Frequency of Passive Voice in Children's Books

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Although language on the whole is acquired seemingly effortlessly by young children, some irksome aspects are mastered notoriously late. One of these is the passive voice (e.g., *The cookies got eaten*). For English learners, performance on passive voice comprehension and production tasks is poorer than on active voice tasks well into the early school years (e.g., Bever, 1970; Borer & Wexler, 1987; Brooks & Tomasello, 1999; Budwig, 2001; Harris & Flora, 1982; Horgan, 1978; Messenger, Branigan, & McLean, 2012; Marchman, Bates, Burkardt, & Good, 1991; Pinker, Lebeaux, & Frost, 1987; Turner & Rommetveit, 1967).

Theoretical accounts of why the passive is so difficult vary. According to syntactic accounts, the passive requires a movement operation that is not yet present in young children's grammar (e.g., Borer & Wexler, 1987). Other accounts instead credit difficulty with the passive to its extremely low frequency in the input—children lack sufficient experience with it to master it until relatively late in childhood (e.g., Bencini & Valian, 2008; Brooks & Tomasello, 1999; Demuth, 1989; Gordon & Chafetz, 1990; Harris & Flora, 1982).

Low frequency must be a contributing factor to poor passive performance, even if not the sole explanation. On any account, exposure is required for learning, and the pervasiveness of frequency-based effects in language acquisition and processing (e.g., Ambridge et al., 2015) indicate that generative accounts of language acquisition must also allow for frequency to affect representations even if it does not fully determine them. In languages in which the passive is more frequent in the input than it is in English—Inuktitut (Allen & Crago, 1996), Sesotho (Demuth, 1989, 1990; Demuth, Moloi, & Machobane, 2010), K'iche' (Pye & Quixtan Poz, 1988), and Zulu (Suzman, 1985, 1987)—children show earlier success with the passive.

According to processing and cue-based accounts, low input frequency plays a specific role in children's comprehension of passive voice: Because of the frequency of agent-first utterances in their input, children have an initial bias to interpret an utterance-initial noun phrase as referring to an agent rather than a patient. Further, they have difficulty revising this initial assignment because of their immature parsing systems (e.g., Huang, Zheng, Meng, & Snedeker, 2013; Stromswold, 2002; see also Zhou & Ma, 2017). Therefore, their lack of

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experience with passive voice makes it difficult for them to parse passive structures effectively, but does not necessarily indicate a lack of syntactic ability or syntactic competence. These accounts are supported by findings that individual differences in processing ability affect passive performance; three recent studies have found relations between processing and success on passive comprehension tasks. Messenger and Fisher (2018) demonstrated that children with lower vocabularies struggled more to comprehend the passive than children with higher vocabularies, but this difference disappeared when processing and task demands were reduced (e.g., with more repetitions of the test sentences). Huang, Leech, and Rowe (2017), and Leech, Rowe, and Huang (2017), drawing on findings that children from lower-socioeconomic status (SES) backgrounds have poorer language processing skills than children from higher-SES backgrounds, found that although 3- to 7-year-old children from both higher- and lower-SES backgrounds could comprehend the passive, children from higher-SES backgrounds performed better than lower- SES peers when the sentence presented a parsing challenge.

Why might SES be associated with variability in language processing, and in turn, with performance on tasks requiring passive comprehension? Although there are large individual differences, on average, children from lower-SES backgrounds receive a lower quantity and quality of language input (and specifically, of child-directed speech), which in turn leads to less well developed processing skills (e.g., Fernald, Marchman, & Weisleder, 2013; Weisleder & Fernald, 2013). Thus, these global language processing skills affect children's abilities to revise their initial parse of passive sentences, and impair performance on passive comprehension tasks.

Another, not mutually exclusive, way in which passive comprehension might vary by family SES is if there are construction-specific differences in the frequency of exposure to the passive voice among higher- and lower-SES children. On this account, children from lower-SES families may display global differences in speed of language processing as well as specific challenges with the passive construction because they have less practice with it. Higher-SES parents use significantly more complex syntax than lower-SES parents in child-directed speech (Hoff-Ginsberg, 1991; Huttenlocher, Vasilyeva, Cymerman, & Levine, 2002; Huttenlocher, Waterfall, Vasilyeva, Vevea, & Hedges, 2010). However, there is no evidence that the passive occurs in especially high frequencies even in higher-SES child-directed speech.

