

Data Analysis Essay

1. Introduction

A reoccurring pair of questions in bilingual language development research is whether simultaneous bilingual children begin with autonomous phonological systems and, if so, whether cross-linguistic interaction exists between them.

One view is that simultaneous bilinguals go through an initial stage where their languages are not differentiated (Volterra and Taeschner, 1978; supported by Leopold, 1939/49 and Schnitzer and Krasinski, 1994 amongst others). This “unitary language system hypothesis” (Genesee, 1989) stands in opposition to more recent evidence, which suggests differentiated systems from early on. For example, Deuchar and Clark (1996) found that a Spanish/English bilingual child had not developed an adult-like voicing system for Spanish by 2;3, yet had done so in English. Research on segmental features, though sporadic, has similarly refuted the claim that the bilingual is effectively a monolingual in early production (Fabiano-Smith and Barlow, 2010; Keshavarz and Ingram, 2002).

This essay will re-examine phonetic transcriptions from Brulard and Carr (2003), who examined their son’s simultaneous acquisition of French and English from 1;10 to 2;6. Similarly to the original, it aims to determine if the data provide enough evidence to advocate a single or dual phonological system. However, whilst Brulard and Carr (2003) investigated features such as stress and syllable structure alongside segmental features, this study will be focused wholly on the latter. Prosodic features were thoroughly investigated in the original study but it is believed that more fruit can still be borne from a re-analysis of discrete segments.

2. Methods

2.1 The subject

Tom is the child of the linguists Inès Brulard and Philip Carr and started producing his first words at around 1;8. He was exposed to native French and an RP-like English from his mother and native (Scottish Standard) English and non-fluent French from his father. For the first year of his life, Tom was raised in North England and had greater exposure to English,

especially from 0;6 onwards when he spent three days a week in his childminder's Tyneside English-speaking household. After that, he and his family moved to France and his childminder switched to that of a Standard French speaker.

It is important to note that there was no "one parent, one language system" enforced in this case. Still, Brulard and Carr (2003) note that they did control the household language, with French being used whilst they lived in England and English being employed when they had moved to France.

2.2 Data

The original data in Brulard and Carr (2003) was comprised of longitudinal diary data in the form of IPA-based, phonetic transcriptions. Though the transcriptions begin at 1;10.00, this research will start its analysis from 2;0.24 onwards. A segment-level analysis would not be sound prior because: 1) the occurrence of the main <CVS> word template begins at 2;0.24, securely marking the beginning of phonological organisation (Vihman, 2002); 2) until 2;0.24 Tom's word forms are highly accurate, perhaps indicating he is operating from a whole-word phonology (Waterson, 1971); 3) by 2;0.24 Tom had reached the 50-word stage.

Brulard and Carr (2003) followed stringent guidelines for data collection. Utilising the criteria outlined in Vihman and McCune (1994), child utterances were counted as words on the basis of factors such as context-of-use and phonetic shape. The data can be said to accurately reflect Tom's word forms; hence, generalisations made here upon patterns between these forms will not be invalid.

2.3 Procedure

To begin with, phonetic inventories for onset and coda consonants in French and English, which had not been created previously, were constructed. Tokens were selected that were closest to the adult target form and a sound had to be produced in the correct position across at least two different words before the sound was said to be in repertoire. For example, the consonant [p] was used in *petit* 'small' [pə'ti] (2;2.21) and *plus* 'more' [ply] (2;4.14); therefore, it is found in Tom's phonetic inventory for French onset sounds. Additionally, sounds were only included in the relevant phonetic inventory if there was evidence of their

accuracy over a period of at least 1 month, which amounts to roughly two data sets as sets were reported at two-week intervals (Brulard and Carr, 2003:181).

It should also be noted that the Maximal Onset Principal (MOP) was adhered to in the construction of inventories. The MOP states that, in the syllabification of disyllabic words, consonants should be syllabified onto the following onset and not the preceding coda so long as this does not violate phonotactic constraints (Carr, 2007:73-76). Thus, [b] in *c'est bon* 'It's good' [se'bɔ̃] (2;0.24) would be counted as an onset and not a coda consonant.

