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**Lexical development of French-Portuguese simultaneous bilinguals: Exploration of vocabulary size, word class distribution and lexical selectivity**

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**Abstract**

This study compares the lexical development of a sample of 29 simultaneous French-Portuguese bilingual children between the ages of 24 and 36 months living in France with the lexical development of a sample of 288 monolingual French children. The data show that bilingual children do not show a lexical developmental delay compared to their monolingual French peers. Moreover, the word-class distribution of productive vocabulary is the same between the French monolinguals and bilinguals in French. Finally, we tested the lexical selectivity by calculating the phonetic complexity of the target words. We found a strong correlation between the phonetic complexity of target words and vocabulary size in both languages for bilinguals. This strong correlation mirrors that found for monolingual peers.

**Keywords:** bilingualism; lexicon; word-class; lexical selectivity; French; Portuguese

## **Introduction**

As more than half of the world's population uses more than one language in their daily lives, there is a need for more studies on bilingual language development with a wide range of language pairs. To this end, the present work aims to compare the development of early words in **French-Portuguese** toddlers with their monolingual peers cross-sectionally. We compared lexical size, word-class distribution and lexical selectivity (also referred to as lexical selection or lexical avoidance) between the two populations and between the two languages in the bilingual group. First a state of the art concerning the productive lexicon size in monolingual and bilingual children, focusing on the different factors that may explain the discrepancies between studies will be presented. Second, the grammatical composition of productive lexicon in both groups will be described. Finally, we will expose the results of studies that have shown lexical selectivity in monolingual and bilingual children.

### ***Lexicon size of monolingual and bilingual children***

Studies that compared expressive lexical development in monolingual and bilingual populations often came to very different results. This is particularly true for studies who looked at quantitative differences between both populations. This diversity or even contradictions in the results may be partly due to the existence of very diverse bilingual situations as well as significant heterogeneity in the methodologies being used. Assessment procedures and language exposure were often identified as two main factors that led to different linguistic outcomes in bilingual children.

Single and two-language assessments are generally opposed in the literature. In a single language assessment, the language of a bilingual child is tested in one language and compared with monolingual norms for that same language. This way of testing leads to the conclusion that bilingual children, as a group, perform below the norms for their age (Hoff et

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al., 2012; Pearson et al., 1993; Vagh et al., 2009) or similar to monolingual speakers (Houwer & Cruz-Ferreira, 2010; Junker & Stockman, 2002). However, a single assessment is more likely to underestimate children's abilities because it does not give them credit for knowledge of the other language.

In a two-language assessment, children's language level is compared to monolingual norms in both languages, giving credit this time to the child's entire knowledge. In this type of assessment, child lexical development is evaluated in different ways that present advantages and drawbacks. Calculation of total vocabulary and total conceptual vocabulary (Conboy & Thal, 2006; Marchman et al., 2010; Marchman & Martínez-Sussmann, 2002; Pearson et al., 1993, 1995) have been widely employed to quantify early productive vocabulary in children receiving bilingual exposure. Total Vocabulary (TV) is the sum of the raw vocabulary score in each of the bilingual child's languages and this total score is interpreted with reference to monolingual norms (Pearson et al., 1993). Total Conceptual Vocabulary (TCV, Swain, 1972) refers to the number of concepts that are shared between languages so that translation equivalents, or words from both languages having the same meaning were counted only once. While TV scores may overestimate children's lexical level by counting the same concept twice (Kern et al., 2019), an effect of underestimation was often found with TCV scores (Core et al., 2013; Hoff et al., 2012; Patterson & Pearson, 2004). Another difficulty with the use of TCV scores is the identification of translations equivalents across languages. This identification is challenging for some content words and impossible for some closed class items. According to Core et al. (2013), a TV score seems to be more reliable in assessing vocabulary development in bilinguals, particularly when using a monolingual standard as comparison. Several studies have compared TCV measures to single language vocabularies and/or to TV measures. In all cases, bilingual's TV scores were higher (Junker & Stockman,

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2002) or equal to monolinguals TV scores (Core et al., 2013; Pearson et al., 1993; Thordardottir et al., 2006). Furthermore, bilinguals' TV scores were higher than their TCV scores (Core et al., 2013; Junker & Stockman, 2002; Thordardottir et al., 2006). Finally, when comparing bilinguals' TCV scores to monolinguals' TV scores, divergent results emerged with bilinguals' TCV scores being equal (Junker & Stockman, 2002; Pearson et al., 1993) or lower (Core et al., 2013; Thordardottir et al., 2006) than monolinguals' TV scores.

These slightly different results could be explained by methodological differences such as data collection tools or questionnaire completion procedure. In most of the cited studies, parental reports (such as the [MacArthur-Bates Communicative Development Inventory \(MB-CDI\)](#) (Fenson et al., 1993), and their various adaptations) were used to evaluate lexical development in monolingual and bilingual populations. Previous studies using the CDIs in a monolingual (Dale, 1991; Feldman et al., 2000, 2005) as well in a variety of bilingual contexts (Gatt, 2007; Marchman & Martínez-Sussmann, 2002; O'Toole & Fletcher, 2010) have shown that parents can reliably report on the words a child can understand and/or produce. However, in both situations, the evaluation procedure can be challenging for parents when they have to remember what words the child said. In a bilingual situation the task is even more challenging as they have to remember what words the child said in which language. To overcome this difficulty, de Houwer et al. (2005) and Bornstein et al. (2006) recommended that two or three adults rate the same child's vocabulary skills in both monolingual and bilingual contexts to increase reliability, although at 13 and 20 months French-Dutch bilinguals with fewer than with three reporters scored similarly to those with three reporters. However, having more than one reporter is not always possible for practical reasons, such as duration of questionnaire completion or uneven competence of parents in the evaluated languages. In most of the studies, the questionnaires were filled out by the main caregiver in the L1, and in the L2 if

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he/she was bilingual in the child's L2. Where the main caregiver was not proficient in the L2, the other parent (or someone who regularly conversed with the child in that language) was asked to complete the questionnaire (Core et al., 2013; O'Toole et al., 2017; Pearson et al., 1997).

