L2 Epenthesis and Ellipsis:
A Perspective of Radical CV Phonology

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ABSTRACT
This article investigates L1 syllable structure's influence on the epenthesis and ellipsis in L2 speech production and introduces the Radical CV Phonology approach into the theorizing of second language phonology. In the experiment of this study, participants were induced to produce nonwords of the syllabic structure of their L1 or L2 or neither so that we can examine the syllable's relationship with epenthesis and ellipsis frequency in speech. The results of the experiment indicate a causal relationship between L1 syllable structure and L2 mispronunciation. We also find the epenthetic and elliptic instances match the RCVP's modeling of the syllable and then succeed in representing the syllable structure of an ESL learner that entails all syllables he may produce.

Keywords: *Syllable structure, L2 phonology, Epenthesis, Ellipsis, Speech error predictivity.*

1. INTRODUCTION

In the history of language science or linguistics, great emphasis has been put on the study of speech sounds, i.e. phonetics and phonology. For students of English as a second language (ESL), the sound system of English is among the most arduous in acquisition, as is evidenced by the early fossilization of L2 phonological acquisition observed by second language acquisition research, and thus, they tend to mispronounce from time to time. Enquiries into the problems caused by the phonological differences between one's first language (L1) and second language (L2) fall into the domain of L2 phonology. Our study investigates epenthesis and ellipsis, the two most frequent mispronunciation types in Chinese ESL students and ESL students whose L1 is of strict consonant-vowel or consonant-vowel-consonant structure. We aim to determine the influence of L1 syllabic structure on L2 mispronunciation and account for it using the formal device of Radical CV Phonology (RCVP).

### 1.1. L2 Mispronunciation and the Syllable

Languages differ not only in segmental inventory but also in how they combine the segments they own. Many phonologists support the view that "segments in the lexicon are syllabified" [3,10], indicating that the syllable is a major factor in phonotactics. Solid research has proven L1 syllable structure's positive correlation with the epenthesis in L2 perception [1,2,4,5]. In this study,

we have designed an experiment that combines the use of nonword with the event description task to test whether this correlation is also true of L2 speech production.

1.2. RCVP and the Syllable

van der Hulst [8] proposed RCVP as a variant of Dependency Phonology (DP) [9,12,13] mainly to model segmental structure with only two elements, C and V. In the latest development of RCVP, besides great improvement in segmental structure account, van der Hulst [10] has integrated a thorough and solid "syntax" of C/V combinations for syllabic structure into RCVP. The choice of the symbols (C and V) for the two elements is motivated by the fact that, in a syllable, a Consonant is favored in the onset head position and a Vowel in the rhymal head position. C/V opposition can represent relative perceptual salience, with V indicating the higher salience. Due to space limit, we refrain from introducing how RCVP evolved from DP and its relevance to other models such as Government Phonology [11] and Feature Geometry [6,7]. RCVP [10] provides a model capable of representing the multi-level C/V dependency relations of the syllable, as can be seen in structure (1).

RCVP has the potential to provide representations of syllabic structures of all languages. In the RCVP geometry, vertical lines indicate heads and slant lines connect dependents to their heads. As (1) shows, RCVP disallows "onsets consisting of two obstruents,

(1)
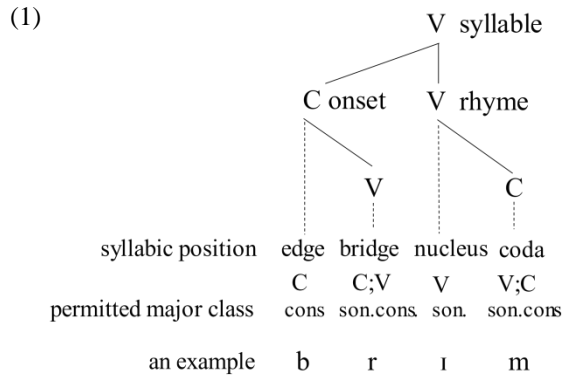
two sonorant consonants and sonorant consonant followed by an obstruent [and] obstruents […] as nuclei and as codas", but "an addition consonant could be adjoined to the syllable node, on either the left or the right edge" [10].

