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BRIEF RESEARCH REPORT

Comprehension of the copula: preschoolers (and sometimes adults) ignore subject–verb agreement during sentence processing

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Abstract

Subject–verb (SV) agreement helps listeners interpret the number condition of ambiguous nouns (*The sheep is/are fat*), yet it remains unclear whether young children use agreement to comprehend newly encountered nouns. Preschoolers and adults completed a forced choice task where sentences contained singular vs. plural copulas (*Where is/are the [novel noun(s)]?*). Novel nouns were either morphologically unambiguous (*tup/tups*) or ambiguous (/geks/ = singular: *gex* / plural: *gecks*). Preschoolers (and some adults) ignored the singular copula, interpreting /ks/-final words as plural, raising questions about the role of SV agreement in learners' sentence comprehension and the status of *is* in Australian English.

Keywords: language change; comprehension; agreement

Introduction

Young children are remarkably adept at comprehending and acquiring new words. This ability is achieved, in part, through their knowledge of syntax and morphology. Children are able to make sense of unfamiliar words when they are used in familiar syntactic constructions (Arunachalam & Waxman, 2010; Bernal, Lidz, Millotte, & Christophe, 2007; Fisher, Hall, Rakowitz, & Gleitman, 1994; Lidz, Gleitman, & Gleitman, 2003; Waxman & Booth, 2001), and when they have familiar morphological structures (Arias-Trejo, Cantrell, Smith, & Canto, 2014; Davies, Xu Rattanasone, & Demuth, 2017; Davies, Xu Rattanasone, Schembri, & Demuth, 2019; Kouider, Halberda, Wood, & Carey, 2006). Yet it is unclear what other morphosyntactic cues children use to interpret newly encountered words. Agreement, for example, is a potentially powerful tool for facilitating sentence processing. Through agreement, different words in a given syntactic structure share one or more grammatical features (such as number), providing listeners with the means to employ their knowledge of one word to facilitate their comprehension of another. However, it is not known whether young children can employ knowledge of agreement – specifically subject–verb (SV) number agreement – to comprehend unfamiliar nouns.

In English (and many other languages), NUMBER may be expressed across multiple words within a sentence. Verbs may agree in number with their subject noun (e.g., *the cat is/was happy*; *the cats are/were happy*), and determiners may agree with the number of their head noun (e.g., *a/that/this cat*; *some/those/these cats*). For regular nouns, number is expressed through morphology. The word *cats* is understood as plural because it has the morphological structure of *cat* + *s*, containing the plural morpheme -*s*. By 24 months, children recognise the morphological structure of novel words, showing that they know that *find the teps* refers to more than one *tep* (Davies *et al.*, 2017). However, in the case of some irregular nouns, agreement is sometimes the only way to determine number (e.g., *look at that/those sheep*; *the fish is/are happy*). Therefore, in order to achieve adult-like comprehension, children must learn to be sensitive not only to the syntactic and morphological structure of a sentence, but also to any grammatical agreement that may exist between words. Yet, it remains unclear to what extent young children are able to use number agreement to determine whether a previously unheard word is singular or plural.

There is some evidence that children are sensitive to English SV agreement violations before the age of two (Soderstrom, White, Conwell, & Morgan, 2007; Sundara, Demuth, & Kuhl, 2011), yet studies of children's comprehension of number agreement appear to yield mixed results. Picture-pointing tasks using familiar words have found that children as old as six years struggle to demonstrate comprehension of SV number agreement (de Villiers & Johnson, 2007; Johnson, de Villiers, & Seymour, 2005). In contrast, in an intermodal preferential looking task (IPL; Golinkoff, Hirsh-Pasek, Cauley, & Gordon, 1987) 24-month-olds were able to identify (and possibly predict) upcoming novel nouns through copula and determiner agreement (e.g., *there are some blickets* vs. *look at the blickets*; Kouider *et al.*, 2006). Other visual world tasks have demonstrated that children aged from 30 months to six years are able to use plural copula SV agreement (i.e., *are*) to facilitate comprehension of familiar plural words, but do not seem to do the same with singular copula SV agreement (i.e., *is;* Lukyanenko & Fisher, 2016; Lukyanenko & Miller, 2018). Another study found that three-year-olds can use both *is* and *are* to correctly predict familiar pictures before being explicitly named, yet they had greater accuracy in predicting plural targets (Deevy, Leonard, & Marchman, 2017). Cross-linguistic differences have also been found. A series of IPL studies showed that French-speaking 30-month-olds were able to comprehend scenes with novel nouns using SV number agreement (*Il(z) embrasse (nt) le gef* 'he/they kiss the gef'; Legendre, Barrière, Goyet, & Nazzi, 2010), yet children of the same age acquiring English (e.g., *The boy(s) kiss(es) the naj*) or Spanish (*besa(n) el micho* 'he/they kiss the micho') were not (Legendre *et al.*, 2014).