As proposed in Grosjean's seminal paper (1989), we concur with the assertion that a bilingual individual is not equivalent to two distinct monolingual individuals coexisting within a single person. Being bilingual involves a unique and complex cognitive and linguistic experience that goes beyond merely having two separate language systems. However, it is worth noting that currently, instruments providing bilingual language acquisition standards are exceedingly scarce (with some exceptions, e.g., Gatt, 2017). Consequently, in the absence of more comprehensive tools, contemporary research often resorts to comparing bilingual development to monolingual standards while exercising due caution.

Most studies agree on the effect of language exposure on the linguistic performances of monolingual (Goodman et al., 2008; Hart & Risley, 1995, among others) and bilingual children (Bridges & Hoff, 2014; Buac et al., 2014; Hoff et al., 2012; Houwer, 2021). A very impressive number of studies largely based on parental report (Paradis, 2016) found significant relationships between input quantity measures and children's lexical development. Since the amount of each language heard by children in bilingual environments can vary considerably, few children reach similar proficiency levels in both languages (Baker & Wright, 2021). They often have stronger skills in one language than in the other, the so-called dominant language. Language dominance variability can explain some observed differences in vocabulary acquisition among the bilingual population. For example, Hoff et al. (2012) showed that in children exposed to two languages, the rate of development of each language varied as a function of the children's relative amount of exposure. English-Spanish bilingual

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children were categorized according to whether their language exposure was English dominant, balanced, or Spanish dominant, and these three groups were compared to each other. For all of the participants, all of the measures of vocabulary and grammar in both languages were related to the relative amount of input in each language respectively. Thordardottir (2011) compared lexical development in five- year-old French and English balanced and unbalanced (> 60% exposure to one language) bilinguals. She found lexical scores of balanced bilinguals being similar to those of monolingual children in both languages whereas unbalanced bilinguals reached the monolingual scores only in their dominant language. This result was replicated in Cattani et al. (2014) who showed that bilingual children exposed to English 60% of the time or more, perform on par with their typically developing monolingual English-speaking peers. It is also important to be aware that there are other factors relevant to bilingual acquisition (such as status and number of input-providers, language status, simultaneous or successive bilingualism, different language pairs, for a review see Unsworth (2016)), or relevant to language acquisition in general (socio-economic status and/or maternal education, gender, see Hoff (2006)) that may have an influence on children's language outcomes and may obscure comparisons between studies.

### ***Grammatical composition of early lexicon in monolingual and bilingual children***

Research on bilingual children has focused mainly on quantitative issues, and there has been relatively less research on the composition of the developing bilingual lexicon compared to the numerous studies on monolingual children. In the two last decades, composition of expressive lexicon and more specifically grammatical composition of monolingual lexicons has been extensively studied in a large variety of languages. These studies on lexical composition reveal general trends but also some differences which have been explained by

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two main factors: the type of language assessment used as well as quality and quantity of language exposure.

The expressive lexicon of children under 4 years of age has been extensively assessed through parental reports and through spontaneous data collected during informal interactions with adults. It has been shown that each type of assessment can have an influence on the grammatical composition of observed lexicon. The use of a parental report could tend to an overestimation, on the part of parents, of nouns to the detriment of predicates and functional words (Pine et al., 1996). This trend has been associated to an uneven number of items proposed in each of the categories: in all the adaptations and versions of the MacArthur-Bates Communicative Development Inventory (MB-CDI) (Fenson et al., 1993) which is the most widely used parental report to date, there are more content words (and even more nouns than predicates) than functional words. Moreover, functional words tend to be less easily identified by adults (Goodman & Nusbaum, 1994).

In most of the studied languages, monolingual children follow the same developmental patterns with grammatical categories being introduced at different stages and developing at different rates. Three waves in lexical development have been described in children between 8 and 30 months of age (Kern & Gayraud, 2010). Up to a lexicon composed of 100 words, nouns are increasing (slowly to 50 words, then sharply to 100 words). During the second wave there is an increase in the percentage of predicates while percentages of nouns remain stable. Finally, when the lexicon is composed of 400 to 600 different words, there is a sharp increase of closed class items. The nominal bias, which refers to a predominance of nouns in the early stage of vocabulary acquisition over other grammatical categories, particularly the verb category, has been documented for many languages (Bornstein et al., 2004; Dhillon, 2010;

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Junyent et al., 2020). However, nominal bias could be mitigated in languages where verbs are favored in the input like Mandarin or Korean (Kim et al., 2000; Tardif et al., 1999).

Only a small number of studies have included word class analyses on bilingual children. Generally, these studies have found that overall grammatical distribution of lexical items of bilingual young children is identical to that of monolinguals. In David and Wei (2008), 13 bilingual French-English children followed longitudinally between 1 and 3 years from families with the one-parent-one-language practice in France or UK acquired all nouns before predicates (which is line with David (2004) and David and Wei (2005) conclusions). The same results were found by Conboy and Thal (2006) in 64 English-Spanish bilinguals between 20 and 30 months in San Diego exposed to the Mexican dialect through either their families or other caregivers. They showed the same lexical composition and composition trajectories in bilinguals as for monolinguals regarding nouns preceding verbs and adjectives and closed class items. Following Pearson and Fernández (1994), it showed also that proportions of different word types in each language varied with same-language vocabulary size and not across languages.

**Table 1. Studies on grammatical distribution in bilingual children**

Authors	Language pairs	Typological Difference	Age (in months)	Socioling. context	Gram. distrib.
David & Wei (2008)	French / English	No	12 to 36	One parent-one language	Like mono; noun bias
David (2004)	French / English	No	16 to 30	One parent-one language	Like mono; noun bias
David & Wei (2005)	French / English	No	12 to 36	One parent-one language	Like mono; noun bias
Conboy & Thal (2006)	English / Spanish	No	20 to 30	Varied exposure	Like mono; noun bias
Levey & Cruz	English /	Yes	22 to 48	Varied	Noun bias

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(2003)	Mandarin			exposure	
Lucas & Bernardo (2008)	Filipino / English	Yes	36 to 47	Varied exposure	Noun bias
Xuan & Dollaghan (2013)	Mandarin / English	Yes	22 à 30	Varied exposure	Noun bias; weaker in Mandarin
Özcan, Altinkamiş & Gillis (2016)	Dutch / Turkish	Yes	8 to 36	Varied exposure	Noun bias; weaker in Turkish

Note: Socioling. Context = Sociolinguistic context; Gram. distrib. = Grammatical distribution (when only nouns and verbs were reported, we only noted the existence of a possible noun bias; if not specified, the noun bias exists for both languages under study).

