Development of phonetic complexity in Arabic, Berber, English and French

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(children's productions, targets, Child Directed Speech, and 50 randomly selected words in the adult language)

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Abstract

The goal of this study is to provide crosslinguistic data on the acquisition of phonetic complexity among children acquiring four different languages: Tunisian Arabic, Berber, English, and French. Using an adaptation of Jakielski's (2000) Index of Phonetic Complexity (IPC), we carried out an analysis to assess phonetic complexity of children's early vocabulary in the four languages. Four different samples from each language were analyzed: 50 words selected from an adult dictionary of each language, 50 words from child directed speech, 50 words targeted by the child, and the child's actual pronunciations of those 50 words. Globally, we hypothesized that children's early productions would be shaped by universal articulatory constraints, but also by the language they are exposed to, depending on its phonological complexity. Our findings show that Arabic and Berber display higher degrees of complexity compared to English and French, and that children acquiring Arabic and Berber target and produce more complex words than children learning English and French.

Children typically produce their first words around 12 months of age. However, the full mastery of an adult-like sound system is not achieved before 8 (Sander, 1972) or even 10-12 years of age (Smith & McLean-Muse, 1986). In English for instance, some phonemes such as /s/ or consonant clusters such as /spl/ are not acquired before 7 and 9 years of age (Smit, Hand, Freilinger, Bernthal & Bird, 1991). This extended period required for the mastery of the speech sound system of the adult language is due to the fact that young children are neither endowed initially with an adult-like vocal tract configuration nor with the neuromuscular control for producing the range of sounds of their ambient language (Kent & Murray, 1982); Green, Moore, & Reilly, 2002; Stoel-Gammon & Sosa, 2007). These anatomical and neurophysiological constraints result in a restriction on children's early phonetic inventories (Green, Nip, Maassen, & Van Lieshout, 2010; Nip, Green, & Marx, 2009). Children's phonetic inventory is initially composed of sounds produced primarily by the jaw (MacNeilage, Davis, Kinney, & Matyear, 2000), on which they have a better muscle control compared to the motion of lips and tongue movements (Green et al., 2002). As a consequence of these biological universal constraints, children acquiring different languages show a similar restricted inventory of sounds (Locke, 1983, 1995). Indeed, babbling and first-word productions demonstrate universal patterns: children show a preference for labials and coronals, stops, nasals and glides, open syllables, short utterances, few consonant clusters (and if any, they tend to be homorganic), and more reduplication than variegation (MacNeilage, Davis, Kinney, & Matyear, 1999; Oller, Eilers, Steffens, Lynch, & Urbano, 1994; Vihman, Macken, Miller, Simmons, & Miller, 1985). Furthermore, these preferences have been shown to influence the words that children select to produce. Thus, the inventory of children's early vocabulary is not composed of randomly selected words. Rather, it has been suggested that children select words with phonetic characteristics that are already present in their own phonological systems (Ferguson & Farwell, 1975; Schwartz, Leonard, Loeb, & Swanson, 1987; Vihman et al., 1985). Other studies on lexical selectivity have shown that children attempt more complex words targets according to age (Dobrich & Scarborough, 1992). An Index of Phonetic Complexity (henceforth IPC) based on the phonetic regularities observed in the babbling and the

first-word period, was proposed to assess children's phonetic development (Jakielski, 2002; Jakielski, 2000; Jakielski, Maytasse, & Doyle, 2006). The IPC has proven to be a valuable tool for different purposes such as assessing phonological skills in toddlers (Morris, 2009), comparing speech acquisition in bilingual vs. monolingual children (Gildersleeve-Neumann & Wright, 2010), or exploring the relationships between phonetic complexity and stuttering (Howell, 2006, 2007). The IPC, which considers productions composed of less preferred segments and segment associations as more complex, permits one to measure the development of phonetic complexity in both targeted and produced words by children. Ward (2001) documented a lexical selectivity bias in children aged 16 to 24 months through the phonetic complexity of targeted words. In addition, it was shown that IPC scores at 12 months predicted speech and language skills at 18 months (Furey, 2003). Biomechanical constraints of the production system (MacNeilage & Davis, 1990) and lexical selectivity are both universal tendencies.

Crosslinguistic studies hence provide support for a strong determination of early phonetic inventories by biological constraints. However, they do not rule out an influence of the ambient language. Languages differ to a large extent in terms of their phonological inventories and phonotactics, making the input more or less difficult to acquire for children. Crosslinguistic analysis of diverse languages enables us to distinguish between potentially universal and language-specific patterns (Stoel Gammon, 2012). In fact, previous analyses have shown that segmental development, namely word shapes and CV co-occurrences, are influenced by input frequency in the ambient language (Saffran, Newport, Aslin, Tunick, & Barrueco, 1997), as well as by the functional load of segments in the language, i.e. how much use a language makes of its available contrasts (Stokes & Surendran, 2005). As languages vary on those parameters, previous findings suggest that some languages may be acquired at a faster rate than others. For instance, So and Dodd (1995) showed that Cantonese children acquire phonology at a faster rate than English-speaking children as they master the contrastive use of tones and vowels by two years and that few phonological errors occur after age four. Similarly, Caselli et al. (1995) observed that Italian children were slower in vocabulary

acquisition compared to English-speaking children: Italian children lag behind the English group in total vocabulary size at most ages between 8 and 16 months. Another crosslinguistic study, comparing L1 vocabulary growth at 16-30 months of age, found that Galician children produce fewer words than Basque, French and Mexican-Spanish-learning children (Pérez-Pereira et al., 2007). In brief, phonetic development seems to be strongly influenced by universal biological constraints but also by the characteristics of the ambient language.

However, considering the ambient language, one must keep in mind that the type of language to which children are exposed (referred to as Child Directed Speech, henceforth CDS) differs in several important ways from the adult language. When addressing children, caregivers adjust their language by simplifying and clarifying the linguistic material (Ferguson, 1964) in order to engage children's attention and facilitate language acquisition (Snow, 1977; Werker et al., 2007)[1]. CDS is characterized by simplified syntax, shorter utterances, restricted vocabulary, repetitions, phonetic modifications (Kuhl, 2000) increased variations in fundamental frequency and longer pauses (Albin & Echols, 1996; Andruski & Kuhl, 1996; Ferguson, 1977; Papoušek, Papoušek, & Symmes, 1991). Moreover, this specific register used by parents to promote infants' language learning has been shown to be almost universal (Ferguson, 1964; Kitamura, Thanavishuth, Burnham, & Luksaneeyanawin, 2001; Kuhl et al., 1997; Monnot, 1999).

The current study aims at examining the phonetic complexity of words produced by children acquiring four different languages: Arabic (Tunisian vernacular), Berber (Tashlhiyt variety), English (American) and French. These languages show different phonetic and phonological characteristics of interest for early language development, such as word length, word complexity (syllable types, consonant clusters) and phonemic inventory diversity. For example, the Arabic lexicon, which is largely derived from basic consonantal roots, includes many polysyllabic words. In terms of syllable

[1] However, some studies suggest that CDS is not necessary facilitating as it introduces more variability in input (Benders, 2013), Dilley et al, 2014), Dodane and Al-Tamimi, 2007), and Sundberg and Lacerda, 1999)

types, French shows a strong preference for open syllables (76%), English exhibits mostly closed syllables (60%) (Delattre, 1965) and Arabic displays 49,92% of closed vs. 50,08% of open syllables (Hamdi, Ghazali & Barkat-Defradas, 2005). These languages also differ in consonant cluster[2] requirements: in Berber, clusters are only possible in word initial position and in Arabic, they are hardly found in word final position. In French both positions are permitted but a bias towards word initial position is attested. Phonemic inventories are also quite diverse. Indeed, when computing the consonant/vowel ratio, two groups emerge: Berber and Arabic are highly consonantal languages (Ridouane & Fougeron, 2011; Hamdi, Ghazali & Barkat-Defradas, 2002) whereas vowels are more frequent than consonants in French and, to a lesser extent, in English, Berber and Arabic display a significant proportion of fricatives as compared to English and French. Moreover, the phonological inventories of Arabic and Berber put forward a large number of back consonants (i.e. uvulars, pharyngeals and glottals) that are known to be acquired rather late (Omar & Nydell, 2007). In sum, this study aims to provide informative contribution comparing the phonetic development in four languages including Berber and Arabic Studies, languages in which studies of phonetic development are rare.