After constructing phonetic inventories, a more general analysis of sorting through the data for interesting patterns resumed. Vowel patterns had not been explored in the original study, yet a notable substitution pattern with [ɔ̃] seemed worthy of inquiry. The presence of [s] or [z] in French and English child forms was also deemed suitable for re-analysis.

3. Results

3.1 Phonetic inventories

Tables 1 and 2 below illustrate the onset and coda consonants Tom had in repertoire in French and English by 2;6.00. N.B. Appendix A and B contain the list of words on which these are based.

Consonants:	Stops	Nasals	Fricatives	Affricates	Approximants
English	p, b, t, d, k, g	m, n		(tʃ) (dʒ)	w, (ɹ), l, j
French	p, b, t, d, k, g	m, n	v, (s)		w, l

Table 1: Comparison of Tom's English and French onset consonants. Brackets indicate the sound was used correctly in only one word.

Consonants:	Stops	Nasals	Fricatives	Approximants
English	(p), (b), t, d, k, g	(m), n, (ŋ)	(f), θ, (s), (z)	l
French	(p), t, d	n	ʁ	(l)

Table 2: Comparison of Tom's English and French coda consonants. Brackets indicate the sound was used correctly in only one word.

Table 1 shows that the majority of onset sounds common to both English and French are present in both inventories and this is particularly true for stops, nasals and approximants. Language-specific onset consonants are only evidenced in English ([ɹ], [tʃ] and [dʒ]) with no appearance of French-only sounds i.e. the voiced uvular fricative [ʁ]. A notable gap is that of fricatives, with only [v] firmly established in French.

In contrast, Table 2 demonstrates a disparity between English and French coda consonants. Sounds common to both languages, such as the stops [p, b, t, d, k, g] and the fricatives [f, s, z], are found to some extent in English but less so in French. Language-specific coda consonants (the English dental fricative [θ]; the Standard French rhotic [ʁ]) should also be noted, for these will be discussed further on. Overall, the English coda inventory appears larger and more complete.

3.2 The use of [ʃ] & [ʒ]

Tables 3 and 4 (*below*) present all incidences of the retroflex fricatives in English and French respectively. These tables include a phonetic transcription of Tom's word forms next to the target word, the adult target form and a gloss for French words (though no claims are made about intended meaning). Note that the two disputed French/English words which contain a retroflex fricative (*mousse* at 2;4.14 and *gazelle* at 2;5.00 in the original transcription data) have not been included in either table.

Age	Target word	Target form	Child Form	Age	Target word	Target form	Child Form
2;0.24	<i>brush</i>	[bʁʌ]	[bɔʃ]	2;5.00	<i>locust</i>	[ˈlokəst]	[kɛˈlɛst]
2;0.24	<i>horse</i>	[hɔ:s]/[hɔ:rs]	[wɔʃ]	2;5.14	<i>bath</i>	[bæ/e θ]	[baʃ]
2;1.7	<i>beast</i>	[bi:st]	[biʃ]	2;5.14	<i>cassette</i>	[kəˈset]	[kɛˈʃɛst]
2;1.7	<i>braces</i>	[brɛɪsɪz]	[beˈʃɪʃ]/[beʃ]	2;5.14	<i>glasses</i>	[glɛsə/ez]	[ˈgʌʃət]
2;2.21	<i>brush</i>	[bʁʌ]	[bɔʃt]	2;5.14	<i>pushchair</i>	[ˈpʰ ʊftʃeə/ɹ]	[ˈpuʃtseə]
2;2.21	<i>nose</i>	[nouz]/[no:z]	[nozʃ]	2;5.14	<i>sausage</i>	[ˈsɔsɪdʒ]	[tɔtʃʃ]
2;2.7	<i>beast</i>	[bɪst]/[bi:st]	[biʃt]	2;5.14	<i>shallot</i>	[ʃəlˈɒt]	[tʃəˈlɔʃ]
2;2.7	<i>washing machine</i>	[wɔʃ]/[wɔ]	[wɔʃt]	2;5.14	<i>shops</i>	[ʃɒps]	[wɔʃ]
2;3.20	<i>kiss</i>	[kʰɪs]	[kɪʃ]	2;6.00	<i>beef</i>	[bi:f]	[biʃ]
2;4.00	<i>beach</i>	[bi:tʃ]	[biʃ]	2;6.00	<i>giraffe</i>	[dʒəˈɹaf]	[ʒiˈaʃ]
2;4.00	<i>mess</i>	[mɛs]	[mɛʃ]	2;6.00	<i>ice cream</i>	[ˌaɪsˈkʰɹi:m]	[ˌaɪʃˈkwɪn]
2;4.00	<i>wasp</i>	[wɒsp]	[wɔʃt]	2;6.00	<i>parachute</i>	[ˈpʰ ærəʃʊt]	[ˈpʌʃut]
2;5.00	<i>cheese</i>	[tʃi:z]	[tʃɪz]	2;6.00	<i>shorts</i>	[ʃɔ:ɔʃts]	[tʃɔt]
2;5.00	<i>fish</i>	[fɪʃ]	[tɪʃ]	2;6.00	<i>sneeze</i>	[sni:z]	[nɪz]

