Supplementary Material A. Language-internal predictions on vowel complexity

Table A lists information on the vowel inventory size of the L1s of the bilingual children. It presents the vowel inventory (column 2), number of vowels (column 3), classification according to World Atlas of Language Structures (WALS) online (column 4), and the rating we gave to it in the current study (column 5). None of the languages spoken by the bilingual children had a small vowel inventory (i.e., less than 5 vowels). The majority of languages had mid-sized or large vowel inventories. We classify those languages whose vowel quality inventories were less than 10 as average (i.e., Albanian, Arabic, Catalan, Farsi, Italian, Japanese, Mandarin, Polish, Romanian, Russian, Spanish and Tagalog) and those languages whose vowel quality inventories were greater than 10 as large (i.e., Dutch, English, Fons, German, Norwegian, Portuguese, and Swedish).1

 French can be classified as a language with a large sized vowel inventory (15 vowels). Overall, 68 children in the database were classified as having a large vowel inventory (ie., 37 monolinguals; 31 bilinguals) and 33 children were classified as having a mid-sized vowel inventory. We predict that children who speak languages with mid-sized vowel inventories will be delayed in vowel accuracy in French in comparison to children who speak languages with large vowel inventories.

1. WALS Online classifies languages with 7 or more vowel qualities as large. For pragmatic reasons (to obtain similar group sizes), we have used the criteria 10. We have followed their guidelines of only referring to vowel quality. Reference to quantity would have led to languages which contain a vowel length distinction (e.g., Japanese, Mandinka, Bosnian/Serbo-Croatian, and Czech) also being grouped as large. Further research outside the scope of this study would be needed to determine which criteria best reflects the influence of vowel inventory size in cross-linguistic interaction.

Table A. Complexity information on vowels in the L1s of the bilingual children as well as in French

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Language | Vowel Inventory | Number of vowels | WALS Online | Rating |
| French | i, y, e, ɛ, ø, œ, u, o, ɔ, a, ə, ɑ ̃, ɛ̃, ɔ̃ | 14a | large | large |
| Arabic | i, e, u+ phonemic length contrast | 3/6b | mid | mid |
| Spanish | i, e, u, o, a | 5c | mid | mid |
| Tagalog | i, e, u, o, a | 5d | mid | mid |
| Russian | i, e, u, o, a | 5e | mid | mid |
| Mandarin | i, y, u, a, ə | 5f | mid | mid |
| Japanese | i, e, u [ɯ ], o, a + phonemic length contrast  | 5/10g | mid | mid  |
| Mandinka | i, e, u, o, a + phonemic length contrast | 5/10h | -- | mid |
| Bosnian/Serbo-Croation | i, e, u, o, a + phonemic length contrast | 5/10i | -- | mid |
| Czech | i, e, u, o, a + phonemic length contrast | 5/10j | -- | mid |
| Farsi | i, e, u, o, [æ](https://en.wikipedia.org/wiki/Near-open_front_unrounded_vowel),ɒ | 6k | mid | mid |
| Polish | i, ɨ, ɛ, u, ɔ, a | 6l | mid | mid |
| Romanian | i, ɨ, e, u, o, a, ə | 7m | large | mid |
| Albanian | i, y, e, u, o, a, ə | 7n | large | mid |
| Italian | i, e, ɛ, u, o, ɔ, a | 7o | -- | mid |
| Catalan | i, e, ɛ, u, o, ɔ, a, ə | 8p | large | mid |
| Norwegian | i, e, y, ø, ʉ, u, o, æ, ɑ, ə+ phonemic length contrast | 10/19q | large | large |
| Fons | i, e, ɛ, u, o, ɔ, a, ĩ, ɛ̃, ũ, ɔ̃, ã | 12r |  | large |
| Dutch | i, ɪ, e, ɛ, y, ʏ, ø, u, o, ɔ, a, ɑ, ə | 13s | large | large |
| Portuguese | i, e, ɛ, a, u, o, ɔ, a, ɐ, ĩ, ẽ, õ, ũ, ɐ̃ | 14t | -- | large  |
| English | i, ɪ, e, ɛ, u, ʊ, o, ɔ, ɒ æ, a, ɜ, ʌ, ə | 14u | large | large |
| German | i, ɪ, e, ɛ, y, ʏ, ø, œ, u, ʊ, o, ɔ, a, aː, ə, ɐ | 16v | large | large |
| Swedish | i, ɪ, e, ɛ, ɛː, y, ʏ, ø, œ, ʉ, u, ʊ, o, ɔ, ɑ, a, ɵ | 17w | -- | large |