Another possibility is that higher-SES children receive increased exposure to the passive voice from books. The passive construction has been suggested to be a feature of "academic" language (e.g., Berman, 2004; Vasilyeva, Huttenlocher, & Waterfall, 2006). Could it be that it is substantially more frequent in children's books than in conversational child-directed speech? If so, this fact could help to explain SES differences, as there are SES-related differences in book exposure in the home (Payne, Whitehurst & Angell, 1994; Scarborough & Dobrich, 1994). Such differences could have cascading effects. Facility with academic language is critical for success in school (e.g., Snow & Uccelli, 2009; Van Kleeck & Schwarz, 2011), and several studies find that children's success in school is

correlated with academic language exposure at home, such as from literacy activities (e.g., Aarts, Demir-Vegter, Kurvers, & Henrichs, 2016; Scheele, Leseman, Mayo, & Elbers, 2012).

Cameron-Faulkner and Noble (2013), Dawson, Hsiao, Tan, Banerji, and Nation (2021), and Montag (2019) have all argued that children's books are in fact a good source of complex linguistic input. Montag (2019) specifically coded for passive voice in a large-scale study and found that it was significantly more frequent in books than in child-directed speech. Her corpus included books directed to children ages 0 to 60 months—many considerably younger than 3 years, the youngest age of most studies of passive voice competence.

Our goal in the current study to ensure that we are not overlooking a potentially rich source of passive construction input by evaluating the frequency of the passive in children's books. We focus on children ages 3 to 5 years, when we think they are in the throes of acquiring passive voice as based on experimental studies, and ages 6 to 8 years, when we expect that they have acquired it or are close to doing so. For comparison, and to replicate Gordon and Chafetz's (1990) and Montag's (2019) prior reports of low frequency in child-directed speech, we also included a sample of child-directed speech.

Additionally, to offer insight into not only the quantity of passive exposure but also its quality, we compare books and child-directed speech with respect to the kinds of passive forms they contain because not all passives are alike. Decades of research have shown that both syntactic and semantic properties affect acquisition: *get*-passives (e.g., The fish got caught (by the fisherman)) are acquired earlier than *be*-passives (e.g., The fish was caught (by the fisherman)), short passives (e.g., The fish was caught) earlier than long passives with a *by*-phrase, and actional passives earlier than non-actional passives (e.g., The fish was seen by the fisherman) (e.g., Fox & Grodzinsky, 1998; Gotowski, 2018; Harris & Flora, 1982; Maratsos, Fox, Becker, & Chalkley, 1985).

Thus, if book text is to support passive acquisition, it may be that higher frequency of some passive types is more useful than others. The full passive structure with a *by*-phrase, the one least likely to occur in child-directed speech, might be particularly useful. For example, in one exceptional case to the frequency-based effects described above, that of Cantonese, for which frequency of the passive is extremely low but it is acquired by age 3, the demoted agent is obligatorily expressed (Lau, 2011). This suggests that strong cues to the passive structure can support acquisition—and supports the notion that even if at a low frequency, the presence of full passives in book text might increase passive success in children exposed to books.

We also include lexical semantic features in our analysis. Verb semantics determine in the ease of acquisition of particular verbs (e.g., Gentner, 1978; Horvath, Rescorla, & Arunachalam, 2018, 2019; Gropen et al., 1991), and moreover, Nguyen and Pearl (2017) argue based on a meta-analysis of children's performance in passive tasks that verb lexical semantics matter for passive acquisition as well. In particular, verbs that are actional rather than stative, and that denote events with a volitional agent and affected patient, tend to yield greater success in tasks requiring children to interpret passives than verbs without these

features (see, e.g., Fox & Grodzinsky, 1998; Gordon & Chafetz, 1990; Hirsch & Wexler, 2006; Horgan, 1978; Maratsos et al., 1985; Meints, 1999; Sudhalter & Braine, 1985). Therefore, we coded the passives in books and child-directed speech according to syntactic and semantic type to examine if these two sources differ in the frequencies of different passive types.