One of the differences between studies finding children able to comprehend English SV number agreement and those who did not was the type of SV agreement tested. Those studies finding children unable to comprehend SV agreement examined the third person singular verbal inflection (3SG: e.g., *the boy jumps*; de Villiers & Johnson, 2007; Johnson *et al.*, 2005; Legendre *et al.*, 2014), whereas those where children did exhibit comprehension examined the copula (*is/are*; Deevy *et al.*, 2017; Kouider *et al.*, 2006; Lukyanenko & Fisher, 2016; Wood *et al.*, 2009). While children are sensitive to 3SG from an early age (Soderstrom *et al.*, 2007; Sundara *et al.*, 2011), this may simply be sensitivity to phonological patterns in their input (Naigles, 2002).

Indeed, 3SG is acquired in children's spontaneous speech much later than the copula (Brown, 1973; de Villiers & de Villiers, 1973). The copula is not only highly frequent in children's input, but also changes its surface form to agree with its subject noun in both number and tense, making these forms perceptually distinct from one another (e.g., *is*, *are*, *was*, *were*). However, it is unclear why differences have been found between children's comprehension of the singular copula *is* and the plural copula *are*.

The present study therefore investigated whether three- and four-year-old children could use copula SV agreement in order to identify the number of newly encountered novel words. While previous studies have shown that children are able to use copula plus determiner agreement to identify the number of novel nouns (Kouider *et al.*, 2006; Wood *et al.*, 2009), the present study tested their ability to use copula SV agreement alone. Children were tested using iPads during preschool using a novel-word two-alternative forced choice comprehension task. For each trial, children were presented with two pictures side-by-side. One picture depicted a single novel animal/object, and the other depicted five identical instantiations of a different animal/object. Children were tested on their comprehension of (1) sentences with unambiguous nominal morphology, and (2) sentences with ambiguous nominal morphology, in which the novel nouns all ended in /ks/, the only English stop + fricative final cluster to occur in both singular and plural words (e.g., *box*, *axe* vs. *clocks*, *sacks*):

(1) where is the tup? / where are the tups?
(2) where is the gex? / where are the gecks?

Given that three-year-olds can use *is*/*are* number information to identify target pictures before they are explicitly named (Deevy *et al.*, 2017), we predicted that children would use the copula to help resolve number ambiguity in novel words ending in /ks/ clusters (e.g., *gex*), which can either be singular or plural. That is, we predicted that three- and four-year-olds would use SV number agreement (in the absence of other clues) to determine the number condition of a previously unheard word. However, we also hypothesised that children would be more accurate on the conditions containing unambiguous nominal morphology, would be more accurate in trials with the plural copula *are*, and that four-year-olds would be more accurate than three-year-olds.

Method

Participants

The participants were 58 three-year-olds (35 girls, 23 boys; aged 3;0–3;11; M_{age} = 3;6, 41.6 months) and 58 four-year-olds (29 girls, 29 boys; aged 4;0–4;11, M_{age} = 4;5, 53.3 months) recruited from 26 preschools across Sydney, Australia. Parents completed a permission form and a short questionnaire providing information about their child's language exposure, postcode, maternal education, and any known hearing loss or developmental disorders.

All participants reported fewer than 10 hours of exposure to other language(s) per week. Participants' socioeconomic status was approximated using their postcode and the Socio-Economic Index for Areas Index of Relative Advantage/Disadvantage (ABS, 2013),

Table 1. Novel words used in task (IPA transcriptions are for Australian English; see Harrington *et al.*, 1997)

Unambiguous nominal morphology		Ambiguous nominal morphology
Singular	*Plural*	*Singular–Plural*
tup /tɐp/	*tups* /tɐps/	*gex-gecks* /geks/
doop /dʊp/	*doops* /dʊps/	*bix-bicks* /bɪks/
gip /gɪp/	*gips* /gɪps/	*dax-dacks* /dæks/
mep /mep/	*meps* /meps/	*gox-gocks* /gɔks/
dap /dæp/	*daps* /dæps/	*nux-nucks* /nɐks/
nop /nɔp/	*nops* /nɔps/	*poox-pooks* /pʊks/

with an overall mean of 82nd percentile for the state of New South Wales (median = 84, range = 53–100). The reported maximum maternal educational levels were postgraduate degree (32.8%), university degree (47.4%), trade college certification (14.6%), and high school certificate (5.2%). Four three-year-olds and 3 four-year-olds reported speech difficulties (e.g., lisp, stutter, cleft palate, or other minor speech production issues). One four-year-old was diagnosed with 'mild autism' a few weeks after participating. No participant reported any hearing loss. All participants passed the PLS-5 Language Screener appropriate for their age (Zimmerman, Steiner, & Pond, 2011).

Eleven additional children were excluded from analysis: 3 three-year-olds and 2 four-year-olds failed the language screener, while 4 three-year-olds and 2 four-year-olds failed to complete all test trials.

Twenty native English-speaking adults who grew up in English-speaking households in Australia also participated in the study (fourteen women, six men; age range 19–59 years, M_{age} = 30.8 years).

Equipment

The task was presented on an Apple iPad Air 2. Auditory stimuli were played through Sennheiser HD 280 pro headphones. The experimental software was constructed using the Serenity Engine (Budziszewski, 2003; Xu Rattanasone, Davies, Schembri, Andronos, & Demuth, 2016).

