# Non-Actional Passives Can Be Comprehended by 4-Year-Olds

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## 1. Introduction

Children's knowledge of the passive (or possible lack thereof) has given rise to a lot of interesting research on language acquisition. One reason that the passive has continued to be an active area of research is because children exhibit seemingly quite late mastery of the passive, relative to other aspects of their target grammar. For the most part, there is consensus in the literature on children's acquisition of the passive about two things, at least for English-acquiring children. First, children have difficulty comprehending passive sentences until they are late into their third year of age or even the beginning of their fourth year of age. Second, even when children begin to comprehend passive sentences, they still fail to comprehend passive sentences of nonactional verbs, perhaps even beyond their sixth year of age (see, *e.g.*, Hirsch & Wexler 2006). This second aspect of the developmental trajectory (*i.e.*, the asymmetry in comprehension of passives of actional verbs on the one hand and nonactional verbs on the other) is often called the Maratsos Effect in the literature because it was first reported in Maratsos et al. (1985).

As a target of explanation, this two-stage developmental trajectory has engendered a variety of proposals. Almost all proposals take for granted that failure to comprehend passive sentences is indicative of non-target grammatical knowledge (*i.e.*, these children do not have the syntax of the passive). We will call such accounts syntactic accounts.[1] Syntactic accounts explain the Maratsos Effect as resulting from the availability of an adjectival passive parse of passive strings with actional verbs and an unavailability of such a parse for passive strings with nonac-

[1]Most syntactic accounts are also "maturational" accounts. That this, these proposals hold that there is an aspect of the child's target grammar that is inaccessible to them for biological reasons and that this knowledge state only becomes available after a biological maturational process has occurred (*e.g.*, Borer & Wexler 1987, 1992, Babyonyshev et al. 2001, Wexler 2004, Orfitelli 2012, Snyder & Hyams 2015). We focus on the Maratsos Effect here, rather than maturation. However, insofar as these syntactic accounts are poor accounts of the Maratsos Effect, we see no reason to posit maturation.

tional verbs. This explanation will be discussed in more detail below in §2, where we show that it is a poor explanation.

In contrast to syntactic accounts, non-syntactic accounts assume that children's difficulty with the passive arises for a non-grammatical reason. Children know the syntax of the passive, but something prevents them from exhibiting this knowledge effectively. Two non-syntactic accounts that have been proposed in the literature are the incremental processing hypothesis (Huang et al. 2013, Huang et al. 2017, Deen et al. 2018) and the idea that difficulty with passives arises because of discourse-infelicitous use of the passive (O'Brien et al. 2006).

Huang et al. (2013) proposed that children process their input incrementally and have a parsing bias to treat the first DP that they hear as an agent. Children are known to have difficulty revising incorrect parses that they commit to early in the course of processing (Trueswell et al. 1999). Thus, if a child commits to a parse where the first DP is an agent, they will be unable to revise this commitment when they hear the passive morphology on the verb, which leads to difficulty comprehending the passive.

O'Brien et al. (2006), on the other hand, propose that children are sensitive to the pragmatics of the passive but have difficulty accommodating infelicitous use of the passive. This is very similar to the explanation of children's difficulty with restrictive relative clauses found in Hamburger & Crain (1982). O'Brien et al. show that when the use of a passive is made more felicitous by adding a third character to a story in a Truth Value Judgment Task (TVJT) (Crain & Thornton 1998) who is another potential logical subject, children's difficulty comprehending the passive disappears.

If these non-syntactic accounts are right,[2] acquisition research on the passive is a case in point of the general idea that many instances of non-adult-like linguistic behavior exhibited by children are not in fact the result of non-target grammatical knowledge but are instead the result of non-grammatical (or non-syntactic) factors that preclude children from demonstrating their syntactic knowledge. Examples of this precise sort of debate in other areas of acquisition research include null subjects in child language (see, *e.g.*, Hyams & Wexler 1993, Bloom 1990), children's difficulty with restrictive relative clauses (see, *e.g.*, Hamburger & Crain 1982), children's difficulty with sentences involving raising predicates (see, *e.g.*, Becker 2006, Hirsch et al. 2008, Choe & Deen 2016), and others. All of these instances are plausibly cases of non-adult-like linguistic behavior arising from extra-grammatical factors, and the passive is another such plausible case.