1. Methods

1.1. Materials

Children's book sample. Forty children's books were chosen on November 2, 2015 from amazon.com, using that website's lists of "Featured" books in each of two age groups: ages 3-5, and 6-8. We selected the first twenty books from each age group in that list that did not meet the following exclusionary criteria: (1) written by an author already represented in the list (to avoid inflating effects of idiosyncratic writing style), (2) directed toward adults (e.g., books about parenting), (3) with a seasonal or religious theme (to avoid books that would only be read by a select group), or (4) not in prose or narrative format (e.g., books of jokes). Both fiction and non-fiction books were included. Some books appeared on the "Featured" list for both age groups; we used these only once and categorized them in the age group for which their rank in the "Featured" list was higher. Because some of the books for older children were quite long, we only coded the first 110 verb phrases of these; this was the average number of verb phrases in the books for younger children.

Child-directed speech (CDS). Caregiver speech from the CHILDES database (MacWhinney, 1991) was analyzed. Ten transcripts were selected from the North American English corpora of caregiver-child interactions in which only one child between the ages of 3;0 and 5;11 was present. These were: Cornell (Hayes, 2004) lsno11; Demetras (Demetras, 1989) tre20; Feldman (Feldman, Keefe, & Holland, 1989; Keefe, Feldman, & Holland, 1989) nchi0227 and nchi 0439; Nicholas (Nicholas & Geers, 1997) nh48m-jobey, nh54m-raidon, and nh54m-cosmo; and Warren (Warren-Leubecker, 1982; Warren-Leubecker & Bohannon, 1984) andy, david, and louise. As with the books, only the first 110 verb phrases from each caregiver speech sample were coded. There were insufficient transcripts in CHILDES from the 6-8 age range to include child-directed data for the older group.

1.2. Coding

Both book and child-directed language were coded at the verb phrase level in the same manner. Each verb phrase was assigned one of the following codes: Active, Copular, Adjectival Passive, Full Get-Passive, Short Get-Passive, Full Verbal Passive, Short Verbal Passive. Modals and "intermediate" verbs (Quirk et al., 1985, e.g., "kept" in *The cat kept jumping*) were excluded from analysis. Active participles (e.g., *was gone*) were distinguished from passive participles by their inability to take a *by*-phrase (whether or not they did in the token). Adjectival

passives (e.g., *The cat was very excited*) were distinguished from short verbal passives (e.g., *The cat was fed*) as in prior work (see, e.g., Levin & Rappaport, 1986; Wasow, 1977) by whether an actional interpretation was possible. Because adjectival passives were excluded from some analyses, we were conservative when in doubt, coding most tokens as verbal passives. Most of the tokens we coded as adjectival passives could be preceded by "very" (e.g., *tired, excited*). We did not distinguish between resultative and stative adjectival passives (Embick, 2004; Kratzer, 1994), and statives without verbal morphology (e.g., *open*) were not coded.

We further categorized the non-adjectival passives according to lexical semantic features of the verbs, using Nguyen and Pearl's (2017) Table 1 as a guideline. Note that because we were conservative in identifying adjectival passives, we were still able to distinguish some of the tokens we had classified as non-adjectival to be "stative" rather than "actional" (e.g., "*[She] was encouraged to change her last name*"). For this coding, we considered the verbs independently of their particular sentence contexts, except insofar as we judged particular verbs to be polysemous and differing in their lexical semantic features by sense—in these cases we used VerbNet (Kipper, Korhonen, Ryant, & Palmer, 2006) to help identify which sense might be relevant.

Three coders were involved in the process; two performed initial coding and a third coded 30% of the book data and 30% of the CDS data for reliability. Interrater agreement was 97.3%; disagreements were resolved by discussion, assisted by the final author.

2. Results

In the children's books for ages 3 to 5, of 1677 non-copular verb tokens coded, 57 tokens, or 3.40%, were any kind of passive, including adjectival passives. If adjectival passives are excluded, 38, or 2.27%, remain.

In the books for older children ages 6 to 8, the pattern is similar; of 2137 verb phrases coded, 80, or 3.74% were any kind of passive including adjectival passives. With adjectival passives excluded, 57, or 2.66%, remain.

In child-directed speech to 3- to 5-year-olds, of 1122 verb phrases coded, 29, or 2.58%, were any kind of passive when adjectival passives were included. With adjectival passives excluded, 23, or 2.050%, remain.