Table 3: Phonetic transcriptions of Tom's English word forms with [ʃ] or [ʒ] alongside target adult forms.

Age	Target word	Gloss	Target form	Child Form
2;1.7	<i>couche</i>	‘nappy’	[kuʃ]	[kuʃ]
2;1.7	<i>zizi</i>	‘willy’	[zi ¹ zi]	[zi ¹ zi]
2;2.21	<i>mouche</i>	‘fly’	[muʃ]	[muʃt]
2;3.06	<i>bonjour</i>	‘hello’	[bɔ̃: ¹ ʒuʁ]	[bu ¹ ʒu]
2;4.14	<i>bêtise</i>	‘stupidity’	[be ¹ tiz]	[be ¹ tiʃ]
2;4.14	<i>bouche</i>	‘mouth’	[buʃ]	[buʃ]
2;5.14	<i>assise</i>	‘seat’	[a ¹ siz]	[a ¹ tiʃ]
2;5.14	<i>douche</i>	‘shower’	[duʃ]	[duʃ]
2;5.14	<i>il se cache</i>	‘it/he hides’	[isəkɑ]	[kaʃ]
2;6.0	<i>chaussure</i>	‘shoe’	[ʃo ¹ syʁ]	[tʃutʃuʁ]
2;6.0	<i>olive</i>	‘olive’	[o ¹ liv]	[liz]

Table 4: Phonetic transcriptions of Tom’s French word forms with [ʃ] or [z] alongside target adult forms.

As can be seen, use of [z] is fairly circumscribed. It always replaces a voiced fricative in either language and five times out of six this is a sibilant fricative (French *olive* ‘olive’ at 2;6.0 in Table 4 being the exception). Conversely, the voiceless retroflex fricative is less predictable. For example, it can replace voiced fricatives in French (*assise* ‘seat’, 2;5.14) and English (*sausage*, 2;5.14). Furthermore, it can replace non-sibilant fricatives in English, as shown in Table 3 by *bath* (2;5.14), *giraffe* (2;6.00) and *beef* (2;6.00).

From the original list of transcription data, it can be observed that [ʃ] or [z] are used as a substitute form for at least one fricative in 29% (12/42) of French words and 28% of English words (30/109) that contain fricatives. But where do they occur exactly? Figure 1 (*below*) displays that the retroflex fricatives generally replace word-final sibilants (>50% in both languages) and occur before word-final [t] roughly 10% of the time in French and 20% in English. However, they appear in neither position more than 20% of the time.

