Language Distance and Language Production Accuracy in Dutch Bilingual Children

Research report

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Abstract

When investigating bilingualism, a typological distance between languages is an important factor that might contribute to language acquisition in bilingual children. The present study investigates the role of language distance on children's language production using the 2in1 project dataset collected to explore the influence of acquired languages on each other. We used the data of 151 Dutch-English, Dutch-German, Dutch-Greek and Dutch-Turkish bilingual children from 4 to 10 years old to predict their accuracy in the sentence repetition task (SRT) by the distance between the languages in the language pair. Multiple linear regression analysis showed that the typological distance was indeed a significant predictor of the language performance: the closer the languages were, the higher the scores in the SRT were. These findings demonstrate that language distance plays a crucial role in child language development, especially with regard to productive vocabulary.

Keywords: child bilingualism, language production, language distance, cross-linguistic influence, vocabulary production

1. Background

Many studies have compared bilingual children's vocabulary with that of monolingual children. Bilingual children have a smaller vocabulary in one language

than monolinguals, but their total vocabulary size (both languages combined) was similar compared to their monolingual peers (Bialystok, Luk, Peets & Yang, 2010; Cote & Bornstein, 2014). One factor that might affect bilingual children's language development is language distance, which affects all levels of the language: phonology, lexicon, syntax and pragmatics (e.g. Asli-Badarneh et al., 2023). For example, one can imagine that Dutch-German bilinguals will have more overlaps in their vocabulary due to the high number of cognates in both languages. On the other hand, Dutch-Turkish speakers are more likely to have two less overlapping lexicons. Will language distance facilitate or interfere with language production? The present study examines the role of language distance on language production accuracy of bilingual children.

Bialystok et al. (2010) examined the receptive vocabulary skills of monolingual and bilingual children, analysing 1,738 children between 3 and 10 years old using the Peabody Picture Vocabulary Test. Additionally, the study explored the impact of language distance, aiming to identify any correlation between vocabulary score differences and language pairs: bilingual children speaking English and an East Asian language were compared with those speaking English and a non-East Asian language. Interestingly, no significant effect of language distance on the vocabulary skills of bilingual children was observed, even in the case of the simplified separation of languages (East Asian and non-East Asian).

Floccia and colleagues (2018) also were interested in the relationship between language distance and vocabulary knowledge of bilingual children. The participants of that study were 2-year-old bilingual toddlers, and all were learners of British English and one of 13 additional languages. Floccia et al. (2018) measured language distance through phonological similarity, morphological complexity, and word order typology. That study found an effect of language distance on the vocabulary skills of bilingual children: children exposed to two languages with a closer linguistic distance demonstrated larger receptive vocabulary in each language. Moreover, not only phonological, but also morphological and syntactic knowledge were all transferred across the two languages.

Because of these contradictory results, Blom et al. (2020) reconsidered the role of language distance by investigating the receptive vocabulary of monolingual Dutch and bilingual (Turkish-Dutch, Moroccan-Dutch, Frisian-Dutch) children. Their receptive vocabulary was tested with the Peabody Picture Vocabulary Test. Participants were divided into three different groups: (1) bilingual group with a small between-language distance, (2) bilingual group with a large between-language distance, and (3) monolinguals (control group). The results of Blom et al. (2020) showed that language distance significantly influenced the development of receptive vocabulary in bilingual children: bilingual children with a smaller language distance

had receptive vocabulary scores similar to monolingual children, whereas those with a larger language distance showed significantly lower receptive vocabulary scores. Overall, the study highlights the significance of linguistic distance as a crucial factor in individual differences and underscores the necessity for a nuanced perspective on bilingualism. Whereas most studies focused on receptive vocabulary, this study aims to investigate the role of language distance and productive skills, more specifically, productive vocabulary. Moreover, the combination of language distance and bilingual children's vocabulary is not well-researched in general. A recent paper by Dixon et al. (2022) dedicated to cross-dataset comparison (143 languages) of vocabulary development between children learning English and their monolingual peers revealed that English learners catch up with monolinguals in receptive vocabulary but not in expressive vocabulary. This discrepancy suggests that there might be different patterns of productive and receptive skills development.