Numerically, there is a slightly larger percentage of passive tokens in the books as compared to child-directed speech, and in books for older children as compared to younger children. However, it is important to remember the scale of the differences—the largest differences are on the order of 1 utterance of 100. Unsurprisingly, we found no statistically significant differences: We submitted the data to four binomial mixed-effects linear regressions, two comparing book and child-directed speech data for the 3 to 5 group only (because we did not have child-directed speech data for 6- to 8-year-olds), and the other two comparing book data for the 3 to 5 group to book data for the 6 to 8 group. For the first two models, we effect coded the fixed factor of type (book coded as 0.5 and child-directed speech coded as -0.5), and for the second two we effect coded the fixed

factor of age group (3-5 coded as -0.5 and 6-8 coded as 0.5). One model of each pair included adjectival passives while the other included only non-adjectival passives as the dependent variable. All four models included source (book or transcript name) as a random factor. The first two models showed no effect of book vs. child-directed speech data within the 3 to 5 age group (with adjectival passives: $p = 0.83$; without adjectival passives: $p = 0.74$), and the second two models showed no effect of age group within the book data (with adjectival passives: $p = 0.35$; without adjectival passives: $p = 0.24$). See Table 1 for full models.

Table 1. Parameter estimates for models testing for differences between book text and CDS in the 3 to 5 age group, and book text in the 3 to 5 vs. the 6 to 8 age groups.

Model: book text vs. CDS, 3 to 5 age group, adjectival passives included *lmer()* syntax: data.lm <- glmer(AnyPassive ~ (1|Source) + SourceType, data = data, family = binomial, glmerControl(optimizer="bobyqa", optCtrl = list(maxfun = 100000))))[1]				
Parameter	Estimate	SE	*z*-value	*p*-value
Intercept	-3.82	0.23	-16.78	< .001
Source (book vs. CDS)	0.087	0.40	0.22	0.83
Model: book text vs. CDS, 3 to 5 age group, adjectival passives excluded *lmer()* syntax: data.lm <- glmer(AnyPassive ~ (1|Source) + SourceType, data = data.excladjp, family = binomial)				
Parameter	Estimate	SE	*z*-value	*p*-value
Intercept	-4.32	0.30	-14.48	< .001
Source (book vs. CDS)	-0.17	0.51	-0.34	0.74
Model: book text, 3 to 5 vs. 6 to 8 age group, adjectival passives included *lmer()* syntax: data.lm <- glmer(AnyPassive ~ (1|Source) + AgeGroup, data = data.excladjp, family = binomial)				
Parameter	Estimate	SE	*z*-value	*p*-value
Intercept	-3.56	0.16	-21.61	< .001
Age (3to5 vs. 6to8)	0.28	0.30	0.93	0.35
Model: book text, 3 to 5 vs. 6 to 8 age group, adjectival passives excluded *lmer()* syntax: data.lm <- glmer(AnyPassive ~ (1|Source) + AgeGroup, data = data.excladjp, family = binomial)				
Parameter	Estimate	SE	*z*-value	*p*-value
Intercept	-4.079	0.22	-18.92	< .001
Age (3to5 vs. 6to8)	0.45	0.38	1.18	0.24

Note that we found a much higher percentage of passives than Gordon and Chafetz (1990), who found 197 examples of adjectival passives and 91 examples of verbal passives in a corpus containing 33,125 non-copular verbs (Gordon and Chafetz reported the number of utterances, but we use Kline and Demuth's (2010)

[1] Because the model initially failed to converge, we increased the number of iterations of attempts at model fit using the glmerControl() function.

report of the number of verbs for the corpus used by Gordon and Chafetz), or just 0.27%. Recall that Gordon and Chafetz excluded repetitions of the same utterance (we included all tokens) and forms for which "the interpretation was too idiosyncratic to be classified as a true passive" (233), such as, "is called," (which we also included). Excluding "is called" from our own counts yields much lower passive frequency; for example, of just 1.60% in child-directed speech. Without an exhaustive list of what Gordon and Chafetz considered idiosyncratic, we undertook our analysis separately. Our critical comparison, of course, is between CDS and book samples.

