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The Effect of Dual Language Exposure on Single Language Development: Comparing Acquisition Rates in Bilingual and Monolingual Children

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Abstract

A central question in bilingual child language acquisition research concerns the effect of dual language exposure on the rate of language development. Previous research has produced conflicting evidence: While some studies have reported similar acquisition rates, other studies have found that bilingual children lag behind their monolingual peers in their vocabulary and grammatical development. The goal of the present study was to contribute to this ongoing debate by investigating acquisition rates in bilingual and monolingual children in single language comparisons. Fifty German kindergarten children aged from 4 to 6 years old participated in the study: 25 German-speaking monolingual children (mean age 63 months [SD=7.5 months]) and 25 bilingually developing children who acquired German in combination with another language (mean age 64 months [SD=8.3 months]). We compared acquisition rates of three global measures (MLU, vocabulary size and vocabulary growth rate) and five local measures of language performance that served as proxies for the assessment of the degree of development of complex sentences with adverbial clauses. We found that – with the exception of MLU – the monolingually developing children were significantly more advanced on all measures of language performance. Implications for understanding bilingual development are discussed.

Keywords: bilingual child language acquisition, rate of development, complex sentences

1 Introduction

The number of bilingually developing children is large and growing[1], yet the language development in bilingual children is still not well understood (McCardle & Hoff 2006). The bilingual literature distinguishes between bilingual children who are exposed to

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[1]An estimated half of the world's children grow up exposed to two or more languages (Grosjean 2010).

two languages from birth ('simultaneous bilinguals') and those who begin language development as monolinguals but who are exposed to a second language later in childhood ('sequential bilinguals'). Simultaneous and sequential bilingualism are conceived of as two different phenomena – bilingual first language acquisition and child second language acquisition respectively (cf. Genesee & Nicoladis 2007; Paradis 2007). While intuitively plausible, these two types are not easily disentangled. De Houwer (2009: 2), for instance, defined 'bilingual first language acquisition' as the "development of language in young children who hear two languages spoken to them from birth" with "no chronological difference between the two languages in terms of when the children started to hear them". Other researchers have proposed a cut-off of exposure to two languages at the age of three (e.g. McLaughlin 1984) or at the age of four (e.g. Genesee & Nicoladis 2007).

In the bilingual child language acquisition literature, there has been an increasing interest in the effects of dual language exposure on child language development (cf. Hoff, Core, Rumiche, Senor & Parra 2012). Much of this interest resolves around questions concerning the course of development and the rate of development: (1) Do monolingual and bilingual children share the same developmental milestones? and (2) Do bilingual and monolingual children showcase the same speed of language acquisition? Concerning the course of development, there is a general agreement that bilingual children follow the same acquisition stages as their monolingual peers, starting off with babbling and one word utterances, followed by multi-word utterances and ending with complex sentences (cf. De Houwer 2009). There is, however, less agreement with regard to the rate of development. While some studies found no difference when bilingual children were compared to monolingual children with regard to vocabulary and grammatical development in the language both groups were acquiring (e.g., De Houwer, Bornstein & Putnik 2013; Paradis 2010; Paradis, Crago & Genesee 2005; Smithson, Paradis & Nicoladis 2014), other studies have found that bilingual children lag behind their monolingual peers in their vocabulary and grammatical development when measured in each language separately (cf. Bialystok & Feng 2011; Bialystok, Luk, Peets & Yang 2010; Gathercole & Thomas 2009; Hoff, Core, Place, Rumiche, Señor & Parra 2012; Marchman et al. 2010; Place & Hoff 2011; Thordardotir, Rothenberg, Rivard & Naves 2006; Vagh, Pan & Mancilla-Martinez 2009). It is important to note at this point that this does not imply that bilingual children are confused or slowed down

