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(Citation)

Learner Corpus Studies in Asia and the World, 2:215-225

(Issue Date)

2014-05-31

(Resource Type)

departmental bulletin paper

(Version)

Version of Record

(JaLCD0I)

<https://doi.org/10.24546/81006702>

(URL)

<https://hdl.handle.net/20.500.14094/81006702>



A Preliminary Investigation of /CC/ Clusters Acquisition by
 Japanese Learners of French Using Oral Corpora
 —Methodological Insights—

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Abstract

We present the methodological framework of an ongoing corpus-based longitudinal study aiming at characterizing the segmental and syllabic interphonological development of Japanese learners of French, both in perception and production, embedded in the international research programme *InterPhonologie du Français Contemporain* (Interphonology of Contemporary French). In this article, we focus on the acquisition of biconsonantal /CC/ clusters and discuss some methodological aspects of corpus-based second language phonological research: the necessity of multitasking on the one hand, and the development of ad hoc procedures for large-scale production data analysis on the other hand. The first one is illustrated in our protocol with three types of task (word repetition, word reading and syllabic counting) and the second one with the design of a semi-manual coding scheme, aiming at providing the researcher with a data-mining tool for automatic data recovery and descriptive statistics of learners' productions.

Keywords

Oral corpus, Japanese learners of French, Pronunciation, Syllabic structure

I Introduction¹⁾

The use of oral corpora to investigate second (or third) language (hereafter L2) phonetic-phonological development is a relatively new branch of corpus linguistics (Gut, 2009; Durand, Kristoffersen & Gut, to appear) in the field of Second Language Acquisition. Indeed, most learners' corpora (initially written and subsequently oral databases) have often been designed to investigate lexical and grammatical features of their interlanguages (e.g. the FLLOC corpus, Myles, 2008). Following Detey, Durand, Laks and Lyche (to appear), we define a corpus of spoken language as "a collection of recordings which are available in a computer-readable form (e.g. wav format) and which are accompanied by transcriptions and annotations aligned with the signal. The transcriptions and annotations should be in standardized formats [...] or in formats easily convertible to them (e.g. Praat texgrids [...]). They should contain essential metadata: information about how and when the recordings were made, how the speakers were selected and who the speakers are (age, sex, social status, etc.). The transcriptions and annotations should be accompanied by a documentation explaining how they were devised" (chap. 1). In the area of interphonology studies, the segmental domain (including coarticulation effects) has been the primary focus of phoneticians (e.g. Flege, 1987; Strange, 2007), while prosody has only recently started to be more widely investigated (e.g. Trouvain & Gut, 2007). Syllabic structure (and phonotactics constraints), on the other hand, has been rather well documented by second language phonologists in standard rule-based (e.g. Tarone, 1980; Broselow, 1983; Carliale, 1991; Ross, 1994) or more recent constraint-based models (see Hancin-Bhatt, 2008), but most of the studies have concentrated on English as the target language, and corpora have scarcely been used. In this article, we present an ongoing longitudinal research project aiming at describing the acquisition of French phonology by Japanese learners, both in perception and production, embedded in the general framework of a larger corpus-based international research programme, the *InterPhonologie du Français Contemporain* project (IPFC) (Detey & Kawaguchi, 2008; Racine, Detey, Zay & Kawaguchi, 2012), which itself is the non-native offshoots of the *Phonologie du Français Contemporain* project (PFC) (Durand, Laks & Lyche, 2009). More specifically, the project aims at documenting the acquisitional paths of five phonological sets: nasal vowels, high rounded oral vowels, the French sandhi phenomenon known as *liaison*, the liquids /R/³ and /l/ and the obstruents /b/ and /v/, as well as biconsonantal syllabic clusters /CC/. In what follows, we focus on consonantal clusters and general methodological issues illustrated with preliminary results in perception.