When contrasting verb-friendly (such as Japanese, Mandarin, Turkish) vs. noun-friendly (such as English, Spanish, French) language pairs, studies have come to different conclusions. In verb-friendly languages, verbs are relatively more frequent in the input and these languages license noun ellipsis more freely. As a result, nouns are produced less frequently and verbs are more likely to occur alone and/or in a salient final position. Although these studies found a nominal bias in most cases, they also showed the presence of language-specific characteristics. **Levey and Cruz** (2003) observed nominal bias in the first 100 words of 17 English/Mandarin children (between 22 and 48 months, all parents being bilinguals) in New York. This bilingual population behaved like their monolingual English peers but not Chinese peers, as verbs are as frequent or even sometimes more frequent than nouns in Chinese-learning children (Tardif, 1995, 1996). Moreover, this population exhibited a different vocabulary composition in both languages, with more verbs in Mandarin. The authors linked these trends to the type of input to which the children were exposed to, with more verbs elicited by parents in Mandarin and nouns in English, as well as to the language characteristics, Mandarin being a verb-friendly language and English being considered a noun-friendly language. **Lucas and Bernardo (2008)** worked in Manila with 60 Filipino–English bilingual children aged 3 and their adult caretakers whose first language was Filipino.

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As both languages differ, in how they emphasize nouns and verbs in typical syntactic forms, the authors explored a possible noun bias in the children's spontaneous productions. The results of their analysis suggest that there was a noun bias in Filipino-English bilingual children which is associated with a similar noun bias in caregiver input. However, the results also showed that noun bias is a language-specific phenomenon. The noun bias detected in children's productions was only present in their English productions and were associated with the preponderance and salience of English nouns in the caregivers' English utterances. In Filipino, the children produced as many nouns as verbs whereas the caretakers exhibited a verb bias. Similarly, Xuan and Dollaghan (2013) quantified noun bias in bilingual Mandarin-English toddlers whose expressive lexicons in each language contained 50-300 words. Parents of 50 children (1;10-2;6) reported separately on their English and Mandarin expressive lexicons. On average, the children's Mandarin vocabularies were larger than their English vocabularies and that nouns outnumbered verbs in both languages. In addition, the size of the noun-verb gap was larger in English than in Mandarin, consistent with previous studies (Tardif et al., 1999). Additional analyses showed that nouns predominated the total number of words as well as the 50 most frequently produced words in both languages, but the list of the most frequent 50 words in English included substantially more nouns and substantially fewer verbs than did the most frequent words in Mandarin, consistent with the main finding of a lower level of noun bias in Mandarin. Finally, Özcan et al. (2016) investigated the Dutch and Turkish lexicon of 55 Turkish-Dutch bilingual children aged between 9 and 36 months with respect to noun-verb categories. They found that vocabulary develops after 12 months and that nouns are prioritized over verbs both in comprehension and production. The noun superiority over verbs is reported both in the Turkish and Dutch

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lexicon, again with a more remarkable difference in Dutch than in Turkish in terms of noun dominance over verbs.

As it was the case for quantitative development of lexicon in monolingual and bilingual children, the quantitative level of input can play a role in the qualitative development of lexicons in production. In monolingual children the grammatical distribution of words in their expressive vocabulary is linked to their age but even more closely to their expressive lexicon size. Considering the high rate of variability among children at the same age, it was recommended to study the grammatical composition of lexicon according to its size (Bates et al., 1994). As already mentioned, children start to produce content words and more precisely nouns before producing predicates and closed class items. These trends are general trends with some interindividual and crosslinguistic differences. In bilingual children, measures of vocabulary size in both languages are related to the relative amount of input in each language respectively (Houwer, 2021). In the case of balanced children, lexical size of bilinguals is similar to those of monolingual children in both languages whereas unbalanced bilinguals reached the monolingual scores only in their dominant language (Cattani et al., 2014). This result raises questions about the grammatical distribution of words among bilinguals in their two languages and in particular that of bilinguals who are clearly dominant in one language. David and Wei (2005) were able to show in a population of **French-English** bilingual children between one and three years that their lexicon comprises globally the same categories as the monolinguals with these categories being represented and evolving at the same rate in both languages. But they also noticed that this was not the case in one child whose vocabulary size was much higher in French than in English. This child with an unbalanced lexicon produced more predicates and closed-class words and less nouns and other words in his dominant language. This study in particular indicates that not only the typological characteristics of

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language pairs have to be considered while studying grammatical composition of lexicon but also the level of language development through lexical size.

***Lexical selectivity in monolingual and bilingual children***

As shown by [Davis et al. \(2002\)](#), as well as Vihman and Croft (2007), the development of first words is linked to biomechanical constraints and in particular to the development of children's articulatory abilities. Thus, in their earliest productions, children produce systematic patterning of sounds that are not encountered in typical adult productions. Anatomical constraints (e.g., larger tongue relative to the vocal tract, tongue in a more anterior position than in adults and differences in palate proportions compared to adults) and immature motor control (e.g., some passive movements of the tongue following the active jaw articulator, working as a single unit movement) result in sound sequence patterns that are shared by all children regardless of the languages they acquire (Byun et al., 2016).

This is why the phonetic characteristics of produced as well as targeted first words differ according to age and/or lexical size. The first words that young children actually produce tend to present a reduced phonetic complexity (e.g., [Gayraud et al., 2018](#) in their crosslinguistic study on 16 children learning French, English, Arabic or Berber). Moreover, children also seem to follow a lexical selectivity strategy as their targeted first words present low level of phonetic complexity (Gayraud et al., 2018; Schwartz & Leonard, 1982). These two trends have been shown in children acquiring different languages through the calculation of the Index of Phonetic Complexity ([ICPC, Jakielski, 2022](#)). For this calculation Jakielski's method has been used (Jakielski, 2022), attributing phonetic complexity points to each word produced or targeted by the children, according to eight parameters: place and manner of articulation, vowel class, end of the word, variegation in articulation place, consonant cluster, length of the word, type of consonant cluster. Very few studies have examined the phonetic

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characteristics of bilingual children's early lexicons. They observed a selection strategy where, in each of their languages, less complex target words were produced first (Babatsouli, 2013; Celce-Murcia, 1975; Vihman, 2002; Yavas, 1995).