in their ability to acquire language. Infants growing up bilingually have the capacity very early in life to separate, categorize and begin to learn their two languages by relying on surface acoustic information (cf. Werker & Byers-Heinlein 2008). Previous studies have also shown that bilingual children are not delayed in the rate at which they acquire linguistic knowledge in total. For example, a study by Hoff et al. (2012) found that while monolingual children outperformed bilingual children in single language comparisons, they were comparable on a measure of total vocabulary. However, there is still conflicting evidence as to whether language development in bilingual children proceeds at the same pace as in monolingual children with regard to acquiring the vocabulary and grammatical constructions of each language, i.e. the effect of dual language exposure is on single language development is still uncertain. Most of the studies on the effects of dual language exposure on the rate of development have used global measures of language development, such as mean length of utterance or total vocabulary size. To our knowledge, no study has investigated language development using local measures that indicate how advanced is the child's use of particular linguistic constructions. Complex sentences (CSs) are particularly well suited to such investigations. The ability to produce and comprehend CSs is often considered to mark a final stage in child language acquisition (cf. Clahsen's 1986 phase model with five general developmental phases; Saxton 2010; Clark 2016). CSs have played an important role in the development of theories of child language acquisition. The acquisition of these constructions has been the focus of much debate between generative and usage-based accounts of syntactic development in children (cf. Borer & Wexler 1987; Bowerman 1979; Brandt, Diessel & Tomasello 2008; Cheng & Corver 2006; Chomsky 1967; Dabrowska, Rowland & Theakston 2009; Diessel 2004; Diessel and Tomasello 2000). Generative accounts hold that children acquire syntactic constructions by activating an innate set of rules (cf. Pinker 1984). The activation of a rule requires a sufficient amount of input, but once it is acquired, children are in the position to produce and comprehend the relevant structures equally well across different contexts, meaning that they move from a no-knowledge state to a full-knowledge state. In contrast, usage-based accounts hold that children gradually build up knowledge about the usage conditions of a construction (cf. Diessel 2004; Tomasello 2003), meaning that "to know a construction isn't an all-or-nothing-state" (Arnon 2011: 82). In addition to highlighting the piecemeal bottom-up nature of the acquisition process, usage-based accounts

have demonstrated the item-based or exemplar-based nature of the development of grammatical knowledge: children's earliest constructions are organized around specific lexical material and only gradually become increasingly more complex and diverse. The bulk of research on the acquisition of CSs has focused on children's comprehension of such constructions in experiments. Most of the studies reported that children have difficulties comprehending CSs until well into the school years. In what is to date the most extensive production study on children's acquisition of CSs, Diessel (2004) has shown that while the earliest CSs emerge around the second birthday, they are less complex and more concrete than CSs in adult speech, i.e. they are organized around concrete lexical material and, although they consist of two clauses, they only encode a single proposition and do not involve embedding. More complex, elaborated, adult-like versions of CSs encoding two propositions in two full-fledged clauses emerge only gradually during the preschool years. These findings explain why children have difficulties comprehending CSs in experiments, while at the same time beginning to use them at an early age. As pointed out by Diessel (2004: 175),

> [i]f we acknowledge that the acquisition process proceeds in a piecemeal bottom-up fashion, and the development of complex sentences originates from simple item-based constructions, the discrepancy between children's performance and their use of complex sentence in spontaneous speech disappears.

The goal of the present study is to contribute to the ongoing discussion regarding the rate of development in bilingually developing children in comparison to monolingually developing children. Couched within usage-based accounts of child language acquisition, the study focuses on the effect of dual language exposure on grammatical and vocabulary development in a single language comparison. The novel contribution of the study is the use of children's spontaneous speech and the inclusion of local measures intended to capture the gradual and item-based nature of language development. These local measures will serve as proxies for the assessment of the degree of development of CSs with adverbial clauses (ACs) in preschool bilingual and monolingual children.

