The developmental relationship between vocabulary and grammar in EAL learners: A longitudinal study

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This report provides additional information on the methods and results for the poster presented at the Child Language Symposium at the University of Sheffield – 11th July 2019. *Please note that this is a working draft that only includes details on the methods and the results and a very brief discussion.*

Methods

Participants

We initially recruited 100 children (48 girls) with English as an additional language (EAL) from 19 Year 1 classes in 9 schools (4 primary schools and 5 infant schools) in the South East of England. Children had a mean age of 5 years 8 months ($SD = .29$) at their first testing session. Of the 100 participants, 89 took part in all testing sessions. Children were invited to take part in the study if they were classified by their school as having English as an Additional Language (EAL). The EAL category is very broad and according to the definition of the UK's Department for Education it includes children "who were exposed to more than one language (which may include English) during early development". Our decision to include children with EAL according to the DfE's definition was deliberate as we wanted our sample to reflect the linguistic diversity of EAL children in primary schools in the UK. Children spoke 28 different languages (43% Polish, 7% Hindi, 5% Arabic, 5% French, 5% Romanian, 4% Malayalam, 4% Nepali, 3% Bengali, 3% Punjabi, 3% Russian, 3% Tamil – 11% of the children spoke two languages other than English). To gather further information on children's bilingual background and relative exposure to English and any other language(s) we invited parents/guardians to complete a questionnaire (De Cat, Gusnato, & Serratrice, 2018) which was available in English, Polish and Urdu. None of the parents/guardians requested a version other than English and Polish.

Procedure

Parents of all the children registered as EAL within their school database, but who were not otherwise included in the Special Educational Needs register, were invited to take part in the study. All children whose parents accepted to take part by signing the consent form were included in the research. Children in the sample had no known language or cognitive difficulty.

Before the testing procedure began the researcher was presented to the children by their teacher or headteacher. Children's consent to take part was sought from each individual child before each testing session. Given the length of the testing procedure, children's wellbeing was monitored throughout, and they were offered a break if tired. Pauses were either composed of five minutes of respite time or were timed to coincide with school-wide breaks (e.g. lunch or mid-morning breaks).

Children were assessed at three time-points: autumn-winter of Year 1 (Time 1), spring-summer of Year 1 (Time 2) and autumn-winter of Year 2 (Time 3). Each child was tested twice at each time point, on average 9 days apart at Time 1 and Time 3, and 6 days apart at Time 2. The distance between sessions at each time point for each child did not exceed 28 days. All measures of vocabulary and morpho-syntactic abilities were collected at all time points as part of a larger testing battery, with the British Picture Vocabulary Test (BPVS – 3; Dunn, Dunn, & NFER., 2009), and the Word Structure subtest from the Clinical Evaluation of Language Fundamentals (CELF – 4; Semel, Wiig, & Secord, 2006) administered in the first session each time, and the Synonyms and the Opposites subtests from the Test of Word Knowledge (TOWK; Wiig & Secord, 1992) and the short version of the Test of Reception of Grammar (TROG – 2; Bishop, 2003; see Whiteside & Norbury, 2017 for TROG short) administered in the second session. The sessions were carried out in a quiet area within the school and all children completed the tasks in the same given order.

Materials

To measure vocabulary breadth the British Picture Vocabulary Test (BPVS – 3; Dunn, Dunn, & NFER., 2009) was administered. This test requires the child to correctly identify the picture for a given word, amongst four alternatives. The test comprised 168 items, divided into 14 sets of 12 items each. Testing started at the appropriate set for age and continued until the child made 8 or more errors in a set. If the child made 2 or more errors in the first set, testing first progressed backwards, until the child made less than 2 errors in a set (baseline set). The

score for this task was computed at the total number of words correctly recognised, including all words preceding the baseline set.

Vocabulary depth was measured with the Synonyms and the Opposites subtests from the Test of Word Knowledge (TOWK; Wiig & Secord, 1992). These tasks required the child to select the correct synonym or antonym for a given word. In both tasks words were presented written, and the experimenter read both the given word and the alternatives aloud. Both tasks presented words of increasing difficulty, with the first set of words requiring a choice between three alternatives, and the subsequent sets of words requiring a choice amongst four alternatives. Testing started with the first word for all children and was interrupted when the child chose the incorrect alternative for five consecutive items. These tasks were independently scored as the total number of items with a correct answer, out of the total 42 items in each task, and the total score for vocabulary depth was computed as the mean of the two scores.