However, there is one issue that remains outstanding if non-syntactic accounts of the acquisition findings regarding the passive are correct. Unlike syntactic accounts, these non-syntactic accounts do not offer a ready explanation of the Marat-

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[2]Note that these two non-syntactic accounts are not mutually exclusive. They both very well may be right. They both have identified two plausible non-syntactic sources of children's difficulty in demonstrating their mastery of the passive, and there is no reason that these two things couldn't both contribute to children's difficulty.

sos Effect, only an explanation of children's difficulty comprehending passives at a relatively advanced age. Notably, however, the experiments that have tested these non-syntactic explanations with English-acquiring children using both actional and nonactional verbs have actually not found evidence of the Maratsos Effect (O'Brien et al. 2006, Deen et al. 2018). That being said, (i) others have failed to replicate the results of O'Brien et al. (2006), including Nguyen & Snyder (2017) and Deen et al. (2018); (ii) the sample sizes of the experiments in both O'Brien et al. (2006) and Deen et al. (2018) are perhaps worryingly small; and (iii) despite not finding the Maratsos Effect, neither O'Brien et al. nor Deen et al. offer an explanation of why so many other researchers have found such an effect and why they did not.

We will show that the Maratsos Effect can and should also be understood as part of this broader theme of children's grammatical knowledge being obscured by extra-grammatical factors. Specifically, we will argue that the Maratsos Effect is a pragmatic task effect. First, in §2, we discuss syntactic accounts in more detail and show that even though they purport to offer an account of the Maratsos Effect, it is an unconvincing and highly unlikely account. In §3, we then offer an alternative explanation of the Maratsos Effect as a pragmatic task effect, building on the discourse infelicity hypothesis from O'Brien et al. (2006). In §4, we present the results of an experiment that tests the predictions of the explanation offered in §3; the results suggest that the Maratsos Effect is indeed a pragmatic task effect, showing that both aspects of the developmental trajectory of the passive can be understood as instances of extra-grammatical factors obscuring grammatical knowledge in children. In §5, we conclude.

## 2. Syntactic accounts and syntactic homophones

Aside from the proposal in Snyder & Hyams (2015),[3] all of the syntactic accounts in the literature share a very similar logic in their explanations of the Maratsos Effect (*e.g.*, Borer & Wexler 1987, 1992, Babyonyshev et al. 2001, Wexler 2004, Orfitelli 2012, Snyder & Hyams 2015). This logic is predicated on what Babyonyshev et al. (2001) call syntactic homophones (*i.e.*, syntactic ambiguity).

A core component of the logic behind these syntactic explanations of English-acquiring children's development is that the Maratsos Effect results from the possibility of assigning an alternative parse to passives of actional verbs, but not passives of nonactional verbs. Children do not have the syntax of the passive until 6 years of age or later, but they are nonetheless able to parse passives of actional verbs as adjectives. This is claimed to be possible for passives of actional verbs because the passive participles of such verbs make good adjectives, while the passive participles of nonactional verbs do not. In other words, the string of a passive

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[3]Snyder & Hyams (2015) propose two instances of maturation, rather than one, to account for the two stages. Our experimental results show that the Maratsos Effect is a pragmatic task effect (cf. §4), thereby ruling out this account.

with an actional verb is "syntactically homophonous" with another parse. It is only when the child exhibits above-chance comprehension of passives of both actional and nonactional verbs that they have acquired the syntax of the passive.

This syntactic homophone explanation of the Maratsos Effect was originally proposed in Borer & Wexler (1987) and has been adopted either implicitly or explicitly by all subsequent syntactic accounts of this developmental trajectory (again with the one exception being the account in Snyder & Hyams (2015)). There are at least three issues with such an account. First, only a substring of a long passive has multiple parses in the adult English grammar. When the *by*-phrase is added, the availability of an adjectival reading disappears in the adult grammar, as can be seen in (1).

(1)    a.    The doll remained torn
       b.  * The doll remained torn by Amy

To the best of our knowledge, there is no independent evidence that children ignore the *by*-phrase (or fail to parse it).

