

large-scale corpus study on child Mandarin passive production, we find the opposite result: long passives (2a) are much more frequent than short passives (2b) in 2- to 6-year-olds' spontaneous production of Mandarin. In this paper, we investigate the effects of input and grammar, especially the role of 'intervention', in children's acquisition of Mandarin passives.

The rest of the paper is organized as follows. Section 2 introduces previous findings on children's production of long vs. short passives in English, Sesotho, and Mandarin. Section 3 discusses possible input effects on child passives and presents our first corpus study, which shows Mandarin-acquiring children produce more long passives than short passives – in contrast to English and Sesotho. A closer look at the data suggests that the type of long passives children produce is more constrained than their input, which we propose to be an effect of (featural) Relativized Minimality (Rizzi 1990, 2018) in the child grammar. In section 4 we introduce the Intervention Hypothesis and we review some important syntactic differences between long vs. short *bei*-passives. Our second corpus study is presented in Section 4.3. Section 5 summarizes our findings and discusses the roles of input and grammar, especially intervention effects, in children's acquisition of Mandarin passives.

2. Previous studies on long and short passives in child production

In child English, spontaneous production of long passives is much less frequent than short passives.³ Horgan (1978) showed that English-speaking children aged 2 to 13 ($N = 234$) produced far more short passives ('truncated passives') than long passives ('full passives') in picture description tasks.⁴ The scarcity of long passives in English child speech was also observed by Gordon & Chafetz (1990) in their corpus study.

A similar short > long passive asymmetry is observed in other languages, even those in which an early acquisition of passives is observed. For example, Sesotho-speaking children acquire passives early (Demuth 1989, Demuth et al. 2010, Kline and Demuth 2010; cf. Crawford 2005). A longitudinal study of four Sesotho-speaking children aged 2;1-4;2 showed that long passives in child language are less frequent than the short ones in all age intervals; overall only 21% of the children's passives are long (Demuth 1989; Kline and Demuth 2010; see also Pye & Poz 1988 on Quiche; Allen & Crago 1996 on Inuktitut).

³ Nonetheless, this short > long passive asymmetry in children's production has not been observed in subsequent comprehension experiments in child English. Although most of these studies have found slightly better performance on short passives than long passives, none of these differences in children's comprehension were statistically significant (Gordon & Chafetz 1990, Hirsch & Wexler 2006a, b, O'Brien et al. 2006, Orfitelli 2012).

⁴ In Horgan's study, 'full passives' included not only long passives with *by*-phrases as shown in (1a), but also those with prepositional phrases headed by *with*, *from*, *for*, and *of* (e.g., *The lamp was broken of the ball*). Short passives were more frequent in child speech than all of these full passive constructions combined.

The advantage of short passives in child English has been attributed to an ‘adjectival strategy’ (e.g., Borer & Wexler 1987, 1992), which claims that short passives in English (usually those with actional verbs) can be treated as the *homophonous* adjectival passives. This non-movement adjectival analysis helps children circumvent the complexity of the A-movement in deriving verbal passives, hence the seemingly earlier acquisition of short (actional) passives.⁵ However, the adjectival strategy is not applicable to languages that do not have homophonous adjectival/verbal passive pairs. Mandarin is one example. In the English short passive (1b), the verb *kissed* can be interpreted as an adjective by young children; whereas Mandarin verbs such as *qin* ‘kiss’ in (2), lacking adjectival homophones, cannot. Therefore, the confounding issue of potential homophonous verbal and adjectival passives in previous English studies is avoided in our research.

Previous studies on child Mandarin have seldomly looked into the production of passives. One longitudinal study by Hu (2013) investigated two Mandarin-speaking children (Child 1 aged 1;0-5;4 and Child 2 aged 0;10-5;7). Her data suggested that both long and short *bei*-passives occur very early in child language, as exemplified below. In total, Child 1 produced 17 long *bei*-passives and 5 short ones, and Child 2 produced 9 long *bei*-passives and 7 short ones in the study periods.⁶

(3) First occurrences of long passives:

a. bei na-ge mao yao-diao le (Child 1, age 2;6)
 BEI that-CLF cat bite-off PERF
 ‘[e] was bitten off by that cat.’ ([e] stands for a dropped subject/topic)

b. bei wo chi-le (Child 2, age 2;11)
 BEI I eat-PERF
 ‘[e] was eaten by me.’