2 Method

Participants

Fifty German kindergarten children aged from 4 to 6 years old participated in the study: 25 German-speaking monolingual children (mean age 63 months [SD=7.5 months]) and 25 bilingually developing children who acquired German in combination with another language (mean age 64 months [SD=8.3 months]). The groups were comparable with respect to gender ($\chi^2(1) = 0.08$, $p > 0.77$), age ($t(47.55) = -0.34$, $p > 0.73$) and the mean number of word tokens a child contributed to the corpus ($\text{mean}_{monolingual} = 1088.64$; $\text{mean}_{bilingual} = 814.00$; $t(46.13) = -1.8938$, $p > 0.06$). For the bilingual group, we used caregiver instruments modeled on the Alberta Language Environment Questionnaire (Paradis, Emmerzael & Sorenson Duncan 2010) to assess information about a child's learning environment, such as whether a child has been exposed to two languages from birth or from entering kindergarten (AGE OF ONSET), the dominant language at home or the typological proximity of the languages acquired. Since pairwise partial correlations revealed that with the exception of AGE OF ONSET none of the variables was significantly related to any of the performance indicators, they will not be further treated in this study. Following McLaughlin (1984), we used a cut-off point of 3 years to distinguish between simultaneous bilingual children (N=12) from sequential bilingual learners (N=13).

Table 1. Participants' age, gender and number of words contributed to corpus

Group	Age	Gender	Word token in corpus
Monolingual	mean = 5;3	female: 16;	mean = 1088.64
(N = 25)	(SD = 7.5)	male: 9	(SD = 561.92)
Bilingual	mean = 5;4	female: 14;	mean = 814
(N = 25)	(SD = 8.3)	male: 11	(SD = 458.29)
Simultaneous	mean = 5;1	female: 7;	mean = 739.17
(N = 12)	(SD = 8.8)	male: 5	(SD =352.17)
Sequential	mean = 5;5	female: 7;	mean = 883.1
(N = 13)	(SD = 5.9)	male: 6	(SD = 543.7)

Procedure

Data elicitation: All children watched a 6.5-minute episode of a popular stop-motion animated children's television series. The children were then given a visual cue to a particular scene and asked to describe what happened in that scene. All verbal interactions between the children and the experimenter were audio-recorded.

Transcription of speech: Transcripts were made from collected audio recordings. All experimenter and child speech was transcribed. The transcription of child speech resulted in two corpora representing spontaneous speech produced by the bilingual children (21,023 word tokens) and their monolingual peers (27,301 tokens). The flow of speech for both children and the experiment was divided into utterances. We defined an utterance as having a single intonational contour within a single conversational turn and consisting of one or more syntactic units, i.e. phrases or clauses. An utterance was usually preceded and followed by a pause. An utterance could contain a single word (*eis*), a single phrase (*in die Küche*), a simple sentence (*dann sind die alle runtergefallen*), or a multi-clause sentence ([*da muessen die immer alles aufbauen] [AC weil ein paar sachen kaputt sind]*).

Language performance measures

Global Measures: Three global measures of child language development were considered: a measure of grammatical development, MEAN LENGTH OF UTTERANCE (MLU) and two measures of vocabulary development, VOCABULARY SIZE (VS) and VOCABULARY GROWTH RATE (VGR). The first measure – MLU – is used as a general

indicator of syntactic development (Brown 1973). MLU was calculated as the number of orthographic words produced per utterance. The vocabulary development was assessed using two indicators of vocabulary richness – VS and VGR. The VS is defined as the number of unique words (word types) that appear in a corpus. The VGR is defined as the number of hapax legomena, i.e. the word types that occur only once in the corpus, divided by the total number of word tokens in the corpus (cf. Baayen 2008). Since these two vocabulary measures are sensitive to corpus size, the monolingual corpus was reduced to the size of the smaller, bilingual corpus, i.e. to 21,023 words.

Local Measures: Building upon usage-based accounts of child language acquisition and, in particular, Diessel's (2004) account of the acquisition of complex sentences, a set of local measures was derived to assess the advancedness of CSs with ACs use in child productions. Diessel (2004) showed that the earliest ACs produced by children are intonationally unbound utterances which follow the semantically associated clauses. Over time, children learn to elaborate these structures and integrate them with an associated main clause. The last step in mastering such constructions involves the capacity to produce bi-clausal units with sentence-initial ACs. This gradual development proceeds in an item-based fashion, i.e. children's earliest productions are organized around a restricted set of adverbial subordinators. Over time this set is broadened to include a wider range of subordinators. To determine the advancedness of the target constructions in children's productions, we assessed for each child the number of different subordinators heading the AC (RANGE.SUB), the proportion of integrated ACs (INTEGRATED) and the proportion of sentence-initial ACs (INITIAL). In addition to these three measures, we also assessed the MLU of an AC (MLU.AC) and the proportion of ACs with sentence-final verbs (POS.VERB) (for the description of the so-called "verb-second effect", cf. Meisel 2006: 99f). Table 2 presents an overview of all performance measures investigated in the present study.