Second, if this really were the strategy that children were using to understand passives of actional verbs, it is surprising that they do not exhibit above-chance comprehension of actional passives at an earlier age. In other words, if they are just understanding these sentences as adjectives, why do they not comprehend them earlier? For example, Booth & Waxman (2003) show that infants as young as 14 months can use the syntactic category information of nouns and adjectives to guide inferences about possible meanings of novel words of each category. This suggests that children must be able to recognize the syntax of adjectives, and so it is surprising, on these accounts, that children do not exhibit above-chance comprehension of actional passives at a much earlier age.

Third, all passive participles can be grammatically used as adjectives in the adult grammar, not just passive participles of actional verbs (cf. Freidin 1975). The apparent unacceptability of some passive participles in canonical tests for adjectivehood is not due to ungrammaticality but instead due either to their semantics or to the pragmatics of their use. For example, both *the hit baseball* and *the seen movie* sound (marginally) unacceptable; however, as (2) shows, they make perfectly fine adjectives when modified.

(2)    a.  The poorly hit baseball
       b.  The rarely seen movie

This suggests, as Freidin (1975) argued, that all passive participles make grammatical adjectives. If children have a different knowledge state about adjectives, as Borer & Wexler (1987: 139, 147–148) have passingly claimed, then an independent account of how the child comes to have the adult knowledge state about adjectives is also needed. Absent such an account, this syntactic homophone strategy seems highly unlikely to be a correct explanation of the Maratsos Effect.

### 3. The Maratsos Effect as a pragmatic task effect

Our account of the Maratsos Effect as a pragmatic task effect builds on the account of the late comprehension of the passive offered in O'Brien et al. (2006), so we first briefly review their account.[4]

### 3.1. Discourse infelicitous use

O'Brien et al. (2006) argue that children's difficulty with the passive stems from discourse-infelicitous use of the passive. They think that children have difficulty with the passive because the stories used in TVJTs do not sufficiently motivate the use of a passive with a *by*-phrase. That is, children have difficulty accommodating infelicitous use of the passive, precisely because they know the syntax and the pragmatics of the passive.

To test this hypothesis, they conduct two experiments. In the first experiment, they tested 11 four-year-old children using stories in a TVJT where there were three characters: one who was the subject of the target passive sentence and two who were plausible complements of the *by*-phrase. For example, one of their stimuli involves a story where Bart finds some bananas; there is a cheetah who doesn't like bananas and so does not chase Bart, but there is a gorilla who wants a banana and decides to chase Bart to get a banana. In such a story, the use of the passive in (3) is more felicitous than in a context where there is no other potential chaser of Bart.

(3)  Bart was chased by the gorilla

O'Brien et al. find that these children exhibit above-chance comprehension of both actional (*chase*, *hug*) and nonactional (*see*) passives.

In their second experiment, they tested 7 three-year-olds, also using a TVJT. This experiment had a condition with only two characters and a condition with three characters. In the two-character (infelicitous) condition, children exhibited at-chance performance on both actional (*chase*, *hug*) and nonactional passives

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[4]We do not address the incremental processing hypothesis from Huang et al. (2013) in this paper. This proposal is discussed briefly in the introduction, and it is interesting in its own right, having received experimental support from experiments in Huang et al. (2013) and Huang et al. (2017), Deen et al. (2018), and Ehrenhofer (2018). However, we do not see how this account could explain the Maratsos Effect. The general idea is that children commit to an initial incorrect parse that is hard to revise. In the case of both actional and nonactional passives, children will have committed to an initial incorrect parse, so revision cost should affect passives of both verb types equally. Nonetheless, as noted in fn. 2, we do not think this account and the discourse-infelicitous use hypothesis are mutually exclusive. They both may very well contribute to children's difficulty in exhibiting their grammatical knowledge of passives until a relatively late age.

(*see*, *like*); however, in the three-character (felicitous) condition, children exhibited above-chance performance on both actional and nonactional passives.