Several studies provide support for the hypothesis that lexical and phonological developments influence one another (Ferguson & Farwell, 1975; McCune & Vihman, 2001; Whitehurst et al., 1991). It has been shown that children select words with phonological characteristics that are already present in their own phonological systems and avoid words with features outside their inventories (Schwartz & Leonard, 1982). In other words, there is a lexical selection related to children's phonological development: children tend to avoid targeting words that are phonologically complex. According to Jakielski and Doyle (2006), this lexical selectivity is particularly important when children have a small lexicon and loses its influence with age. A measure has been developed to assess the phonological complexity of children's actual and target productions: the Index of Phonetic Complexity (IPC) (Jakielski, 2022). The IPC is based on the phonetic regularities observed during babbling and the first word period. Complexity points are assigned to each word produced or targeted by the children, according to eight parameters: place and manner of articulation, vowel class, end of the word, variegation in terms of articulation place, consonant cluster, length of the word, and type of consonant cluster. IPC calculations of target words have been performed mainly on groups of monolingual children. According to these studies, there is a lexical selectivity bias in very young children and this selectivity bias seems to decrease with age. Ranta and Jakielski (1999) showed that English-speaking toddlers between 16 to 20 months targeted words of low phonetic complexity in 50% of the time compared to 26% of the time for 23-26 month olds. Ward (2001) showed that the phonetic complexity of the words targeted by the children increased by 32% between the ages of 12 and 24 months. Jakielski et al. (2006) extended this work by looking at the

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development of the phonetic complexity of the words produced by 21 children between 24 and 35 months of age. The children were divided into 3 age groups: 24-27 months, 28-31 months, and 32-35 months. The results showed that the IPC of the target words increased with age, but only significantly between group 1 and group 2.

In bilingual children, Celce-Murcia (1978) observed lexical selectivity and avoidance strategies in an English-French bilingual two-year-old child. The child's selection of the English or French equivalent of a word was based on avoidance of phonologically difficult features. Another study was carried out by Yavaş (1995) with a **Turkish-Portuguese** child in Brazil. Data from the first 50-word period indicated that word selection depended on the words' phonological characteristics, with the simpler word being selected in each language. Yavaş proposed that the children's patterns of attempted words were shaped in a language-independent way by the avoidance of certain segments or clusters. Where these constraints were not critical, the choice depended on the length and the syllabic structure of the words (Miller, 2000). Finally, Chami et al. (2022) examined the development of the ICP of words targeted by bilingual **Lebanese-French** or **Lebanese-English** children. They observed an increase in the phonological complexity of target words with age in both languages, following the same trend as monolingual children.

### **This study**

This study addresses the question of early lexical bilingual development with a study on the quantitative and qualitative development of productive lexicon in young French-Portuguese speaking children in France. A comparison of rate of development and word class distribution of productive vocabulary has been conducted between this bilingual group and French monolingual children from the same age group. No direct comparison with Portuguese monolingual children will be undertaken as the norms in both languages have been based on

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different assessments which makes the comparison not reliable. Indeed, the European Portuguese version of the MB-CDI (Fenson et al., 1993) we used, is composed of a much larger number of words than the French one. Moreover, the French-Portuguese toddlers under study are more exposed to French than Portuguese.

French-Portuguese bilingualism is now quite common in French-speaking European countries and is linked to the evolution of Portuguese immigration (Pires, 2019). For example, in France, in 2012, 8% of the entrants were Portuguese (Brutel, 2014). However, few studies have been conducted on the phonological and lexical development of this population (Almeida, 2011; Kern et al., 2019; O'Toole et al., 2017; Valente et al., 2018). Although French and Portuguese belong to the Romance language family, they have some notable phonological and lexical differences (cf. Almeida, 2011). Moreover, they seem to share the same noun bias (Rescorla et al., 2016).

These considerations led us to investigate the specific characteristics of vocabulary development in bilingual French-Portuguese toddlers. A first set of questions concerns the quantitative aspect of language development in bilingual children compared to monolingual children. To date, there is no real consensus on the lexical development of bilingual children for methodological reasons: there are too many different ways of estimating lexical sizes (Marchman et al., 2010) and the populations studied are very heterogeneous (Houwer, 2021).

The questions we will answer are:

- Do monolinguals outperform bilinguals in vocabulary acquisition and does this answer hold true when calculating total or conceptual vocabulary?
- Do bilinguals' lexicons show the same patterns of word-class composition as monolinguals' lexicon?

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- Do we observe lexical selectivity in the bilinguals' vocabulary and, if so, is this lexical selectivity present in both languages?

Before comparing the bilinguals with the monolinguals, we will compare the size of their productive vocabularies in French and Portuguese to make sure that they are indeed dominant in French, as we would expect from the information collected in the Questionnaire for Parents of Bilingual Children: Infants and Toddlers Version - PaBiQ-IT (O'Toole et al., 2017), which is a tool for assessing children's background and language exposure. If the dominance of French is confirmed, we would expect that monolinguals would not perform better than bilinguals when comparing their productive vocabulary in French (Cattani et al., 2014). Furthermore, we expect that the total productive vocabulary of bilinguals, that is, the set of French and Portuguese words they have acquired, will be larger than that of monolinguals (Kern et al. 2019). We will then test whether the results remain the same for each word-class. Finally, we expect the composition of the monolinguals' lexicon, in terms of the proportion of each word class that composes it, to be comparable to the French lexicon of the bilinguals since they are dominant in French, but not to their Portuguese lexicon.

Lastly, we will examine the presence of lexical selectivity through the observation of the phonetic characteristics of the targeted lexicons of both monolingual and bilingual groups. Based on the results obtained with monolinguals (Schwartz & Leonard, 1982) and bilinguals (Yavaş, 1995), we expect a tendency for monolingual and bilingual toddlers to target more phonetically simpler words than complex ones.