We elaborated six interrelated hypotheses for our crosslinguistic study:

H1. The different languages should display different degrees of complexity. The dictionary words in Berber and Arabic, which are highly consonantal languages, should have higher complexity scores compared to the more vocalic English and French.

The following IPC parameters are of special interest for our cross linguistic analysis:

a. *Place of articulation*: More complexity expected in Arabic, due to the many back (i.e. dorsal) consonants, and in French, due to the frequent /ʁ/ (Gromer & Weiss, 1990).
b. *Clusters*: More complexity expected in Berber and Arabic, in which clusters are more frequent.

[2] In the present study, the term 'cluster' refers to consonant sequences that occur both within and across syllables.

c. *Complex articulation*[3] should contribute to complexity in Berber and Arabic.

d. *Word length*: More complexity on this parameter is expected in Arabic, which shows many polysyllabic words due to the insertion of vocalic patterns and affixes into the root for lexical derivation.

e. *Final Consonant*: Less complexity is expected in French, due to its preference for open syllables.

f. *Variegation (Place)*: More variegation is expected in Arabic, due to the non-homorganic consonantal rule, which constrains the root-skeleton.

g. *Variegation (Manner)*: in Arabic the non-homorganic consonantal rule which constraints the root-skeleton leads to expect this language will attest more variegation than the others.

h. *Rhoticity*[4] will contribute to complexity in American English only.

H2. In each language, we expect the words that mothers use when addressing their children (CDS) to be less complex than the words used in the "adult" language (i.e. represented here through dictionary words).

H3. According to the lexical selectivity hypothesis, children should attempt words (targets) that are less complex to produce than many other words in the adult language (Dictionary).

H4. Given the biomechanical constraint hypothesis, we expect children's actual productions to be less complex than the targets they attempt.

H5. However, we expect an effect of the ambient language: children acquiring a phonologically more complex language should target and produce more complex forms. Hence, we expect Arabic- and

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[3] When consonant articulation occurs at the same time as another articulation is being made at a different place in the vocal tract, the consonant is said to form a complex articulation.

[4] Rhoticity in English (the pronunciation of the historical rhotic consonant /r/) is one of the most prominent features distinguishing varieties of English. Here we studied the acquisition of American English, which belongs to the rhotic varieties.

Berber-speaking children's IPC scores to be higher than those observed for English- and French-speaking children.

H6. In sum, if a complex parameter is frequent in the ambient language, children should use it or attempt it more often than if it is not present in the ambient language.

Table 1. recapitulates the different hypotheses

H1	Dictionary	Globally, Berber and Arabic should show higher complexity because they are highly consonantal languages a. More complexity in Arabic and French for place of articulation b. More complexity in Berber and Arabic for clusters c. More complexity in Berber and Arabic for complex articulations d. More complexity in Arabic for word length e. Less complexity in French for final consonant f. More complexity in Arabic for variegation (Place) g. More complexity in Arabic for variegation (Manner) h. More complexity in English for Rhoticity
H2	CDS	Less complexity in CDS compared to Dictionary
H3	Targets	Less complexity in Targets compared to Dictionary
H4	Actual	Less complexity in Actual compared to targets
H5	Targets & Actual	Targets and Actual in Berber and Arabic should be more complex than in French and English
H6	Targets & Actual	Targets and Actual should reflect the ambient language

Table 1. Predictions for Dictionary, CDS, Target and Actual words in the four different languages

Method

Participants

Sixteen children from four linguistic communities: Arabic (Tunisian vernacular), Berber (Tashlhiyt variety), American English and French were included in the study. The parents did not report any concerns about the children's language development, hearing status, or general development. The Arabic and Berber data are part of The PREMs Project[5] (Principal Investigator:

[5] http://www.ddl.ish-lyon.cnrs.fr/projets/prems/index.asp?Langue=EN&Page=Presentation

Sophie Kern). The French data are part of the French Kern corpus (Kern, Davis, & Zink, 2009), and the English data comes from the Providence Corpus (Demuth, Culbertson, & Alter, 2006).

Table 2. Participants' demographic information

Language	n	Sex	Age Range (months;days)
Arabic	4	2M/2F	8;09 – 24;06
Berber	4	2M/2F	7;21 – 18;12
English	4	2M/2F	11;27 – 20;05
French	4	3M/1F	9;09 – 22;22

Procedures

The children were recorded in natural settings at home in interaction with their mother. The recording sessions took place twice a month from the onset of first word production until a few months after the lexical spurt. As Jakielski (2000) recommend to use 50 words to compute the IPC, four lists of 50 words were analyzed for each language: (i) the first 50 words actually produced by each child (hereafter referred to as Actual), (ii) the targets corresponding to these first 50 words, (iii) 50 words randomly extracted from CDS produced by each mother and (iv) 50 words from the adult language randomly selected from dictionaries (See APPENDIX 1 to 4 for an illustration). For each list, an adaptation of the Index of Phonetic Complexity (Jakielski, 2000) was computed (see Table 2). The IPC is based on the phonetic regularities observed during the babbling and the first- words periods. Vocal outputs that are composed of the less preferred segments (or segment associations) in early development are rated as more complex in the IPC. This allows measuring the development of phonetic complexity in both word targets and words actually produced by the children. The IPC consists of eight parameters: consonants by place and manner, vowels by class, word shape and word length (in syllable type and number), singleton consonants by place variegation, contiguous consonants and cluster by type (i.e. homo- vs. hetero-organic). However, as this measure was initially designed to capture the phonetic complexity of English, it must be adapted for crosslinguistic

comparison in order to account for other determining features of phonetic complexity exhibited in the 4 languages under examination..

Data analysis

In order to take into consideration the typological peculiarities of our linguistic sample, we first had to integrate into the original IPC model a new parameter relative to consonantal articulation. We called it *consonant by articulation class* in reference to Jakielski's first two parameters (i.e. Consonant by place and manner class and Consonant by place class). This new parameter was created in order to discriminate between simple vs. complex articulations (see n.1). In Arabic and Berber, two types of secondary (or complex) articulation are phonemically attested: pharyngealization (both in Arabic and Berber) and labialization (in Berber only). Basically, during the realization of a pharyngealized consonant (for example [$t^{ˤ}$, $d^{ˤ}$, $ð^{ˤ}$]), the pharynx is constricted and the root of the tongue is retracted. Such consonants, which require a skillful control of the back of the vocal tract (Barkat-Defradas & Embarki, 2009), are acquired very late in development (Omar, 1973). We therefore added 1 point for such complex segments, that are typical of Afro-asiatic languages (Hetzron, 1997). The same rationale was applied for labialization, which consists of adding lip rounding to the principal articulation. We considered radical consonants (i.e. pharyngeals) as particularly complex in terms of the consonant by place class, since they are, on the one hand, even more posterior than dorsals (that are themselves considered as complex in the original IPC model) and, on the other hand, since the mastery of production for these consonants is reported to occur rather late (Amrayeh, 1994; Amrayeh & Dyson, 1998). Lastly, considering the fact that consonantal clusters are frequent in the Western varieties of colloquial Arabic, under the influence of Berber, and can thus be very long (up to seven contiguous consonants), we decided to add up to 2 points when more than two consonantal segments are contiguous. Table 2 recapitulates the different parameters included in our IPC adaptation.