2. Research Question

In our study, we will investigate to what extent language distance influences bilingual children's productive language skills measured by a sentence repetition task (SRT; Marinis & Armon-Lotem, 2015) in Dutch-English, Dutch-German, Dutch-Greek and Dutch-Turkish bilinguals. Our hypothesis is that the closer the languages are, the higher the scores in SRT will be due to a possible facilitation effect of overlapping vocabulary and syntactic structures in two languages. For example, as Dutch and German both belong to a Germanic branch of the Indo-European family, Dutch-German bilinguals are expected to score higher in the SRT in both languages than Dutch-Turkish bilinguals, because Turkish is a member of a different language family (Glottolog 4.8).

3. Participants

The data for this study is a subset of a larger dataset created by the 2in1 project (https://www.ru.nl/cls/our-research/research-groups/cognitive-developmental-aspects-multilingualism/2in1-project-nl/) that investigates language interaction in simultaneous or early sequential bilingual children. To cover the largest number of different language pairs represented in the projects, data of 151 Dutch-English, Dutch-German, Dutch-Greek and Dutch-Turkish bilingual children living in the Netherlands from 4 to 10 years old (Table 1) were selected for the study.

Table 1

Participants Overview

Dataset	Language pair	Age range, years	Number
cvd3	Dutch-German	7-10	31
cvd3	Dutch-Turkish	7-10	23
gjk1	Dutch-German	7-10	35
gjk1	Dutch-English	7-10	36
ek1	Dutch-Greek	4-9	26

4. Methods

The 2in1 dataset consists of a parental questionnaire as a measure of language exposure BiLEC (Bilingual Language Experience Calculator; Unsworth, 2013), SRT scores and productive vocabulary task scores as measures of children's language production abilities. In accordance with our research question, the selection of the datasets was motivated by the diversity of represented languages (we aimed at including various language pairs with the dataset we had access to) to provide for different levels of language relatedness.

Among all BiLEC variables, our choice fell on the age of testing (age_testing), the percentage of the use of Dutch during activities (nld_richness) and the amount of Dutch used by children at home (nld_output_home). This selection was motivated by the intent to narrow down the model in the interest of time, focusing on language input and output. Both language exposure (Thordardottir, 2019) and use (Ribot et al., 2018) were reported to have influence on productive vocabulary skills.

Age as a parameter was included to control for the overall amount of the time the language is used.

SRT was chosen as a measure of productive skills as the data on this task was provided for the majority of the language pairs in the dataset. VerbatimPropCorr and GrammScore.StrictPropCorr variables for the task in Dutch and another language were selected for the model since they were present across all datasets. VerbatimPropCorr stands for the accuracy of repeated sentences, 1 being 'the sentence was repeated entirely verbatim' (Marinis & Armon-Lotem, 2015, p. 23) and 0 being 'there were one or more changes in the children's response' (Marinis & Armon-Lotem,

2015, p. 23). GrammScore.StrictPropCorr is a score of grammaticality of the sentence varying from 0, there was a grammatical error, to 1, there were no errors. To the dataset, a column was added for each participant, detailing how closely related the languages they speak are. This new variable was called language_distance and was coded as a continuous variable with 1 being the most closely related and 4 being the least closely related. Dutch-German was given the value 1, Dutch-English the value 2, Dutch-Greek the value 3 and Dutch-Turkish the value 4.

After this, linear regression models were fitted in R (R Core Team, 2022) to see whether this language_distance variable is an important predictor for SRT-scores. 4 different types of base models were made, according to the type of SRT-score that was to be predicted:

- Verbatim model: predicts VerbatimPropCorr scores.
- OL Verbatim model: predicts OL_VerbatimPropCorr scores.
- GrammScore model: predicts GrammScore.StrictPropCorr scores.
- OL GrammScore model: predicts OL_GrammScore.StrictPropCorr scores.

All these base models predicted scores based on age_testing, nld_output_home and nld_richness. After all base models were run, language_distance was added to them all to verify the effect of language_distance on the predicted scores. For the Verbatim models, data was available from all languages (Dutch-German, Dutch-English, Dutch-Greek and Dutch-Turkish), but for the GrammScore models Dutch-Turkish data was not available.