## **Method**

### ***Participants***

We collected data on a group of 29 French-Portuguese bilingual children: 17 aged 24-30 months and 12 aged 31-36 months. They were recruited through advertisements (newspapers,

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websites) or personal contacts. The parents were second-generation Portuguese living in France but speaking French and Portuguese at home. Only typically developing children who had at least one parent speaking European Portuguese on a regular basis and who were born in France are reported here.

The data of the 17 bilingual children aged 24-30 months were compared to the French norms of the French version of the MB-CDI, the Inventaire Français du Développement Communicatif (IFDC; Kern & Gayraud, 2010), consisting of 288 monolingual French-speaking children of the same age recruited in France. We excluded both preterm and multiple birth children in both the monolingual and bilingual groups (Sansavini et al., 2021).

**Table 2. Demographic characteristics of the children**

Lg	N	Age (months)	Mean age (SD)	% girls	% first born	% of mothers holding a university degree
Fr/Pt	17	24-30	27.4 (1.9)	29.4%	52.9%	52.9%
Fr/Pt	12	31-36	34.5 (1.7)	16.7%	50.0%	66.7%
Fr	288	24-30	26.3 (2.1)	51.4%	58.3%	61.5%

***Material and procedures***

Three parental questionnaires, described in detail below, were completed by the parents: two vocabulary assessment in each language and one for collection of information on the child's background and language exposure. Parents were given a period of two weeks to complete the three questionnaires. This period allowed parents sufficient time to observe their child and complete the questionnaires and was short enough to provide an overview of the child's lexical profile for a given age.

***Vocabulary assessment***

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For this study, we used the French F-CDI (Kern & Gayraud, 2010) as well as a pilot version of the Portuguese adaptations P-CDI (Carvalho, 2013; Silva et al., 2017) of the MB-CDI words and sentences (Fenson et al., 2007). These questionnaires are aimed at assessing expressive vocabulary and grammatical development in monolingual children aged between 16 and 30 months. In this paper, only the vocabulary section of the CDI is investigated. The vocabulary section of the F-CDI and the pilot version of the P-CDI checklist consisted of 690 and 853 words, respectively, which parents were asked to check for spontaneous production by their child, regardless of whether the word was mispronounced or not. In order to ensure the best accuracy, we asked the families to have the questionnaires completed by the person who most often cared for the child, which could be done in consultation with the other members who cared for the child. For the bilingual group, this was the child's mother for almost all participants, but in two cases the father completed the questionnaire. The same trend was found for the monolingual group, in that a majority of mothers answered the questionnaires.

All data collected through the CDIs were entered into an Excel spreadsheet prior to statistical analysis. While only the total number of words in French (TWFR) was calculated for the monolingual French children, four scores were calculated for each bilingual:

- Total Words in French (TWFR with a maximum of 690 words);
- Total Words in European Portuguese (TWEP with a maximum of 853 words);
- The total vocabulary (TWFR+TWEP), which is the sum of the French and Portuguese words ticked in the CDIs.;
- The Total Conceptual Vocabulary (TCV), which is the sum of concepts produced in French and/or Portuguese. In the CDIs, a French word may refer to the same concept as a word in Portuguese, for instance, *canard* and *pato* have the same basic meaning, (*duck*). If

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these two words, *canard* and *pato*, are checked, then for this score, we do not count two words, but one concept.

As F-CDI and P-CDI do not share neither the same number of items (690 vs. 853) nor the same semantic distribution, we have listed the words that share the same meaning (or concept) in the two CDIs in order to be able to compare CDI-F and CDI-P. We also grouped the 22 CDI semantic categories into four word classes, as proposed in the F-CDI manual (Kern & Gayraud, 2010): “Sound Effects and Animal Sounds & Games and Routines” (SEAS&GR); “Closed Class Items” (CCI); “Nouns”; “Predicates”. We ended-up with 444 shared items between F-CDI and P-CDI, with roughly the same proportion for each word class compared to the original CDIs (see Table 3 for an overview).

**Table 3. Number and proportion of items by word class**

	<i>SEAS&amp;GR</i>	<i>CCI</i>	<i>Nouns</i>	<i>Predicates</i>	<i>Total</i>
<i>F-CDI</i>	39 (5.7%)	105 (15.2%)	379 (54.9%)	167 (24.2%)	690
<i>P-CDI</i>	55 (6.5%)	140 (16.4%)	476 (55.8%)	182 (21.3%)	853
<i>Shared items</i>	15 (3,4%)	71 (16.0%)	268 (60.3%)	90 (20.3%)	444

***Children’s background and language exposure assessment***

The Questionnaire for Parents of Bilingual Children: Infants and Toddlers [Version \(PaBiQ-IT, O’Toole et al., 2017\)](#) an adaptation of the PaBiQ (Tuller, 2015) is used to address a range of child and family-related background factors relevant to language acquisition. This questionnaire includes questions on demographic variables: children’s health, family size,

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parental education and occupation, as well as questions on language exposure: age of first contact with each language, child’s and by caregivers’ use of languages.

All bilingual children in this study were exposed to their target languages from birth. Parents rated the frequency of exposure to both languages on a 5-point scale (0 meaning never exposed to 4 always exposed). Children were exposed more frequently to French (3.88, SD=0.33) than to Portuguese (3.24, SD=0.83). As mentioned above, all these children lived in France at the time of the study, and at least one of their parents reported communicating regularly with them in Portuguese.

For each child, we calculated his/her No Risk index (Almeida et al., 2017; Tuller et al., 2018). The No Risk index is calculated based on parental concerns, the age of first word and the first sentence, and language difficulties in the family. The results showed that no child in this population was at risk for language disorders.

***Phonetic complexity measurement***

To measure word phonetic complexity we used the Index of Phonetic Complexity (IPC, Jakielski, 2022), since it has been shown to be a reliable measure (Morris, 2009) and allows to have a measure that encapsulates both paradigmatic and syntagmatic complexity (complexity of a phoneme vs. complexity of a sequence). IPC has been proposed with eight production-based parameters (see Table 4). As there are no rhotic vowels in French and Portuguese, the parameter “vowels by class” has been removed from the calculation of the phonetic complexity of French and Portuguese words.