(4) First occurrences of short passives:

a. ta jiu bei bing zai bingui shangmian (Child 1, age 3;6)
 3SG just BEI freeze at freezer top
 ‘She/He/It was just frozen on top of the freezer.’

b. bei yao-le (Child 2, age 1;11)
 BEI bite- PERF
 ‘[e] was bitten.’

⁵ The A-movement in verbal passives was thought to be difficult for ‘pre-mature’ children (approximately before the age of 5) according to Borer and Wexler’s (1987, 1992) *A-Chain Deficit Hypothesis*. However, more recent studies showed that children of these ages have no difficulty with A-movement of VP-internal subjects or unaccusative constructions (see a review in Snyder & Hyams 2015).

⁶ Hu (2013) analyzed children’s production of *bei*-passives, as reported here, and also other types of non-canonical passives (and non-passive unaccusative constructions) which we do not discuss in our paper. She provided a list of child passives collected in her study, but did not annotate nor analyze any other data, such as children’s total number of utterances or child-directed speech.

By contrast, experimental studies of child Mandarin have shown a delay in the comprehension of long passives. Xu and Yang (2008) tested 48 Mandarin-speaking children aged 3 to 5, with a two-choice picture selection task. Their results show that with bare actional verbs, long passives pose significantly more difficulty for children than short passives. The oldest group tested in their study (age 5) showed adult-like comprehension on short actional passives, with 95.8% correct responses, but did not perform well with long actional passives, with only 60.4% correct.

On its face, this delay in comprehending long passives conflicts with Hu's (2013) earlier observation that long passives are produced early in child Mandarin. As we will see, it also conflicts with the results of our extensive corpus analysis (section 3.2), which shows that children produce long *bei*-passives early and more frequently than short passives. We will come back to this puzzling contrast in section 5, where we propose that children's difficulty of comprehending long passives in Xu and Yang's (2008) experiments came from another source: intervention by overlapping morphosyntactic features.

3. Study 1: An input effect in child Mandarin

Previous studies suggest that children's production of passives is affected by their input. In English the frequency of short passives over long in children's production can be attributed to the same pattern found in adult language (Gordon and Chafetz 1990). The corpus study in Sesotho also showed that when the effects of discourse are controlled, adults and children produce long passives at the same rate—22% and 20% respectively (Kline and Demuth 2010).⁷ Our corpus study found the same input effect, as we now detail.

3.1. Corpus data collection and annotation

The current study collected data from the Mandarin corpora on CHILDES (MacWhinney 2000), which contain the spontaneous child productions of 1,182 monolingual Mandarin-speaking children aged from 2 to 6, as well as their language input (CDS) during the recorded sessions, both transcribed in the standard CHAT format (MacWhinney & Snow 1990).⁸ The KWAL program was used in the Computerized Language Analysis (CLAN; MacWhinney 2000) software to extract all child and adult utterances containing the Mandarin passive marker *bei*, as well as the two lines before and two after the target utterance.

⁷ When the effects of discourse are not controlled, the proportion of long passives in Sesotho CDS (60%) is significantly higher than that in the child production (21%) due to the prevalence of subject questions in the CDS, which are obligatorily long passives in Sesotho (Kline and Demuth 2010).

⁸ This study investigated the following corpora: AcadLang, Chang1, Chang2, ChangPlay, ChangPN, Erbaugh, LiReading, LiZhou, TCCM-Reading, TCCM, Tong, Xinjiang, Zhou1, Zhou2, Zhou3, ZhouAssessment, ZhouDinner, and ZhouNarratives.

After excluding 19 incomplete sentences, three indistinguishable utterances (i.e., those marked with ‘xxx’ in the transcripts), and two immediate repetitions, we found a total of 396 *bei*-passive utterances in the child corpora. In the CDS, there were 1,005 *bei*-passives, with no data excluded.