Notably, the Maratsos Effect actually disappears in this experiment, since we see three-year-olds exhibiting above-chance performance of both actional and nonactional passives. One might be concerned about the relatively small sample size in both experiments and the small number of verbs that were tested. Moreover, Nguyen & Snyder (2017) and Deen et al. (2018) have both failed to replicate this finding. Nonetheless, the attempted replications in Nguyen & Snyder (2017) and Deen et al. (2018) each have their own sample size issues. While the participant sample size in Nguyen & Snyder (2017) is reasonable on the assumption that this is a relatively large effect ($n = 20$), they test the same four verbs that were tested in O'Brien et al. (2006). Westfall et al. (2014) show that experiments in which a sample of participants respond to a sample of stimuli (*i.e.*, most psychology experiments), statistical power (the probability of rejecting the null hypothesis when the alternative hypothesis is true) actually asymptotes depending on the size of the stimulus sample. That is, even as the number of participants goes to infinity in an experiment, power can remain quite low if the number of stimuli is small. So while the sample size in Nguyen & Snyder (2017) was reasonable for an effect size that is large, the small number of stimuli may have created a ceiling for maximum attainable power in their study, which means that even were the alternative hypothesis true, they would be unlikely to reject the null hypothesis.

In the attempted replication in Deen et al. (2018), they tested 4 actional verbs and 4 nonactional verbs. The sample of stimuli was thus more reasonable, but they only tested 7 children in one age group and 9 children in another age group. Thus, power in this study might have been quite low as well.

Of course, it should be reiterated that the study reported in O'Brien et al. (2006) also had a very small sample of participants and a very small sample of stimuli. Significant results that arise from underpowered studies are more likely to be false positives than significant results that arise from highly powered studies (see, *e.g.*, Ioannidis 2005). It is therefore unclear which of these findings should be privileged. However, as we argue next, the discourse-infelicitous use hypothesis of O'Brien et al. (2006) provides a potential explanation of the Maratsos Effect, so we think there is a theoretical reason for being predisposed to believe the finding reported in O'Brien et al. (2006) despite its sample size shortcomings and despite the failed replications.

## 3.2. Topic and the Maratsos Effect

Even though O'Brien et al. do observe the disappearance of the Maratsos Effect, it's not immediately obvious why this should be so, given their account. Nonetheless, we think their account provides the beginnings of an explanation.

First, it is worth being clear about what can make the use of a passive felicitous relative to a discourse. In English, the subject of a passive is highly topical (*e.g.*, Givón 1990, Shibatani 1985), and the *by*-phrase normally carries narrow focus. A

passive sentence can therefore be naturally used when what is at issue is the content of the *by*-phrase. For example, the use of a sentence like (4) is quite natural and felicitous in a context where there are multiple potential lovers of Squirrel, and what is at issue is who loves Squirrel and who does not.

(4)  Squirrel is loved by Mouse

This is why O'Brien et al. expected that adding a third character to a TVJT story makes the use of the passive felicitous, thereby precluding children from having to try to accommodate an infelicitous use of a sentence and thereby ameliorating their performance.

Now, is there any reason to think that the demands of discourse-felicitous use should differentially impact actional and nonactional passives? Interestingly, passives of nonactional verbs sound odd out of the blue, devoid of any context, whereas this is not the case for passives of actional verbs. In (5) and (6), we report these judgments, marking those sentences that sound odd out of the blue with "#". These are our judgments, but they have been corroborated via informal collection of judgments from several other native English speakers.

(5)  a.  # Andy was known by Amy
     b.  # Andy was remembered by Amy

(6)  a.  Andy was hugged by Amy
     b.  Andy was chased by Amy

Notably, the oddity of sentences like those in (5) when uttered out of the blue disappears when the *by*-phrase contains a quantifier, as can be seen in (7).

(7)  a.  Andy was known by everyone
     b.  Andy was remembered by everyone

Why should this be? As noted, a subject of a passive in English is highly topical. Moreover, nonactional verbs usually indicate some property about the mental state of their external argument. For example, a sentence like *Amy knows Andy* indicates that Amy's mental state is such that she knows Andy. It is therefore unsurprising that sentences like those in (5) should sound odd out of the blue since the at-issue meaning that they convey is something about the mental state of a non-topical argument of the sentence. To put it more concretely, the use of (5a) is odd relative to a neutral discourse context because the topic of the sentence is *Andy*, but the predicate expresses something about Amy's mental state, not Andy's. On the other hand, when a quantifier is the complement of the *by*-phrase, such as in (7a), the predicate now conveys something about the popularity of Andy, who is in fact the

topic of the sentence, thereby making the sentence more natural out of the blue.[5] On the other hand, for actional verbs like *hug* in (6a), the predicate expresses something about Andy—namely, that he was hugged by Amy—and Andy is the topic of the sentence. This shows that there is in fact a reason to expect differences in discourse felicity between actional and nonactional verbs, particularly relative to a neutral or minimal discourse context.