Although passives were quite infrequent in books, as in child-directed speech, books may still provide higher quality input, for example, in the form of full *be*-passives that provide the most explicit evidence about the passive structure. Therefore, we explored the types of passives that appeared in both sources, focusing for the remainder of the analyses only on the 3 to 5 age group to permit comparison between book text and CDS. We carried out two comparisons. First, given evidence that *get*-passives are acquired earlier than *be*-passives, and that short passives are acquired before full passives, we asked whether there were differences in the prevalence of *get*- vs. *be*-passives, and short vs. full passives in book text as compared to child-directed speech. Second, given evidence that the lexical semantics of verbs influences passive acquisition (see Nguyen & Pearl, 2017), we asked about the prevalence of lexical semantic properties in the passives occurring in both book text and child-directed speech. Adjectival passives were excluded from both of these analyses.

For the first analysis, we coded each passive occurrence for whether it was a *get*- or *be*- passive, and whether it was a short or full passive. See Figure 1. Short *be*-passives were by far the most common in both the book text and CDS samples, in equal measure, and full *get*-passives were absent.

Full *be*-passives were numerically more prevalent in book text, and short *get*-passives were more prevalent in CDS. This pattern is consistent with the notion that full *be*-passives belong to an academic speech register while short *get*-passives belong to a colloquial register. Further, it holds promise for the idea that book text might provide at least some exposure to the full *be*-passive and its strong cues that might support passive acquisition. However, the differences were numerically small, and not statistically significant: To investigate whether these differences were reliable, we submitted the data to two binomial mixed-effects regressions, one comparing *be*- vs. *get*- (*be*- coded as 1, *get*- coded as 0, collapsing across length), and the other comparing short vs. full (short coded as 1, full coded as 0, collapsing across *be* vs. *get*). Both models included a fixed factor of sample as above (book coded as 0.5 and child-directed speech coded as -0.5) The former model showed a significant intercept ($p < .005$, indicating that *be* passives were more common than *get* passives), but no effect of book text vs. CDS. See Table 2 for parameter estimates. The latter model did not converge due to insufficient variance. The minimal variance and small sample size likely contributed to the failure to find effects and these results should not be taken as evidence that book text and CDS are qualitatively equal; however, nor is it the case that there are large identifiable differences between them that are likely to play a substantial

role in children's daily experiences. To the extent that differences do exist, they may be small.

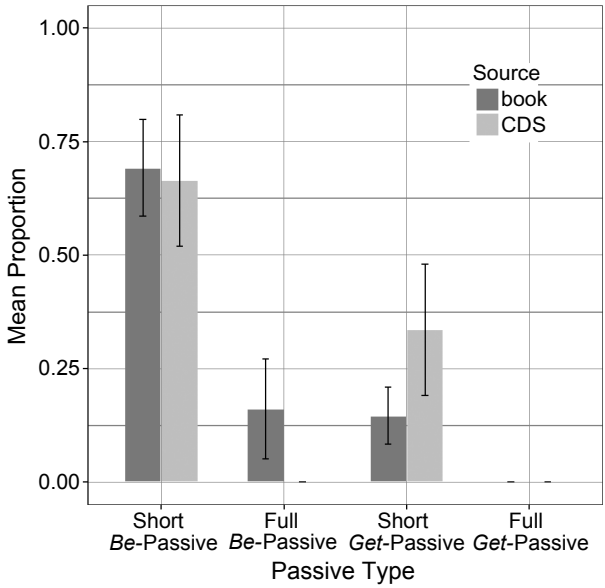

Figure 1. For the 3 to 5 age range, passive frequency in book text and CDS divided by syntactic type.

Table 2. Parameter estimates for the model testing *be* vs. *get* passives in book text and CDS for the 3 to 5 age group.

Model: *be* vs. *get*, 3 to 5 age group, adjectival passives excluded *lmer()* syntax: data.lm <- glmer(BEvGET ~ (1|Source) + SourceType, data = data, family = binomial				
Parameter	Estimate	SE	*z*-value	*p*-value
Intercept	1.27	0.43	3.60	< .005
Source (book vs. CDS)	0.85	0.81	1.051	0.29

For the second analysis, we coded each passive according to the lexical semantics of the verb, drawing on Nguyen and Pearl's Table 1: each verb was coded as +/- actional, stative, volitional, affected, object-experiencer, subject-experiencer, and agent-patient. We used diagnostics discussed by Nguyen and Pearl and the literature cited therein. Two coders coded independently, discussed differences, and then recoded until 100% agreement was achieved. The coders judged the verbs themselves without consideration of their larger contexts in the sentences in which they occurred, except for cases in which it seemed that a specific sense of a verb was relevant. See Figure 2. Not surprisingly, binomial mixed-effects regressions, one for each lexical semantic feature, showed no effect of book text vs. CDS. In both genres, prototypical actional passives with volitional

agents and affected patients were the most frequent, and these are the verb types that Nguyen and Pearl find to be the earliest acquired. (Models for the object-experiencer and subject-experiencer features did not converge due to insufficient variance.) Book text, then, does not appear to provide different input with respect to verb type than CDS. See Table 3 for all parameter estimates.