Table 3. Adapted Index of Phonetic Complexity Scoring Scheme (based on Jakielski, 2000)

Parameter		No points for:	One point each for:	Maximum possible points:
1	Consonant by articulation class	Simple	Complex	1 point each
2	Consonant by place class	Labials, Coronals, Glottals	Dorsals Pharyngeals	1 point each
3	Consonant by manner class	Stops, Nasals, Glides	Fricatives, Affricates, Liquids	1 point each
4	Vowel by class	Monophtongs Diphtongs	Rhotics	1 point each
5	Word shape	Word ending in a vowel	Word ending in a consonant	1 point each
6	Word length in syllables	Monosyllabic and dissyllabic words	Tri+ syllabic words	1 point each
7	Consonants by place variegation	Reduplicated	Variegated	1 point each
8	Consonants by manner variegation	Reduplicated	Variegated	1 point each
9	Contiguous consonants	Words without a cluster	Words with consonant clusters	CC = 1 point > 2C = 2 points
10	Cluster by type	Homorganic clusters	Heterorganic clusters	1 point each

Our purpose here is to compare the total phonetic complexity of children's production cross-linguistically, as well as the contribution of each of the parameters accounting for it. Translating each word into a phonetic sequence in which each element is described (as a vowel, a consonant, or a secondary articulation, with consonants being identified in terms of place and mode of articulation), we can identify and compute each parameter, and the IPC as their total sum. Table 3 provides an example of IPC scoring for four dictionary words in each language.

Commenté [DC1]:
It = ? The production or the complexity?

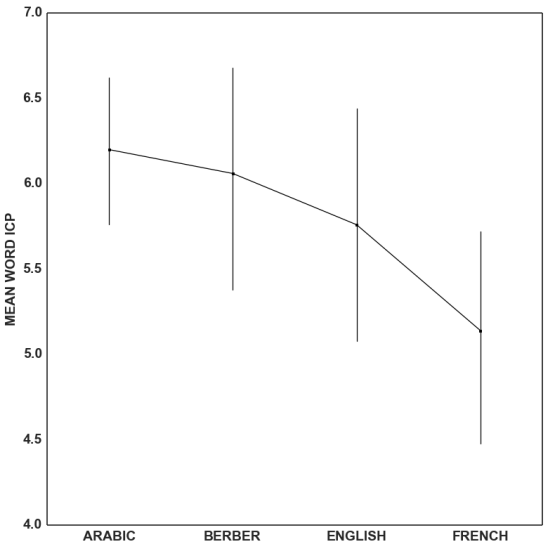
Table 3. Index of Phonetic Complexity Scoring for 4 words in each language

Language	Item	IPA Transcription	Consonant by articulation class	Consonant by place class	Consonant by manner class	Vowel by class	Word shape class	Word length in syllables	Consonants by place	Consonants by manner	Contiguous consonants	Cluster by type	**Total IPC**
French	fork	fuʁʃɛt	0	1	1	1	0	0	1	1	1	1	7
English	mixture	mɪkstʃər	0	1	3	1	1	0	1	1	2	1	11
Berber	girl	tafruxt	0	1	2	0	1	1	1	1	2	2	11
Arabic	he fell	sqətˁ	1	1	1	0	1	0	1	1	1	1	8

Results

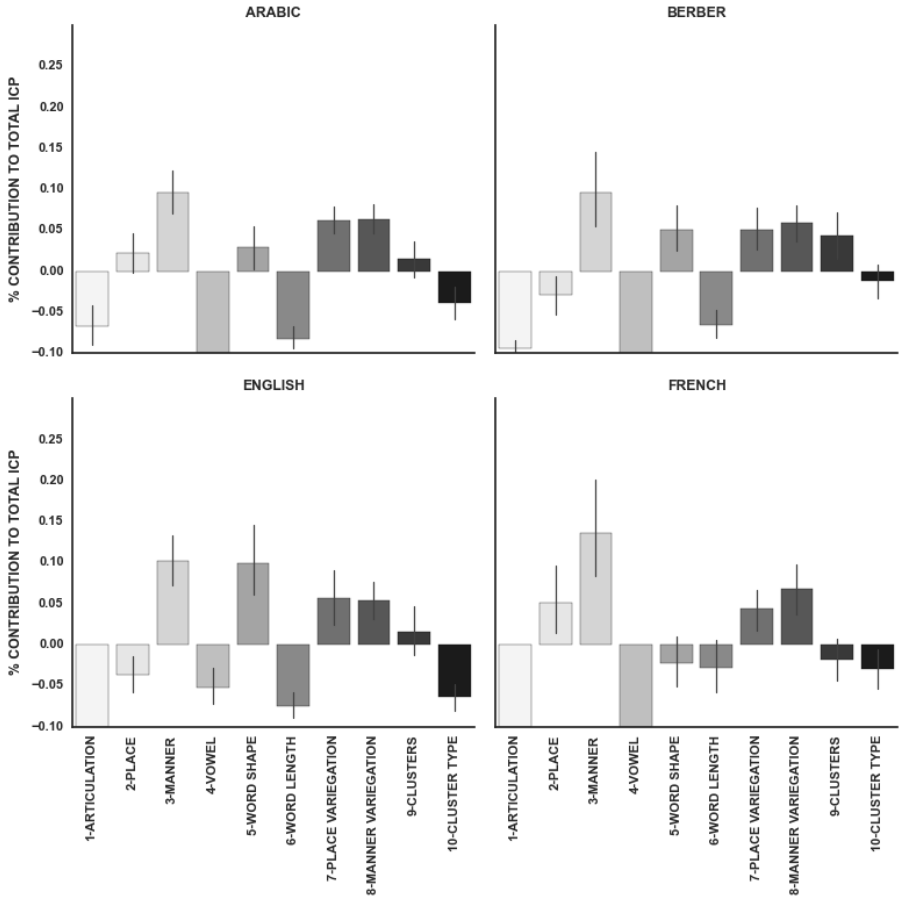
The dictionary sample is a window on the expected mean word phonetic complexity of the languages under study. The sample being rather small, we also computed the confidence interval of the mean with a 5% type I error by bootstrapping the sample to estimate the interval of values for the mean phonetic complexity for the dictionary as a whole. Figure 1 shows that the 4 languages have indeed different mean word IPCs, with a decreasing decline from Arabic > Berber > English > French. As expected given the sample size the 95% confidence intervals are large, but they still support this complexity decline.

Figure 1. Mean word IPC showing a decreasing decline from Arabic > Berber > English >
Vertical bars show the 95% confidence interval for the means for the dictionary as a whole.



Since the IPC is computed as the sum of 10 phonetic parameters, depending on the language, this overall complexity can be attributed to different parameters. Figure 2 shows the individual contribution of each parameter to the overall IPC for the dictionary sample. Contributions are computed as the difference between the proportion of the overall complexity (that is, the IPC the parameter actually accounts for), and what would be expected from a uniform contribution of all parameters. Since there are ten of those, the uniform contribution null hypothesis would set each parameter's contribution at 10 %. Specific parameter contributions will thus vary between -0,1-0,9.