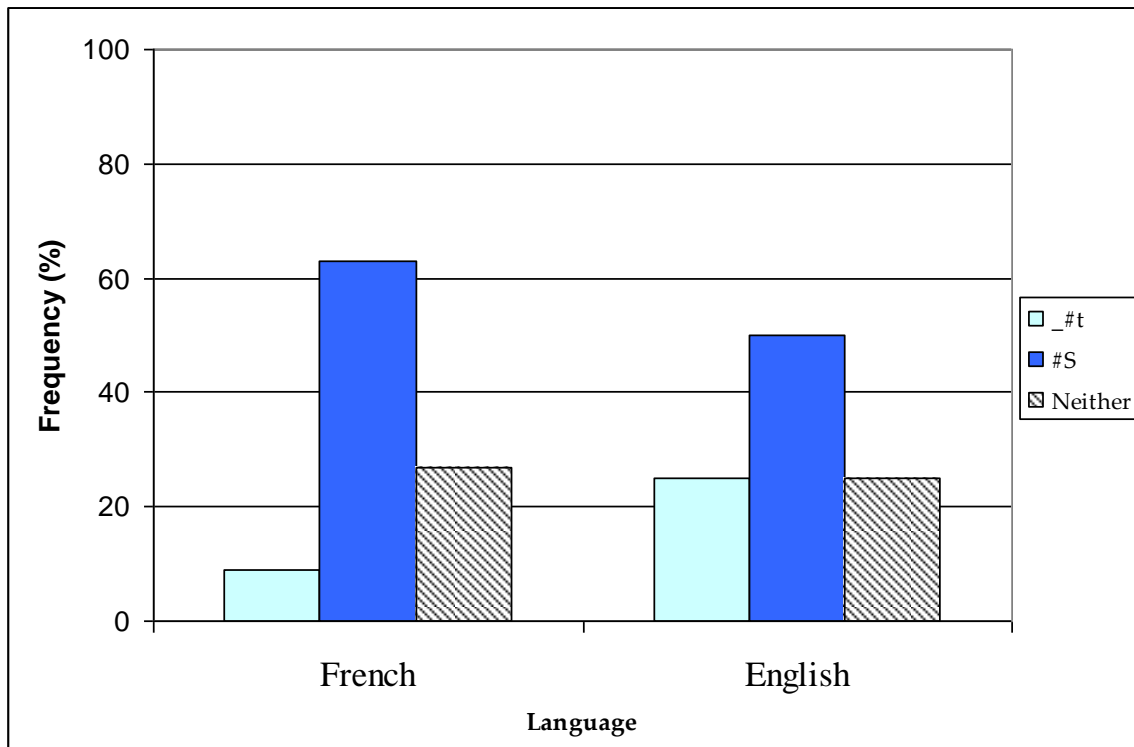


Figure 1: A chart to compare the word position of the retroflex fricatives used by Tom. Due to differences between frequency of use in French and English, quantities have been expressed as a percentage.

3.3 The vowel [ɔ]

In the list of Tom’s word forms, the vowel quality of the vowels in French match their adult target 71% (42/59) of the time. In English, this is slightly less (62% (117/189)). Hence, it is interesting to investigate the cause of this inaccuracy.

One such cause is the use of the open-mid back rounded vowel [ɔ] in substitution for another vowel. Table 5 lists all of the word forms in French and English in which this arises.