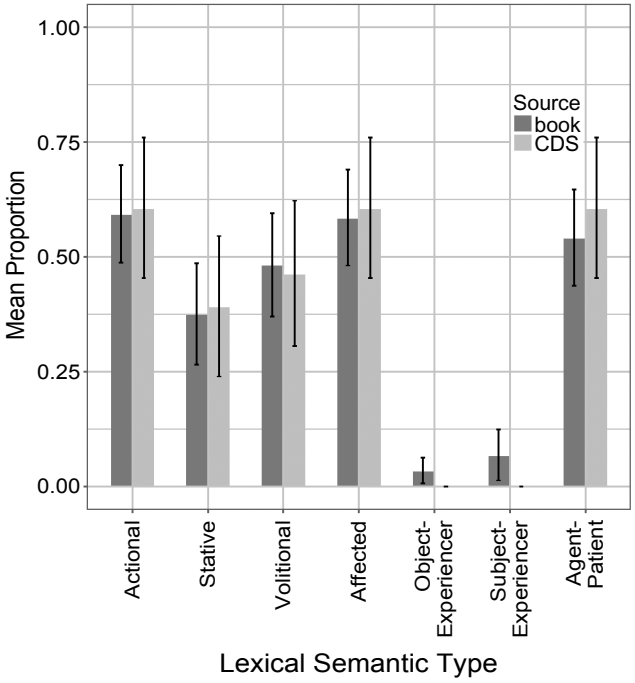

Figure 2. For the 3 to 5 age range, passive frequency in book text and CDS divided by verb type using Nguyen and Pearl's (2017) coding.

Table 3. Parameter estimates for models testing lexical semantic verb features in book text and CDS for the 3 to 5 age group.

Model: actional feature, book text vs. CDS, 3 to 5 age group, adjectival passives excluded *lmer()* syntax: data.lm <- glmer(Actional ~ (1|Source) + SourceType, data = data, family = binomial				
Parameter	Estimate	SE	*z*-value	*p*-value
Intercept	0.35	0.41	0.86	0.39
Source (book vs. CDS)	0.44	0.83	0.54	0.59
Model: stative feature, book text vs. CDS, 3 to 5 age group, adjectival passives excluded *lmer()* syntax: data.lm <- glmer(Stative ~ (1|Source) + SourceType, data = data, family = binomial				
Parameter	Estimate	SE	*z*-value	*p*-value
Intercept	-0.50	0.45	-1.11	0.27
Source (book vs. CDS)	-0.64	0.89	-0.72	0.48
Model: volitional feature, book text vs. CDS, 3 to 5 age group, adjectival passives excluded *lmer()* syntax: data.lm <- glmer(Volitional ~ (1|Source) + SourceType, data = data, family = binomial				
Parameter	Estimate	SE	*z*-value	*p*-value
Intercept	0.052	0.41	0.13	0.90
Source (book vs. CDS)	0.49	0.82	0.60	0.55
Model: affected feature, book text vs. CDS, 3 to 5 age group, adjectival passives excluded *lmer()* syntax: data.lm <- glmer(Affected ~ (1|Source) + SourceType, data = data, family = binomial				
Parameter	Estimate	SE	*z*-value	*p*-value
Intercept	0.30	0.39	0.76	0.45
Source (book vs. CDS)	0.39	0.79	0.49	0.63
Model: agent-patient feature, book text vs. CDS, 3 to 5 age group, adjectival passives excluded *lmer()* syntax: data.lm <- glmer(AgtPat ~ (1|Source) + SourceType, data = data, family = binomial				
Parameter	Estimate	SE	*z*-value	*p*-value
Intercept	0.12	0.40	0.31	0.76
Source (book vs. CDS)	0.031	0.78	0.040	0.97