II The acquisition of biconsonantal clusters by Japanese learners of French

Japanese learners of a given target language (TL) are known to struggle when it comes to acquiring complex syllabic structures (as is the case in English or French for instance), since the basic moraic system of the Japanese phonological system follows a monomoraic (C)V template: consonantal clusters and codas are usually not allowed in Japanese. Many studies in the fields of psycholinguistics, loanword phonology and second language acquisition have documented the way Japanese speakers usually handle these structures (typically with vocalic epentheses, i.e. insertion of a vowel between the two consonants, even though the deletion of one of the two consonants and/or the modification of one the segments is also a possible strategy): some researchers argue that perception plays an essential role in the process (e.g. Peperkamp & Dupoux, 2003), while others defend the importance of phonological constraints (see Rose & Demuth, 2006, as well as Dohlus, 2010). Other factors, such as orthographic representations (Detey & Nespoulous, 2008) or loanword adaptation conventions (Haunz, 2007) have also been put forward to account for the way these structures are processed. Yet, to our knowledge, no study has investigated the issue in French, in production and perception, over a period of nearly two years in a corpus-based approach.

In their study of the audiovisual processing of /CC/ clusters by Japanese learners of French, Detey and Nespoulous (2008) used a metaphonological task (syllabic counting) to address the same issue, and obtained different results for /s/+consonant (/sC/) clusters on the one hand and Obstruant+Liquid (OBLI) clusters on the other hand, which fit with previous results in the literature related to sonority distance: more epenthesis for /sC/ clusters than for OBLI clusters. A comparable task of syllabic counting has also been used by Erickson, Akahane-Yamada, Tajima and Matsumoto (1999) to assess the perception of rhythm-bearing units by Japanese learners of English, a task which engages not only auditory perception but also metaphonological awareness and phonological metric categories. However, in order to describe more accurately the process by which Japanese learners acquire complex syllabic clusters, a multi-task protocol, used in a longitudinal study is needed, assessing both the perceptual side, the phonetic production side, as well as the metaphonological dimension of their learning process, which is what we have been carrying out in the CLIJAF project described in the following section.

III The CLIJAF project ²⁾

The methodological protocol of the CLIJAF project (*Corpus Longitudinal Interphonologique d'Apprenants Japonais de Français*) is divided into two parts: on the perception side, an AXB task (to test segmental discrimination ability) and a syllabic counting task (to test the speech segmentation ability in the case of /CC/ clusters) using

bisyllabic, trisyllabic and quadrisyllabic non-words (e.g. “aplapa”); on the production side, we use the generic protocol designed for the IPFC project, consisting of: 1) the repetition of a Japanese-specific wordlist, 2) the reading of a generic wordlist (common to all PFC and IPFC surveys), 3) the reading of the Japanese-specific wordlist, 4) the reading of a generic text (common to all PFC and IPFC surveys). The perceptual experiment was performed with an online experimental platform designed for the project (*Labguistic*), while the productions tasks were carried out online with a Moodle system. In order to avoid a major pre-identification effect, the perception session preceded the production session. This protocol has been used four times over a period of nearly two years at Tokyo University of Foreign Studies with Japanese first year students (mean age 19 at the time of the first recording), who just started to learn French as beginners (after respectively 4 months, 7 months, 12 months and 19 months of study), in a multimedia classroom, equipped with individual monitors and microphone-headphones sets. The number of participants changed over the course of the two years, so that we tested 39 students for the first session, 27 for the second, 24 for the third and 20 for the fourth.

In the perceptual part of the survey devoted to syllabic counting, three independent variables were involved: learning stage (from 1 to 4 over two years), position in the word (word-initial or word-medial), nature of the cluster (two categories: /sC/ and OBLI). Subjects were instructed to count the number of syllables (“onsetsu” in Japanese) in the French stimuli they would hear. Examples of syllabic segmentation in French were provided and the stimuli were presented as “parts of French words”, e.g. (“trapa” would be the final part of “attrapa” = ‘caught’ in English). Fillers with schwa were also randomly inserted in the list of stimuli, providing pairs such as /spapa/ vs /s@papa/ (the “@” symbol represents a schwa vowel in SAMPA alphabet). Subjects listened twice to each stimulus and had to click on a button below a number between 2 and 4 on the screen within 5 seconds.

