Supplementary Materials

S1: Additional corpus details



Figure S1

Development of different verb groups in child-directed speech in the recording sessions over age for each child: (A) number of tokens; (B) number of types. Neither lexical causatives nor morphological causatives make up the majority of all verbs.



Development of different verb groups in child speech in the recording sessions over age for each child: (A) number of tokens; (B) number of types. Neither lexical causatives nor morphological causatives make up the majority of all verbs.

S2: Raw entropy measures for different verb groups in CDS and CS, respectively



Figure S3

Development of entropy for different verb groups in child-directed speech in the recording sessions at different ages for each child

Note. Dots represent the raw measures and the lines are from local regressions with a span of 0.3.



Development of entropy for different verb groups in child speech in the recording sessions at different ages for each child

Note. Dots represent the raw measures and the lines are from local regressions with a span of 0.3.

S3: Local regression of entropy ratio: Preliminary observations



Figure S5

Local regression to depict the overall development of the entropy ratio of all verbs

Note. The dots stand for the raw developmental ratio and the error shading is plotted based on the standard deviation as computed by the local regression.



Local regression to depict the overall development of the entropy ratio of lexical causatives

Note. The dots stand for the raw developmental ratio and the error shading is plotted based on the standard deviation as computed by the local regression.



Local regression to depict the overall development of the entropy ratio of morphological causatives

Note. The dots stand for the raw developmental ratio and the error shading is plotted based on the standard deviation as computed by the local regression.



Local regression to depict the overall development of the entropy ratio of non-causatives

Note. The dots stand for the raw developmental ratio and the error shading is plotted based on the standard deviation as computed by the local regression.

S4: Alternative segmented analysis with BIC (Bayesian Information Criterion)

This analysis was run in order to test if our results held when the best model was selected with a parsimonious criterion (i.e., BIC) and thus a model with two breakpoints was not preferred, as a model with two breakpoints could be over-fitting with the short time span of our data. We used the *selgmented* library in R (Muggeo, 2020) and, as in the main analysis, treated the developmental ratio as the dependent variable and the age as the independent variable, while searching for the existence of breakpoints with Hypothesis testing and determining the number of breakpoints with BIC (Muggeo, 2016). Instead of setting an upper limit of the number of breakpoints, we relied on BIC to decide on the best model, which theoretically penalizes more parameters (due to sharply increased penalty term) and thus tends to choose a more parsimonious model (Chakrabarti & Ghosh, 2011).



Figure S9

Segmented analysis using BIC on the developmental ratio for all 7 children: lexical causatives, non-causatives, and all verbs.



Segmented analysis using BIC on the developmental ratio for all 7 children: morphological causatives versus all verbs.

For each child and each verb group, a model with only one breakpoint was consistently selected (see Fig. S9 and Fig. S10). Fig. S9 shows largely overlapped trajectories between the three verb groups, confirming that lexical causatives share a similar pattern of development in child speech. Fig. S10 shows a generally delayed start of development for morphological causatives, but the development is steady afterwards, reaching a level close to adults at around 3 years of age, as seen in the results of Analysis 2 (see Fig. 5).

Table S1

Detailed Performance Metrics

Class	Precision	Recall	F1-Score	Support
No OBJ	0.90	0.86	0.88	101
With OBJ	0.61	0.69	0.65	32
Accuracy			0.82	133
Macro Avg	0.75	0.77	0.76	133
Weighted Avg	0.83	0.82	0.82	133

References

- Chakrabarti, A., & Ghosh, J. K. (2011). AIC, BIC and recent advances in model selection. In P. S. Bandyopadhyay & M. R. Forster (Eds.), *Philosophy of statistics* (pp. 583–605, Vol. 7). North-Holland. https://doi.org/https://doi.org/10.1016/B978-0-444-51862-0.50018-6
- Muggeo, V. M. (2016). Testing with a nuisance parameter present only under the alternative: A score-based approach with application to segmented modelling. *Journal of Statistical Computation and Simulation*, 86(15), 3059–3067.
- Muggeo, V. M. (2020). Selecting number of breakpoints in segmented regression: Implementation in the r package segmented. *Technical report*.