1. Rose & Wauquier-Gravelines (2007)
2. Dyson & Amayreh (2007); We indicate the vowels of Modern Standard Arabic. Certain dialects have greater numbers of vowels.
3. Harris (1983)
4. Schachter (2013)
5. Jones (1953)
6. Duanmu (2000)
7. Ota & Ueda (2007)
8. N’Gom (1997)
9. Morén (2006)
10. Kučera (1961)
11. Majidi & Ternes (1999)
12. Gussman (2007)
13. Chitoran (2002), Renwick (2012)
14. Moosmüller & Granser (2003)
15. Loporcaro & Bertinetto (2005)
16. Harrison (1997)
17. Kristoffersen (2007)
18. Dagba & Boco (2014)
19. Booij (1999)
20. Cruz-Ferreira (1995)
21. Howard (2007)
22. Kohler (1999)
23. Engstrand (1999)

Supplementary Material B. Language-internal predictions on word-final consonants and cluster complexity

 Table B lists complexity information on word-final consonants and clusters in the L1s of the bilingual children. It lists whether there are restrictions in terms of place- or manner-of-articulation (column 2), the presence of final clusters (yes, no, or restricted) (column 3), and the rating we gave to it in the study (column 4).

 We group Spanish, Italian, Portuguese, Mandarin, Japanese, and the two African languages, Fons and Mandinka, as languages containing low complexity (i.e., segmentally restricted) final consonants. All other languages (i.e., Tagalog, Arabic, Farsi, Albanian, Czech, Bosnian/Serbo-Croatian, Russian, Romanian, Polish, English, German, Dutch, Norwegian, and Swedish) were considered as languages with high complexity final consonants since they could contain word-final consonants with different places and manners of articulation and could contain final clusters.

 Word-final consonants in French may consist of different manners (stops, nasals, fricatives, and liquids) and places-of-articulation (labial, coronal, and dorsal). French also contains word-final clusters such as obstruent-liquid (e.g., table /tabl/ “table”) and liquid obstruent clusters (e.g., porte /pɔʁt/ “door”). Thus, it was classified as a language containing high complexity word-final consonants and clusters. In our database, 68 children were classified as having high complexity final consonants and clusters (i.e., 37 monolinguals; 31 bilinguals) and 33 were classified as having low complexity final consonants and clusters. We predict children who speak languages with low complexity final consonants and clusters will be delayed in their final consonant and cluster accuracy in French in comparison to children who speak languages with high complexity final consonants and clusters.

 Our predictions are based on the assumption that word-final consonants are codas. Not all phonological theories adopt this position. Some linguists argue that word-final consonants are onsets of empty-headed syllables (Kaye, 1990, Kaye, Lowenstamm & Vergnaud, 1990). Views differ, however, as to whether word-final consonants are always syllabified as onsets (Kaye et al., 1990) or whether they are syllabified as onsets in certain languages only (Piggott, 1999). In the case of French, several authors strongly argue that word-final consonants are syllabified as onsets of empty-headed syllables (de Almeida, 2014; dos Santos, 2007; Rose. 2000). We do not adhere to this position for several reasons. First, it is not straightforward to formulate predictions of cross-linguistic interaction for onsets of empty-headed syllables due to the fact that many of the languages studied do not have information on the status of empty headed syllables. Second, acoustic analyses suggest that at least some children have coda consonant representations for word-final consonants. Yuen, Miles, Cox and Demuth (2015), in an acoustic analysis of a single child’s speech between the ages of 1;3 and 1;5 found that the child treated the C2 of CVC and CVCV target words differently, producing the C2 with longer closure duration for the monosyllables than the disyllables, consistent with a coda interpretation of final consonants. In sum, we assume that word-final consonants and clusters occupy coda position. However, we avoid the use of the word “coda” to acknowledge that varying syllabic interpretations of word-final consonants exist.