Auditory stimuli and preparation

The auditory stimuli were produced by a female native speaker of Australian English in a child-appropriate register and recorded in a sound-attenuated room using Cool Edit Pro 2.0 (at 48 kHz). The novel words are presented in Table 1.

The 18 novel words contained only early acquired onset stops (Smit, Hand, Freilinger, Bernthal, & Bird, 1990) and Australian-English short vowels (Harrington, Cox, & Evans, 1997). All plural novel words were inflected with the early-acquired voiceless plural allomorph /-s/ (Davies *et al.*, 2017). The plural was perceptually salient in this task as it contrasted in both place and manner to its attached consonant (unambiguous: /ps/, ambiguous: /ks/). The stimuli also included four familiar words, two singular: *box* and

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Figure 1. Animate and inanimate novel visual stimuli.

fox; and two plural: *clocks* and *ducks*. All stimuli were presented in carrier phrases: *where is the X?* (singular) and *where are the X?* (plural).

To control for any phonetic variation, the auditory stimuli were spliced (using Praat; Boersma & Weenink, 2016). Each spliced token contained three parts: carrier phrase + word stem + coda burst (and frication). Each unambiguous singular word contained the same /p/ coda burst, each unambiguous plural word contained the same /ps/ coda burst and frication, and each ambiguous word contained the same /ks/ coda burst and frication. The same recorded version of each target word was spliced into both singular and plural conditions (e.g., *tup*/*tups*). One version of each carrier phrase was spliced into singular and plural tokens.

Visual stimuli

The visual stimuli contained eight novel inanimate objects and sixteen novel cartoon animals. The novel visual stimuli did not resemble anything real or fictional (Figure 1). They were constructed as both single object/animal (singular) pictures and five object/animal (plural) pictures. For the familiar word trials, *hat*, *fox*, *frog*, and *box* were depicted as singular pictures and *clocks*, *cows*, *ducks*, and *shirts* as plural pictures.

Procedure

Data for this study were collected alongside a study on children's acquisition of plural morphology (see Davies *et al.*, 2019). The task was carried out in a quiet area of children's preschools. Participants sat at child-sized tables where both the language screener and the iPad task were carried out. Headphones were worn to minimise any noisy distractions. To ensure that the relevant plural morphemes could be heard, children were played a plural /s/ spliced from the stimuli. If the child indicated they

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could not hear the /s/ (through repetition or description of the sound), the volume was increased.

Children then completed sixteen trials (twelve novel, four familiar) in which they were presented with two pictures side-by-side, one depicting a solitary object/animal (singular), and another depicting five different objects/animals (plural). The two pictures were matched for animacy (i.e., pictures were either both inanimate or both animate). In the trials with unambiguous nominal morphology, the stimuli contained both a plural morpheme (or not) and the appropriate agreeing copula form (e.g., *where* ***is*** *the tup?* vs. *where* ***are*** *the tu****ps****?*). In the trials with ambiguous nominal morphology, the target novel word contained a /ks/ coda cluster, which is number-ambiguous (e.g., *fox* /fɔks/ vs. *socks* /sɔks/; *where* ***is*** *the gex?* /geks/ vs. *where* ***are*** *the gecks?* /geks/). Children were encouraged to touch the novel picture/object that best matched the auditory stimulus. Upon touching a picture, regardless of whether it was the target or the distractor, an audible *chirrup* would play, and the picture would flash. Familiar word trials were included to maintain children's attention throughout the task, and to remind them of the potential number ambiguity of /ks/ final nouns. While no positive or negative feedback was provided, the experimenters gave participants positive encouragement, e.g., "good try" or "keep up the good work" if they appeared shy or unsure. Adults were tested in a similar manner at a quiet desk at the university.

Design

To avoid any potential picture preference effects, four counterbalanced versions of the experiment were constructed. Across these four versions, each novel animal/object was used once as a singular target, once as a singular distractor, once as a plural target, and once as a plural distractor. Over the four versions, every trial had a unique combination of novel word and novel animals/objects. Unlike the novel trials, the four familiar trials were always presented with the same picture pairings, with the same target words (underlined) across the four versions (*clocks* vs. *hat*, *cows* vs. *fox*, *frog* vs. *ducks*, *box* vs. *shirts*).

Results

We hypothesised that three- and four-year-olds would use both nominal morphology and copula SV agreement to determine the number condition of novel words. Planned t-tests were therefore used to compare the singular/plural and the unambiguous/ambiguous novel word trials to chance (0.5).[1] While all conditions were found to be significantly different to chance, three- and four-year-olds were both significantly BELOW chance for the ambiguous singular condition (Table 2). That is, in trials where the auditory stimuli were of the form *where is the gex* (/geks/), children selected the plural picture. Contrary to prediction, this suggests that children interpreted /ks/-final novel nouns as being inflected for plural, despite SV agreement with the singular copula *is*.

We also predicted that children would be more accurate in the conditions containing unambiguous nominal morphology, would be more accurate in trials with the plural copula, and that four-year-olds would be more accurate overall. Indeed, a three-way

[1]All statistical analyses were carried out using the base stats package in *R* (R core team, 2016), unless otherwise stated.