Table 2: Overview of all performance measures investigated

Type	#	Name	Description
GLOBAL	1	MLU	Mean length of utterance (in words)
	2	VS	Vocabulary size
	3	VGR	Vocabulary growth rate
LOCAL	4	MLU.AC	Mean length of AC (in words)
	5	VERB.POS	Proportion of correct verb positioning
	6	RANGE.SUB	Number of different subordinators used
	7	INTEGRATED	Proportion of ACs that are integrated into multi-clause construction
	8	INITIAL	Proportion of integrated ACs that are sentence-initial

Statistical Analysis:

With the exception of the two global vocabulary measures, all language performance measures were analyzed using Generalized Additive Models (Hastie & Tibshirani 1990) using the MGCV package (Mixed GAM Computation Vehicle with GCV/AIC/REML Smoothness Estimation; Wood 2011) for the statistical software system R (R Core Team 2015). Children's scores on each performance measure were used as the predicted variables in the models. We entered AGE as a penalized regression spline with up to five degrees of freedom as a control variable. To assess whether performance was affected by dual language exposure, we added the term GROUP to the model, which distinguished monolingually and bilingually developing children. Likelihood ratio tests were used to determine if the inclusion of GROUP led to a statistically significant increase in model fit. For the local measures, the analysis was extended to investigate if performance was affected by the age of onset of learning German. To this end additional models were fitted where performance on a given measure was modeled as a function of AGE and a three-level factor that distinguished monolingual children from simultaneously and sequentially bilingually developing children. Differences in performance between simultaneous and sequential bilinguals were assessed by comparing a model that included GROUP as a two-level factor with a model that instead included GROUP as a three-level factor. To assess if the productions of monolingual and bilingual children differed with regard to VS and VGR, we made use of the COMPARE.RICHNESS.FNC function provided by the

package LANGUAGER for R (Baayen 2013), which is based on LNRE models (cf. Baayen 2008).

Results

Before we turn to the local language performance measures, we briefly present the results of the analyses of the three global measures. The analysis of MLU scores indicated that bilingual and monolingual children were comparable on that measure ($MLU_{monolingual}$ = 7.8 [SD = 2.37], $MLU_{bilingual}$ = 7.41 [SD = 2.11]). Model comparisons using the likelihood ratio test showed that GROUP was not a significant predictor ($\Delta\chi^2$=2.32, p > 0.48). The analysis of vocabulary richness scores revealed significant differences in both VS (number of types in monolingual corpus = 3220, number of types in bilingual corpus = 2779, z = -8.36, p > 0.0001) and VGR (monolingual VGR = 0.09, bilingual VGR = 0.07, z = 5.72, p < 0.0001). Turning to the results of local language performance measures, we found 1,021 utterances containing ACs in our data: 601 in the monolingual corpus and 420 in the bilingual corpus (simultaneous = 183; sequential = 237). An overview of mean performance and standard deviations across measures and groups is presented in Table 3.

Table 3: Univariate descriptive statistics on local performance measures

Group	MLU.AC	mean VERB.POS	mean INTEGRATED	mean INITIAL	mean RANGE.SUB
Monolingual	11.41 (2.96)	0.66 (0.25)	0.52 (0.24)	0.12 (0.08)	4.67 (1.83)
Bilingual	9.26 (3.07)	0.59 (0.31)	0.31 (0.34)	0.04 (0.07)	2.35 (1.43)
Simultaneous	9.23 (2.83)	0.61 (0.32)	0.32 (0.29)	0.05 (0.1)	2.62 (1.59)
Sequential	9.29 (3.32)	0.56 (0.31)	0.30 (0.37)	0.03 (0.05	2.29 (1.38)