The Word Structure subtest from the Clinical Evaluation of Language Fundamentals (CELF-4; Semel, Wiig, & Secord, 2006) was used as measure of morphological knowledge. In this task the child and the experimenter took turns to describe a series of pictures, with the experimenter priming the child to the correct structure to use, by describing the example picture for each morphological structure in full, and then starting the description of the subsequent pictures, and waiting for the child to finish the sentence. This task therefore required the child to produce the final word in a given sentence, with its correct morphological declension. All children completed all 32 items of the test and the total score was the number of items correctly completed.

To measure syntactic knowledge we administered the short version of the Test of Reception of Grammar (TROG – 2; Bishop, 2003; see Whiteside & Norbury, 2017 for TROG short). In this task children are required to select the picture that correctly depicts a spoken sentence, amongst four alternatives. This task comprises of 40 items, with all participant starting at the first item, and continuing until they made 6 consecutive errors, with most children completing the test in full. The total score was the number of items correctly completed.

Parental Questionnaire: Parents completed a questionnaire on how much their children heard and used English and their home language during the week. The questionnaire was adapted from De Cat, Gusnato and Serratrice (2018). From the questionnaire it was possible to derive parental information: SES was computed through the Office for National Statistics website

(https://onsdigital.github.io/dp-classification-tools/standard-occupational-classification/ONS_SOC_occupation_coding_tool.html), using parental job titles, while maternal education was directly provided from the parents on a scale from 0 (none) to 4 (university). The index of English Cumulative Input, that considered how many hours per week the child was exposed to English, was computed through a series of questions regarding how much the children spoke and heard the language at home and from whom, and including whether their exposure had started from birth, and whether it was likely to be interrupted during school holidays (for example by visiting parents' home country). With this index it was possible to estimate how many months corresponding to monolingual English exposure children had received in their life. Questionnaires were distributed during Time 1, and collected between Time 1 and Time 2.

Data analysis

For each variable, a linear growth model comprising of both an intercept and a linear slope was estimated using the package lavaan (Rosseel, 2012) in R (R core Team, 2013). This model included all possible significant covariates: age at Time 1, mother's education, SES and English Input were entered in the model if they significantly correlated with the original outcome. The significance of the linear growth was assessed by the comparison of this model with a model containing only an intercept but not a slope (no growth model) as suggested by Grimm, Ram and Estabrook (2017). A further model was estimated to assess quadratic growth, and only retained if the fit to the data was significantly improved compared to the simpler linear growth model. After determining the best fitting model in terms of growth, the influence of the covariates was estimated, by removing non-significant covariates and assessing model fit, until the best fitting simplest model was estimated.

Once the best model for each variable was computed, we computed bivariate growth model including one vocabulary measure and one grammar measure in turn, to determine the longitudinal relationship of vocabulary and grammar. These models included an estimate of the relationship between slopes and intercepts in the two constructs, as well as estimates for the relationship between the intercept of one construct and the slope of the other. Finally, we estimated the parameters that indicated the effect of the level of one construct at each time point on the level of the other construct at the subsequent time point, in order to assess the longitudinal effect of one variable on the other over time. Four models were specifically computed: a bivariate growth model without any direct path between the two constructs

which would indicate that the two constructs are correlated but neither leads to the other in development, a bivariate growth model with a direct path from vocabulary to subsequent grammar scores, which would indicate vocabulary precedence over grammar, a bivariate growth model with a direct path from grammar to vocabulary, which would indicate a precedence of grammar over vocabulary, and a bivariate growth model including all possible direct paths. These model were compared, and the simplest, best fitting model was retained.

Results

Means and standard deviations for all the measures are included in Table 1. The exploration of distribution graphs didn't indicate any floor or ceiling effects.