Table 2. Planned *t*-tests of proportion accuracy vs. chance (0.5) for children's trials with ambiguous and unambiguous nominal morphology, by age (*p* values adjusted using Holm–Bonferroni method)

	Three-year-olds					Four-year-olds				
	df	M	SD	*t* statistic	*p* value (adjusted)	df	M	SD	*t* statistic	p-value (adjusted)
Singular copula with unambiguous nominal morphology e.g., *where is the tup* (/tɐp/)?	57	0.62	0.33	2.35	.03*	57	0.72	0.29	2.35	.02*
Plural copula with unambiguous nominal morphology e.g., *where are the tups* (/tɐps/)?	57	0.65	0.36	0.00	<.001***	57	0.87	0.26	0.00	<.001***
Singular copula with ambiguous nominal morphology e.g., *where is the gex* (/geks/)?	57	0.39	0.35	0.75	.02*	57	0.25	0.32	0.75	<.001***
Plural copula with ambiguous nominal morphology e.g., *where are the gecks* (/geks/)?	57	0.71	0.32	1.43	<.001***	57	0.88	0.23	1.43	<.001***

Note. *$p < .05$; ***$p < .001$.

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mixed ANOVA found significant main effects for MORPHOLOGICAL AMBIGUITY ($F(1,114) = 42.75$, $p < .001$), NUMBER ($F(1,114) = 58.13$, $p < .001$), and AGE ($F(1,114) = 12.16$, $p < .001$). Significant two-way interactions were found for MORPHOLOGICAL AMBIGUITY by NUMBER ($F(1,114) = 58.31$, $p < .001$), MORPHOLOGICAL AMBIGUITY by AGE ($F(1,114) = 8.83$, $p < .01$), and NUMBER by AGE ($F(1,114) = 8.12$, $p < .01$). Post-hoc comparisons of MORPHOLOGICAL AMBIGUITY and AGE by NUMBER were performed using the *emmeans* package (Lenth, 2019; Table 3).

Post-hoc comparisons show that the singular ambiguous trials were consistently less accurate than their unambiguous counterparts. That is, children consistently interpreted the ambiguous nominal morphology trials (e.g., *where is the gex?*) as referring to a plural referent (recorded as incorrect), and the unambiguous nominal morphology trials (*where is the tup?*) as referring to a singular referent (recorded as correct). No differences were discovered between three- and four-year-olds within the same trial types, suggesting that accuracy on the singular trials did not change with age (also, see Davies *et al.*, 2019).

For the plural trials, four-year-olds were significantly more accurate than the three-year-olds, suggesting that children attain better comprehension of plurals with age. No differences were found between the unambiguous and ambiguous plural trials, suggesting that novel words such as *tups* and *gecks* were equally regarded as plural in the presence of the plural copula *are*.

Paired *t*-tests were then used to examine whether the presence of *is* or *are* affected children's likelihood of choosing a plural picture in the ambiguous trials. Both the three-year-olds ($t(57) = -2.43$, $p = .02$) and four-year-olds ($t(57) = -3.17$, $p < .01$) chose the plural picture significantly more often in the plural condition. This could show that (a) the presence of *is* made the children less likely to interpret an ambiguous noun as plural, or (b) the presence of *are* made the children more likely to interpret an ambiguous noun as plural, or (c) both of the above.

Adult results were not included in the statistical analyses above due to ceiling effects. Every trial was answered correctly for both UNAMBIGUOUS and AMBIGUOUS PLURAL conditions and for the UNAMBIGUOUS SINGULAR condition. However, adults were not at ceiling for the AMBIGUOUS SINGULAR condition ($M = 0.83$, $SD = 0.24$), though they were still significantly above chance ($t(19) = 13.52$, $p < .001$). A Kruskal–Wallis rank sum test (Pohlert, 2014) revealed a significant effect for trial condition ($\chi^2 = 22.68$, $p < .001$), with post-hoc pairwise comparisons (Nemenyi test with chi-squared approximation for independent samples; Pohlert, 2014) revealing AMBIGUOUS SINGULAR to be different to all other conditions ($p < .01$). These results were driven by seven adult participants who did not identify all three ambiguous singular trials as referring to the singular target picture; five adult participants identified two out of three as singular, one identified one out of three as being singular, and one identified none as being singular, interpreting all three as plural instead. The adults who did not reach ceiling in the ambiguous singular condition were significantly younger ($M_{age} = 23.3$ years, 21–31) than those who identified all trials in this condition as singular ($M_{age} = 34.8$ years, 19–59; $t(14.81) = 2.81$, $p = .01$). Overall, these results show that adults were paying attention to the copula, but that some of the younger adults sometimes interpreted words such as *gex* (/geks/) as plural, despite the presence of the singular copula *is* (Figure 2).