3. General Discussion

Children's acquisition of the passive voice has been a topic of language acquisition research for decades. It poses interesting puzzles both for thinking about language acquisition—how do children manage to acquire it given limited evidence—and about language development—assuming abstract grammatical knowledge, why does it take them so long to become proficient users of it? Input frequency is likely to play a role, and it is particularly noteworthy that studies have found extremely low rates of exposure in the input to passive voice in English. Our goal in the current study was to examine whether children's books

might make up some substantial, previously unrecorded, portion of passive voice exposure. We also wondered whether the types of passive voice instances found in books differ from those in CDS, perhaps with books providing more instances that might be particularly helpful for learning how the structure works. But the overarching conclusion of this small study is that passive voice usage is numerically slightly higher in book text than CDS, but not significantly so. Moreover, children's books do not differ significantly from CDS in type of passives; it is not the case, for example, that children's books have an overwhelming proportion of full passives with a *by*-phrase, although it is notable that these did occur sometimes in our children's book sample and not at all in our CDS sample. (See Davies, Lingwood, and Arunachalam, 2020 for parallel findings with adjectives—adjectives do not occur substantially more in contexts that are thought to support adjective acquisition in books than they do in CDS.)

It is therefore unlikely that exposure to books constitutes a substantial portion of children's passive voice input, at least at the ages when most experimental studies suggest that children are actively acquiring passive voice. This finding stands in contrast to Montag (2019), who found that children's books directed to ages 0-60 months do have significantly more passive voice than CDS. We are unsure why our results differ, but we suspect one of three factors. First, Montag's study was much larger, containing 100 books to our 40. Our small sample size is a limitation. Second, our sample of books was directed to the top end and beyond of the age range that Montag investigated. It could be that older children receive more balanced exposure to passive voice that is more similar both books and CDS. Third, differences in coding schemes may have large impacts on the results. In CDS in particular, we found many instances of the same or similar phrases that might have been coded differently in previous work (e.g., "it's called…"). For this reason, having a well-articulated coding scheme, ideally based on distinctions made in the linguistics literature, for how passives will be coded is important for achieving replicable results on this topic.

Our finding suggests that it is unlikely that SES-related difference in book exposure are alone responsible for slower processing of passive voice constructions in lower-SES children. One suggestive possibility is that the very rarity of passive voice in the input marks it as a kind of academic or "special" language register, and that there are SES-related differences in children's interest in and attention to academic language (Corriveau, Kurkul, & Arunachalam, 2016). Interestingly, a preference for academic language may be learnable; Leech, Haber, Arunachalam, Kurkul, and Corriveau (2019) found that exposure to bespoke books including a lot of passive voice and other complex syntax increased lower-SES children's willingness to learn from speakers who used an academic speech register.

However, this possibility says little about processing-based differences in passive language ability. The importance of processing in grammatical acquisition (e.g., Omaki & Lidz, 2015) as well as lexical acquisition (e.g., He & Arunachalam, 2017; He, Kon, & Arunachalam, 2020) is clear, and so a full explanation will need to address the data about processing as well. While lexical processing studies establish that processing speed is predictive of language and

cognitive outcomes (e.g., Koenig et al., 2020; Marchman & Fernald, 2008), we understand less about how processing of complex structures like the passive is driven by lexical vs. structural factors, and how these relate to other abilities.

3.1. Is the passive really academic language?

We began from the premise that passive voice is a feature of academic language and may therefore be of higher frequency in book text. The low rate of passives in books, too, does not necessarily call into question this notion, given that we targeted books aimed at the preschool years when the passive is being acquired. Given the low frequency of passives in corpus work, however, we wondered whether there are indeed settings in which it is more common. Montag and MacDonald (2015) examined relative clauses in literature for older children (ages 4 to 16 years) and found that passive relative clauses are more frequent in literature than in child-directed speech, and further that children with more text exposure produced more passive relative clauses in a picture-description task. But we are unaware of measures of passive voice in written language outside of relative clauses.