1.3. Objectives and Significance

This study seeks to determine the effect of L1 syllable structure on L2 production and attempts to explain this effect with a formal approach. Based on the RCVP model, we hypothesize: Unintentional epenthesis and/or ellipsis occur where the given segment will incur the other C/V construction than fits the corresponding syllabic position, including the possible adjunct position, of any acquired structure in order to re-form the illegitimate syllable into legitimate syllable(s).

We will also use the RCVP to formally analyze the data we induce through the experiment to see whether it is consistent with our hypothesis. This will add to our understanding of the interactions between phonological representations and implementation processes.

2. METHOD

We devised a "non-word description task" for speech elicitation; the experiment was programmed and conducted with PsychoPy3 (2020.2.10) and participants' descriptions were recorded with Audacity software.

2.1. Design

The experiment was divided into two parts, each with two levels of the syllable structure factor, which in part 1 were legitimate syllable contact (SC) in L1, and legitimate SC only in L2, and in part 2, legitimate onset in L2 and illegitimate onset in both languages. There were two participant groups, English majors (3 acquisition levels according to their TEM8 scores) and non-English majors (6 acquisition levels according to their CET4 scores).

2.2. Material

The material falls into four groups（see Table 1 and Table 2）. The "L1 legit SC group" exhausts the possibilities of syllable contact in Chinese and the "L2 legit SC" group is meant to include the contact of as many types of coda consonant and onset consonant as possible.

Table 1. Material used in part 1.

L1 legit SC	L2 legit SC
finlo	fiblo
banta	bapta
kundi	kusdi
ganpi	gatpi
henma	hejma
dunby	dufby
jandi	jakdi
lindu	limdu
mangfa	masfa
pingba	pilba
songly	sotly
tengwu	tezwu
zingto	ziwto

The nonwords in part 2 have onsets disallowed in the Chinese. The "L2 legit onset" tests onsets allowed in English and the last group tests onsets existing in neither Chinese nor English.

Table 2. Material used in part 2.

L2 legit onset	L1 & L2 Illegit onset
bime	btime
kake	ktake
speel	skpeel
splick	spflick
spride	spkride

2.3. Participants

There were 34 participants (24 non-English majors and 10 English majors). They were all undergraduates and graduates at the University of Chinese Academy of Sciences.

2.4. Procedure

A nonword appears on one of the five positions, i.e. up, down, left, right and middle, on the display (see Figure 1), and the participant is requested to describe the nonword with the following form: I see X up/down/left/right/in the middle (X being the nonword). The descriptions are recorded backstage.

finlo

Figure 1 A trial where the nonword "finlo" is shown on the left of the screen and the participant should say "I see 'finlo' left".

3. RESULTS

We obtained the mispronunciation rate of each participant in part 1 and part 2 and conducted a univariate ANOVA respectively on the part 1 and part 2 data to see if syllable structure has a main effect on the mispronunciation frequency.

3.1. Statistics

Statistical analysis has been carried out with SPSS 26 on the significance and effect size of syllable structure (SS) and acquisition level (AL) in the change of mispronunciation frequency. Results are shown in the table below:

Table 3. The sigs. (p values) of the two factors in part 1 & part 2.

	AL 1	SS 1	AL 2	SS 2
Non E-majors	.147	.000	.013	.000
E-majors	.553	.009	.145	.033

The results show that L1 syllable structure has a significant effect on mispronunciation frequency. The data we acquired may be conducive to more findings if further analyzed, which is reserved for our follow-up study. Participants produced various epenthetic and/or elliptic forms for one nonword. Owing to the limited space, here we only list the mispronounced forms of the nonword "spflick" to illustrate their variety in color and relative scarcity in position. We use square brackets "[]" to indicate epenthetic segments, which is written in IPA, and round bracket "()" to indicate elliptic segments.

3.2. Mispronunciation Forms

Participants produced various epenthetic and/or elliptic forms for one nonword. Owing to the limited space, here we only list the mispronounced forms of the nonword "spflick" to illustrate their variety in color and relative scarcity in position. We use square brackets "[]" to indicate epenthetic segments, which is written in IPA, and round bracket "()" to indicate elliptic segments (Table 4).