Table B. Complexity information on word-final consonants and clusters in the L1s of the bilingual children as well as in French

|  |  |  |  |
| --- | --- | --- | --- |
| Language | Restricted in PoA or MoA | Presence of complexcodas | Rating |
| French | Not restricted in PoA, MoAa | yesb | high comp |
| Fons | no codasc | noc | low comp |
| Italian | restrictedb | nob | low comp |
| Portuguese | restrictedb,d | no or marginald | low comp |
| Spanish | restricted – coronal onlye | no or marginalb | low comp |
| Mandarin | restricted – [n, ŋ]f | no | low comp  |
| Japanese | restricted – nasals onlyg | no | low comp |
| Mandinka | restricted - [ŋ]h | no | low comp. |
| Tagalog | not restrictedi  | marginal – in loan wordsi | highcomp |
| Catalan | not restrictedj  | yesj | high comp. |
| Arabic | not restrictedk  | yesk | high comp |
| Farsi | not restrictedl  | yesl | high comp |
| Romanian | not restrictedm  | yesb,m | high comp |
| Russian | not restrictedn  | yesn | highcomp  |
| Polish | not restrictedo  | yeso | high comp. |
| Albanien | not restrictedp  | yesp | highcomp  |
| Bosnian/Serbo-Croatian | not restrictedq  | yesq | high comp |
| Czech | not restrictedr  | yesr | high comp |
| English | not restricteds  | yess | high comp. |
| German(including Swiss German) | not restrictedt  | yest | high comp. |
| Dutch | not restrictedu  | yesu | high comp. |
| Norwegian | not restrictedv  | yesv | high comp. |
| Swedish | not restrictedw  | yesw | high comp. |

1. Dell (1995)
2. Marotta (2016)
3. Dagba & Boco (2014)
4. Mateus & d’Andrade (2000)
5. Harris (1983)
6. Duanmu (2007)
7. Ota (2001)
8. N’Gom (1997)
9. Chen, Bernhardt & Stemberger (2016)
10. Prieto (2006)
11. Amayreh & Dyson (1998)
12. Alamolhoda (2000)
13. Chitoran (2002)
14. Yanushevskaya & Bunčić (2015)
15. Rubach & Booij (1990)
16. Friedman (2004)
17. Uzelac (1971)
18. Dankovičová (1999)
19. Bauer (2015)
20. Wiese (1996)
21. Trommelen (1983)
22. Kristoffersen (2007)
23. Riad (2014)

Supplementary Material C. Language-internal predictions on initial cluster complexity

Table C lists complexity information on initial clusters in the L1s of the bilingual children. It shows the initial cluster types (column 2), and the rating we gave it in the study (column 3). In the column on initial cluster types, we divided languages into four main groups: (1) languages with no clusters or consonant + glide sequences only (CG); (2) languages with OL clusters only; (3) languages with OL and /s/C clusters; and (4) languages with OL, /s/C, and “complex” clusters. By “complex”, we refer to languages such as Russian, Polish and Romanian which contain an extensive range of initial clusters with sonority plateaus and falls (e.g., /pt, mʃ/).

Languages with no initial clusters or with CG sequences only were considered to have the lowest complexity. A simple onset in structural terms is less complex than a branching onset, and, in many languages, CG sequences are not structurally represented as branching onsets. As Table C indicates, Mandinka, Arabic, Farsi, Japanese, Mandarin, Tagalog, and Fons belong to the low complexity cluster group.1

Languages with OL clusters only were considered to be of mid complexity. These include Spanish, Portuguese2, and Catalan. We considered them to have less complexity than languages which have a full set of /s/C clusters or which have complex clusters consisting of sonority plateaus or falls. First, languages with OL clusters form a subset-superset relationship with languages which contain OL and /s/C clusters (Schwartz & Goad, 2017). In terms of relative complexity, the smaller subset with fewer structures is considered less complex than the larger subset with more structures. Second, languages with OL, /s/C, and complex clusters also allow three-element (or more) clusters (/s/CC). Thus, we appeal to the notion of cardinality or number. Clusters are least preferred (or more complex), when their cardinality is greater, that is, when they contain more elements (Vennemann, 2012). Third, based on sonority markedness criteria, clusters which have sonority plateaus and falls are more marked than clusters which have small or large sonority rises (Berent, Steriade, Lennertz, & Vaknin, 2007; Tamburelli, Sanoudaki, Jones, & Sowinska, 2015). Languages in the high complexity group include Italian, English, German, Dutch, Norwegian, Swedish, Albanian, Czech, Bosnian/Serbo-Croatian, Polish, Romanian, and Russian.