Figure 2: Specific parameter contribution with respect to the uniform contribution null hypothesis. Values range from -0,1 to 0,9 for each of the 10 parameters composing the IPC.

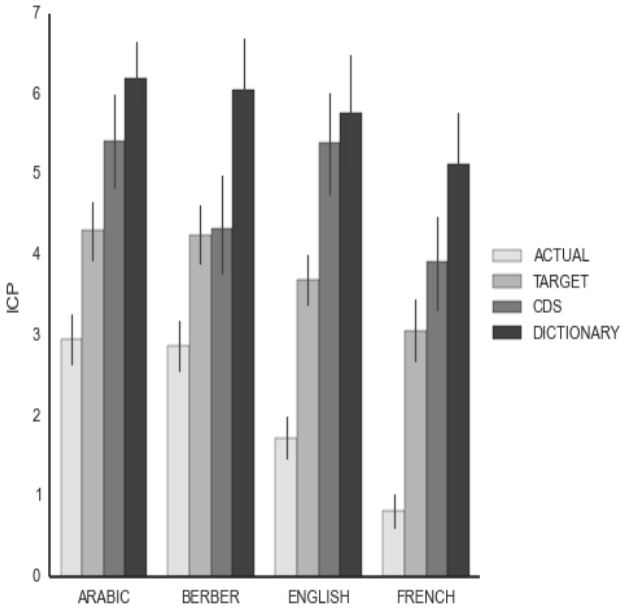


As expected, Arabic and French display a greater contribution of place of articulation, and French exhibits less complexity than all three other languages in word shape due to the preferential open final syllables. However, contrary to our assumptions about consonantal clusters, only Berber displays these as significant contributors to overall phonetic complexity, whereas Arabic and English scale the same, in only slight excess of the 10 % contribution baseline, while French is slightly in deficit for this specific complexity component. The number of syllables does not show differences across languages either. Having distinguished monophthongs and diphthongs in our data description, word length is computed as the number of vowels, assumed to act as syllabic nuclei (except for

Berber, where, null syllabic nuclei were also identified, using Dell and Elmedlaoui's (2012) syllabification algorithm). For this parameter, all four languages exhibited less than the 10% contribution anticipated if all of the parameters make an equal contribution

Complexity measures on the dictionary samples provide the baseline against which children's production and lexical selectivity, but also Child Directed Speech (CDS) can be analyzed. Figure 3 shows the mean IPC values for the different lists in the various languages.

Figure 3. Mean word IPC and 95M confidence intervals for the Dictionary/adult language, CDS, actual child production and target for Arabic, Berber, English and French

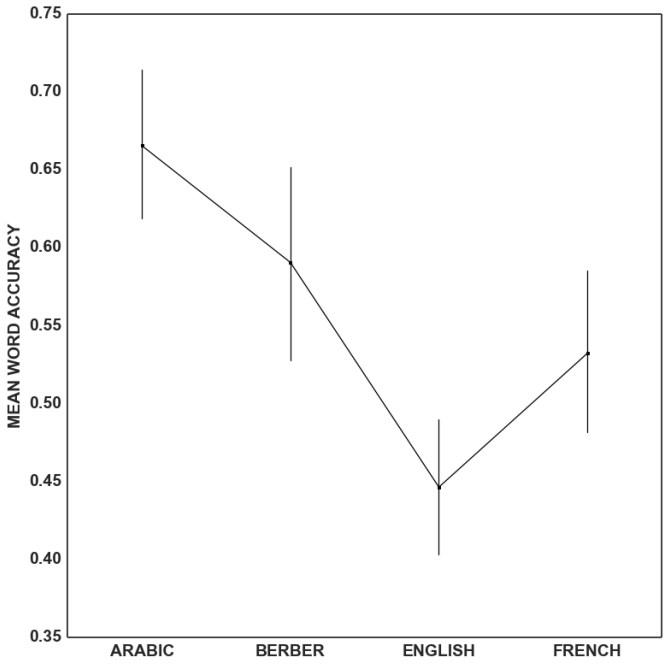


Although the general tendency is that of a decreasing complexity decline from Dictionary/adult language to CDS to Target to Actual child productions, major differences exist between languages. For instance, CDS in Arabic and English shows the highest complexity compared to the dictionary sample, but Berber, while showing a lower mean IPC for CDS, also exhibits comparable levels of phonetic complexity between CDS and the targets selected by children for production. Moreover, Arabic and Berber show similar Target complexity and an Actual-to-Target complexity differential.

But while English and French display lower Target complexity, they also display larger Actual-to-Target complexity differentials, with lower achieved complexity in children's actual production, especially for French.

However, these Actual-to-Target complexity differentials do not necessary translate into Actual-to-Target accuracy. Given that the individual parameters focus primarily on consonants, we computed the Actual-to-Target accuracy in the realization of consonants for the 4 languages (Figure 4).

Figure 4. Mean Actual-to-Target accuracy in consonant production for Arabic, Berber, English and French. Vertical bars display the 95% confidence interval

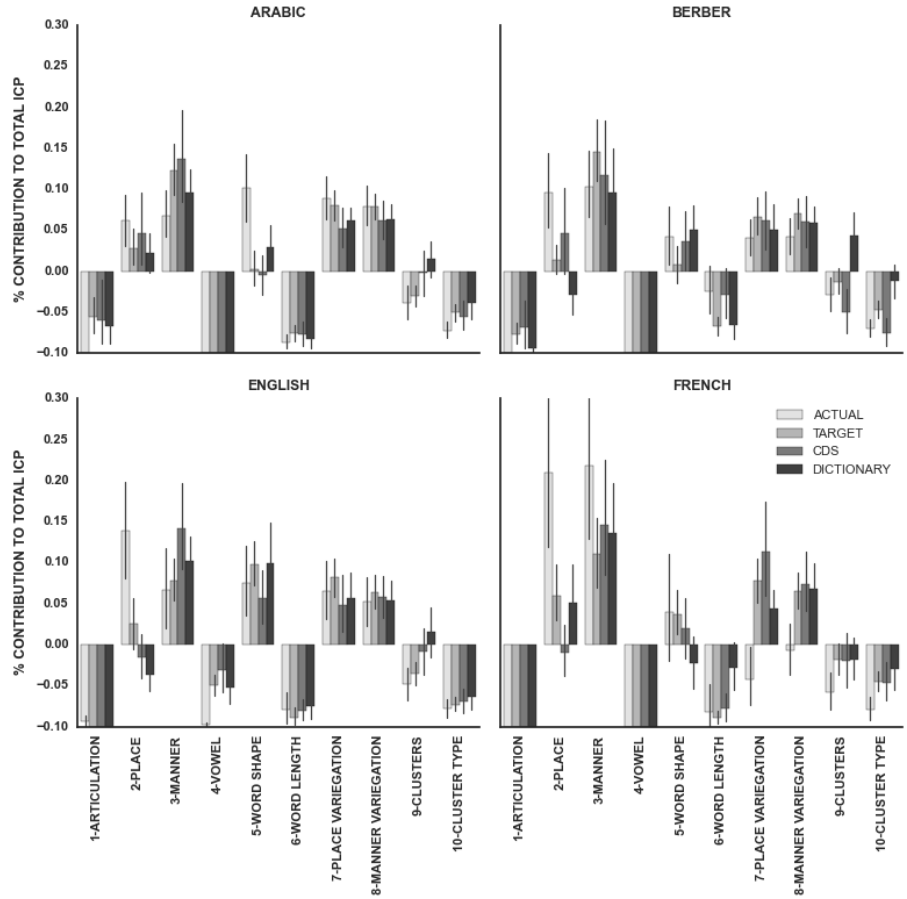


Despite the larger overall Actual-to-Target complexity differential, French children achieve better accuracy, while English children achieve the worst accuracy scores. More importantly though, and despite larger Target complexity, Arabic and Berber children achieve the highest accuracy scores. These results suggest that typological characteristics of the language indeed play a role in the

acquisition process and call for a detailed examination of the individual contribution of each parameter to the overall IPC score of children's actual production, as compared to the language (dictionary) parameter contribution landscape.