We annotated the sentence type of each *bei*-passive: (i) long passives (with an overt EA phrase after *bei*), (ii) short passives (without an overt EA phrase), or (iii) ungrammatical construction. There were 38 ungrammatical constructions, all found in the children’s utterances, including transitivity errors, word order errors, uninterpretable sentences, and other types of errors.

3.2. Long and short *bei*-passives in child speech and CDS

Our search for *bei*-passives first confirmed the previous observation of early passive production in Hu’s (2013) longitudinal study. The corpus data showed that Mandarin-speaking children already use a range of different verbs in both long (5) and short passives (6) around the age of 2 to 3.

- (5) a. *bei* mama na-zou le (2;01)
 BEI mom take-away PERF
 ‘[e] was taken away by mom.’
- b. Guaiguai tongtong *bei* xiongxiong chi-guang (2;06)
 Guaiguai all BEI bear eat-up
 ‘Guaiguai is all eaten up by the bear.’
- (6) a. ni ganggang you-mei-you *bei* ya-bian? (3;02)
 you just_now have-not-have BEI press-flat
 ‘Have you been pressed flat just now?’
- b. da-jiujiu yeshi *bei* pen-shang (3;04)
 eldest-uncle also BEI spray-up
 ‘Eldest uncle was also sprayed.’

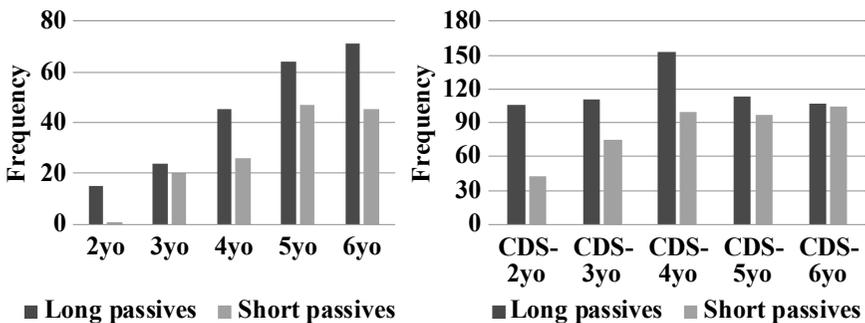


Figure 1. Frequencies of *bei*-passives in child speech (left) and CDS (right)

Among the 358 grammatical *bei*-passives produced by 2- to 6-year-olds, long passives (61.2%) are significantly *more frequent* than short passives (38.8%) ($p < .001$, binomial test), contrary to previous studies in other languages showing a higher percentage of short passives. Our results also show a similarly high proportion of long passives in the Mandarin CDS — 58.5% — which is not significantly different from the child data ($X^2(1) = 0.78, p = .38$). The frequency of each type of passive observed in child speech and CDS input are shown in Figure 1.

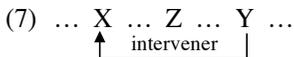
The high rate of long passives in child Mandarin can be attributed to the frequency of such passives in the input. It may also be that the children frequently use long passives for the same pragmatic or other reasons that Mandarin-speaking adults do. The interesting question, which we turn to shortly, is why children — who are known to adhere to a strict version of intervention — are able to produce long passives at all.

4. Study 2: An intervention effect in child Mandarin beyond input

Despite the similarity in child and adult production in terms of the prevalence of long passives, children's passive production did not match their input in all respects. In our second corpus analysis, we show that children's long passives are more restricted than the adult ones. Specifically, children produce far more long passives with arguments that are *mismatched* in animacy while the CDS shows the opposite tendency — far more passives with animacy-*matched* arguments. This contrast cannot be explained by input; instead, it demonstrates an important distinction between child and adult grammars, that is, children are subject to an intervention effect in long passives but adults are not.

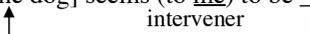
4.1. The Intervention Hypothesis

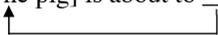
The Intervention Hypothesis (e.g., Hyams & Snyder 2005, Friedmann et al. 2009, Adani et al. 2010, Orfitelli 2012, Snyder & Hyams 2015, Mateu 2016, among others) claims that children are subject to a stricter version of (featural) Relativized Minimality (RM, Rizzi 1990, 2018) than adults, and therefore, as diagrammed in (7), the dependency between a moved element X and its gap Y is harder for children to acquire when it crosses an *intervener* Z that is also a potential antecedent for that gap.