 French contains mainly OL clusters, although it also contains /s/ + stop clusters, which appear in loan words (e.g., ski, sport, stop) and are infrequent in children’s speech (Andreassen, 2013).3 We classify French as having mid complexity initial clusters. In our database, 9 children were coded as speaking languages with low complexity initial clusters, 65 children were classified as speaking languages with mid complexity initial clusters (37 monolinguals; 28 bilinguals) and 27 children were classified as speaking languages with high complexity initial clusters. We predict that children speaking languages with no clusters (or CG sequences) will be at a disadvantage for producing clusters in French and thus we anticipate delay. In contrast, children speaking high complexity languages should show accelerated production of clusters in French. Their L1s contain clusters with greater numbers of elements or more marked sonority sequences.

1 Tagalog has clusters in loan words but native speakers often produce them with an epenthesized vowel between cluster members (Chen et al., 2016). Some sources indicate that Fons has C/l/ clusters (Lefebvre & Brousseau, 2002); others indicate that it has no clusters (Dagba & Boco, 2014). Regardless of which source is correct, it seems that the complexity of onset sequences in Fons is lower than in a language which has a full set of OL clusters.

1. Portuguese is somewhat different from the other languages, however, since surface level clusters arise due to vowel deletion which creates greater ambiguity for the learner than in French (Almeida, 2011). To take account of this, we conducted two analyses, one in which Portuguese was coded as having high complexity initial clusters and one in which it was coded as having mid complexity initial clusters. There were no differences in the findings. In the Results, we present the findings based on Portuguese having mid complexity initial clusters.
2. Furthermore, Schwartz and Goad (2017) point out that /s/ + stop sequences are typologically less marked than other /s/ sequences (i.e., /s/ + nasal, /s/ + lateral, /s/ + rhotic), so even taking into consideration the marginal presence of /s/ + stop clusters in French, other languages with a full set of /s/ + C clusters have a more marked system of /s/C sequences than French.

Table C. Frequency and complexity information on initial clusters in the L1s of the bilingual children as well as in French

|  |  |  |
| --- | --- | --- |
| Language | Initial cluster typesa | Rating |
| French | OL, /s/Cb  | mid |
| Mandinka | noc | low |
| Arab | no but present at surface due to syllable deletion (9-30%)d | low |
| Farsi | noe  | low |
| Japanese | Cj onlyf | low |
| Mandarin | CGg | low |
| Tagalog | CGOL in loan words onlyh | low |
| Fons | CG, C/l/i | low |
| Catalan | OLj | mid |
| Portuguese | OLk | mid |
| Spanish | OLl | mid |
| Italian | OL, /s/Cm | high |
| English | OL, /s/Cn | high |
| German | OL, /s/Co | high |
| Dutch | OL, /s/Cp | high |
| Norwegian | OL, /s/Cq | high |
| Swedish | OL, /s/Cr | high |
| Albanian | OL, /s/C, complexs | high |
| Czech | OL, /s/C, complext | high |
| Bosnian/-Serbo-Croatian  | OL, /s/C, complexu | high |
| Polish | OL, /s/C, complexv | high |
| Romanian | OL, /s/C, complexw | high |
| Russian | OL, /s/C, complexx | high |

1. This column categorizes word-initial clusters into obstruent-liquid (OL), /s/C, and complex (clusters containing sonority plateaus or reversed sonority).
2. Schwartz & Goad (2017); French has a restricted set of /s/C clusters such as /s/ + stop.
3. N’Gom (1997)
4. Hamdi, Ghazali, & Barkat-Defradas (2003).
5. Akbari (2013) (some reports indicate CG and OL clusters in loan words)
6. Ota & Ueda (2007)
7. Duanmu (2007)
8. Chen, Bernhardt & Stemberger (2016).
9. Lefebvre & Brousseau (2002)
10. Wheeler (2005)
11. Mateus & d’Andrade (2000)
12. Harris (1983)
13. Davis (1990)
14. Bauer (2015)
15. Hall (1992); Schaefer & Fox-Boyer (2016)
16. Fikkert (1994
17. Johnson & Lancaster (1998)
18. Sigurd (1965)
19. Klippenstein (2010)
20. Racz (2010)
21. Uzelac (1971)
22. Tamburelli, Sanoudaki, Jones, & Sowinska (2015)
23. Chitoran (2002)
24. Holden (1978)

Supplementary Material D. Language-internal predictions on palatal fricative complexity.