While the children (and some adults) interpreted the nouns with ambiguous nominal morphology as plural, despite singular copula SV agreement, it was not clear whether participants were simply attending to nominal morphology, or whether they were

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Table 3. Post-hoc comparisons for singular and plural novel-word trials by nominal morphology (unambiguous, ambiguous), and age (three-year-olds, four-year-olds); *p* values adjusted for multiple comparisons using the Tukey-HSD method

	Singular trials				Plural trials			
Contrast	df	estimate	*t* ratio	*p* value (adjusted)	df	estimate	*t* ratio	*p* value (adjusted)
3-year-olds (ambiguous) vs. 4-year-olds (ambiguous)	395	0.13	2.29	.10	395	−0.17	−2.99	.02*
3-year-olds (ambiguous) vs. 3-year-olds (unambiguous)	227	−0.24	−4.73	<.001***	227	0.06	1.27	.58
3-year-olds (ambiguous) vs. 4-year-olds (unambiguous)	395	−0.34	−5.88	<.001***	395	−0.16	−2.79	.03*
4-year-olds (ambiguous) vs. 3-year-olds (unambiguous)	395	−0.37	−6.38	<.001***	395	0.24	4.09	<.001***
4-year-olds (ambiguous) vs. 4-year-olds (unambiguous)	227	−0.47	−9.47	<.001***	227	0.01	0.23	1
3-year-olds (unambiguous) vs. 4-year-olds (unambiguous)	395	−0.1	−1.79	.23	395	−0.22	−3.89	<.001***

Note. *$p < .05$; ***$p < .001$.

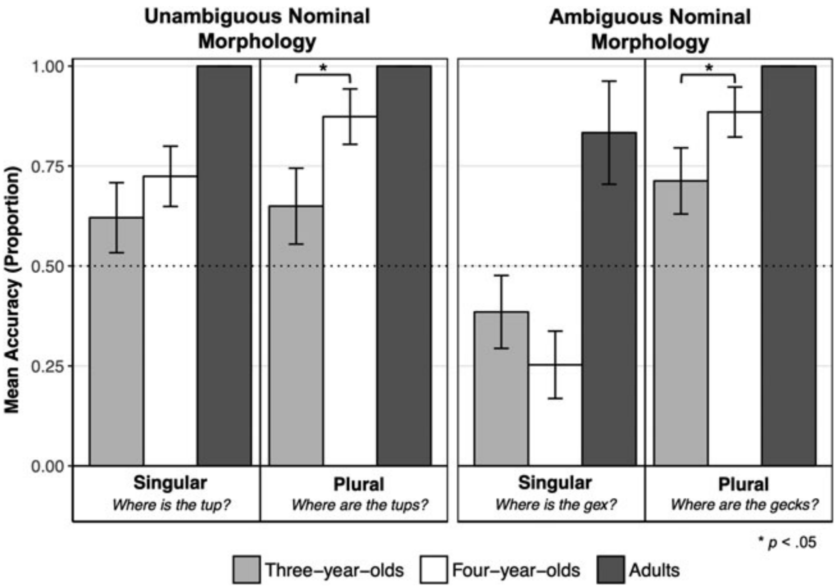

Figure 2. Children's and adults' accuracy for the novel word trials. Error bars ± 1SE.

instead sensitive to other cues. Novel words used in the ambiguous singular trials had phonotactic forms similar to higher-frequency[2] /ks/-final singular words (e.g., *gox* /gɔks/ to *box* /bɔks/); lower-frequency singulars (e.g., *bix* /bɪks/ to *mix* /mɪks/; *dax*/ dæks/ to *axe* /æks/); extremely low-frequency words not present in the CHILDES corpus database (MacWhinney, 2000) (e.g., *gex* /geks/ to *hex* /heks/); or had no real-word singular analogues at all (i.e., *nux* /nɐks/; *poox* /pʊks/). A one-way ANOVA therefore looked at whether stimulus item (*gex*, *bix*, *gox*, *dax*, *nux*, *poox*) affected children's accuracy in the ambiguous singular trials. A non-significant, yet trending effect was found ($F(5,342) = 2.16$, $p = .06$), which appeared to be largely driven by children's slightly better accuracy on ambiguous singular trials with the novel words *gox* (/gɔks/; which has higher-frequency real-word singular analogues, such as *box* and *fox*) and *poox* (/pʊks/; which has no singular analogues, only plurals such as *books*; see Figure 3). For the adults, the only stimulus item that was consistently identified as singular was *bix* (/bɪks/); all other items were identified as being singular roughly 65–90% of the time (Figure 3). However, overall, there is no compelling evidence that stimulus item affected performance.