In the production part of the survey, three sets of data have been collected: 1) repetition and reading of the Japanese-specific wordlist (focusing on OBLI clusters with the following words: “gras”, “glas”, “le gras”, “le glas”, “aigre”, “aïgle”, “exprimé”, “expliqué”); 2) reading of the PFC wordlist (which includes consonantal contacts – tautosyllabic or not - in the following series: “intact, nous prendrions, islamique, infect, brun, ex-femme, socialisme, aspect, creux, bouleverser, explosion, influence, ex-mari, étrier, brin, blanc, slip, peuple, extraordinaire, meurtre, vous prendriez, étriller, feutre, quatrième, trouer, creuse, brun, brin”); 3) the PFC text (which includes several of these clusters as well as triconsonantal clusters, e.g. /pR/ and /stR/ (in Reference French, see Lyche, 2010) in the first sentence of the text “Le premier ministre ira-t-il à Beaulieu?”).

The overall objective of the study is to examine whether, on a span of time of two years of university learning, there are some noticeable acquisitional differences between: 1) perception and production; 2) tasks (word repetition vs word reading vs text reading vs

non-words syllabic counting) ; 3) consonants (especially /sC/ vs /OB+R/ vs /OB+L/). Beside the experimental insight it provides us with for psycholinguistic modelization, it can also be useful for pedagogical applications in terms of teaching objectives and pronunciation curriculum.

IV Preliminary results in perception and methodological issues

One of the difficulties we encounter when investigating the acquisition of /CC/ clusters by Japanese learners of French partly lies in the distinction between the phonetic level (which corpus can help investigate) and the phonological level (which perceptual experiments can probe to some extent). In terms of perception, one can think of an elaborate set of tasks aiming at distinguishing whether a C@CV unit or a CCV is perceived, and the syllabic counting task included in the CLLJAF protocol is one of the most straightforward. The preliminary results obtained at this stage show an overall improvement in the correct identification of the number of syllables over the four sessions (with both /CC/ target stimuli and fillers in both initial and medial positions): 21.27% of incorrect answers in session 1, 18.69% in session 2, 16.21% in session 3 and 15.23% in session 4. When we consider the /CC/ target stimuli only, the rates of incorrect answers highlight a sharper difference between sessions 1 & 2 on the one hand (with respectively 18.51% and 18.87% of errors) and sessions 3 & 4 on the other hand (with respectively 13.93% and 12.19% of errors). These preliminary figures show a positive learning trend in terms of metaphonological ability to segment and count the number of syllables included in the stimuli, but it does not give us any insight in the metrical grid involved in their production in French. Testing both sides of the phonological competence is essential, especially if we consider psycholinguistic models of speech production such as Levelt and colleagues' (Levelt & Wheeldon, 1994; Cholin, 2008), which posits the existence of a mental syllabary, with articulatory gestural scores ready to be phonetically encoded, at least for high-frequency syllables

When it comes to production data, however, there is always a certain degree of uncertainty concerning the actual presence or absence of a phonological element between the two consonants. Whether subjects are actually producing /CCV/ or /CdevoicedVCV/ units (which can be interpreted as an interlanguage-related epenthesis process followed by a devoicing rule, as in /spat/ ('spat') in English actually realized as [sɰpat] (see Major, 1987; Ross, 1994)), or whether the inserted vowel is epenthetic (phonological) or exrescent (phonetic) (Shibuya & Erickson, 2010), the TL-like surface form cannot always, even through detailed acoustic analysis, reveals the phonological units involved at a higher cognitive level: hence the usefulness of investing perception, production and metaphonological awareness with the same subjects. Moreover, using a corpus-approach to handle the production data, should enable the researcher to minimize the impact of idiosyncrasies and performance errors thanks to the leveling

Target C1	Target C2	Target C3	Target C4	Left context	Right context
01 = [p]	01 = [p]	00 = null	00 = null	1 = ##	1 = ##
02 = [b]	02 = [b]	01 = [p]	01 = [p]	2 = V#	1 = #V
03 = [m]	03 = [m]	02 = [b]	02 = [b]	3 = V	1 = V
04 = [f]	04 = [f]	03 = [m]	03 = [m]		
05 = [v]	05 = [v]	04 = [f]	04 = [f]		
06 = [t]	06 = [t]	05 = [v]	05 = [v]		
07 = [d]	07 = [d]	06 = [t]	06 = [t]		
08 = [n]	08 = [n]	07 = [d]	07 = [d]		
09 = [l]	09 = [l]	08 = [n]	08 = [n]		
10 = [s]	10 = [s]	09 = [l]	09 = [l]		
11 = [z]	11 = [z]	10 = [s]	10 = [s]		
12 = [S]	12 = [S]	11 = [z]	11 = [z]		
13 = [Z]	13 = [Z]	12 = [S]	12 = [S]		
14 = [k]	14 = [k]	13 = [Z]	13 = [Z]		
15 = [g]	15 = [g]	14 = [k]	14 = [k]		
16 = [R]	16 = [R]	15 = [g]	15 = [g]		
		16 = [R]	16 = [R]		