Figure 5 shows that not all parameters contribute in the same way to the mean IPC of the child's actual production, depending on the language, with respect to how they contribute in the other samples, and especially, the Dictionary.

Figure 5. Mean parameter contribution by sample (Dictionary, CDS, Target and Actual) and by language (Arabic, Berber, English, French)



For instance, Arabic Actual shows an enhanced tendency for children to produce closed final syllables, irrespective of what is displayed in either the Target or the CDS, thus mirroring more of the dictionary tendency than these two latter samples do. On the other hand, clusters, which contribute to different extents to the IPC of Berber, Arabic and English (dictionary), do not in any of the other samples, suggesting that both CDS and Targets selected by the children tend to misrepresent clusters during this phase of acquisition, thereby reducing the complexity of their production.

A tendency that appears common to all languages, however, is the large contribution of manner of articulation in CDS with respect to Dictionary which is reflected for Arabic and Berber in the Target selected by children for production, while French, where this is not the case, displays an enhanced contribution of manner in the Actual production of the children. Place of articulation also displays a trend common to all languages, with enhanced contributions in Actual production, irrespective of their contribution in the other samples. However, whereas place and manner contribute the most in French to actual production, their variegation contributes the least, contrary to all three other languages.

Discussion

Using an adaptation of Jakielski's (2000) Index of Phonetic Complexity (IPC), we carried out an analysis to assess phonetic complexity of children's early vocabulary in four languages: Arabic, Berber, English and French. Globally, we hypothesized that children's early productions would be shaped by universal articulatory constraints, but also by the language they are exposed to, depending on its phonological complexity.

Considering language-specific aspects, we observed that as hypothesized, some languages of our samples, namely Arabic and Berber, show higher IPC scores (complexity) than English and especially French (H1). The different IPC parameters contribute differently to complexity. Manner and place of articulation contribute significantly to complexity in all four languages, and not only in Arabic and French as predited by H1a. In other words, children in these languages do not

systematically avoid fricatives or liquids, which are frequent in the ambient language. Similarly for Place of articulation, although children prefer labials and coronals to dorsals in the early period of production, they are able to produce posterior consonants (like dorsals and/or pharyngeals) when required by the ambient language (i.e. typically in Arabic and Berber where they are rather frequent). However, some parameters clearly differ across languages. Clusters are significant contributors to phonetic complexity in Berber, and, to a lesser extent, in Arabic and English (H1b.). As for final consonant, French is confirmed to be easier than the other languages, as expected as predicted by H1e. In contrast, some other parameters that were expected to play a role in complexity scores (H1 c., d., f. g. h.), in particular word length and complex articulation (H1 c. and d.), do not seem to contribute significantly to the global complexity score. In sum, we found a decreasing complexity: Berber < Arabic < English and we hypothesized that these differences in phonetic complexity in the adult languages would influence phonetic development in children acquiring these languages. An obvious assumption is that a phonetically complex language such as Berber would take longer to acquire, and would be more challenging to reach accuracy. Nevertheless, our findings suggest that this is not the case. Although our sample is too small to draw solid conclusions, our data indicate that Berber infants are not delayed in the timing of first words production, given that first words are produced as early as 7 months of age in one of our subjects. Similarly, children acquiring Arabic and Berber show the best accuracy scores compared to the *a priori* easier languages, English and French.

Turning to universal aspects of phonetic development (H2, H3 & H4), our findings are in line with previous work underlying the universal tendency for caregivers to modify their speech when addressing children (H2) (Ferguson, 1964, 1978; Kitamura et al., 2001; Kuhl et al., 1997; Monnot, 1999). Some studies had investigated motherese in Arabic and Berber and cultural differences have been documented in the range of modifications of CDS (Ferguson, 1956, Gumperz & Hymes, 1964, Bynon, 1968, Omar, 1973, Haggan, 2002, Al-Shatty, 2003 and Ferguson, 2004) and the fact that caregivers use a special register to address young children remains indisputable cross-linguistically. The vast majority of CDS studies are focused on semantic, syntactic or prosodic characteristics. Fewer

address the phonetic characteristics of CDS, but Kuhl et al. (1997) for instance showed that mothers in different languages (American English, Russian and Swedish) produce vowels that are acoustically more extreme when addressing their young children, thus providing information about the sound system of the infant's native language in an exaggerated form. CDS thus promotes language learning by separating sounds into contrasting categories. The present study did not focus on potential modifications of segments in CDS, but our findings show that caregivers use words that are less complex than in the adult language. This suggests the operation of lexical selectivity in CDS just as lexical selectivity is hypothesized in children's productions. Thus, one can assume that caregivers reduce the gap between children's restricted articulatory capacities and the necessary capacities to produce phonetically complex words of the adult language.

As predicted by H3, children also seem to select the words they produce or attempt to produce depending on their phonetic complexity (Ferguson & Farwell, 1975; Schwartz et al., 1987; Vihman et al., 1985). Indeed, in the four languages under study, we observed that words attempted (Target) or produced (Actual) by children have lower complexity scores than CDS or adult words (H3 and H4). Finally, the fact that in all the four languages, actual productions show reduced complexity compared to attempted (and obviously CDS or adult) words illustrates the fact that during this early period of first word productions, children's early phonetic inventories are strongly limited by anatomical and neurophysiological constraints (Green et al., 2002, 2010; MacNeilage et al., 2000; Stoel-Gammon & Sosa, 2007).

Looking at the detailed parameters that children either produce or avoid depending on the language, our findings show a mixed influence of language specificity and neurophysiological constraints. Globally, children's actual productions tend to reflect the tendencies displayed in adult productions (H5 and H6). The fact that children's use of closed syllables (Actual) in Arabic mirrors the adult language (dictionary words) but not targets nor CDS remains to be explained. However, clusters, which are strong contributors of complexity in Berber (and to a lesser extent in Arabic and English), seem to be avoided by children acquiring these languages. This finding is not surprising, as

consonant clusters appear to be especially challenging for children. Indeed, they are not produced before age 2 and their acquisition is one of the longest-lasting aspects of speech acquisition in normally developing children (McLeod, Van Doorn, & Reed, 2001). In sum, the different IPC parameters are not equally difficult for children to produce: while some (such as producing fricatives or dorsals) can be overcome by children even at a very early age in spite of biological constraints, others (such as consonant clusters) need more time to master.

