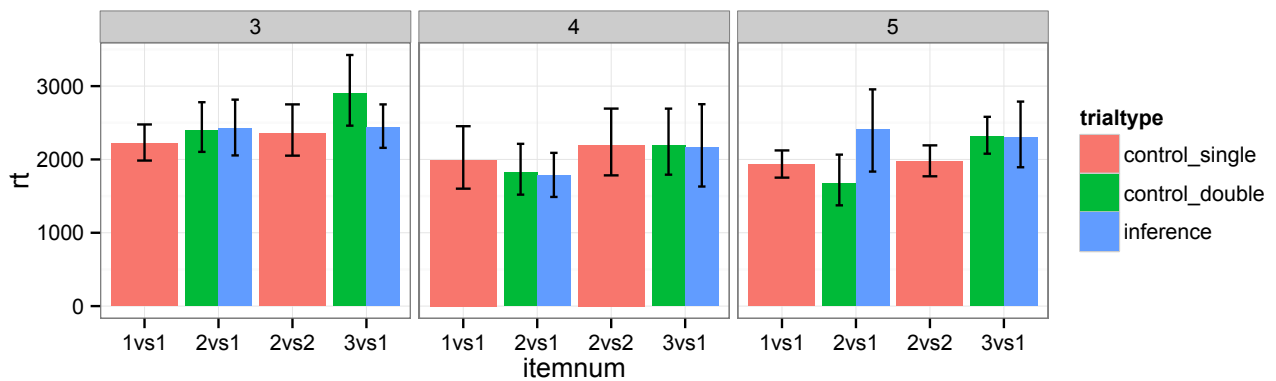

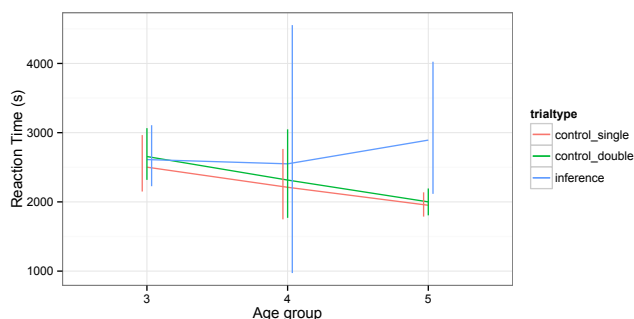Figure 6: Average reaction times for different numbers of features present.

Figure 5: Average reaction times for correct responses.

Conclusion

The current work looked at children's processing of ad-hoc implicatures with an eye-tracking paradigm, and found that adults and children older than 3 years show robust looking toward the inferential targets, although at slower and overall lower rate compared to semantically unambiguous targets, whereas younger children tend to show the opposite pattern of looking to the more salient distractor. One potential cause for younger children's failures on these implicature computation tasks might be relatively poor inhibitory control, which causes them to look toward more salient items despite utterance implicatures that indicate less salient items as inferential targets. In Experiment 2, we found some preliminary evidence that the relative gap between children's performance in finding semantically unambiguous target versus implicated target becomes greater as the saliency gap between two competing items increases.

In sum, the current work found that children older than 3 years are able to compute implicatures, when they have access to lexical alternatives in the context, even though these pragmatic inferences seem to be generally slower and harder to make than unambiguous interpretations of utterances, even for adults. Furthermore, younger children's failures on pragmatic tasks might be caused by their lack of inhibitory control to overcome differing saliency of potential referents. Overall, the current work is one step further towards reconciling children's early-emerging pragmatic abilities with their successes and failures in implicature tasks.

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