To explore this issue, we undertook investigation of a small sample of language in a highly erudite context: the Supreme Court of the United States, which provides a relatively unique opportunity to examine both oral and written language from the same individuals. We examined approximately 100 verb phrases in each of 8 sources: oral argument from four cases (Abramski v. United States, Knox v. Service Employees International Union, Rodriguez v. United States, and Padilla v. Kentucky), and written material related to each of these same cases (the syllabus, or a summary added by the Court to help the reader understand the main opinion, for the first three cases, and the Court's opinion for the last case). We omitted footnotes, and for the oral argument excerpts, we did not distinguish among different speakers. We found that indeed, passive voice was more frequent in both oral and written Court language: in the oral argument transcripts, 9.6% of verb phrases were passive, and in the written syllabi and opinion, 12.7% were passive. Of the passives, the majority (83% of passives in the oral arguments, and 41% of the written materials), were short *be*-passives, with full *be*-passives next (10% in the oral arguments and 14% in the written materials), followed by reduced relatives (e.g., "…conduct committed on American soil") (23% in the oral arguments and 48% in the written materials). It is reasonable, then, to say that passive voice is academic language, and that occurs at similar frequencies in speech and writing in the context of the Court.

3.2. How frequent is frequent enough?

An interesting problem for studying rarely encountered linguistic constructions or phenomena is that we do not know how much input is required for learning. That is, given that children's books do contain some passive voice, and slightly more than child-directed speech, could that cumulative amount of input be sufficient to speed the acquisition process for an avid book listener? Yang

(2002, 2010, 2011) identifies relations between frequency of exposure to various constructions and acquisition of relevant syntactic features. He notes that features that appear to be acquired developmentally very early occur in the input with about 7% or greater frequency (e.g., 25% for *wh*-questions, 7% for French verb raising), and features that appear to be acquired at or after 3 years of age occur much more rarely than that, with less than 2% frequency (e.g., expletive subjects in English). Previous corpus work on child-directed speech clearly puts the input frequency of passive voice below the 7% and even below the 2% threshold. Yang's interest is in parameter-setting rather than acquisition of syntactic frames, and this argument may not generalize more broadly (Yang, 2010). Further, there is a large gap between the 7% that has been shown to be sufficient for early acquisition and the less than 2% that is associated with late acquisition, and we do not yet know where in between these two numbers the true threshold would be if one could be identified. But broadly speaking, our finding of passive frequency at around 2-3% in both book text and CDS suggests that children with a high degree of book exposure do indeed receive more passive exposure than the rare <2%.

When considering the relation between frequency of exposure and acquisition, it is also relevant to remember that although passive acquisition is delayed relative to active, the age at which children succeed on passive voice tasks, even in English, has decreased as our experimental methods to assess their knowledge have become more sophisticated (e.g., Abbot-Smith, Imai, Durrant, & Nurmsoo, 2017; Bencini & Valian, 2008; Messenger & Fisher, 2018; O'Brien, Grolla, & Lillo-Martin, 2006). Although children do perform better with active voice tasks at earlier ages, these newer experimental results suggest that early work underestimated children's passive comprehension and production abilities. Given the low frequency of the passive across both speech and books, it is remarkable that young children show some competence with the passive even at 2 and 3 years of age.

3.3. Limitations

Several limitations of the current study warrant attention. First, because of the low overall frequency of passive voice in the input, our analyses were likely underpowered to detect any differences among passive voice types. Over the long time scale of the preschool years, it remains plausible that differential exposure to different passive voice types plays a role in development. Second, although we chose one approach to sampling popular children's books (best seller lists on amazon.com), this sample of 40 books may not reflect the amount of individual variation in the books that children are read, especially for older children (Hudson Kam & Matthewson, 2017).

Third, we only considered the book texts themselves and not the language that parents use during book-reading. Despite the relatively low rate of passive exposure in children's books, it is without doubt that book-reading, and especially shared book-reading, is valuable for children's linguistic development. Parent talk is more syntactically complex overall, even if not specifically in passive voice,

during book-reading as compared to other activities (e.g., Crain-Thoreson, Dahlin, & Powell, 2001; Hoff-Ginsberg, 1991; Noble, Cameron-Faulkner, & Lieven, 2018), and is tuned to children's abilities in various ways (e.g., Arunachalam, 2016; Hoff-Ginsberg, 1994; Huttenlocher et al., 2007; Newport et al., 1977). Further, depending on characteristics of the language being acquired, acquisition of passive voice is related to other aspects of morphosyntactic development (e.g., Pruitt, Oetting, & Hegarty, 2011), and so it should be related to exposure in multiple ways. Much larger analyses of corpora of parent-child interactions are critical if we are to understand the full characteristics of children's language exposure.

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