APPENDIX 1. Examples of ARABIC data

	Actual IPA	Target IPA	*Translation*	CDS IPA	*Translation*	Dictionary IPA	*Translation*
1	mɛm:æ	mama	*mommy*	tˤɑ:ħ	*to fall*	ʕəʃb	*medical*
2	itæjj	tˤɑj	*Peek a boo*	ʔi:ʒæ	*he comes*	ħuku:m	*monopole*
3	pæ	papa	*daddy*	tˤɑtˤɑ	*tata*	ħi:la	*ruse*
4	dæ	la:	*no*	ʔaħħæ:	*ouch !*	farləχla	*fieldmouse*
5	ʔi	ʔɛj	*yes*	kiχχæ	*eew !*	msisa	*bracelet*
6	tæ:ħ	tˤɑ:ħ	*it fell*	qu:l	*tell*	ħəwəl	*to try*
7	bæj	bah	*ok*	næħħi:	*remove*	qa:l	*tell*
8	æm	mam:i	*mum*	ʔahajjæ:	*here it is*	mraħħəm	*marble*
9	bæħ	baħ	*It disappeared*	wi:ni	*where is it ?*	zra:ʕi:	*agricultural*
10	ʔɛjʒi	ʔiʒa	*come here !*	ʃu:	*what is it ?*	mdˤəl	*straw*
11	bɛj	baj baj	*bye-bye*	daddu:ʃ	*walk*	mudˤif	*stewart*
12	tɛd:	ʃi:d:	*hold !*	jɛzzi	*stop !*	butˤa-in	*ventricule*
13	ʔæħ:	ʔaħ:	*ouch !*	træh	*show me !*	dəħʃ	*baby donkey*
14	hup	ħutˤ:	*put down !*	ba:ħ	*gone (nothing !)*	wəsχ	*fouling*
15	ʒaʒæ	ʤa:ʒa	*chicken*	alo	*hello*	səqqa:t	*gourmet*
16	ħibɛʃ	mænħibɛʃ	*I don't want*	ʔaʕmil	*do*	kursi	*saddle*
17	ktib	ʔiktibli	*write (to me)*	hæ:t	*put*	ʕrəq	*sweat*
18	ka	kask	*your helmet*	læ:	*no*	ħadd	*fence*
19	tæ:ʕi	mtæ:ʕi	*mine*	ʔɛj	*go !*	rijja:ga	*bib*
20	bebe	bebe	*baby*	χu:	*brother*	qəm	*estimate*
21	kak:æ	kaka	*poo*	kaka	*poo*	məstəɣəl	*profiteer*
22	tat:a	batˤ:ɑ	*canard*	jimʃi	*he goes*	bəlɣa	*oriental slipper*
23	tatæ	tˤɑtˤɑ	*beat !*	sˤɑħi:t	*thank you*	ʃkara	*bag*
24	ħutæ:	ħuta:	*fish*	ʔaqɛf	*up !*	bəqra:ʒ	*tea pot*
25	bab	dub	*ours*	bæʕ	*bèè (bleat noise)*	ħɛ:l	*weather*
26	na:n	ħsˤa:n	*horse*	ʒi:b	*bring*	sˤəffa	*clarify*
27	næhnæ	lihnæ	*here*	hæðɪka	*this one*	məllɛ:ħ	*seller*
28	mæ mæ	mæ:	*water*	tħutˤ	*place*	da-ijəb	*melting*
29	kæk	qird	*monkey*	ʔistannæ	*wait*	qəfza	*jump*
30	tæ:ħ	muftæ:ħ	*key*	ʔælʕib	*play*	da:r	*home*
31	taw taw	taw:a	*now*	ʃʕær	*hair*	ma:t	*perish*
32	dæb:u:sæ	dab:uzæ	*bottle*	mtaʕ	*his*	rʒaʕ	*take back*
33	ʃbi:k	ʃbi:k	*what happens to you ?*	sˤɑfiq	*applaud !*	tˤbi:b	*doctor*
34	ʔuxdæn	ʔuxzur	*watch !*	ʃnuwæ	*what*	faħħəm	*explain*
35	kas:ar	tkas:ir	*you broke*	bismilah	*bless you*	hdər	*argue*
36	bæz	xubz	*bread*	ʕaqu:la	*nice*	sqətˤ	*fall*
37	fasu:	ʕasˤfu:ra	*bird*	ʔaʕtˤi	*give*	ɣri:b	*unheard-of*
38	tax:a	kix:a	*eew !*	matmissiʃ	*don't touch*	bətˤtˤəl	*idle*
39	ʕam	ʕam:i	*my uncle*	ʔuqʕud	*sit down !*	mʕalləm	*expert*
40	ku:ra	ku:ra	*ball*	ɣa:di	*there*	səndu:q	*coffin*
41	di	haði	*this one*	ʃbi:k	*what happens*	hənd	*magnet*
42	tiz:a	hizha	*lift it up*	nrakablik	*I'll put it together*	qəmr	*moon*
43	laħda	laħðˤa	*one minute please*	tkallim	*talk*	qəsma	*part*
44	kuja	xuja	*my brother*	nχabbi:h	*I hide*	stəχbər	*be informed*
45	ku:	qu:m	*get up !*	ħsˤɑ:n	*horse*	ʒəʕʕada	*spatula*

46	nanːi	nanːi	*sleep !*	ʕasˤfuːra	*bird*	aθat	*furniture*
47	ʔahu	ʔahuwa	*here it is !*	matibkiːʃ	*hurry up (don't cry)*	mədwəd	*nursery*
48	tatː	jtatːti	*(he) beats*	kifæːʃ	*how ?*	rqiːq	*menu*
49	ræjæ	mræjæ	*mirror*	nhizz	*bring*	dərbuka	*drum*
50	stanːæ	ʔistana	*wait !*	suːq	*market*	ʕilaqa	*Coat rack*