To summarize, passive sentences can be felicitous or infelicitous relative to a discourse because of their information structure. One example of this is that passive sentences are more naturally/felicitously used in contrastive focus discourses when what is at issue is the content of the *by*-phrase. Another example of this is that, relative to a neutral discourse context, nonactional verbs express properties of the mental state of their external argument; so, when a passive of a nonactional verb is used in such a context, it sounds odd because that which is predicated by the sentence is actually predicated of the focused element in the sentence, not the topic element of the sentence. The information structure of passives of such verbs, however, can be manipulated by the use of a quantifier as the complement of the *by*-phrase, rendering the passive sentence more felicitous in a neutral discourse context. However, this is not necessarily the case for actional verbs since that which is predicated by the passive of an actional verb is predicated of the topic of the sentence, not the focused element of the sentence. This difference in the default information structure of actional and nonactional verbs offers a potential explanation of the Maratsos Effect, a hypothesis that we experimentally test in this paper.

## 4. The experiment

In this section, we report the results from an experiment designed to test the predictions of the hypothesis that the Maratsos Effect is a pragmatic task effect.

### 4.1. Predictions

If the Maratsos Effect is driven by the different default information structure demands of a nonactional passive, then designing stories that make the use of a nonactional passive with a quantified *by*-phrase felicitous should ameliorate children's comprehension of such sentences. Above, it was observed that, relative to a neutral discourse context, passives of nonactional verbs with universally quantified *by*-phrases sound better than those with referential *by*-phrases. When given

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[5]This is not just about quantifiers. There are a variety of ways in which the default information structural properties of a non-actional passive can be manipulated that make it much more felicitous out of the blue. One more way is adverbial modification, as in (i).

(i)    a.  # Andy was seen by Amy
       b.    Andy was frequently seen by Amy

a sentence that involves passivization of a nonactional verb relative to a story that licenses the use of a quantifier in the *by*-phrase, children should exhibit above-chance comprehension of such sentences.

However, it is most common to see knowledge of the passive tested with sentences that use referential DPs as the complement of *by*-phrase. In order to ensure that the results are comparable to previous studies, we also tested children with passives that used *by*-phrases with a referential DP. Even though there is a difference between the felicity of this kind of sentence compared to a passive sentence with a universally quantified *by*-phrase complement relative to a neutral discourse context, this is not necessarily the case relative to a non-neutral discourse context. We tested sentences like (8) and (9) with the same story.

(8) Squirrel was loved by everyone

(9) Squirrel was loved by Mouse

Designing a context that makes the use of (8) felicitous also makes the use of (9) felicitous, since the context will most naturally be a contrastive-focus-type discourse.

If the Maratsos Effect is a pragmatic task effect, then so long as a context has been supplied that makes the use of a nonactional passive felicitous, four-year-old children should still exhibit above-chance performance, regardless of whether the *by*-phrase uses a universal quantifier or a referential DP. Moreover, by testing both types of sentences, we can ensure that any above-chance comprehension results in the quantifier condition are not just a fluke having to do with the quantifier, rather than being driven by four-year-old children's mastery of the syntax passive.

On the other hand, if the Maratsos Effect is not a pragmatic task effect, then participants in this study should still exhibit at-chance comprehension of the passive.

## 4.2. Design and materials

We designed stories for 8 nonactional verbs (*know*, *love*, *like*, *miss*, *spot*, *see*, *forget*, and *hear*). For the reasons discussed above in §3.1, we wanted to ensure that we tested a larger number of verbs. In order to test this many nonactional verbs in a single session with a four-year-old, we designed each story so that the puppet could utter two target sentences about each story. This cut the number of stories that the experimenter had to read to the child in half, saving a lot of time. Each child heard 10 stories total (2 training stories with 2 sentences each, and 8 target stories with 2 target sentences each). This allowed for 16 target sentences per child, meaning that each child heard two sentences with each target verb, one in the active and one in the passive. The four different voice (active vs. passive) and truth (true vs. false) combinations were counterbalanced between subjects. Whether or not the logical subject was the universal quantifier, *everyone*, or a referential DP was also a between-subjects manipulation.