**Table 4. IPC parameters and count (without “vowels by class”).**

Consonants by place class	Each dorsal	+1
Consonants by manner class	Each fricative, affricate, and liquid	+1
Word shapes	Word ending with a consonant	+1
Word length in syllables	Word with more than 2 syllables	+1
Singleton consonant by place	Word with place variegated	+1

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variegation	singleton consonants	
Contiguous consonants	Each consonant cluster	+1
Clusters by type	Each heterorganic cluster	+1

Note: heterorganic cluster refers to a consonant cluster with a change of place of articulation between the two consecutive consonants.

The sum of the points given by the production-based parameters determines the complexity score of a word. For example, the word *vache* (cow) has an IPC score of 4 (1 point for each fricative, 1 point for the fact that the two singleton consonants do not share the same place of articulation, and 1 point for ending with a consonant).

In order to compare the phonetic complexity of each dataset, we excluded from the 444 items that are present in both the F-CDI and the P-CDI (shared items), all the words in the “Sound Effects and Animal Sounds” word class (words in this word class are generally acquired early, but some will be rated as phonetically complex because they may consist of a string of consonants, such as “grrrr” in the F-CDI), and closed class items except “Words about time” word class (closed class items have a low phonetic complexity, but are acquired much later than the other items). Therefore, the statistical analysis done for IPC was based on a subset of 376 shared items. If there were several phonetic forms of the same word, the IPC was computed on the most frequent one.

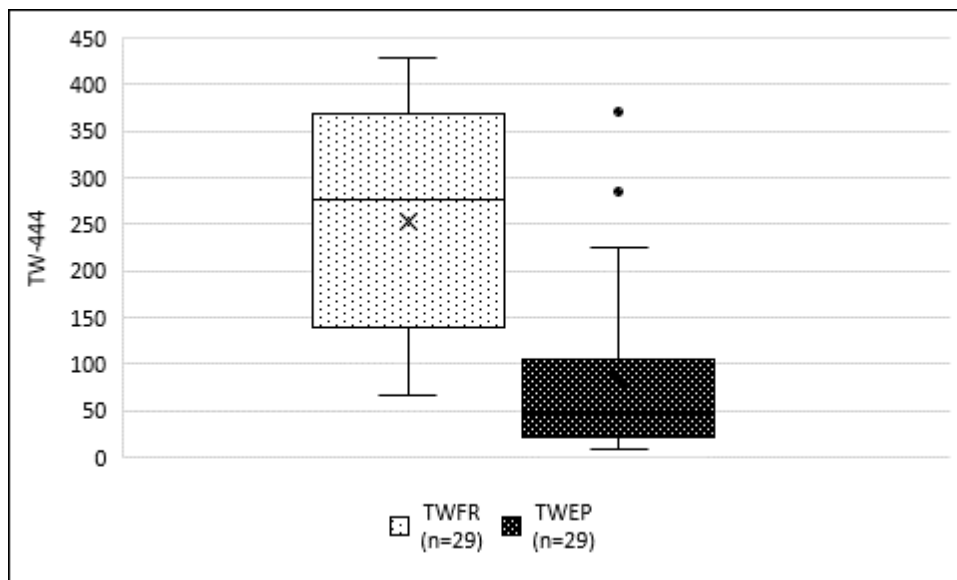
**Results**

For the above reasons, and for the sake of clarity and comparability, the results that include the phonetic complexity factor will be proposed on the basis of the list of 376 items that are present in both the F-CDI and the P-CDI. When the comparison was based on the F-CDI only, the results obtained were identical regardless of the score used (full F-CDI or the subset of 444 items or 376 items).

*Quantitative development of productive vocabulary*

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As we have seen, all the bilingual children were born in France and are on average dominant in French. To confirm the PaBiQ-IT results on dominance, we first compared the vocabulary of the French bilingual children with their Portuguese vocabulary. The outcome is identical for both the 29 bilingual children (see Figure 1) and the subgroup of 17 children aged between 24 and 30 months. The Wilcoxon test revealed that the size of their French lexicon assessed by the F-CDI (TWFR-444) is statistically different from that of their Portuguese lexicon assessed by the P-CDI (TWEP-444) ( $n=29$ ,  $V=435$ ,  $p<0.01$ ;  $n=17$ ,  $V=150$ ,  $p<0.01$ ). The bilingual group clearly has a larger vocabulary size in French than in Portuguese.

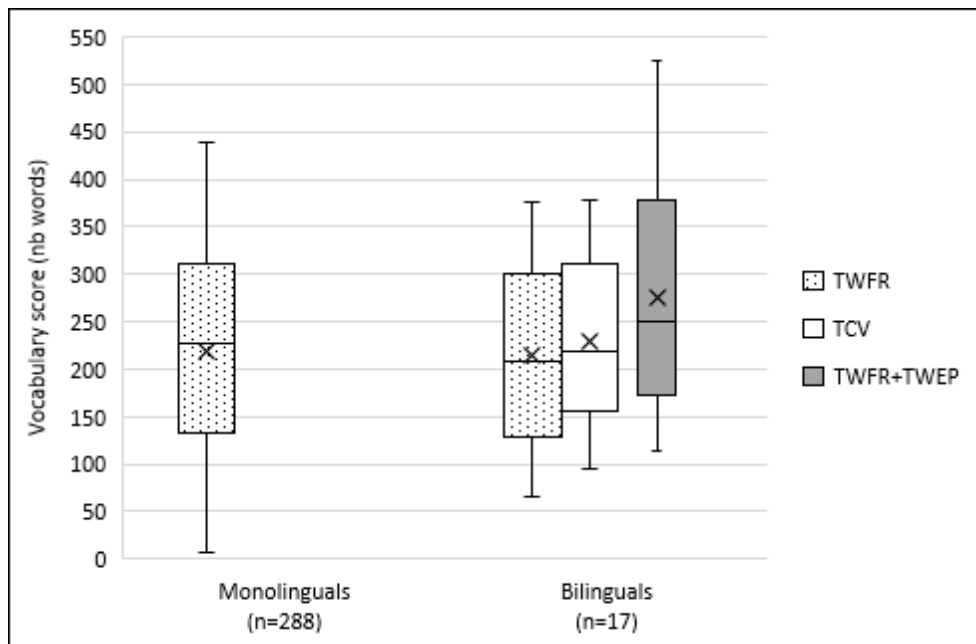


**Figure 1. Distribution of bilingual children's TW-444 (age range: 24-36 months) in French (TWFR) and Portuguese (TWEP)**

Since the bilingual children are clearly dominant in French, we expect their vocabulary to be at least equivalent to that of the monolingual group of the same age. As the CDI is normed for children aged 16 to 30 months, we compared the data of the bilingual children aged 24 to 30 months with the French monolingual children of the same age group from the F-CDI norming.