APPENDIX 2. Examples of BERBER data

	Actual IPA	Target IPA	*Translation*	CDS IPA	*Translation*	Dictionary IPA	*Translation*
1	bːabːa	bajbaj	*goodbye*	dːaħ	*hit (have a pain)*	ara	*give*
2	babaː	baba	*dad*	ʕaw	*noise*	aman	*water*
3	amːaː	mama	*mom*	aratid	*give it to me*	afus	*hand*
4	hbːa	sːˤbːatˤ	*shoes*	ixʃ	*it is bad (thing)*	ilm	*skin*
5	ajalːa	lalːa	*auntie*	titːi	*sit down*	krf	*tie*
6	haːh	hak	*take*	xːiʃ	*it is bad (thing)*	adr	*press*
7	manːama	lmunika	*toy*	ʃaʃːa	*a donky*	rgl	*close*
8	qːaqːa	ʁika	*like this*	fufːu	*hot/fire*	ifta	*he went*
9	tːa	xtːa	*this one (fem.)*	baʕːa	*sheep*	usin	*they took*
10	bːaħ	bːaħ	*disappeared*	bːaħ	*It's over*	awid	*bring!*
11	məməm	mumːu	*toy (generic)*	dːaw	*walk / go*	inijas	*tell him*
12	hatːi	hatːi	*here it is (fem.)*	dajdːa	*fall down*	ufiɣ	*I found*
13	ajːaː	tajːaː	*another one (fem.)*	baʕːatin	*sheep*	lkmɣ	*I arrived*
14	ʃɛʃ	ʃaʃːa	*horse (baby talk)*	ʃtːi	*grandfather*	tamːnt	*honey*
15	bːɛħbːa	aħbːudˤ	*tummy*	kakːa	*chocolate*	takurtː	*ball*
16	bula	bula	*this is a light bulb*	etːej	*move !*	agrzam	*lion*
17	mna	magana	*this is a watch*	buʕːu	*monster*	tafruxt	*girl*
18	qaqːa	kukuʕːu	*cock (baby talk)*	tinxarin	*nose*	afrux	*boy*
19	alaqa	alqːaʕ	*sheep*	tabatːˤaħt	*foot*	imi	*mouth*
20	aːlaː	ara	*give me*	tafust	*hand*	argaz	*man*
21	baʕpːɛʕ	lbanan	*banana*	tamzːˤuxt	*ear*	tamɣart	*woman*
22	tːɛtetːe	ʁid	*here*	tagajːut	*head*	amadl	*hill*
23	tʃtiʃk	juʃkad	*he came*	timimit	*mouth*	amdlu	*cloud*
24	aːpbː	ibːi	*it is ripped*	tiwalin	*eyes*	skr	*do*
25	acaːca	agajːu	*head*	mimiʃ	*mouth*	fl	*let*
26	memːe	ʕmti	*my aunt*	tabitːu	*eyes*	ls	*wear*
27	handbːa	andːu	*we are going*	tidˤudˤin	*fingers*	gn	*sleep*
28	ʃu	ʃuf	*look*	ʃkːata	*eat (it)*	izˤuran	*veins*
29	neːnːe	ninːi	*sleep (baby talk)*	tasːawalt	*trousers*	azˤalim	*onion*
30	aʃːe	adʃːʁ	*I will eat*	banana	*banana*	tiwit	*you took away*
31	ajːiː	hajːi	*here I am*	biʒːu	*baby*	tabrat	*letter*
32	haʃtʃkːa	iʃqːa	*it is tough*	tˤrʃt	*break*	smun	*pick up*
33	ʃual	ʃuwːr	*slow down*	ʕanː	*car*	knu	*lean*
34	anana	wijnːa	*mom's one*	babat	*shoes*	kru	*rent*
35	ʃaʃaː	matˤeʃa	*tomatoes*	fufːu	*fire/ hot*	igawr	*he sit down*
36	bakːaʔ	baraka	*that's enough*	akːik	*give / Show*	tkʃmt	*you entered*
37	ʁːa	ʁwːa	*this one*	baja	*biscuits*	ssnkr	*wake*
38	alti	xalti	*my aunt*	stːii	*grandfather*	udm	*face*
39	mamiandːu	manisrandːu	*where*	ħmal	*donkey*	idamːn	*blood*
40	d	adˤadˤ	*finger*	ʕːu	*fermented milk*	aɣrum	*bread*
41	mimːi	amuʃː	*cat*	daʕ	*also*	juda	*it's enough*
42	bwa	iswa	*he drank*	xːixːiʃ	*dirty*	izra	*he saw*
43	jːah	jah	*yes*	kukuʕːu	*cok*	alim	*straw*
44	ːufːuʔ	sfːuʁt	*get him out*	ħaħːa	*boho / cut*	afunas	*bull*
45	fːufːu	ifːuʁ	*he went out*	dːaħːati	*hit (me)*	ajdi	*dog*
46	mːam	imːim	*it's tasty*	bːˤatˤ	*shoes*	ngr	*between*

47	pxːu	buxːuʃ	*here's the insect*	ħawa	*cow*	tirmt	*food*
48	ʃːaʔ	ʃː	*eat*	hawhaw	*dog*	azur	*terrace*
49	sːasːa	sʱhsːa	*be quite*	tˁanun	*yogourt*	izgr	*he crossed*
50	adːa	tdːˁrˁ	*she felt down*	tiʒiʒːit	*meat*	xdmn	*they worked*

APPENDIX 3. Examples of ENGLISH data

	Actual IPA	Target IPA	*Translation*	CDS IPA	*Translation*	Dictionary IPA	*Translation*
1	dʌˈbɛ	bʌmbəl ˈbiː	*bumble-bee*	ˈækrəˌbæt	*acrobat*	əˈsiːtəs	*acetous*
2	dæˈdeɪ	dædiː	*daddy*	əˈdɔr	*adore*	ˈɑrʧˌduk	*archduke*
3	əˈzi	dʌrtiː	*dirty*	ænt	*ant*	ˈbækɪs	*bacchus*
4	dʌwɪ	dɑgiː	*doggie*	əˈslip	*asleep*	ˈbæsʧən	*bastion*
5	dʌdi	dʌkiː	*duckie*	ˈbeɪbiˌsɪtər	*babysitter*	ˈbætəl	*battle*
6	ɑbwiː	beɪbiː	*baby*	ˈbætəl	*battle*	klæʃ	*clash*
7	hʌ	kaʊ	*cow*	ˈbɪskət	*biscuit*	kɔɪn	*coin*
8	dʌ	dɑt	*dot*	ˈkɛrfəl	*careful*	kʌm	*come*
9	hʌbu	lɑbstər	*lobster*	ʧɑk	*chalk*	cyclin	*cyclin*
10	ʌmɛ	mɑmiː	*mommy*	ˈdɑrlɪŋ	*darling*	dælˈmeɪʃən	*dalmatian*
11	mʌm	muːn	*moon*	ˈdɪfərənt	*different*	dɛd	*dead*
12	bəˈbɛ	pʌpiː	*puppy*	ˈizi	*easy*	dɪsˈgrʌntəld	*disgruntled*
13	ʊˈwʌ	bɑl	*ball*	ɛnˈʤɔɪ	*enjoy*	ˈɛstʃuˌɛri	*estuary*
14	ɛ	aɪ	*eye*	fɑrm	*farm*	ˈfrizɪŋ	*freezing*
15	ɑtʃi	ɑntiː	*auntie*	ˈfɪlθi	*filthy*	fjuz	*fuse*
16	kizɪ	kɪtiː	*kitty*	ʤəˈræf	*giraffe*	heɪz	*haze*
17	æː	rɔr	*roar*	gɜrl	*girl*	ˈhɛvi	*heavy*
18	diθhɪ	tiːʧər	*teacher*	greɪt	*great*	ˈhaɪbərˌneɪt	*hibernate*
19	dʌʔdæ	bækpæk	*backpack*	gɪˈtɑr	*guitar*	ˈɪnˌsɛst	*incest*
20	bɑ	bɛr	*bear*	ˈhɛvi	*heavy*	ɪnˈtoʊn	*intone*
21	peɪ	bai	*bye*	hɔrs	*horse*	ˈlɑgər	*lager*
22	dʌkʰ	stʌk	*stuck*	ˈɪnˌsɛkt	*insect*	lɪv	*live*
23	bu	bluː	*blue*	ˈɪʧi	*itchy*	mæʧ	*match*
24	bɑk	boʊt	*boat*	ˈʤækət	*jacket*	ˈmɛntəl	*mental*
25	bʊk	bʊk	*book*	ˈʤʌgəlɪŋ	*juggling*	ˈmɪksʧər	*mixture*
26	bo	baʊ	*bow*	ˌkæŋgəˈru	*kangaroo*	ˈpeɪpəl	*papal*
27	bu	bruːm	*broom*	kaɪt	*kite*	ˈroʊmən	*roman*
28	gʊˈkeɪ	kʊkiː	*cookie*	ˈleɪtər	*later*	rul	*rule*
29	duʃ	ʃuːz	*shoes*	liv	*leave*	ˈskɛrsli	*scarcely*
30	bu	bʌrd	*bird*	ˈlɪkɪŋ	*licking*	tæb	*tab*
31	bɑk	blæk	*black*	lʌv	*love*	ˈtækəl	*tackle*
32	pɪˈteɪ	pɪglət	*piglet*	ˈmægnət	*magnet*	ˈviəməns	*vehemence*
33	bu	buːts	*boots*	min	*mean*	ˈvɜrʤənəl	*virginal*
34	bʌˈbaʊwɪs	bʌbəlz	*bubbles*	ˈmʌŋki	*monkey*	vəˈsɪfərəsli	*vociferously*
35	boː	bʌg	*bug*	neɪm	*name*	ˈwikli	*weekly*
36	keɪk	keɪk	*cake*	ˈnɛkləs	*necklace*	waɪld	*wild*
37	kɑː	kɑr	*car*	naɪs	*nice*	kærɪdʒ	*carriage*
38	kɑk	klɑk	*clock*	ˈɔrəndʒ	*orange*	tɛkst	*text*
39	flɛlɑ	flawər	*flower*	ˈpeɪntɪŋ	*painting*	bɑks	*box*
40	fuː	fuːd	*food*	ˈpɪkʧər	*picture*	ˈaʊtˌlaɪn	*outline*
41	kik	kɪk	*kick*	ˈreɪni	*rainy*	pækt	*pact*
42	mu	muːs	*moose*	rɔr	*roar*	pʊt	*put*
43	pik	pɪŋk	*pink*	ˈsændi	*sandy*	riˈpʌblək	*republic*
44	doʃ	stɑrz	*stars*	ˈskrʌbɪŋ	*scrubbing*	raɪt	*right*
45	sɛː	sʌn	*sun*	sit	*seat*	ˈsædnəs	*sadness*
46	fwi	θriː	*three*	spəˈgɛti	*spaghetti*	snæp	*snap*
47	tos	toʊz	*toes*	ˈtɪkət	*ticket*	skwiz	*squeeze*