We found that monolingually developing children were significantly more advanced than the bilingually developing children on all local measures of performance (MLU.AC $\Delta\chi^2$ = 1292.43, p < 0.0001, VERB.POS $\Delta\chi^2$ = 1.23, p < 0.0001, INTEGRATED $\Delta\chi^2$ = 2.87, p < 0.0001, INITIAL $\Delta\chi^2$ = 0.58, p < 0.0001, and RANGE.SUB $\Delta\chi^2$ = 1110.10, p < 0.0001). We further found that the performance of simultaneous bilinguals was significantly better than the performance of sequential bilinguals for all measures with the exception of MLU.AC and VERB.POS (INTEGRATED $\Delta\chi^2$ = 1.03, p < 0.0001, INITIAL $\Delta\chi^2$ = 0.05, p < 0.001, RANGE.SUB $\Delta\chi^2$ = 17.57, p < 0.05, MLU.AC $\Delta\chi^2$ = 4.57, p > 0.33,

VERB.POS $\Delta\chi^2 = 0.09$, $p > 0.11$). A graphical representation of the results is shown in Figure 1 below.
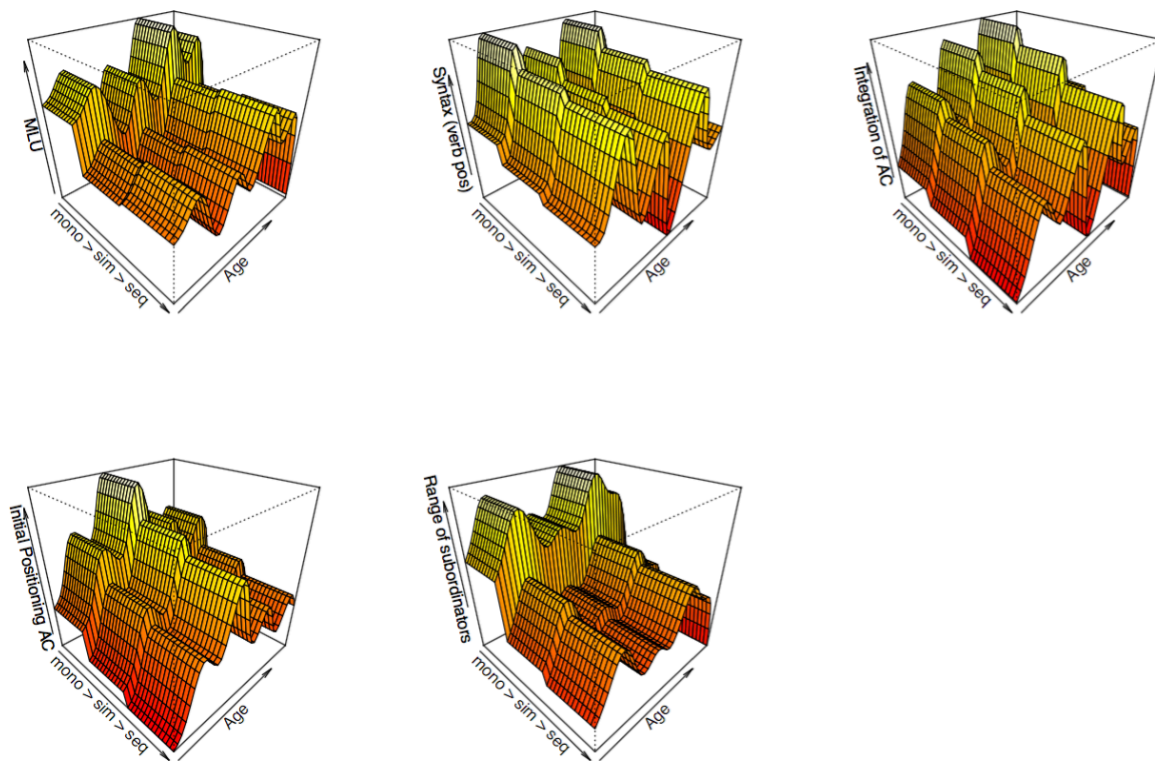
Figure 1: Perspective plots of model predictions for all local measures of language performance

Discussion

The purpose of this study was to contribute to the ongoing discussion regarding whether language development in bilingual children proceeds at the same rate as in monolingual children in acquiring vocabulary and grammatical knowledge. Previous studies have typically used standardized parent-report questionnaires assessing children's language development and have primarily employed global receptive measures of language performance, such as vocabulary size. The novelty of the present study lies in the use of children's spontaneous speech and the inclusion of local measures serving as proxies for the assessment of the degree of development of the target constructions. We investigated the rate of development in 50 bilingually and monolingually developing children aged 4 to 6 years using three global and five local measures of language performance in single language comparisons (German).