Table 1. Mean (and Standard Deviations) for the measures described in the present study

		Time 1	Time 2	Time 3
Covariates	Mother Education (N = 89)	3.36 (.81)	-	-
	SES (N = 74)	6.43 (3.41)	-	-
	Age Time 1 (N = 100)	68.40 (3.50)	-	-
	English Cumulative Input (N = 92)	25.18 (16.48)	-	-
Language Skills	Vocabulary Breadth	68.83 (15.57)	77.67 (14.46)	84.83 (15.90)
	Vocabulary Depth	8.51 (4.62)	12.36 (5.04)	15.14 (5.90)
	Morphological Knowledge	14.53 (6.23)	18.03 (5.29)	21.17 (5.01)
	Syntactic Knowledge	22.21 (8.01)	25.80 (7.96)	28.78 (6.52)

Table 2. Spearman correlations between the measures

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Covariates	1 - Mother Education	-	-.68*	.08	.32*	.28*	.31*	.18	.29*	.22	.41*	.28	.33*	.25	.36*	.41*	.36*
	2 - SES		-	-.19	-.42*	-.38*	-.29	-.18	-.23	-.35*	-.35*	-.24	-.28	-.33*	-.27	-.32*	-.28
	3 - Age Time 1			-	.20	.14	.32*	0.15	.19	.20	.16	.18	.19	.21	.17	.10	.16
	4 - English Input				-	.64*	.40*	.48*	.46*	.61*	.53*	.47*	.39*	.62*	.40*	.52*	.41*
Time 1	5 - Vocabulary Breadth					-	.59*	.70*	.69*	.88* ¹	.73* ¹	.62*	.58*	.85* ¹	.70* ¹	.62*	.54*
	6 - Vocabulary Depth						-	.63*	.60*	.55*	.66*	.56*	.60*	.64*	.67*	.48*	.57*
	7 - Morphological Knowledge							-	.66*	.64*	.60*	.80*	.69*	.73*	.65*	.71*	.62*
	8 - Syntactic Knowledge								-	.65*	.68*	.63*	.74*	.72*	.66*	.65*	.71*
Time 2	9 - Vocabulary Breadth									-	.71* ¹	.60*	.59*	.86* ¹	.69* ¹	.61*	.51*
	10 - Vocabulary Depth										-	.67*	.65*	.68*	.78* ¹	.69*	.61*
	11 - Morphological Knowledge											-	.74*	.67*	.65*	.82*	.68*
	12 - Syntactic Knowledge												-	.62*	.64*	.68*	.81*
Time 3	13 - Vocabulary Breadth													-	.72* ¹	.71*	.64*
	14 - Vocabulary Depth														-	.63*	.62*
	15 - Morphological Knowledge															-	.68*
	16 - Syntactic Knowledge																-

Correlations significant at <.01

¹Pearson correlations are reported as both measures were normally distributed

Receptive vocabulary growth

The best fitting model for vocabulary breadth was a model that included a linear slope as well as an intercept, and that included English Input as the only covariate ($\chi^2 (2) = 3.35, p = .188$, CFI = .996, TLI = .987, RMSEA = .082 (95% CI: .000–.231), SRMR = .028, BIC = 2862.95). The linear growth model was better than a model that predicted no growth ($\chi^2 (6) = 13.76, p = .032$), while the addition of a quadratic component did not improve fit ($\chi^2 (4) = 3.75, p = .440$). Mother's education and SES as covariates did not significantly improve the model ($\chi^2 (4) = 4.28, p = .370$), while English Input as covariate did ($\chi^2 (2) = 46.07, p < .001$).

English Input significantly predicted the intercept ($\beta = .61, p < .001$), but not the slope ($\beta = .46, p = .071$), indicating English Input had an effect on the initial score in vocabulary breadth scores, but did not influence his growth. This is consistent with the lack of correlation between Intercept and Slope ($r = .35, p = .239$), and the lack of significant variance in the Slope ($\sigma = 15.99, p = .102$), which suggest that all children had similar growth, independently from their starting point and their level of English Input. The model confirmed that there was high variability in children's vocabulary level, and there was significant growth from Time 1 to Time 3, as the intercepts for both Intercept and Slope were significant (Intercept: $\beta = 68.78, p < .001$; Slope: $\beta = 25.42, p = .007$) and the variance for the Intercept was significant ($\sigma = 137.51, p < .001$).

Vocabulary depth growth

The best fitting model for vocabulary depth was a linear growth model with English Input and Age as covariates ($\chi^2 (4) = 5.97, p = .201$, CFI = .989, TLI = .973, RMSEA = .070 (95% CI: .000 – .179), SRMR = .051, BIC = 2155.51). The initial model including a linear growth term was better than a model that predicted no growth ($\chi^2 (7) = 15.24, p = .033$), while the addition of a quadratic component led to a model with identification problems, which did not improve fit ($\chi^2 (7) = 5.31, p = .622$). Mother's education and SES as covariates did not significantly improve the model ($\chi^2 (4) = 6.13, p = .189$), while age ($\chi^2 (2) = 8.32, p = .016$) and English Input ($\chi^2 (2) = 19.14, p < .001$) as covariates did.