48	wɛt	wɛt	*wet*	ˈjunɪˌkɔrn	*unicorn*	taɪm	*thyme*
49	pʌrpo	pʌrpəl	*purple*	wæks	*wax*	ˈtraɪəl	*trial*
50	dʒi:	tri:	*tree*	ˈjɛloʊ	*yellow*	voʊg	*vogue*

APPENDIX 4. Examples of FRENCH data

	Actual IPA	Target IPA	*Translation*	CDS IPA	*Translation*	Dictionary IPA	*Translation*
1	ma:ma	mamɑ̃	*mummy*	ʁəgaʁd	*look*	ɑ̃tɔʁs	*sprain*
2	pa:	papa	*daddy*	komɑ̃se	*start*	bʁutij	*trinket*
3	toχto tœ:	dodo	*sleep*	pas	*think*	ɑ̃tuzjasme	*get enthusiastic*
4	pa:	pɛ̃	*bread*	vjɛ̃	*come*	eʁezi	*heresy*
5	tœde:	tete	*suck*	tɛlmɑ̃	*so much*	ʁətʁɛ	*withdrawal*
6	ta:te	taʁtin	*sandwich*	ivɛʁ	*winter*	tʁuve	*find*
7	da:da:	gato	*cake*	dusmɑ̃	*slowly*	kʁəvɛzɔ̃	*flat*
8	œbi:	abɛj	*bee*	pø	*can*	kanaʁ	*duck*
9	bɛbe:	bebe	*baby*	dədɑ̃	*inside*	duluʁø	*painful*
10	te:te	tɛte	*head*	gʁɑ̃	*big*	libeʁalism	*liberalism*
11	tata:	tata	*auntie*	fɛ	*do*	pʁɔvizjɔ̃	*supply*
12	bibi:	bottle	*baby*	vwala	*here*	ʒødi	*Thursday*
13	ɔp	ɔp	*hop*	kɔm	*like*	kʁist	*Christ*
14	awo:	alo	*hello*	atɑ̃	*wait*	avaʁi	*damage*
15	kuku:	kuku	*hello*	lezaʁ	*lizard*	ɑ̃gaʁ	*shed*
16	apo:	pɔ̃pje	*fireman*	dakɔʁ	*okay*	ʁɑzwaʁ	*razor*
17	po:	po	*pot*	ale	*go*	tɑ̃	*time*
18	kokœ	tɔ̃tɔ̃	*uncle*	aʁiv	*arrive*	ataʁde	*linger*
19	ape:	papje	*paper*	avɑ̃taʒ	*advantage*	kuʃe	*lying*
20	œma:ʁœ:	kameʁa	*camera*	mwɛ̃	*less*	maʁʃɑ̃	*seller*
21	tete:	tete	*sucking*	dɑ̃	*in*	səkwe	*shake*
22	kokɛ:	elikɔptɛʁ	*helicopter*	pɔʁtik	*crossbar*	tʁiko	*knitting*
23	ɔva:	oʁəvwaʁ	*bye bye*	pusɛ̃	*chick*	vɑ̃	*wind*
24	tatɔ:	klakson	*horn*	amne	*brought*	deʁegle	*upset*
25	ba:	bal	*ball*	ʁapɛl	*remember*	dɛʁm	*dermis*
26	ba:	bɛ̃	*bath*	ʒø	*games*	ɔtɔmatik	*automatic*
27	apa:	lapɛ̃	*rabbit*	butɔ̃	*button*	ɑ̃gɔ̃se	*constrain*
28	bi:bo:	bibʁɔ̃	*bottle*	tele	*TV*	ɔfʁiʁ	*offer*
29	gu:	lego	*lego*	komɑ̃	*how*	vəly	*hairy*
30	mɔ:	mɔʁ	*bite*	lɛs	*let*	velɛ	*vellum paper*
31	ma:	mal	*hurt*	lynɛt	*glasses*	ɛʁb	*grass*
32	ne:ne	mimi	*cute*	aplɛ	*called*	defile	*parade*
33	apo:	ʃapo	*hat*	pwasɔ̃	*fish*	kale	*wedge*
34	ame:	fɛʁme	*closed*	penibl	*tiresome*	kɔ̃tʁəpɛtʁi	*spoonerism*
35	bɛ	tɔ̃b	*fall*	vaʃ	*cow*	epanwiʁ	*blooming*
36	pu:	pul	*hen*	ẽtɛʁdi	*forbidden*	dɔsil	*docile*
37	fwɑ	fʁwa	*cold*	ʃosɛt	*socks*	ʃɑ̃s	*chance*
38	vy:	pyl	*jumper*	gaʁsɔ̃	*boy*	apsɑ̃	*absent*
39	ka:	kask	*helmet*	pətit	*small*	aspik	*aspic*
40	py:	py	*stink*	kat	*four*	fam	*woman*
41	afa:	paʁfœ̃	*perfume*	pʁɛ	*ready*	manifɛstasjɔ̃	*demonstration*
42	nɔ:ne	koksinɛl	*ladybird*	tabl	*table.*	peje	*pay*
43	ane:	fɛʁme	*close*	aspiʁatœʁ	*vacuum cleaner*	sɛ̃	*saint*
44	bu:	bul	*ball*	mɔ̃tʁ	*show*	tiʁɑjœʁ	*infantryman*

45	af	ʒɪʁaf	*giraffe*	telekomɑ̃d	*remote control*	ynite	*unit*
46	ɔu:	ʃosyʁ	*shoe*	dəbu	*stand*	ɔnɔʁe	*honor*
47	bube:	pubɛl	*trash*	nuʁityʁ	*food*	etɛ̃	*off*
48	dada:	salad	*salad*	kanaj	*raffish*	kɑ̃	*camp*
49	ʁo:gwɛ	dekʁoʃe	*pick up*	pubɛl	*trash*	seʁɔm	*serum*
50	api:	apɥi	*press*	mɑ̃ʒe	*eat*	kɑ̃tɔnad	*No one in particular*

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