In the case of passives, the movement of the internal argument (IA) to the surface subject position may cause difficulty for children, as the intervening EA triggers a violation of their stricter version of RM.⁹

Orfitelli (2012) found that children's comprehension of subject-to-subject raising (StSR) in English is poor with StSR predicates that select an intervening experiencer (overt or implicit) such as *seem*, *appear* in (8a), but good with 'non-experiencer' StSR predicates such as *(be) about*, *(be) likely* in (8b), which do not project an experiencer.

- (8) a. Experiencer StSR: [The dog] seems (to me) to be ___ purple.


 b. Non-experiencer StSR: [The pig] is about to ___ roll in the mud.


Crucially, she found a near perfect within-subject correspondence in children's acquisition of experiencer StSR sentences (8a) and verbal passives with non-actional verbs: If one of these two structures was delayed for a given child, both were, and if one had been mastered, both had. Therefore, she claimed that the EA triggers intervention in passives when the IA moves across it, the same way an experiencer triggers intervention when the subject raises over it in (8a), even when the intervener is not explicitly realized.¹⁰

In line with RM and the Intervention Hypothesis, some previous studies have shown that intervention in child grammars is sensitive to the morpho-syntactic features (e.g., number, gender, animacy) of the intervening DP and the moved DP. In particular, intervention is triggered when the moved DP's features are identical to or a subset of the intervener's features; when their features are disjunctive, the intervener does not disturb the dependency between a moved element and its trace (Friedmann et al. 2009, Adani et al. 2010, Belletti et al. 2012 among others).

For example, Mateu and Hyams (2020, 2021) found that English-speaking children's comprehension of object relative clauses (RC) and object 'sluices' (an elliptical construction) were overall worse than the subject counterparts, but crucially, their performance on object RC and sluices both improved significantly when there was a mismatch in the animacy features between the intervening subject and the moved object phrase. For example, the subject RCs in (9) were overall easier for children to understand than the object RCs (10), consistent with the Intervention Hypothesis. Moreover, children's difficulty comprehending object RCs (and object sluices) significantly decreased when there was a

⁹ For adults, the EA in passives is either (i) an adjunct (according to Bruening 2013, Legate 2014 and others) and therefore does not trigger intervention effects; or (ii) an argument that the IA is 'smuggled' over (Collins 2005) in a phrasal movement, hence also no violation of RM.

¹⁰ Orfitelli follows Collins (2005) in assuming that short passives have an implicit EA in English. In her study, children's behavior with structures containing overt and implicit interveners did not differ. She argues that implicit arguments can also trigger intervention effects.

In long passives, the EA functions as a subject of the phrase embedded under *bei*, as evidenced by its ability to bind a subject-oriented logophor *ziji* ‘self’ in (13) and to bind an anaphor *ta-ziji* ‘himself/herself’ in (14).

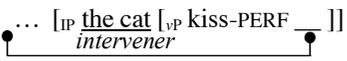
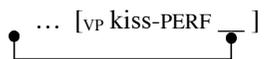
- (13) Zhangsan_i bei Lisi_i guan zai ziji_{i/j}-de fangjian
 Zhangsan BEI Lisi lock at self-GEN room
 ‘Zhangsan_i was locked by Lisi_i in his_{i/j} own room.’

(Adopted from Huang 1999)

- (14) zhe-tiao xinxi bei mei-ge ren_i fa-gei le ta-ziji_i
 this-CLF message BEI every-CLF person send-to PERF 3SG-self
 ‘This message was sent by everyone_i to himself/herself_i.’

By contrast, no EA is syntactically projected in short passives. This results in a much smaller phrase under *bei* that only allows A-movement, hence the lack of A-bar properties in short passives, as previously shown by the obligatoriness of the EA in (11) and (12).