Age	Target word	Target form	Child Form	Age	Target word	Target form	Child Form
2;0.24	<i>brush</i>	[bʁʌʃ]	[bɔʃ]	2;5.14	<i>clock</i>	[kʰ lɔk]	[kʰ lɔk]
2;0.24	<i>duck</i>	[dʌk]	[kɔk]	2;5.14	<i>lock</i>	[lɔk]	[lɔk]
2;2.21	<i>brush</i>	[bʁʌʃ]	[bɔʃt]	2;5.14	<i>sausage</i>	[ˈsɔsɪdʒ]	[tɔtɪtʃ]
2;3.06	<i>cup</i>	[kʰ ʌp]	[pɔk]	2;5.14	<i>shallot</i>	[ʃəlˈɔt]	[tʃəˈlɔtʃ]
2;3.20	<i>bottle</i>	[ˈbɔtʃ]	[ˈbɔˈtɔ]	2;5.14	<i>shops</i>	[ʃɔps]	[wɔʃ]
2;3.20	<i>socket</i>	[sɔˈkɪt]	[kɔˈkɪt]	2;6.00	<i>dog</i>	[dɔg]	[dɔg]
2;4.00	<i>wasp</i>	[wɔsp]	[wɔʃt]	2;6.00	<i>slipper(s)</i>	[slɪpə(ɹ)(z)]	[ˈʔɔˈʔɔ]
2;4.14	<i>moth</i>	[mɔ θ]	[mɔ θ]	2;4.14	Fr: <i>croquette</i> ‘fried food roll’	[kʁɔˈkɛt]	[kɔˈkɛt]
2;5.00	<i>chocolate</i>	[ˈtʃɔklɛt]	[tʃɔˈkɛt]	2;5.14	Fr: <i>culottes</i> ‘pants’	[kyˈlɔt]	[kɔˈlɔt]

Table 5: A table to show the use of [ɔ] in place of another vowel in Tom’s English and French words

In English, [ɔ] replaces [ɒ] (69% - 11/16 words) or [ʌ] (25% - 4/16 words), appearing outside of this pattern only once in *slipper(s)* at 2;6.00. In French, [ɔ] is used instead of [o] or [y].

4. Discussion

The main purpose of this study was to investigate whether a re-analysis of segmental features from Tom in Brulard and Carr (2003) could shed further light on the “one phonological system or two” debate in child bilingualism. Discussion in view of this question and the above results will now take place.

4.1 Phonetic inventories

If one looks at the onset and coda consonants that are shared between the two languages, such as the bulk of stops and fricatives (Tranel, 1989: 126-127), it is apparent that even when Tom is capable of articulating a sound in one language, it may not appear in the other language’s inventory. For example, the coda stops [b, k, g] are in repertoire in English but not in French. The lack of identical phonetic inventories may indicate two separate phonological systems.

What is not obvious from the inventories alone is that most of the aforementioned language-specific sounds did not leak into the other language – apart from the French rhotic [ʁ], as stated by Vihman (2002:249). This lack of transfer gives credence to the assertion that Tom is acquiring two separate and distinct phonologies. Whilst the English inventory is larger overall, size differences can partly be attributed to adult English utilising more consonants than French (Tranel, 1989: 125).

4.2 The use of [ʃ] & [ʒ]

Brulard and Carr (2003:188) and Vihman (2002: 249) both discuss that retroflex fricatives crop up in Tom’s clusters with word-final [t], yet it is clear from Figure 1 that there is merit for their discussion as a separate pattern altogether.

Rather, it seems that [ʃ] and [ʒ] are a substitute for primarily word-final sibilants but also word-final fricatives in general. The pattern begins in English (Table 3: *brush, horse*) and transfers to French a few weeks later (Table 4: *couche* ‘nappy’, *zizi* ‘willy’) and is thereafter a consistent substitution pattern that continues for at least 5 months in Tom’s speech. The use of the same phonological process in two languages could indicate interaction between the two systems; on the other hand, it is much harder to argue that a shared substitution pattern is

relevant to phonological organisation rather than simply phonetic difficulty. By comparison, Ingram (1981/2) displayed how different substitution patterns, such as [l] for /r/ in Italian and [w] for /r/ in English in a bilingual Italian-English child, will point to two phonological systems.

4.3 The vowel [ɔ]

The open-mid back rounded vowel [ɔ] is found in both English and French phonology (Tranel, 1989:36-37); however, the vowels it substitutes for are not. The open-mid back unrounded vowel [ʌ] and the open back rounded vowel [ɒ] are present in British English (Ladefoged, 2006:39) but not French (Tranel, 1989:36-37) and the opposite holds true for [o] and [y]. Perhaps then Tom is using a vowel found in both systems to replace language-specific sounds he is less comfortable with in production.

Another possibility is that the proximity of the vowels in phonetic space may have caused categorisation problems, as they are all open/open-mid back vowels except for [y]. This explanation would not necessarily imply one or two systems but simply language development problems.