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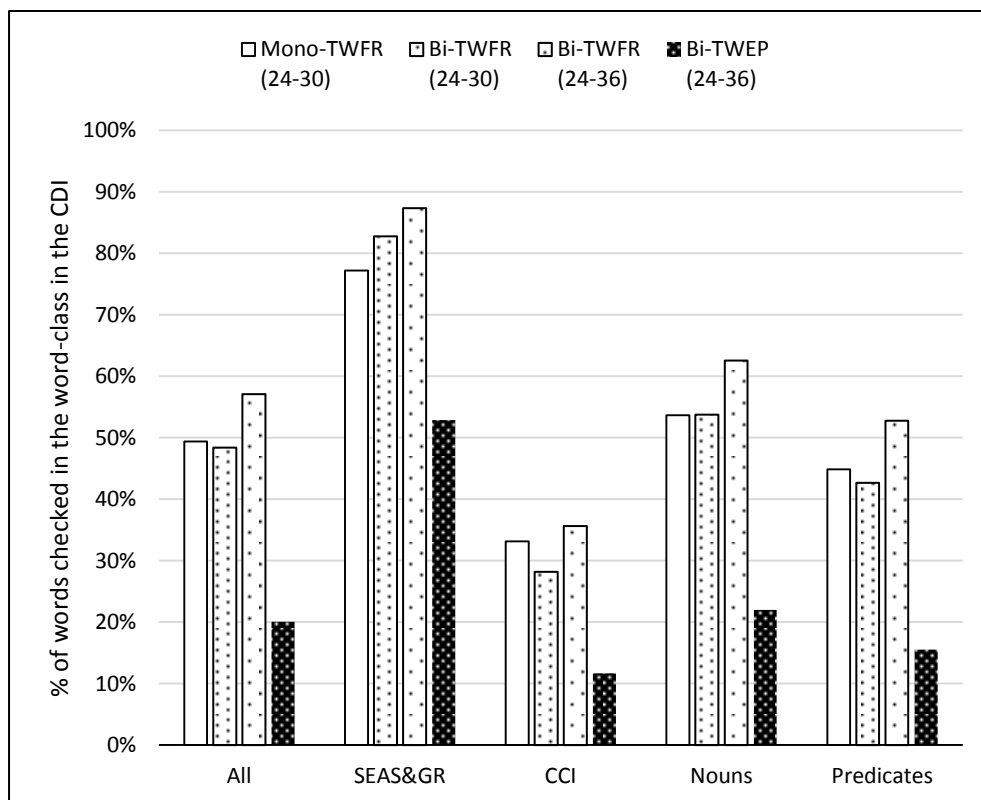
Since the data do not show a normal distribution, Mann-Whitney tests were used to compare the different vocabulary scores of the bilingual children with the TWFR scores of the monolingual group in the same age range. The results revealed no difference between the performance of these two groups of children on the TWFR ( $W=2362$ ,  $p=0.81$ ), as can also be seen in Figure 2. As expected from the literature, the bilingual children who participated in this study performed as well as the monolingual group in terms of the size of their productive lexicon in French. The same result was found when the TWFR of the monolingual group was compared with the TCV of the bilingual children ( $W=2548.5$ ,  $p = 0.77$ ). As the literature suggests in such a case, we can support the hypothesis that the TWFR+TWEP of the bilingual group will be greater than the TWFR of the monolingual group (one-tailed test). This is exactly what we observe ( $W=1858.5$ ,  $p<0.05$ ). The total number of words (Fr+EP) of the bilingual group tends to be higher than the number of words of the monolingual group.



**Figure 2. Distribution of vocabulary scores of monolingual and bilingual children (age range: 24-30 months)**

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The results found for the productive vocabulary of the children who participated in the study as a whole also hold true also when we look at the percentage of the child's productive vocabulary by word class, as shown in Figure 3. The percentage of productive vocabulary per word class does not differ between the monolinguals and the bilinguals (remember that the monolingual group is restricted to the age group 24-30). Nevertheless, for the bilingual children, for each word class, the percentage of productive vocabulary in this word class assessed with the F-CDI is higher than the percentage of productive vocabulary in the same word class assessed with the P-CDI.



**Figure 3. Percentage of productive vocabulary for each word-class**

***Word-class distribution of productive vocabulary***

We also examined the proportion of words per word class within each lexicon. We expect these proportions to be relatively similar between the monolingual children and the French lexicon of the bilingual children. However, given the observed difference in lexicon size between the French and Portuguese vocabularies of the bilinguals, it is possible, for example, that word-class “SEAS&GR” is more important in proportion for the Portuguese vocabulary. Indeed, words in this word class are often the first to be acquired and are therefore already part of the child's vocabulary when their lexicon size is still relatively small. To have a first idea of whether or not there is a difference, the proportion of each word-class for a given lexicon, as a percentage of the TWFR for monolinguals and bilinguals of the same age group, and as a percentage of the TWFR and TWEP for all the bilingual children, is presented in Table 5.

**Table 5. Proportion of each word-class for the same lexicon**

Group	SEAS&GR	CCI	Nouns	Predicates	
Mono (24-30) TWFR	5.28%	10.73%	65.58%	18.41%	100%
Bi (24-30) TWFR	5.77%	9.30%	67.05%	17.87%	100%
Bi (24-36) TWFR	5.17%	9.98%	66.12%	18.73%	100%
Bi (24-36) TWEP	9.17%	8.35%	67.02%	15.46%	100%

A chi-squared test showed no difference between the proportion of each word class in the lexicon of the monolingual children and the bilingual children of the same age range but revealed a statistically significant difference between the French and Portuguese lexicons of

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all the bilingual children. It confirms the prevalence of the word class “SEAS&GR” and the low proportion of the word class “Predicates” in small size lexicons.