There has been a debate in the syntax literature over the identity of the moved element in the derivation of Mandarin passives.¹¹ The current study abstracts away from the technical details of these analyses but focuses on their consensus that the extraction of the IA (be it the surface subject itself or a bound null operator or PRO; see footnote 11) crosses an existing argument in long passives, but not in short passives, as illustrated in (15).

- (15) a. Dependency in Mandarin long passives: 
 b. Dependency in Mandarin short passives: 

Since the extraction of the IA crosses an intervening EA in long passives (15a), but not in the short ones (15b), the Intervention Hypothesis makes the following two predictions regarding children’s acquisition of Mandarin passives: First, Mandarin long passives will be harder for children to acquire than short passives. Second, the difficulty in acquiring long passives will be alleviated by featural mismatches between the two arguments the EA and the IA. As noted in Study 1 (section 3.2), long *bei*-passives seem to be much more frequent than the short ones in child speech. On its face this seems problematic for the Intervention Hypothesis. In the following section we address the second prediction, that the

¹¹ Ting (1998) and Huang (1999) proposed that *bei*-passives have a base-generated surface subject. In long passives a bound null operator undergoes the extraction across the EA as shown in (15a), while in short passives a PRO controlled by the surface subject undergoes the extraction in (15b). By contrast, many more recent studies claim that the surface subject in *bei*-passives derives from movement (e.g., Liu & Huang 2016, Chen 2019). That is, the subject itself undergoes the extraction in (15a) and (15b).

potential intervention effect in long passives can be alleviated by featural mismatches between the two arguments – the EA and the IA.

4.3. Animacy conditions in full-NP long passives by children and adults

Our second study uses the same corpora as in Study 1, aiming to investigate the feature content of the NPs in children's and adults' production of long passives. Among the features previously examined in the intervention literature, *animacy* is the best test feature for our study, due to the lack of grammatical gender and number in Mandarin.

In order to see the animacy match/mismatch effects, we annotated animacy of the two arguments involved in the long passive utterances, namely the IA (the surface subject) and the EA. The animacy of each NP was based on our world knowledge and the contexts provided by the two utterances before and after the *bei*-passives. The animacy distinction was binary (animate vs. inanimate), with both human beings and animals considered as equally animate.¹²

Because the mismatch of NP types (e.g., [\pm wh], [\pm NP]) between the moved element and the intervener also affects intervention (e.g., Bentea et al. 2015), we identified the following four types of NP in our data and examined only the long passives in which both arguments are of the *same* NP type.

- (16) a. full NPs: *xionghao* 'panda', *zhe-ge daxiang* 'this elephant', etc.;
 b. personal and demonstrative pronouns (PRON): *wo* 'I', *zhe-ge* 'this', etc.;
 c. proper names (RP);
 d. *wh*-phrases: *shei* 'who', *shenme* 'what', etc.

However, the long passives with two PRONs, two RPs, or two *wh*-arguments had sample sizes too small and thus were excluded.¹³ As a result, only the long passives with two full NP arguments were included, such as (17). Henceforth we refer to them as *full-NP long passives*.

- (17) *daxiang bei da juren cai-si* (3;10)
 elephant BEI big Giant trample-dead
 'The elephant was trampled to death by the big Giant.'

In total there were 35 full-NP long passives in child speech and 52 in the CDS. Our results show that children's production did not match their input with respect to animacy properties. As shown in Figure 2, in the child data 77.1% of the full-NP long passives contained animacy-*mismatched* arguments, while in the adult

¹² Dolls and stuffed animals might also be considered animate by children. However, there were no such references in the data. Cartoon characters such as *dahuilang* 'Big Bad Wolf' were all considered animate.

¹³ In the child data, there were only 3 long passives with two PRON arguments, 1 with two RPs, and 0 with two *wh*-arguments.

data 76.9% of the passives contained animacy-*matched* arguments ($X^2(1) = 24.7$, $p < .001$).