These experimental design considerations led to the creation of four different testing conditions: quantifier 1, quantifier 2, referential 1, and referential 2. The 8 target stories were exactly the same in all four conditions. An example of one of the eight target stories is given in (10).[6]

(10) Squirrel wanted to get married. There were three people that she really liked: Snail, Butterfly, and Mouse. She liked them all so much, that she couldn't decide who she wanted to marry. Snail, Butterfly, and Mouse were really good friends. Snail and Butterfly really liked Squirrel and wanted to marry her, too. Mouse was good friends with Squirrel, but he didn't want to marry her. One day, Squirrel, Butterfly, Snail, and Mouse were all playing together. As they were playing together, Mouse started to realize that he actually did want to marry Squirrel. He was having a lot of fun playing together with her, and he thought they would make a great couple! A few days later, Snail, Butterfly, and Mouse were all playing together at the top of a hill and talking about Squirrel. Mouse said he now realized that he wants to marry Squirrel too. They all started talking about how they would decide who gets to marry her. They decided they would have a competition and ask her to judge. The hill they were on had a telescope, so they decided to look for Squirrel through the telescope in order to find her. Snail and Butterfly started looking through the telescope, and they noticed her right away! Mouse couldn't quite reach the telescope, but he found a log to stand on so that he could look through it. After looking through it for a minute, he noticed Squirrel too! They decided to go find her and start the competition.

The two target sentences for each of the four different conditions for this story are given in (11) and (12). Each story always had a passive target sentence and an active target sentence.

(11) Quantifier/Referential 1 condition
   a. Everyone/Mouse saw Squirrel
   b. Squirrel is loved by everyone/Mouse

(12) Quantifier/Referential 2 condition
   a. Squirrel was seen by everyone/Mouse
   b. Everyone/Mouse loves Squirrel

Note that because there are multiple potential lovers/seers of Squirrel, the use of a passive with these verbs and with *Squirrel* as the subject is felicitous relative to the discourse. To reiterate, the prediction of the pragmatic task effect account of the Maratsos Effect is that children participants in the study are expected to exhibit above-chance comprehension of the passive sentences, regardless of whether

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[6]All materials, including the accompanying images, are available upon request.

a universal quantifier or a referential DP is the complement of the *by*-phrase, because the felicity conditions of the passive are met and so children are not forced to try to accommodate a context that makes the use of the passive felicitous.

## 4.3. Procedure

The stories were presented to the participants with accompanying images on a laptop as a slideshow, effectively in a storybook format. At the end of each story, the experimenter prompted the puppet, Snuggles, for a target sentence by asking Snuggles something like *Snuggles, can you find us someone who loves Squirrel*. Again, each target story had a passive target sentence and an active target sentence. The passive target sentence was always presented to the participant before the active sentence.

## 4.4. Participants

We tested 3 adults in each of the four conditions, for a total of 12 adults. Adults were recruited through an extra credit opportunity for an introductory undergraduate course in linguistics at the University of Maryland.

We tested 42 children overall. Children were recruited from the University of Maryland's Center for Young Children (an on-campus school for children) as well as from the Infant and Child Studies Consortium at the University of Maryland. Children were only included in the analysis if they correctly answered at least three out of the four training sentences, which indicates that they understood the task and were doing it correctly. The training sentences were simple active transitive sentences that used actional verbs. As a result, 8 children were excluded. This left 7 children in the quantifier 1 condition (4;0,28–5;0,0; mean: 4;6,10), 9 children in the quantifier 2 condition (4;3,24–4;11,20; mean: 4;6,10), 10 children in the referential 1 condition (4;1,27–5;0,0; mean: 4;7,4), and 8 children in the referential 2 condition (4;0,19–4;9,12; mean: 4;4,1). Collapsing across counterbalanced conditions gives 16 children in the quantifier condition (4;0,28–5;0,0; mean: 4;6,10) and 18 children in the referential condition (4;0,19–5;0,0; mean: 4;5,23).