5. Results

Multiple Linear regressions were calculated to predict SRT-test scores based on age_testing, nld_output_home and nld_richness. In all cases, a significant regression equation was found (see Table 2).

For all model types, inclusion of the language_distance variable, improved the model's AIC-score (see Table 3). Lower AIC-scores indicate better predictor models, so inclusion of language_distance improves the model.

Table 2

Regression Analysis Results

Model	R2-value	F-value	Degrees of Freedom	p-value
Verbatim	0.40	25.66	3, 143	<0.005
OL Verbatim	0.58	50.82	3, 143	<0.005
GrammScore	0.52	18.92	3, 63	<0.005
OL GrammScore	0.64	30.25	3, 63	<0.005

Table 3

AIC-scores for all Models (Base and With Inclusion of language_distance)

Model	AIC-score Base	AIC-score with language_distance
Verbatim	-68.24	-113.71
OL Verbatim	62.06	-12.26
GrammScore	-78.30	-79.29
OL GrammScore	1.47	-16.82

For each model with language_distance included, it was checked which variables were significant predictors, to check if language_distance is indeed an important predictor variable (see Table 4). The b-value indicates the magnitude and direction of the influence of the variable to the score. A negative b-value indicates that the lower the value of the variable is, the higher the predicted score is and vice versa.

This means that for all models, except the Grammar Score, language_distance is a significant predictor, and the direction of the effect is always negative: the closer the languages are, the higher the SRT-score is. The distribution of SRT-scores, based on language distance, can be seen in the Figures 1-4.

Table 4

Significant Predictors for Each Model and Their b-coefficient, Standard Deviation (std), t-value and p-value

Model	Significant predictors	b-coefficient	Std	t-value	p-value
Verbatim	age_testing	0.05	0.01	5.34	<0.005
	language_distance	-0.10	0.01	-7.37	<0.005
OL Verbatim	age_testing	0.06	0.01	4.29	<0.005
	nld_output_home	-0.23	0.07	-3.38	<0.005
	nld_richness	-0.39	0.11	-3.45	<0.005
	language_distance	-0.18	0.02	-9.84	<0.005
GrammScore	age_testing	0.07	0.01	6.27	<0.005
	language_distance	-0.05	0.03	-1.80	0.07
OL GrammScore	age_testing	0.06	0.02	3.76	<0.005
	nld_output_home	-0.17	0.09	-1.94	0.06
	nld_richness	-0.43	0.15	-2.91	0.01
	language_distance	-0.20	0.04	-4.73	<0.005