***Lexical selectivity***

For monolingual children, the phonetic complexity of targeted words increases as a function of lexical size and/or age (e.g., Jakielski et al., 2006). First, we wanted to replicate this result with monolingual French children but also to see if this finding is valid with bilingual children. As mentioned in the section on ‘Material and Procedures’, we reduced the data set from 444 to 376 items, excluding grammatical categories that are acquired late but are phonetically simple (e.g., pronouns, prepositions...) to avoid a bias in the analysis. The IPC was used to calculate the phonetic complexity of a targeted word. A Spearman’s rank correlation was used to find out whether the French monolingual group has an IPC of targeted word that increases with increasing lexicon size. The result confirmed this hypothesis ( $r_s=0.87$ ,  $p<0.01$ ).

Before performing the same analysis for the bilingual children, we had to check that the 376 words in the F-CDI that matched semantically with words in the P-CDI (translation equivalent) were not always matched for phonetic complexity. For example, for the word *hat*, the French IPC [ʃapo] is 2 and the Portuguese IPC [ʃepew] is 3. If IPC is always similar for each semantically matched word between F-CDI and P-CDI, the fact that for the productive lexicon of bilingual children a correlation between IPC and lexicon size is found in both languages could not be attributed with certainty to the influence of phonetic complexity. In this case, the correlation found could be due to the fact that children acquire certain concepts first and these concepts would generally be embodied in a simpler phonetic form. In order to rule out this potential issue, a Spearman correlation was applied to the 376 shared items of the F-CDI and P-CDI. The result revealed that the F-CDI and P-CDI are only weakly correlated

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( $r_s=0.28$ ,  $p<0.05$ ). Thus, now, if a strong correlation is found for the bilingual children between the IPC and the size of their lexicon for each of their languages, it cannot be attributed to the mere fact that some concepts might be acquired first regardless of the language.

After this verification, the same statistical analysis as for the French monolinguals was applied to the bilingual population. The hypothesis was also confirmed for the bilingual children for their French vocabulary ( $r_s =0.85$ ,  $p<0.01$ ) as well as for their Portuguese vocabulary ( $r_s =0.84$ ,  $p<0.01$ ). Therefore, for both the monolingual group and the bilingual children, whether in French or Portuguese, as children develop a productive vocabulary, the phonetic complexity of the words they target tends to increase, and for the bilinguals, it confirms that the result regarding the influence of phonetic complexity is not due to a comparable amount of phonetic complexity for each semantically matched word (translation equivalent) between F-CDI and P-CDI.

**Discussion**

The current study replicated previous results obtained with CDIs on a bilingual population and explored two factors that might partly explain why some words are acquired before others: word class and phonetic complexity of targeted words.

The bilingual children were born in France, live in a French-speaking environment and showed more proficiency in French than in Portuguese. This type of bilingualism at work in the population studied could explain the fact that we find no difference between the French monolinguals and the bilingual children with regard to their respective French lexicon. Both have a similar lexicon size for French and have a lexicon with comparable proportions of nouns, predicates, closed class items and “Sound Effects and Animal Sounds & Games and Routines” (SEAS&GR). Therefore, this specific bilingual environment does not hinder French

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lexical development (Kern et al., 2019). However, the Portuguese lexicon of the bilingual children was different from their French lexicon, both in size and in the proportion of each word class. Their French lexicon was larger and included, proportionally, more ‘predicates’ and less ‘SEAS&GR’ than their Portuguese lexicon. These results show that the bilingual children are more advanced in French than in Portuguese, and that the proportion of each word-class in the lexicon changes with time and exposure. Nevertheless, it is worth noting that the development of their Portuguese lexicon seems to be delayed in contrast to the development of their French lexicon, which is within the norm. However, and more importantly, their total vocabulary (TWFR+TWEP) is larger than that of monolinguals.

Regarding phonetic complexity and lexical selectivity, it has previously been suggested that in monolinguals, the productive vocabulary of children with a small number of words in their lexicon tends to be phonetically simpler (Gayraud et al., 2018), which may be due, at least in part to a lexical selectivity strategy (Schwartz & Leonard, 1982). In other words, in each of their languages, children may select less phonetically complex targets, or avoid more phonetically complex targets, resulting in less complex word produced first (Celce-Murcia, 1975; Yavaş, 1995). This finding seems to hold true for the French monolinguals: children with a smaller lexicon had a lexicon composed of simpler words than the children with a larger lexicon. The same trend was observed in the bilingual population for each of their languages, despite the substantial difference between the French and Portuguese lexicons in terms of the phonetic complexity of translation equivalent pairs (e.g. “pillow” Fr/EP *oreiller/travesseiro* [ɔʁeje]/[trəvisɛjɾu]). This result suggests that lexical selectivity based on phonetic complexity plays a role, since for the same subset of words (translation equivalents), bilingual children tend to select the less phonetically complex ones for each of their languages to produce first. **Conclusion**

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The results on lexical size and proportion of word class in bilingual children in this study confirms that a single language clinical assessment is feasible when bilingual children are dominant in the language being assessed (here French), as bilingual children would be comparable to their monolingual peers. This is consistent with the work of Cattani et al. (2014) who showed that in bilingual scenarios with more than 60% of exposure to English, bilingual children learning British English and an additional language can be assessed using monolingual standards. Further investigation of the qualitative development of productive vocabulary is a promising avenue for research and clinical use. A better understanding of the development of the proportion of word classes in the lexicon of the typically developing child is clinically relevant.

Since different word classes do not emerge at the same rate, and since phonetic complexity seems to play a role in the choice of the first words produced by children, we can hypothesize that the influence of phonetic complexity and then the phenomenon of lexical selectivity will be stronger for word classes that emerge first, such as nouns, and that this influence will be less strong for word classes that emerge later, such as verbs (Kern & dos Santos, 2018). This line of research seems promising in light of the initial results obtained in this study and provides insights on an ecosystemic approach to multilingual acquisition, as covered within the present volume, by discussing such factors as input, cross-linguistic typological variance of the lexicon, biomechanical constraints, sociolinguistic factors in the assessment of bilinguals, clinical implications, assessment batteries on child case history and language exposure/use based on parental feedback, etc.

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