 Table D lists information on the palatal fricatives and affricates in the L1s of the children in this study. It indicates the phonetic symbol for the palatal consonant (column 2), the number of palatal consonants in the phonetic inventory (column 3)1 and whether any palatalization (a process whereby underlying non-palatal consonants surface as palatals) applies in the adult language (yes or no, column 4). Languages with two or fewer palatal fricatives were considered as “low palatal” languages. These included Dutch, Tagalog, Swedish, Spanish, Arabic, Norwegian, Fons and Mandinka. Portuguese has also two palatal consonants but it has a palatalization process and, thus, it was categorized along with Italian, Farsi, Catalan, English and German which have three to four palatal consonants. They were considered as “mid palatal” languages. Czech, Romanian, Japanese, Bosnian/Serbo-Croatian, Mandarin, Albanian, Russian and Polish have either five or more palatal consonants or they have palatalization processes (e.g., Czech and Romanian). They were characterized as “high palatal” languages.

 French has two palatal consonants and, thus, is classified as a “low palatal” language. In our database, 51 children were classified as speaking “low palatal” languages (37 monolinguals; 14 bilinguals), 34 were classified as speaking “mid palatal” languages and 16 were classified as speaking “high palatal” languages. We predict that bilingual children speaking “high palatal” languages should display acceleration in their acquisition of palatal consonants in French; those speaking “mid palatal” languages should be at an advantage for acquiring palatal consonants but the effect will be less strong (i.e., moderate acceleration).

1. Japanese and Mandarin have a number of surface level palatal fricatives but they arise due to palatalization and are not considered underlying phonemes.

Table D. Information on palatal fricatives and affricates in the L1s of the bilingual children as well as in French

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Language | Alveo-palatal and palatal affricates in inventorya | No of consonants | Palatalization process | Rating |
| French | ʃ, ʒ | 2 |  | low |
| Dutch | no(ʃ, ʒ)b  | 0 |  | low |
| Tagalog | no(ʃ, ʒ, ʧ, ʤ)c | 0 |  | low |
| Swedish | ɕ | 1 |  | low |
| Spanish | ʧ, (ʃ, ʝ)d | 1 |  | low |
| Arabic | ʃ, ʤ | 2 |  | low |
| Norwegian | ʃ, ç | 2 |  | low |
| Fons | ʧ, ʤ | 2 |  | low |
| Mandinka | ʧ, ʤ | 2 |  | low |
| Portuguese | ʃ, ʒ | 2 | yese | mid |
| Italian | ʃ, ʧ, ʤ | 3 |  | mid |
| Farsi | ʃ, ʒ, ʧ, ʤ | 4 |  | mid |
| Catalan | ʃ, ʒ, ʧ, ʤ | 4 |  | mid |
| English | ʃ, ʒ, ʧ, ʤ | 4 |  | mid |
| (Swiss) German | ʃ, ʒ, ʧ, ç | 4 |  | mid |
| Czech | ʃ, ʒ, ʧ, (ʤ) | 3 | yesf | high |
| Romanian | ʃ, ʒ, ʧ, ʤ | 4 | yesg | high |
| Japanese | [ɕ, ç, ʑ, ʨ, ʥ]  | 5 | yesh | high |
| Bosnian/Serbo-Croatian | ʂ, ʐ, tʂ, dʐ ʨ, ʥ | 6 | yesi | high |
| Mandarin | [ɕ, ʨ, ʨʰ]ʂ, ʈʂ, ʈʂʰ | 6 | yesj | high |
| Albanian | ʃ, ʒ, ʧ, ʤ, cç, ɉʝ | 6 | yesk | high |
| Russian | sʲ, zʲ, tsʲʂ, ʐ, ɕ, ʑ, ʨ,  | 8 | yesl | high |
| Polish | ɕ, ʑ, ʨ, ʥʂ, ʐ, tʂ, dʐ | 8 | yesm | high |