In the final model, the Intercept was significantly predicted by both English Input ($\beta = .38, p < .001$) and age ($\beta = .28, p = .004$), however the slope was only predicted by English Input ($\beta = .38, p = .009$) and not age ($\beta = -.03, p = .769$), indicating that scores in vocabulary depth

were influenced by both English Input and age, but growth in vocabulary depth was only determined by English Input. The model also highlighted a significant relationship between slope and intercept ($r = .39, p = .013$), suggesting that children with higher levels of vocabulary depth showed greater levels of growth than children with lower levels of vocabulary depth. Both intercepts and variances were significant for both the intercept and the slope in the model (Intercept: $\beta = 8.52, p < .001, \sigma = 13.34, p < .001$; Slope: $\beta = 6.53, p < .001, \sigma = 5.51, p = .012$), indicating that, not only did children start at different levels of vocabulary depth, but the growth was not consistent in all participant, with those with higher knowledge and higher levels of English Input increasing their vocabulary knowledge over time more than those with lower initial knowledge and English Input.

Morphological knowledge growth

The best fitting model for morphological knowledge is a linear growth model with English Input as covariate ($\chi^2 (2) = 2.27, p = .322, CFI = .999, TLI = .997, RMSEA = .036$ (95% CI: .000 – .205), SRMR = .014, BIC = 1831.90). The initial model including a linear growth term was better than a model that predicted no growth ($\chi^2 (6) = 54.87, p < .001$), while the addition of a quadratic component led to a model with identification problems, which did not improve fit ($\chi^2 (4) = 2.79, p = .594$). Mother's education and SES as covariates did not significantly improve the model ($\chi^2 (4) = 1.68, p = .794$), while English Input ($\chi^2 (2) = 27.22, p < .001$) as covariates did.

In the final model, the Intercept was significantly predicted by English Input ($\beta = .48, p < .001$), while the Slope was not ($\beta = .12, p = .572$), indicating that scores in morphological knowledge were influenced by initial English Input, but growth was not. Intercept and Slope were not significantly correlated ($r = -.23, p = .307$), suggesting that the level of morphological knowledge did not determine growth. The model confirmed that there was high variability in children's level of morphological knowledge, there was significant growth from Time 1 to Time 3 and the growth in morphological knowledge was not equal amongst all children, as the intercepts and variances for both Intercept and Slope were significant (Intercept: $\beta = 14.55, p < .001, \sigma = 27.77, p < .001$; Slope: $\beta = 6.18, p < .001, \sigma = 2.50, p = .002$).

Syntactic knowledge growth

The best fitting model for syntactic knowledge is a linear growth model with English Input as covariate ($\chi^2(4) = 5.44, p = .245, CFI = .991, TLI = .987, RMSEA = .060$ (95% CI: .000 – .172), SRMR = .058, BIC = 2077.41). The initial model including a linear growth term was better than a model that predicted no growth ($\chi^2(4) = 19.44, p < .001$), while the addition of a quadratic component led to a model with identification problems, which did not improve fit ($\chi^2(6) = 6.88, p = .332$). SES ($\chi^2(2) = 1.05, p = .591$). and Mother's education ($\chi^2(2) = 3.80, p = .150$) as covariates did not significantly improve the model, while English Input ($\chi^2(2) = 20.19, p < .001$) as covariate did.

In the final model, the Intercept was significantly predicted by English Input ($\beta = .49, p < .001$), while the Slope was not ($\beta = -.27, p = .374$), indicating that scores in morphological knowledge were influenced by initial English Input, but growth was not. The correlation between Intercept and Slope was set to 0, for convergence problems in the model, given that it was not significant in the initial, non-convergent model ($r = -.69, p = .177$). The variance of the Slope was also set to 1, as it produced convergence problems. The final model confirmed that there was high variability in children's level of syntactic knowledge and there was significant growth from Time 1 to Time 3 (Intercept: $\beta = 22.22, p < .001, \sigma = 38.84, p < .001$; Slope: $\beta = 5.11, p < .001$).