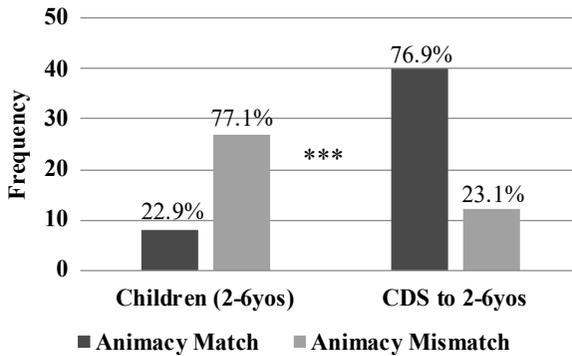


Figure 2. Animacy (mis)match in full-NP long passives in child Mandarin and CDS

Recall our previous results in Study 1, children use long passives significantly more frequently than short passives, consistent with what they hear in the input but apparently violating Intervention. Study 2 shows, nonetheless, that children’s passives differ from the input in a crucial respect: most of the full-NP long passives they produced contained two arguments with mismatched animacy features, which arguably shows an alleviation-by-featural-mismatch effect on intervention in child grammar. Importantly, the same alleviation effect was not observed in the adults’ production.

5. Discussion

The unique morpho-syntactic properties of Mandarin make it a good language for investigating the acquisition of passives. Syntactic evidence (see section 4.2) suggests that the EA in Mandarin long *bei*-passives is an argument – as opposed to an optional adjunct like the English *by*-phrase (Bruening 2013, Legate 2014; but cf. Collins 2005, Angelopoulos et al. 2020) – and it is structurally absent (not just phonologically unpronounced) in short passives. This asymmetry between the long and short forms makes sharp predictions regarding the potential intervention effects in child Mandarin. If children derive long passives the same way as adults (which we see as the null hypothesis), the EA should cause intervention effects in children’s long passives: First, long passives should be harder for children to acquire than short passives due to the syntactic intervention of the EA; and second, the difficulty in acquiring long passives could be alleviated by the featural mismatches between the EA and the IA.

Our corpus studies first demonstrated a significant long > short passive asymmetry in child Mandarin, not previously observed in other languages. The prevalence of long passives in child Mandarin reflects the higher frequency of

long passives in their input.¹⁴ In this respect children's language does not differ significantly from that of their parents. However, a closer look at the data suggests that child passives differ from the input in a crucial way: children – but not adults – overwhelmingly produced full-NP long passives with two arguments that have mismatched animacy features, arguably an alleviation of intervention. This distinction suggests that children are subject to a stricter grammatical constraint than adults, in that the intervention of the EA in long passives does not cause difficulty in adult language as it does in child language, to the point that children but not adults seem to rely on featural mismatch to evade the intervention difficulty.

Our hypothesis predicts that if the features (such as animacy and NP types) of the IA and the EA match, children will find long *bei*-passives difficult to comprehend and/or produce. In this regard, let us recall the apparent conflicting comprehension-production results in previous Mandarin studies: Mandarin-speaking children produce grammatical long *bei*-passives as early as the age of 3 but seem to have delayed comprehension of long (but not short) actional passives. In Xu and Yang's (2008) picture-selection task with images depicting two animals acting out two events with reversed theta-role assignments (e.g., The cat was hit by the dog vs. The dog was hit by the cat), children aged 3-5 generally performed worse on long passives (average 57.3% correct) than the short ones (average 88.6%). By the age of 5, children already show near-ceiling performance on short actional passives but their comprehension of long actional passives is significantly worse. We can explain these comprehension results when we consider the NPs used in Xu and Yang's (2008) study: all the long passives tested in their experiment contained two animacy-matched full-NP arguments such as *the cat* and *the dog*, which – by our hypothesis – should trigger an intervention effect and hence produce poor performance.

We therefore predict that children's comprehension of long passives will improve with two arguments that have mismatched features (different NP types, different animacy, etc.) in Mandarin and also other languages. A Mandarin study by the author testing this hypothesis is in progress.

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¹⁴ Why Mandarin-speaking adults in our corpus study use long passives more frequently is an open question. There are several possible directions to consider, such as the A-bar properties of long *bei*-passives that are not observed in other languages, and/or some pragmatic requirements for explicitly producing the EA under certain scenarios.

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