1. The inventory of palatal fricatives and affricates was compiled by consulting multiple sources on the consonant inventories of these languages.
2. Sources vary whether [ʃ, ʒ] are considered phonemes in Dutch. They are used in foreign words.
3. Tagalog does not have underlying alveo-palatal fricatives but they are present in loan words (Chen et al., 2016)
4. Sources vary according to the number of alveo-palatals in Spanish. [ʃ] appears in loan words; [ʝ] may be realized as an approximant or affricate.
5. /s, z/ become palatals in syllable-final position (Miguel, 2000).
6. Coronals and velars become palatals before front vowels (Kučera, 1961).
7. Consonants are palatalized preceding high vowel /i/ predominantly in word-final position (Chitoran, 2002).
8. Japanese does not have underlying (alveo)-palatal fricatives but they surface due to palatalization process. /s, z, h/ are palatalized before /i/ and /j/ (Ito & Mester, 1995).
9. Velar consonants are palatalized preceding front vowels in Serbo-Croatian (Browne, 1993)
10. The fricatives [ɕ, ʨ, ʨʰ] are not considered to be underlying but surface before high front vowels (Norman, 1988). [ʂ, ʈʂ, ʈʂʰ] are retroflex but are often produced with post-alveolar articulation (see also Polish).
11. Coronals and velar become palatals before front vowels (Kolgjini, 2004).
12. Palatal consonants are very present in Russian. There are two sets of consonants: plain and palatalized. Palatalization also applies in the context of front vowels (Padgett, 2001).
13. Velar consonants are palatalized preceding front vowels (van der Hulst & van de Weijer, 1991).

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Supplementary Materials E. Summary of the statistical models (glmer in R) for the six dependent variables: PCC, PVC, word-final consonants, initial clusters, final clusters, and palatal fricatives.

**modelPCC=glmer(PCCCorrect/PCCTarget ~ AgeMonths \* Vocab + AgeMonths \* dom + (1 | Speaker) + (1 | word)**

Fixed effects:

 Estimate Std. Error z value Pr(>|z|)

Intercept 3.75558 0.17759 21.148 < 2e-16 \*\*\*

AgeMonths 0.01020 0.15066 0.068 0.9460

Vocab 0.55700 0.09475 5.879 4.13e-09 \*\*\*

dom21 -0.17848 0.19133 -0.933 0.3509

dom3 0.03058 0.23028 0.133 0.8943

AgeMonths:Vocab -0.00809 0.07630 -0.106 0.9156

AgeMonths:dom2 0.35444 0.17535 2.021 0.0432 \*

AgeMonths:dom3 0.23139 0.19162 1.208 0.2272

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

**modelPVC=glmer(PVCCorrect/PVCTarget ~ AgeMonths \* Vocab + AgeMonths \* dom + AgeMonths \* VowCom + (1 | Speaker) + (1 | word)**

Fixed effects:

 Estimate Std. Error z value Pr(>|z|)

Intercept 4.6077 0.2360 19.526 < 2e-16 \*\*\*

AgeMonths 0.3448 0.1911 1.805 0.0711 .

Vocab 0.8235 0.1116 7.382 1.56e-13 \*\*\*

dom2 0.1111 0.2105 0.528 0.5975

dom3 -0.1421 0.2912 -0.488 0.6254

VowCom 0.3175 0.1907 1.665 0.0959 .

AgeMonths:Vocab 0.1861 0.0891 2.088 0.0368 \*

AgeMonths:dom2 0.1029 0.1914 0.538 0.5906

AgeMonths:dom3 0.1678 0.2389 0.702 0.4826

AgeMonths:VowCom -0.3231 0.1843 -1.753 0.0796 .

**modelcoda=glmer(Codacorrect ~ AgeMonths \* Vocab + AgeMonths \* dom + AgeMonths \* CodaCom + (1 | Speaker) + (1 | word)**

Fixed effects:

 Estimate Std. Error z value Pr(>|z|)

Intercept 3.87372 0.35910 10.787 < 2e-16 \*\*\*

AgeMonths -0.17167 0.21973 -0.781 0.43462

Vocab 0.32595 0.11973 2.722 0.00648 \*\*

dom2 0.04418 0.24088 0.183 0.85447

dom3 0.22631 0.31255 0.724 0.46900

CodaCom 0.08069 0.21707 0.372 0.71012

AgeMonths:Vocab -0.02632 0.09520 -0.276 0.78224

AgeMonths:dom2 0.52909 0.22067 2.398 0.01650 \*

AgeMonths:dom3 0.71222 0.26144 2.724 0.00645 \*\*

AgeMonths:CodaCom-0.23458 0.21022 -1.116 0.26447

**modelClusIn=glmer(ClIncorrect ~ AgeMonths \* Vocab + AgeMonths \* dom + AgeMonths \* ClusCom+ (1 | Speaker) + (1 | word)**