We found no difference in rate of development with respect to the global

measure of MLU. This contrasts with previous studies that have reported bilinguals to lag behind their monolingual peers on MLU-based measures (e.g., Hoff et al., 2012; Blom 2010). These studies have focused on a younger cohort between 1.5 and 3 years of age, where MLU is shown to be a sensitive indicator of grammatical development. However, in later stages of development "much of the growth in complexity is the result of internal reorganization of utterance form, rather than addition of new structure" (Owens 1999: 190) and associated developmental achievements include the use of *wh*-questions, noun and verb phrase elaboration and complex sentences (Retherford 2000).

Turning to vocabulary development, we found that the monolingual children were more advanced than the bilingual children on measures of VS and VGR. This is consistent with previous studies. Bilingual children typically obtain lower scores than monolinguals on measures of both receptive (Bialystock, Luk, Peets & Yang 2010; Calvo & Bialystock 2014) and productive vocabulary (Hoff, Rumiche, Burridge, Ribot, & Welsh 2014; Oller & Eilers 2002)[2]. Using the Peabody Picture Vocabulary Test, a more recent large-scale study of more than 1,700 bilingual children between ages 3 and 10 years, Bialystok, Luk, Peets & Yang (2010), reported significantly higher scores for monolinguals at every age examined.

The analyses of local measures revealed that achievement in all major milestones of producing ACs described in Diessel (2004) was affected by dual language exposure: children exposed to only one language were more advanced than children exposed to two languages with regard to the proportion of ACs that were integrated into a multi-clause structure, the proportion of ACs in sentence-initial positions, and the range of different subordinators used. We also found that monolingual children produced ACs that on average were longer and had a larger proportion of verb-final word order. At this point we would like to note that, while limitations in sample size preclude a definitive conclusion, visual inspection of the development of performance over time suggested a catching-up effect in bilingual children: for virtually all local performance measures the distance to monolingual performance levels decreased towards the end of the age range examined (between ages 5-6).

The findings presented in the current study suggest that the rate of language

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[2] But see De Houwer, Bornstein & Putnik (2013) for an exception.

development is paced by children's access to input, as children whose daily language exposure is divided between two or more languages are, on average, likely to be exposed to less of each language than children whose daily language exposure is in only a single language (see, for example, De Houwer 2009; Hoff et al. 2012; Paradis, Nicoladis, Crag, & Genesee 2011). Differences in the sheer amount of input could also explain the finding that simultaneous bilinguals outperformed sequential bilinguals in our study. UB-oriented research has underlined the ubiquity of frequency effects in monolingual language acquisition (see Ambridge, Kidd, Rowland & Theakston 2015 for a recent review). Recent research on bilingual child language development is consistent with this by-now large literature on monolingual development that finds that variability among children in their rates of development is predicted by the amount of language input they are exposed to. For example, Hoff et al. (2012) have reported that within the bilingually developing sample, all measures of vocabulary and grammar were related to the relative amount of input in that language. In addition to the amount of input, socio-economic status has been shown to be another important child-external factor to affect language development in bilingual children (Calvo & Bialystock 2014). As mentioned above, we investigated a set of child-external variables regarding the children's learning environments but found no correlations with any of the language performance indicators. As the present study was limited in statistical power, future work is needed to determine the effects of child external factors on the rate of development.

Despite its limitations, we believe that the inclusion of local measures intended to capture the gradual and item-based nature of language development has the potential to lead towards a more nuanced understanding language performance and can inform the development of bilingual language norms. An adequate understanding of what can be expected of bilingually developing preschool children is of critical importance to avoid the interpretation of their linguistic behavior as symptomatic of delay or even impairment when, in fact, it is typical of children acquiring more than one language (see e.g. Genesee 2006, for a discussion).

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