Bivariate models

Vocabulary Breadth and Morphological Knowledge

Figure 1 presents the best fitting bivariate linear growth model between vocabulary breadth and morphological knowledge ($\chi^2(6) = 6.01, p = .422, CFI > .999, TLI > .999, RMSEA = .005$ (95% CI: .000 – .130), SRMR = .023, BIC = 3875.47). Models that included either a direct effect of vocabulary over subsequent grammar ($\chi^2(2) = 1.47, p = .479$) or grammar over subsequent vocabulary ($\chi^2(2) = .82, p = .663$) did not improve model fit.

In the final model there was a significant correlation between the Intercept of Vocabulary Breadth and Morphological Knowledge ($r = .59, p < .001$), but not their Slopes ($r = -.37, p = .260$), furthermore there was a significant correlation between the Intercept of Morphological Knowledge and the Slope of Vocabulary Breadth ($r = .62, p = .023$), but not between the Intercept of Vocabulary Breadth and the Slope of Morphological Knowledge ($r = -.04, p = .833$). This suggests that children with better vocabularies also had more morphological knowledge, but the two abilities grew relatively separately. On the other hand children with

better morphological knowledge also tended to have a steeper growth in their vocabulary than children with lower levels of morphological knowledge.

Figure 1. Bivariate growth model with vocabulary breadth and morphological knowledge

Vocabulary Depth and Morphological Knowledge

Figure 2 presents the best fitting bivariate linear growth model between vocabulary depth and morphological knowledge ($\chi^2(11) = 15.51, p = .160$, CFI = .991, TLI = .977, RMSEA = .064 (95% CI: .000 – .132), SRMR = .068, BIC = 3680.67). Models that included either a direct effect of vocabulary over subsequent grammar ($\chi^2(2) = 3.18, p = .204$) or grammar over subsequent vocabulary ($\chi^2(2) = 1.60, p = .449$) did not improve model fit.

In the final model, as for the simpler one variable growth model, Intercept and Slope of Vocabulary depth were correlated ($r = .37, p = .012$), English Input predicted the Intercept of both Vocabulary Depth ($\beta = .39, p < .001$) and Morphological Abilities ($\beta = .48, p < .001$), and also the Slope of Vocabulary Depth ($\beta = .39, p = .004$), while Age only predicted the Intercept of Vocabulary Depth ($\beta = .22, p = .009$). Furthermore, there was a significant correlation between the Intercept of Vocabulary Breadth and Morphological Knowledge ($r = .62, p < .001$), but not their Slopes ($r = .08, p = .790$), and there was a significant correlation between the Intercept of Morphological Knowledge and the Slope of Vocabulary Breadth (r

= .54, $p = .001$), but not between the Intercept of Vocabulary Breadth and the Slope of Morphological Knowledge ($r = -.19$, $p = .500$). This suggests that, exactly as it was for vocabulary breadth, children with deeper vocabularies also had more morphological knowledge, but the two abilities grew relatively separately. On the other hand children with better morphological knowledge also tended to have a steeper growth in their vocabulary depth than children with lower levels of morphological knowledge.

Figure 2. Bivariate growth model with vocabulary depth and morphological knowledge

Vocabulary Breadth and Syntactic Knowledge

Figure 3 presents the best fitting bivariate linear growth model between vocabulary breadth and syntactic knowledge ($\chi^2 (10) = 15.47$, $p = .116$, CFI = .990, TLI = .979, RMSEA = .074 (95% CI: .000 – .142), SRMR = .051, BIC = 4119.84). Models that included either a direct effect of vocabulary over subsequent grammar ($\chi^2 (2) = 3.75$, $p = .153$) or grammar over subsequent vocabulary ($\chi^2 (2) = 2.71$, $p = .258$) did not improve model fit.

In the final model there was a significant correlation between the Intercept of Vocabulary Breadth and Syntactic Knowledge ($r = .61$, $p < .001$), while the correlation between their

Slopes could not be freely estimated, due to model non-convergence, and was therefore set to 0, as it was not significant in the full non-convergent model ($r = -.94, p = .204$), similarly the correlation between the Slope for Syntactic Knowledge and the Intercept for Vocabulary was set to 0, due to non-convergence, but was not significant in the original model ($r = -.22, p = .527$). On the other hand the correlation between the Intercept of Syntactic Knowledge and the Slope of Vocabulary Breadth did not cause convergence problems, and was approaching significance ($r = .53, p = .053$). This suggests that children with better vocabularies also had more syntactic knowledge, but the two abilities grew relatively separately.