Fig. 2 Left section of the code for /C₁C₂C₃C₄/ clusters in CLLJAF (basic version, in SAMPA)

Output	C1	C2	C3	C4
1 = Targetlike	10 = Targetlike	10 = Targetlike	00 = null	00 = null
2 = Uncertain	15 = Prosthesis	20 = Epenthesis	10 = Targetlike	10 = Targetlike
3 = Altered	20 = Epenthesis (after C1)	(after C2) 30 = Deletion	20 = Epenthesis (after C3)	20 = Epenthesis (after C4)
	30 = Deletion	4X = Metathesis	30 = Deletion	30 = Deletion
	4X = Metathesis with X = 2, 3, 4	with X = 1, 3, 4	4X = Metathesis with X = 1, 2, 4	4X = Metathesis with X = 1, 2, 3
	50 = Change	50 = Change	50 = Change	50 = Change
	60 = XDeletion	60 = XDeletion	60 = XDeletion	60 = XDeletion

Fig. 3 Right section of the code for /C₁C₂C₃C₄/ clusters in CLLJAF (basic version)

The first four fields allow us to identify up to four consonants in the target cluster (quite frequent in French with verbs such as *exprimer* = 'to express') using a double digit code for each consonant (e.g. 01=[p]). Even though not all combinations are possible in

French, that choice strengthens the coherence of the overall coding scheme within the IPFC project, since the same values are used for the characterization of each independent consonant in studies devoted to the segmental realizations of learners' productions (e.g. the realizations of /R/ and /l/). The fifth and sixth fields are used for the left and right context description (word initial/final, pre/post-vocalic, with/without word boundary). The eighth field offers a first global description of the cluster, and the last four fields allow for a more refined characterization of each of the segments involved: prosthesis= addition of a vocalic segment before the consonant, epenthesis= addition of a vowel after the consonant, deletion= deletion of the consonant, metathesis= segmental swap with another consonant of the cluster, change= segmental modification of the consonant, XDeletion indicates that one of the consonants has disappeared but without specifying which one, e.g. *facteur* 'mailman' realized as [fas9R] (in SAMPA phonetic alphabet). The data thus coded is then processed by the Dolmen platform, an open-source software for phonological analyses with plugins specifically developed for the IPFC project (Eychenne & Paternostro, to appear). Once the data coding stage is completed (currently under process), we should be able to quickly draw a rather detailed portrait of learners' acquisition of /CC/ clusters and compare it with the results obtained in the perception-based syllabic counting task.

V Conclusion

In this article, we describe the methodological framework of a corpus-based longitudinal study (four sessions over two years), in perception and production, of the acquisition of French phonology by beginner Japanese university students in Japan. We focus on biconsonantal clusters (common in French but not allowed in Japanese) and argue for the necessity of a multi-task protocol, which we illustrate with three tasks: repetition (which involves auditory perception and oral production), reading aloud (which involves graphophonemic activation and text-based oral production) and syllabic counting (which involves auditory perception and metaphonological awareness). The preliminary results of the syllabic counting task point to an overall improvement in correct identification over the four sessions, but the local analysis of individual production data may potentially not allow us to draw any conclusion on the actual acquisition of the /CC/ structure at a phonological level. Corpus-based analyses are thus needed to distinguish idiosyncrasies and performance errors from actual recurrent patterns in non-native productions. In order to semi-automatically process such large amounts of data, we have designed a coding scheme with an ad hoc software, which we describe in the latter part of the article.

Notes

- ¹⁾ We would like to thank Julien Eychenne for his essential contribution to the project described in this article.
- ²⁾ The CLIJAF project has been supported by a Grant-in-Aid for Scientific Research (B) from the MEXT and the JSPS (n°23320121).
- ³⁾ We use this symbol to represent a generic underspecified segment (see Lyche, 2010).

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