Discussion

The present study adds to a growing body of evidence showing that children use morphological structure to facilitate their comprehension of newly heard words (Arias-Trejo *et al.*, 2014; Davies *et al.*, 2017, 2019; Kouider *et al.*, 2006; Lew-Williams & Fernald, 2007). The results expand on previous findings, demonstrating that children (and to some degree, adults) use lexical form as the primary cue to meaning – even in the presence of copula SV agreement. Despite predictions that

[2]Childfreq using the CHILDES database (Bååth, 2010)

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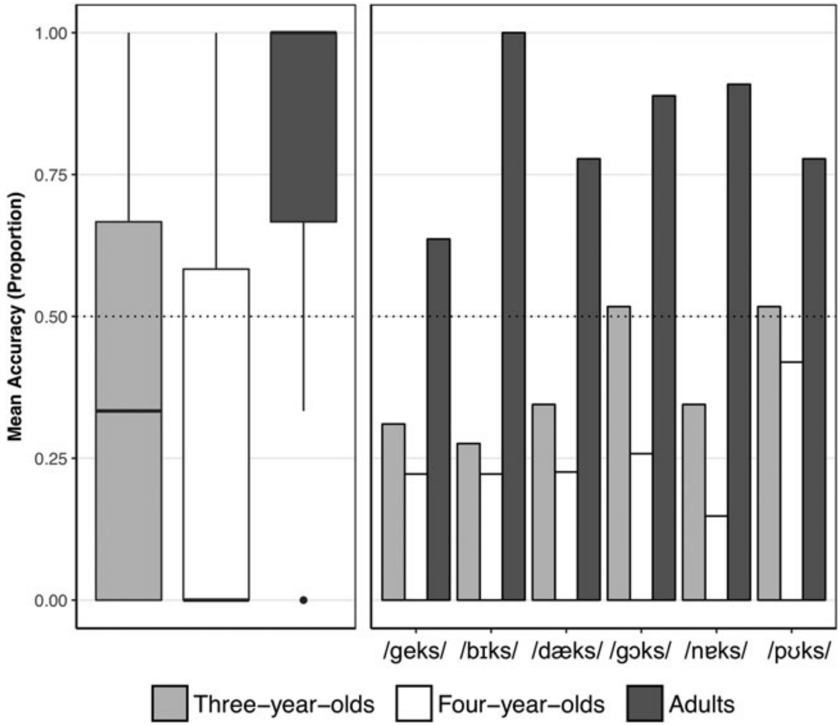

Figure 3. Participants' accuracy in the ambiguous singular trials, by age group (left) and age group by stimulus item (right).

three- and four-year-olds would use copula SV agreement to comprehend the number of morphologically ambiguous /ks/-final nouns (Deevy *et al.*, 2017; Lukyanenko & Fisher, 2016), we found that children primarily relied on the perceived number information at the end of the word. That is, children interpreted morphologically ambiguous nouns in sentences as such as *where is the gex* (/geks/)? as plural, disregarding the copula number information. Yet, it was not just children who did so; approximately one-third of the adults also interpreted some of these singular copula sentences as referring to a plural referent. Thus, the present study also adds to a growing body of evidence showing asymmetries between comprehension of the singular and plural copula (Deevy *et al.*, 2017; Lukyanenko & Fisher, 2016; Lukyanenko & Miller, 2018).

These results seem to sit uncomfortably with previous research showing language processing as a predictive process. Language comprehension is incremental, established moment by moment as the sentence unfolds (Kamide, Altmann, & Haywood, 2003). Young children show evidence of incremental processing, whether it be through semantic biases, such as in German (Mani & Huettig, 2012), or grammatical agreement, such as gender in Spanish (Arias-Trejo *et al.*, 2014; Lew-Williams & Fernald, 2007) and copula subject–verb agreement in English (Deevy *et al.*, 2017; Lukyanenko & Fisher, 2016). Yet, these results show that children eschew the singular interpretation of *where is the gex* (/geks/)? despite the

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copula appearing earlier in the sentence than the noun. However, the present study is unable to tell whether participants were ignoring the verb *is* completely. Children's (and some adults') initial interpretation may have been 'corrected' upon hearing what was perceived as a plural morpheme. Future studies employing on-line measures (such as eye-tracking) would be better able to investigate whether this was the case.

There is a possibility that these results are merely task-related. Participants were screened on their perception of /-s/ before performing the task, and it was carried out alongside another study looking at plural perception (Davies *et al.*, 2019). That is, participants may have been primed to interpret fricative-final words as plural. However, the results of Davies *et al.* show that children do not simply interpret fricative-final words as plural, as /s/- and /z/-final novel words such as *koss* (/kɔs/) and *tizz* (/tɪz/) are comprehended as being singulars by children as young as three.

One reason for these results might be the participants' language model. English speakers often mismatch number agreement under certain conditions of non-adjacency (e.g., *the cost of the improvements have not yet been estimated*; Bock & Miller, 1991), and contraction (e.g., *where's your shoes?*; Crawford, 2005; Lukyanenko & Miller, 2018; Meechan & Foley, 1994). Yet, in the current study the copula was both adjacent to the noun phrase and uncontracted. There are, however, many examples of copula SV agreement mismatches in everyday Australian English, including interviews on television and radio programming, such as: *There is a million dollars in the bank account …*, *There is still further investigations …*, and *The key question is, what is those emission targets?* These results may thus reveal something more broadly about use of the singular copula in Australian English. The adults who did not identify all of the ambiguous singular trials as singular tended to be younger than those at ceiling. This is could be an indication of a stable variation within Australian English, that was (for whatever reason) better captured in the younger adult participants, or alternatively, it may be indicative of language change in progress. Indeed, similar dialects have undergone changes in copula SV agreement, such as New Zealand English (e.g., *they was getting loose*; Hay & Schreier, 2004). However, these results are only suggestive; more investigation is needed.