The use of a cross-linguistic phonological process may signify at least interaction between Tom's French and English systems but the paucity of incidences in French means that no firm generalisation can be made.

4.4 Evaluation and suggestions for further research

The outcome of Brulard and Carr (2003) was mixed in respect of whether Tom had one production system or two but a re-analysis of segmental evidence leads one to believe he may have separate but non-autonomous systems.

From a methodological viewpoint, a concentration on phonetic data alone has pitfalls. Johnson and Wilson (2002:275) argue that the most persuasive evidence on bilingual language differentiation comes from prosodic and acoustic analysis and that a focus on segments may illustrate merely that a child has a large, varied phonetic inventory (a view shared by Lleó and Kehoe, 2002:234). However, this study has attempted to focus on how Tom maintained distinctions between the two languages, which Johnson and Wilson (2002: 276) note as a useful contribution to simultaneous bilingual research.

It will always be problematic to clarify whether two-year-old bilingual children have one or two phonological systems, especially considering the difficulty of separating out general language development issues from those specific to simultaneous bilinguals. Perhaps asking the question entirely is unnecessary (Vihman, 2002). Nevertheless, further research on segmental data with a large sample of children and a tightly-controlled methodology fit for replication, like that of Fabiano-Smith and Barlow (2010), can still generate findings of importance and may yet help detach the problems of language differentiation from that of disorder.

Word count (excluding tables and figures): 2169

5. References

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6. Appendices

Appendix A: Tables related to English sounds

Consonant	Word 1	Token	Word 2	Token
p	<i>peg</i> (2;2.7)	[pɛg]	<i>paper</i> (2;3.20)	[pe'pəp]
b	<i>rabbit</i> (2;0.24)	[ba'brɪ]	<i>bottle</i> (2;2.7)	['bɔ'tɒ]
t	<i>train</i> (2;0.24)	[twɛn]	<i>trip</i> (2;4.00)	[twɪt]
d	<i>dead</i> (2;3.06)	[dɛd]	<i>digger</i> (2;5.00)	['dɪgə]
k	<i>cat</i> (2;0.24)	[kæt]	<i>cooker</i> (2;2.21)	[ku'kʊk]
g	<i>gone</i> (2;3.20)	[gɔn]	<i>grape</i> (2;5.14)	[gweɪ]
m	<i>milk</i> (2;0.24)	[mɪlk]	<i>money</i> (2;2.21)	[ma'ni]
n	<i>knob</i> (2;2.21)	[nɒb]	<i>nut</i> (2;6.00)	[nʌt]
tʃ	<i>chocolate</i> (2;5.00)	[tʃɒ'kɛt]		
dʒ	<i>jacket</i> (2;0.24)	[dʒæk]		
w	<i>wet</i> (2;1.21)	[wet]	<i>wasp</i> (2;4.00)	[wɒʃt]
ʒ	<i>train</i> (2;6.00)	[tʁɛn]		
l	<i>look</i> (2;2.21)	[lʊk]	<i>plum</i> (2;5.00)	[plʌn]
j	<i>onion</i> (2;4.00)	['anjən]	<i>puke</i> (2;5.00)	[pjʊx]

Table 6: A table that lists the words from which the inventory of English onset sounds is derived.

Consonant	Word 1	Token	Word 2	Token
p	<i>soup</i> (2;5.14)	[tʌp]		
b	<i>tub</i> (2;4.00)	[pʌb]		
t	<i>bucket</i> (2;1.7)	[bʌ'kit]	<i>hat</i> (2;3.06)	[ʔat]
d	<i>dead</i> (2;3.06)	[dɛd]	<i>bad</i> (2;5.14)	[bʌd]
k	<i>duck</i> (2;0.24)	[kʌk]	<i>sock</i> (2;2.21)	[kɒk]
g	<i>leg</i> (2;3.06)	[lɛg]	<i>big</i> (2;5.14)	[bɪg]
m	<i>shampoo</i> (2;5.14)	[ʔʌm'bu]		
n	<i>train</i> (2;0.24)	[tweɪn]	<i>come in</i> (2;3.20)	[kʌ'mɪn]
ŋ	<i>blanket</i> (2;5.14)	['blʌŋkɪt]		
f	<i>wolf</i> (2;6.00)	[wʌf]		
θ	<i>teeth</i> (2;4.14)	[tiθ]	<i>mouth</i> (2;6.00)	[mauθ]
s	<i>glass</i> (2;6.00)	[glʌs]		
z	<i>clothes</i> (2;6.00)	[kloz]		
l	<i>ball</i> (2;1.21)	[bɔl]	<i>pill</i> (2;2.21)	[pɪl]