Figure 1

Predicted Verbatim Scores per Language Distance Group

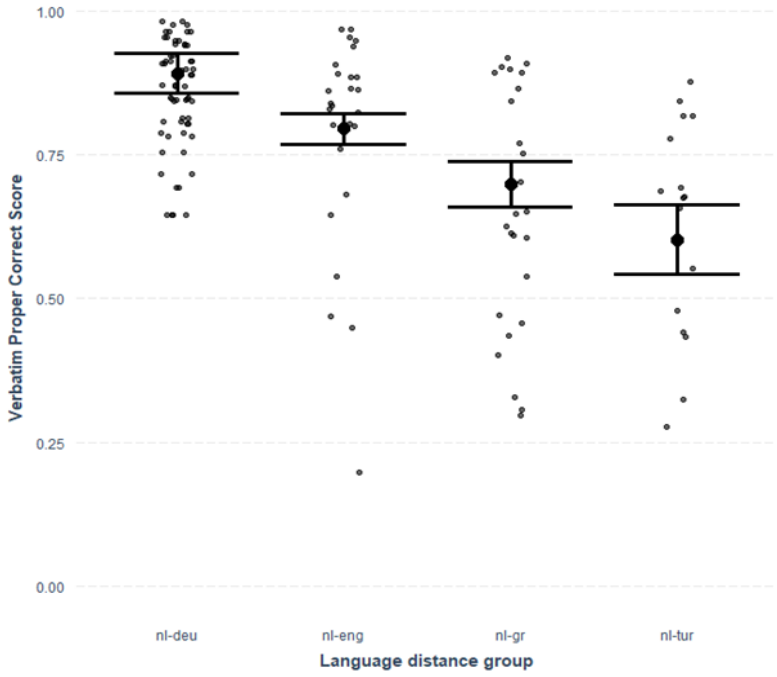


Figure 2

Predicted OL Verbatim Scores per Language Distance Group

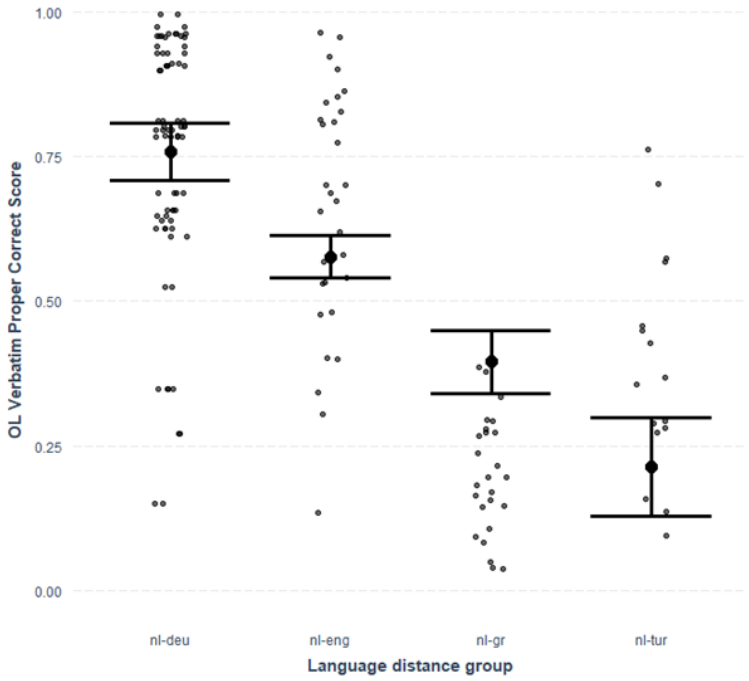


Figure 3

Predicted Grammatical Scores per Language Distance Group

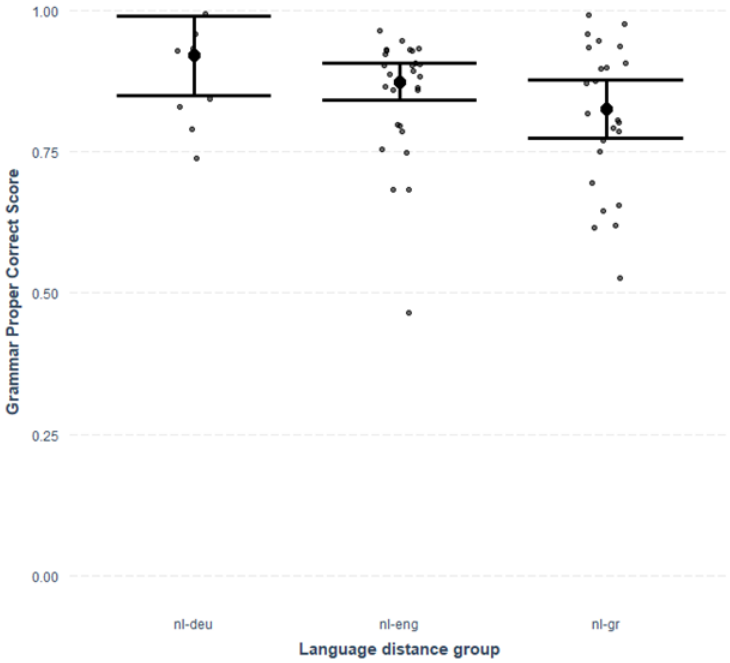
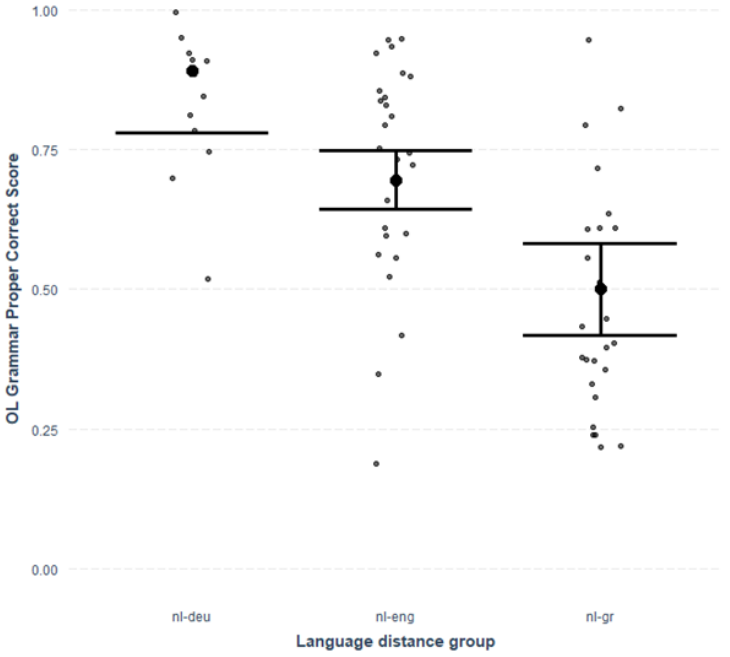