Fixed effects:

 Estimate Std. Error z value Pr(>|z|)

Intercept 3.26379 0.71110 4.590 4.44e-06 \*\*\*

AgeMonths 0.11949 0.84374 0.142 0.887383

Vocab 0.86857 0.22470 3.865 0.000111 \*\*\*

dom2 0.28423 0.43633 0.651 0.514784

dom3 0.15575 0.57593 0.270 0.786825

ClusCom22 0.03943 0.62696 0.063 0.949853

ClusCom3 0.68799 0.62979 1.092 0.274653

AgeMonths:Vocab 0.16647 0.16848 0.988 0.323119

AgeMonths:dom2 0.35527 0.38250 0.929 0.352991

AgeMonths:dom3 -0.24792 0.50767 -0.488 0.625308

AgeMonths:Clus2 0.61231 0.81793 0.749 0.454093

AgeMonths:Clus3 0.68011 0.81349 0.836 0.403132

**modelClusfin=glmer(ClusFincorrect ~ AgeMonths \* Vocab + AgeMonths \* dom + AgeMonths \* CodaCom + (1 | Speaker) + (1 | word)**

Fixed effects:

 Estimate Std. Error z value Pr(>|z|)

Intercept 2.15751 0.39086 5.520 3.39e-08 \*\*\*

AgeMonths 0.05137 0.28826 0.178 0.858550

Vocab 0.59609 0.15999 3.726 0.000195 \*\*\*

dom2 -0.04237 0.30930 -0.137 0.891044

dom3 0.38288 0.40899 0.936 0.349197

CodaCom 0.21090 0.28359 0.744 0.457083

AgeMonths:Vocab -0.17107 0.12903 -1.326 0.184882

AgeMonths:dom2 0.30282 0.28356 1.068 0.285555

AgeMonths:dom3 -0.04939 0.34545 -0.143 0.886316

AgeMonths):CodaCom -0.03724 0.27361 -0.136 0.891751

**modelPal=glmer(Palcorrect ~ AgeMonths \* Vocab + AgeMonths \* dom + AgeMonths \* PalCom + (1 | Speaker) + (1 | word)**

Fixed effects:

 Estimate Std. Error z value Pr(>|z|)

Intercept 2.81522 0.79127 3.558 0.000374 \*\*\*

AgeMonths 0.37109 0.70038 0.530 0.596227

Vocab 0.37732 0.29038 1.299 0.193804

dom2 -0.22873 0.57766 -0.396 0.692129

dom3 -0.03777 0.89530 -0.042 0.966353

PalCom23 0.11061 0.67177 0.165 0.869219

PalCom3 -0.52799 0.76611 -0.689 0.490705

AgeMonths:Vocab -0.10722 0.22721 -0.472 0.637002

AgeMonths:dom2 0.77506 0.53576 1.447 0.147996

AgeMonths:dom3 0.26891 0.76820 0.350 0.726302

AgeMonths:Pal22 -0.75419 0.60594 -1.245 0.213256

AgeMonths:Pal23 0.05886 0.76179 0.077 0.938418

**Simplified model for palatals (no interaction variables added)**

**modelPal= glmer(Palcorrect ~ AgeMonths + Vocab + dom + PalCom + (1 | Speaker) + (1 | word)**

Fixed effects:

 Estimate Std. Error z value Pr(>|z|)

Intercept 2.81201 0.79595 3.533 0.000411 \*\*\*

AgeMonths 0.52785 0.23334 2.262 0.023687 \*

Vocab 0.41189 0.27889 1.477 0.139707

PalCom2 0.15557 0.68809 0.226 0.821131

PalCom3 -0.56437 0.77981 -0.724 0.469237

dom2 -0.29631 0.58463 -0.507 0.612273

dom3 -0.09621 0.89803 -0.107 0.914680

1. We display the models in which dominance was coded: dom1=non-dominant; dom2=dominant; 3=monolingual. The baseline measure is non-dominant. Bilingual status was determined by recoding the analyses: dom1=monolingual; dom2=dominant; dom3=non dominant. The baseline measure is monolingual. Bilingual status was not found to be significant in any of the models.

2. Cluster complexity is coded as Clus1=low; Clus2; mid; Clus3=high. The baseline measure is low complexity.

3. Palatal complexity is coded as Pal1=low; Pal2; mid; Pal3=high. The baseline measure is low complexity.