Table 7: A table that lists the words from which the inventory of English coda sounds is derived.

Appendix B: Tables related to French sounds

Consonant	Word 1	Gloss	Token	Word 2	Gloss	Token
p	<i>petit</i> (2;2.21)	‘small’	[pə ^l ti]	<i>plus</i> (2;4.14)	‘more’	[ply]
b	<i>baguette</i> (2;1.7)	‘baguette’	[ba ^l get]	<i>bol</i> (2;2.7)	‘bowl’	[bɔl]
t	<i>t’es là?</i> (2;2.7)	‘you’re here?’	[tɛ ^l la]	<i>à tout à l’heure</i> (2;4.00)	‘see you later’	[ʔata ^l lɛχ]
d	<i>dehors</i> (2;1.21)	‘outside’	[dø ^l ɔχ]	<i>donnes</i> (2;2.21)	‘gives’	[dɔn]
k	<i>encore</i> (2;0.24)	‘again’	[ɑ ^l kɔχ]	<i>coton</i> (2;2.7)	‘cotton’	[kɔ ^l tɔ̃]
g	<i>baguette</i> (2;1.7)	‘baguette’	[ba ^l get]	<i>guèpe</i> (2;4.00)	‘wasp’	[gɛt]
m	<i>mouche</i> (2;2.21)	‘fly’	[muʃt]	<i>mimines</i> (2;4.00)	--	[mi ^l min]
n	<i>canard</i> (2;0.24)	‘duck’	[ka ^l naʁ]	<i>minute</i> (2;2.21)	‘minute’	[mi ^l nyt]
v	<i>au revoir</i> (2;2.7)	‘goodbye’	[ʔovwaχ]	<i>tu vois?</i> (2;5.00)	‘you see?’	[tu ^l vwa]
s	<i>C’est bon</i> (2;0.24)	‘it’s good’	[se ^l bɔ̃]			
w	<i>Oh oui!</i> (2;2.7)	‘oh yes!’	[o ^l wi]	<i>tu vois?</i> (2;5.00)	‘you see?’	[tu ^l vwa]
l	<i>t’es là?</i> (2;2.7)	‘you’re here?’	[tɛ ^l la]	<i>câlin</i> (2;3.20)	‘cuddle’	[ka ^l lɛ̃]

Table 8: A table that lists the words from which the inventory of French onset sounds is derived.

Consonant	Word 1	Gloss	Token	Word 2	Gloss	Token
p	<i>pipe</i> (2;2.21)	'pipe'	[pip]			
t	<i>baguette</i> (2;1.7)	'baguette'	[ba'get]	<i>minute</i> (2;2.21)	'minute'	[mi'nyt]
d	<i>pintade</i> (2;3.20)	'guinea fowl'	[ba'dad]	<i>(re)gardes!</i> (2;5.00)	'look!'	[gaʁd]
n	<i>donnes</i> (2;2.21)	'gives'	[dɔn]	<i>mimines</i> (2;4.00)	--	[mi'min]
ʁ	<i>canard</i> (2;0.24)	'duck'	[ka'naʁ]	<i>(re)gardes!</i> (2;5.00)	'look!'	[gaʁd]
l	<i>bol</i> (2;2.7)	'bowl'	[bɔl]			

Table 9: A table that lists the words from which the inventory of French coda sounds is derived.