Figure 3. Bivariate growth model with vocabulary breadth and syntactic knowledge

Vocabulary Depth and Syntactic Knowledge

Figure 4 presents the best fitting bivariate linear growth model between vocabulary breadth and syntactic knowledge ($\chi^2 (13) = 15.22, p = .294, CFI = .995, TLI = .988, RMSEA = .041$ (95% CI: .000 – .112), SRMR = .079, BIC = 3932.21). Models that included either a direct effect of vocabulary over subsequent grammar ($\chi^2 (2) = 2.78, p = .249$) or grammar over subsequent vocabulary ($\chi^2 (2) = .29, p = .864$) did not improve model fit.

In the final model, as for the simpler one variable growth model, Intercept and Slope of Vocabulary depth were correlated ($r = .40, p = .012$), English Input predicted the Intercept of both Vocabulary Depth ($\beta = .40, p < .001$) and Syntactic Knowledge ($\beta = .49, p < .001$), and also the Slope of Vocabulary Depth ($\beta = .38, p = .011$), while Age only predicted the Intercept of Vocabulary Depth ($\beta = .20, p = .015$). Furthermore, there was a significant correlation between the Intercept of Vocabulary Breadth and Syntactic Knowledge ($r = .66, p < .001$), but not their Slopes ($r = -.18, p = .741$), and there was a significant correlation between the Intercept of Syntactic Knowledge and the Slope of Vocabulary Breadth ($r = .60, p = .005$), but not between the Intercept of Vocabulary Breadth and the Slope of Syntactic Knowledge ($r = .15, p = .720$). This suggests that children with deeper vocabularies also had more syntactic knowledge, but the two abilities grew relatively separately. On the other hand children with better syntactic knowledge also tended to have a steeper growth in their vocabulary depth than children with lower levels of syntactic knowledge, while growth in syntactic knowledge was not linked to levels of vocabulary depth.

Figure 4. Bivariate growth model with vocabulary depth and syntactic knowledge

Discussion

The results of the growth models suggest that the skills measured (vocabulary breadth, vocabulary depth, morphological knowledge and syntactic knowledge) all grew throughout the period examined. The growth of these skills was linear, without decrement over time. All children, independently from their starting point, increased their vocabulary breadth and morphological and syntactic skills similarly, without any difference between lower and higher achieving children, while growth and skill in vocabulary depth were positively correlated, suggesting that more skilled children also increased their vocabulary depth over time more rapidly than children with shallower vocabularies. This pattern could be described as a Matthew effect, where children with higher skills also increased their skills more rapidly.

English input predicted levels of vocabulary breadth, depth and morphological and syntactic skills, suggesting that children with higher exposure to English tended to have higher scores in both vocabulary and grammar at all time points. However, English input did not predict growth in vocabulary breadth and grammar, suggesting that children grew in these skills similarly, independently of the amount of English they were exposed to at the beginning of year 1, probably due to relatively stable exposure to the language they all received during the school day. This was not, however, the case for vocabulary depth which increased more rapidly in children with higher amounts of exposure to English.

Age also predicted the intercept for vocabulary depth, suggesting, on the whole, that older children and those with higher input in English had deeper vocabularies, and those with deeper vocabularies and higher input in English, in turn, increased their vocabulary depth faster than for less skilled children and for those with lower English input.

All of the bivariate growth models showed a correlation between levels of vocabulary and levels of grammatical knowledge, but failed to show any correlation between their growth, suggesting that vocabulary and grammatical skills are correlated in EAL children, but these abilities grow independently.

Three out of four of the models (vocabulary breadth and morphological knowledge, vocabulary depth and morphological knowledge, and vocabulary depth and syntactic knowledge) also showed a correlation between grammar level and vocabulary growth, with the fourth model showing a correlation that neared significance. These results suggest that there was no primacy of grammar over vocabulary in this age range, children with higher levels of grammar also grew more in their vocabulary than children with low grammar abilities. Importantly, the reverse correlations between vocabulary levels and grammar

growth were not significant. We conservatively interpret this unidirectional relationship as suggesting that grammatical skills might have an effect on vocabulary growth over time.

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