## 4.5. Results

There was no evidence for differences across the counterbalanced conditions, so we plot the results collapsed across the counterbalanced conditions in Figure 1. Children answered 74% (SD=18%) of actives and 71% (SD=19%) of passives accurately in the quantifier conditions; in the referential conditions, children answered 68% (SD=20%) of actives and 66% (SD=14%) of passives accurately. Visual inspection of the figure suggests that children exhibited above-chance comprehension of the passive in both the quantifier and referential conditions. To confirm this, we can check whether the intercept terms in the two intercept-only mixed-effects logistic regression models for the child passive data from above (one

for each main condition) are significantly greater than 0. The model summary for the quantifier condition model is given in Table 1, and the model summary for the referential condition model is given in Table 2. The intercept terms in both models are significantly different from 0, meaning that the log odds of being right are significantly greater than 0. These estimates can be converted to odds ratios by exponentiating them. In the quantifier condition, children were $e^{0.940} \approx 2.56$ times significantly more likely to be right than wrong; in the referential condition, children were $e^{0.652} \approx 1.92$ times significantly more likely to be right than wrong.
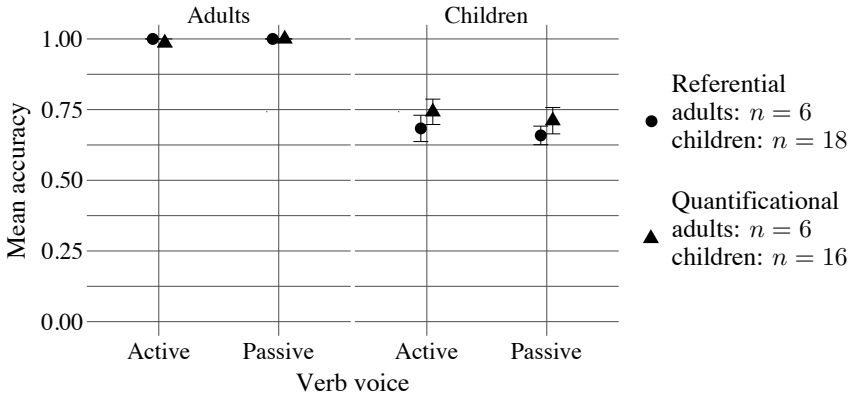


**Figure 1. Average accuracy for adults and children, by voice, collapsing across the counterbalanced conditions (error bars indicate one standard error of the mean)**

**Table 1. Fixed effect of quantifier condition model**

| Fixed effect | Estimate | Std. Error | $z$-value | $p$-value | |
|---|---|---|---|---|---|
| Intercept | 0.940 | 0.235 | 4.007 | 6.15e−5 | *** |

**Table 2. Fixed effect of referential condition model**

| Fixed effect | Estimate | Std. Error | $z$-value | $p$-value | |
|---|---|---|---|---|---|
| Intercept | 0.652 | 0.176 | 3.697 | 2.18e−4 | *** |

## 4.6. Discussion

The results of this experiment bear out the prediction of the hypothesis that the Maratsos Effect is a pragmatic task effect—namely, children exhibited above-chance comprehension of nonactional passive sentences when the story made the use of a passive felicitous relative to the discourse. This happened in both the

quantifier and referential conditions, so it cannot be said that children's above-chance comprehension of the passives was driven by an idiosyncrasy of the universal quantifier in the stimuli.

While mean accuracies were somewhat low, there is also no evidence for differences between actives and passives, so we think these low accuracies just reflect noise in the data caused by the complexity of the stories and the length of the task. For example, while efforts were made to reduce the length of the task (cf. §4.2), it still took around 30 minutes with each participant, plausibly leading to noisier data.

## 5. Conclusion

This paper has shown that the Maratsos Effect is a pragmatic task effect and that four-year-old children know the syntax of the passive. This recasts how we should understand the developmental trajectory of the English-acquiring child with respect to the passive that many researchers have sought to explain. In particular, this finding tells against the maturational syntactic accounts that posit that the syntax of the passive is acquired at six years of age or later, when maturation of Universal Grammar happens. Moreover, this finding comports with many other findings that show that what looked like non-adult-like linguistic behavior does not reflect non-target syntactic knowledge but instead results from extra-grammatical factors obscuring target grammatical knowledge (see, among many others, Hamburger & Crain 1982, Bloom 1990, Becker 2006, Choe & Deen 2016).

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