Overall, this study shows that young children make use of the cues provided by nominal morphological structure to comprehend newly heard words, even when potentially ambiguous. This study raises questions about when copula SV agreement is understood in an adult-like way, but also raises questions about what ADULT-LIKE actually entails. Understanding how children use syntax agreement and morphology to facilitate language processing has important clinical implications for children with hearing loss and developmental language disorder, for example (Conti-Ramsden, 2003; Deevy & Leonard, 2018; Koehlinger, Owen Van Horne, Oleson, McCreery, & Moeller, 2015; McGuckian & Henry, 2007). Future studies with older children and speakers of other English dialects would shed further light on these issues. The current study provides a first step in that direction.

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References

Arias-Trejo, N., Cantrell, L. M., Smith, L. B., & Canto, E. A. A. (2014). Early comprehension of the Spanish plural. *Journal of Child Language*, *41*(6), 1356–72.

Arunachalam, S., & Waxman, S. R. (2010). Meaning from syntax: evidence from 2-year-olds. *Cognition*, *114*(3), 442–6.

ABS (Australian Bureau of Statistics) (2013). Socio-economic Indexes for Area (SEIFA), Table 1: Postal Area (POA) SEIFA Summary, 2011 (data cube: Excel spreadsheet, cat. no. 2033.0.55.001). Retrieved from <http://www.abs.gov.au/ausstats/abs@.nsf/DetailsPage/2033.0.55.0012011> (last accessed 19 September 2017).

Bååth, R. (2010). ChildFreq: an online tool to explore word frequencies in child language. *Lucs Minor*, *16*, 1–6.

Bernal, S., Lidz, J., Millotte, S., & Christophe, A. (2007). Syntax constrains the acquisition of verb meaning. *Language Learning and Development*, *3*(4), 325–41.

Bock, K., & Miller, C. A. (1991). Broken agreement. *Cognitive Psychology*, *23*(1), 45–93.

Boersma, P., & Weenink, D. (2016). *Praat: Doing phonetics by computer* [Computer Program]. Version 6.0.18. Available at <http://www.praat.org/>.

Brown, R. (1973). *A first language: the early stages*. Oxford: Harvard University Press.

Budziszewski, P. (2003). *Serenity Engine* [computer software]. Sydney, NSW: Toybox Labs.

Conti-Ramsden, G. (2003). Processing and linguistic markers in young children with specific language impairment (SLI). *Journal of Speech, Language, and Hearing Research*, *46*(5), 1029–37.

Crawford, W. J. (2005). Verb agreement and disagreement: a corpus investigation of concord variation in existential there + be constructions. *Journal of English Linguistics*, *33*(1), 35–61.

Davies, B., Xu Rattanasone, N., & Demuth, K. (2017). Two-year-olds' sensitivity to inflectional plural morphology: allomorphic effects. *Language Learning and Development*, *13*(1), 38–53.

Davies, B., Xu Rattanasone, N., Schembri, T., & Demuth, K. (2019). Preschoolers' developing comprehension of the plural: the effects of number and allomorphic variation. *Journal of Experimental Child Psychology*, *185*, 95–108.

de Villiers, J. G., & de Villiers, P. A. (1973). A cross-sectional study of the acquisition of grammatical morphemes in child speech. *Journal of Psycholinguistic Research*, *2*(3), 267–78.

de Villiers, J. G., & Johnson, V. E. (2007). The information in third-person /s/: acquisition across dialects of American English. *Journal of Child Language*, *34*(1), 133–58.

Deevy, P., & Leonard, L. B. (2018). Sensitivity to morphosyntactic information in preschool children with and without developmental language disorder: a follow-up study. *Journal of Speech, Language, and Hearing Research*, *61*(12), 3064–74.

Deevy, P., Leonard, L. B., & Marchman, V. A. (2017). Sensitivity to morphosyntactic information in 3-year-old children with typical language development: a feasibility study. *Journal of Speech, Language, and Hearing Research*, *60*(3), 668–74.

Fisher, C., Hall, D. G., Rakowitz, S., & Gleitman, L. (1994). When it is better to receive than to give: syntactic and conceptual constraints on vocabulary growth. *Lingua*, *92*, 333–75.

Golinkoff, R. M., Hirsh-Pasek, K., Cauley, K. M., & Gordon, L. (1987). The eyes have it: lexical and syntactic comprehension in a new paradigm. *Journal of Child Language*, *14*(1), 23–45.

Harrington, J., Cox, F., & Evans, Z. (1997). An acoustic phonetic study of broad, general, and cultivated Australian English vowels. *Australian Journal of Linguistics*, *17*(2), 155–84.

Hay, J., & Schreier, D. (2004). Reversing the trajectory of language change: subject–verb agreement with *be* in New Zealand English. *Language Variation and Change*, *16*(3), 209–35.

Johnson, V. E., de Villiers, J. G., & Seymour, H. N. (2005). Agreement without understanding? The case of third person singular /s/. *First Language*, *25*(3), 317–30.