Table 4. The mispronunciations of the nonword "spflick".

| Original form	spflick
Mispronounced forms	sp[ɯ]flick
	spf[ɯ]lick
	sp[u]flick
	sp[u]f(l)ick
	sp[ə]flick
	sp[ɚ]flick
	s(p)f[ə]lick
	sp[ə](f)lick
	sp(f)lick
	(sp)flick
	sp[ɑ]flick
	sp[ɪ]flick
	sp[i]flick
	sp[i](f)lick

4. DISCUSSION

This study has determined the relationship between L1 syllable structure and epenthesis and ellipsis in L2 production and found that the way segments are inserted or omitted in a word is predictable by RCVP.

Lett us take the nonword "spflick" as an example. [p] and [f] are all obstruents, the combination of the two sounds is prohibited in a syllable according to RCVP (see structure (1) in 1.2). A [s] sound is a legitimate adjunct to the onset node on the left edge and both [p] and [f] are legitimate C-heads for the sonorant consonant dependent [l]. Then, if bound to be produced, "spflick" needs to re-syllabify, i.e. the addition of a vowel to make "sp" a syllable itself or the deletion of one segment in "pf", and sometimes both occur as long as the final production is legitimate. But these are for the formation of a possible syllable dictated by RCVP, which entails all simpler syllable structures. We believe that L2 speakers invoke their acquired structure (AS), one that is more complex than L1 structure and less complex than L2 structure, for epenthesis and ellipsis. The fact that a participant realized "spflick" as "sp[u]f(l)ick" is a vivid illustration of this point.

(2)

V Syllable

C Onset   V Rhyme

C Coda

n,ŋ
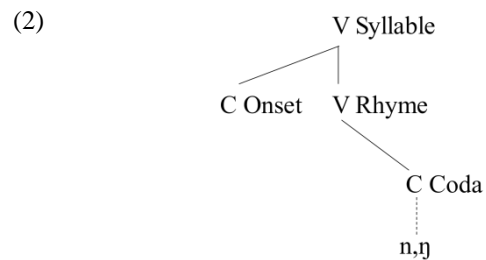
The syllabic structure of Mandarin Chinese could be represented as structure (2) above. The structure for "sp[u]f(l)ick" is as follows:

(3)
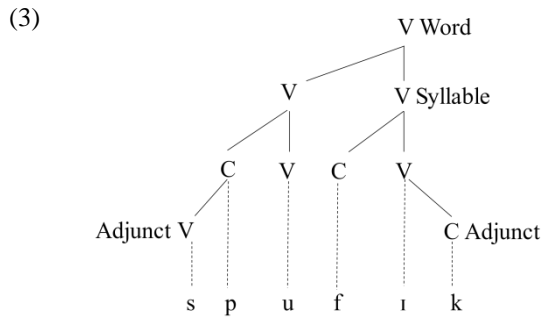
By adding, to the Mandarin syllable structure, the C/V constructions which it does not contain but are present in the structure for the mispronunciation, namely those of adjuncts allowed in English, we obtain the said participant's AS:

(4)
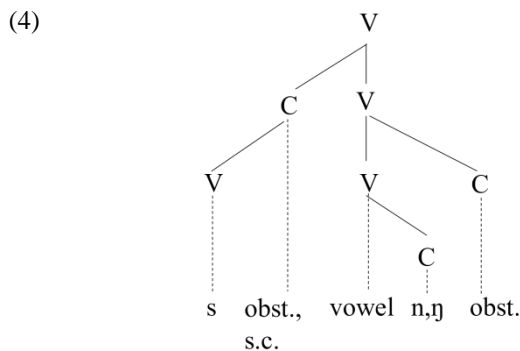
This structure is also supported by the participant's other cases of epenthesis and ellipsis. The participant's treatment of "spflick" can be expressed as "sp & flick"; then, "sp" and "flick" are minimallly syllabified as [spu] and [fɪk] according to this AS. The non-branching onset C node indicates that the participant has only one position for both obstruents and sonorant consonants. It can be predicted that any syllable that is more complex than the AS will be epenthesized or pruned by the speaker.

5. CONCLUSION

This study has proven (1) that L1 syllable structure is a major cause of L2 epenthesis and ellipsis and (2) that this effect may decrease with the rise in L2 acquisition level and (3) provided empirical support for the RCVP syllable model and our RCVP-based hypothesis about why and how epenthesis and ellipsis occur (see 1.3).

This article has also (4) verified the feasibility of deducing, from the difference between the RCVP representations of a student's L1 syllable structure and mispronunciation structure, their acquired structure (AS), which could be a significant indicator of phonological acquisition level and the direction of pedagogical improvement.

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