Figure 4

Predicted OL Grammatical Scores per Language Distance Group



6. Discussion

Inclusion of language distance as a predictor in the regression models improved the models: AIC-scores were lower over the base models which did not include language_distance, meaning that language distance is an significant predictor of SRT-scores. Moreover, the effect of language_distance on the SRT-scores was always negative and significant, suggesting that the closer the languages are (lower language distance), the higher the SRT-scores are. These results are in agreement with our hypothesis: children speaking more typologically similar languages score higher in the productive vocabulary task due to a possible facilitation effect of overlapping vocabulary and syntactic structures in two languages. The results are also in accordance with the described literature (e,g, Blom et al., 2020), supporting the claim that if languages a person learns are more closely related, they perform better on tests in both languages. Compared to the literature mentioned above that only looked at receptive vocabulary, our study addressed productive vocabulary. However, as mentioned in the background section, the productive skills of bilingual children can be quite different from their receptive skills, thus research into their productive skills should not be ignored.

Some interesting findings were the following: The largest influence of language distance was observed for the verbatim component of the SRT-tasks in both languages, which can be indicated by the AIC-score improvements. While the grammar scores did also improve, the AIC-value difference was smaller than for the verbatim results. This could be due to the difficulty of both tasks: in the verbatim task children have to repeat exactly what was being said, while in the grammar task only the sentence structure needs to be correct. Thus, the verbatim task may be harder and more proficiency in the language may be needed. This would explain the difference in AIC-scores between both tasks, as the harder task might benefit more from language similarities.

There is quite a large variation between the AIC-score differences between the GrammScore and the OL GrammScore models, with the AIC-score difference in the GrammScore model being quite small. This could be, because exposure to the main language (in this case Dutch) was a lot higher for most children in this study than their other language, indicating some sort of the threshold effect. This means that the higher exposure there is to a language, the less influence of language distance there is on certain tasks. This effect was not visible for the OL GrammScores, because exposure to the other language was not high enough, thus the threshold for less language distance effects was not present.

7. Conclusion

We found that language distance is a significant predictor of SRT-scores. Moreover, language distance negatively influences SRT-scores, meaning that the closer the two languages are related, the higher the test-scores are. These results are in line with our hypothesis and previous literature. Future research could address some shortcomings in our study:

- In our regression models, we only included predictors related to language use and output, while not including predictors related to socioeconomic status, family composition, neighbourhood, etc. due to time constraints. In a future study, these variables could be added to more accurately verify the influence of language distance on test scores.
- While 151 participants is not a low number, regression models become more accurate the more data you have, so gathering data from more participants could yield more accurate results. Moreover, we mainly tested children from age 7-10, so expanding this age range could also give more insights into the effects of language distance.
- In this study, we only looked at one task (SRT) as a measure of how well children are able to speak a language. Inclusion of a broader spectrum of language tasks could shed more light on the effects of language distance while learning two languages.

These outcomes provide a better understanding of child bilingualism, and they demonstrate that language distance plays a role in bilingual children's productive vocabulary skills.

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