Kamide, Y., Altmann, G. T. M., & Haywood, S. L. (2003). The time-course of prediction in incremental sentence processing: evidence from anticipatory eye movements. *Journal of Memory and Language*, *49* (1), 133–56.

Koehlinger, K., Owen Van Horne, A. J., Oleson, J., McCreery, R., & Moeller, M. P. (2015). The role of sentence position, allomorph, and morpheme type on accurate use of s-related morphemes by children who are hard of hearing. *Journal of Speech, Language, and Hearing Research*, *58*(2), 396–409.

Kouider, S., Halberda, J., Wood, J., & Carey, S. (2006). Acquisition of English number marking: the singular–plural distinction. *Language Learning and Development*, *2*(1), 1–25.

https://doi.org/10.1017/S0305000919000680 Published online by Cambridge University Press

Legendre, G., Barrière, I., Goyet, L., & Nazzi, T. (2010). Comprehension of infrequent subject–verb agreement forms: evidence from French-learning children. *Child Development*, *81*(6), 1859–75.

Legendre, G., Culbertson, J., Zaroukian, E., Hsin, L., Barrière, I., & Nazzi, T. (2014). Is children's comprehension of subject–verb agreement universally late? Comparative evidence from French, English, and Spanish. *Lingua*, *144*, 21–39.

Lenth, R. (2019). *Emmeans package: Estimated Marginal Means, aka Least-Squares Means. R package version 1.3.4*. Online <https://CRAN.R-project.org/package=emmeans>.

Lew-Williams, C., & Fernald, A. (2007). Young children learning Spanish make rapid use of grammatical gender in spoken word recognition. *Psychological Science*, *18*(3), 193–8.

Lidz, J., Gleitman, H., & Gleitman, L. (2003). Understanding how input matters: verb learning and the footprint of universal grammar. *Cognition*, *87*(3), 151–78.

Lukyanenko, C., & Fisher, C. (2016). Where are the cookies? Two- and three-year-olds use number-marked verbs to anticipate upcoming nouns. *Cognition*, *146*, 349–70.

Lukyanenko, C., & Miller, K. (2018). Children's and adults' processing of variable agreement patterns: agreement neutralization in English. In *Proceedings of the 42nd Boston University Conference on Language Development*, *15*. Online <http://www.lingref.com/bucld/42/BUCLD42-37.pdf>.

MacWhinney, B. (2000). *The CHILDES project: tools for analyzing talk: Volume I: Transcription format and programs, volume II: The database*. Cambridge, MA: MIT Press.

Mani, N., & Huettig, F. (2012). Prediction during language processing is a piece of cake–but only for skilled producers. *Journal of Experimental Psychology: Human Perception and Performance*, *38*(4), 843–7.

McGuckian, M., & Henry, A. (2007). The grammatical morpheme deficit in moderate hearing impairment. *International Journal of Language & Communication Disorders*, *42*(s1), 17–36.

Meechan, M., & Foley, M. (1994). On resolving disagreement: linguistic theory and variation – there's bridges. *Language Variation and Change*, *6*(1), 63–85.

Naigles, L. (2002). Form is easy, meaning is hard: resolving a paradox in early child language. *Cognition*, *86* (2), 157–99.

Pohlert, T. (2014). *The pairwise multiple comparison of mean ranks package (PMCMR)*. Online <https://CRAN.R-project.org/package=PMCMR>.

R Core Team (*2016*). *R: a language and environment for statistical computing*. Vienna: R Foundation for Statistical Computing.

Smit, A. B., Hand, L., Freilinger, J. J., Bernthal, J. E., & Bird, A. (1990). The Iowa articulation norms project and its Nebraska replication. *Journal of Speech and Hearing Disorders*, *55*(4), 779–98.

Soderstrom, M., White, K. S., Conwell, E., & Morgan, J. L. (2007). Receptive grammatical knowledge of familiar content words and inflection in 16-month-olds. *Infancy*, *12*(1), 1–29.

Sundara, M., Demuth, K., & Kuhl, P. K. (2011). Sentence-position effects on children's perception and production of English third person singular –s. *Journal of Speech, Language, and Hearing Research*, *54*(1), 55–71.

Waxman, S. R., & Booth, A. E. (2001). Seeing pink elephants: fourteen-month-olds' interpretations of novel nouns and adjectives. *Cognitive Psychology*, *43*(3), 217–42.

Wood, J. N., Kouider, S., & Carey, S. (2009). Acquisition of singular–plural morphology. *Developmental Psychology*, *45*(1), 202–6.

Xu Rattanasone, N., Davies, B., Schembri, T., Andronos, F., & Demuth, K. (2016). The iPad as a research tool for the understanding of English plurals by English, Chinese, and other L1 speaking 3- and 4-year-olds. *Frontiers in Psychology*, *7*. https://doi.org/10.3389/fpsyg.2016.01773

Zimmerman, I. L., Steiner, V. G., & Pond, R. E. (2011). PLS-5: preschool language scale-5 [measurement instrument]. *San Antonio, TX: Psychological Corporation*.

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