Prosodic Word in Chengdu Dialect

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Abstract

This paper will present a study on the prosodic word (hereafter PW) in Chengdu Dialect (CD), one of the prosodic constituents in the prosodic hierarchy [1] [2] [3] [4]. It argues for the existence of PW in CD by showing 1) that PW, as defined perceptually as an inseparable entity, constitutes the convergent domain of the application of a few tone and segmental sandhi rules, and 2) that this PW can not be matched with any constituent in the morpho-syntactic hierarchy, and 3) the domain of the application of these sandhi rules can not be stated in morpho-syntactic terms.

Index terms: Chengdu Dialect, prosodic word, prosodic constituents, morphology-phonology mismatch

1. Introduction

So far little has been said about the prosodic structure of Chengdu dialect (CD), a dialect, which is spoken by the greater majority of people in Chengdu, capital city of southwest China's Sichuan province, and which belongs to Southwest Mandarin, a branch of Northern Chinese (also called "Mandarin" in broad sense). This paper will present a study on the prosodic word (hereafter PW) in CD, one of the prosodic constituents in the prosodic hierarchy. It shows that PW does exist in CD.

2. About the data to be analyzed

The present study aims to investigate the prosody of natural speech of CD. For this reason, we make an acoustic analysis of spontaneous speech by three native speakers of CD. Each informant was told to tell a story about their life experience about thirty minutes in a relaxed state.

Our transcription of the speech data is made by Praat 5.2.26. It includes the five tiers of Word, Pinyin, Syllable, Sandhi and Break, with the first two transcribing the standard pronunciation of each syllable in Chinese characters and IPA, respectively. Syllable tier transcribes the actual pronunciation of each syllable in IPA, and Sandhi tier the real tonal value of each syllable in Chao's five-digit letters in our data. The Break tier labels the level of perceptual break. Details about the different levels of break are given in Table 1.

The transcription was made by a student of linguistics (T1) and the author (T2), both knowing CD well. Before the transcription of the speech data used for the present study, we labeled the same set of speech data selected from the three informants for comparison of the break indices. In case of inconsistency, a new commonly recognized standard will be set up. After a few such sessions, the inter-transcriber consistency was found to be over 85%. Then only the present author annotated all the speech data to be analyzed in the present study and for limitation of time the other transcriber labeled only two minutes of them so as to check again the inter-transcriber consistency. Our statistics shows a high inter-transcriber consistency of more than 90% for all break indices but B2, which has a consistency of 86.21%. The fact that 10.3% of what the present author labeled as B2 is annotated as B1 suggests that it is difficult to distinguish B1 from B2. Anyhow, the overall high inter-transcriber consistency ensures the validity of the prosodic transcription by the author.

Table 1. *Break indices and their perceptual effects*

break index	corresponding boundary	perceptual effects and examples if convenient
B-1	reduced syllabic boundary	between reduced syllables: ni+men—ni<B-1>m
B0	normal syllabic boundary	default case within a polysyllabic word: tsoŋ<B0>kue 'China'
B1	prosodic word (PW)boundary	the minimally perceptible break
B2	prosodic phrase (PPh)boundary	short break larger than B1 but smaller than B3
B3	intonational phrase (IP)boundary	larger than B2; a sense of being non-final about what is going on
B4	utterance (U)boundary	the largest break, a sense of being final about something being said

3. The internal duration pattern of PW and tone sandhi in CD

A PW consists of a minimum of one syllable and a maximum of five syllables in CD. Perceptually, in CD PW is normally characterized with a strong syllable followed by, if any, one or more weak syllables. Acoustically, it has the normal duration pattern of a long syllable followed by, if any, one or more short syllables. We did a statistical analysis of all the PWs contained in a five-minute speech data from a female informant**.** The detailed statistics are given in another paper in preparation. Now we just mention the results of the analysis. The analysis shows that the initial syllable in all four types of PW, that is,

monosyllabic, disyllabic, trisyllabic, quadrisyllabic and pentasyllabic PWs, is noticeably longer than both the mean duration of all syllables in the speech data, and that of those syllables after it, which is normally shorter than the mean duration of all syllables. Thus, the overall duration pattern of PW can be formalized as LSn ($0 \leqslant n \leqslant 4$).

CD has four tones, whose citation forms are 45, 31, 53 and 213 in Chao's letters, respectively. We assume the following underlying representation for the four tones in CD T1(MH), T2(ML), T3(HL) and T4(LM). CD has the following three tone sandhi rules.

Rule one (R1):   MH→H/X＿＿
Rule two (R2):   HL→ HH/＿＿ X
Rule three (R3):   LM→ L/X＿＿

First let us look at R3 involving T4. Given that in CD a PW normally has the duration pattern of LSn($0 \leqslant n \leqslant 4$), where the initial syllable is markedly longer than any other, if any, subsequent syllable, which is shorter than M, it is reasonable to predict that T4 following another tone will be changed from a low rise to a plain low due to insufficient duration of its host syllable. As far as our speech data is concerned, this prediction is confirmed, since in nearly all cases of T4 following another tone in a PW, T4 shows up as a low tone. Similarly, R3 can be accounted for in the same way.

So far we have accounted for R1 and R3 by resorting to the insufficient duration of the host syllables of T1 and T4. However, a natural question could be raised as to why T2 and T3 preceded by another tone in the same PW fail to undergo any tone sandhi. It is important to note that in CD the tones undergoing tone sandhi (T1 and T4) are rising, whereas those without any tone sandhi (T2 and T3) are falling. The reason for the different tone sandhi behavior between T1 and T4 on the hand and T2 and T3 on the other in CD, we suggest, is that it takes more time to realize the former two than the latter two, since pitch lowering is faster than pitch elevation [5] [6] [7].

There is another issue we must tackle before a satisfactory account of the relation between tone sandhi and syllable duration is completed. Now that the normal duration pattern of a PW is LS$_n$, why is T3 changed to a high level tone when occurring on the initial syllable of a PW, which should be long enough for it to fully realize its underlying high falling tone? We assume that this is caused by a constraint in CD, which forbids a high falling tone PW-initially. Within the framework of Optimality Theory [8][9], it is a top ranked constraint, which is never violated in CD. This is a tricky issue needing further study since this explanation offered here seems a little ad hoc.

4. PW as the convergent domain of the application of sandhi rules in CD

4.1 PW as the domain of the application of tone sandhi rules in CD

This subsection will show that PW, defined as a perceptually inseparable entity so far, constitutes the application domain of tone sandhi rules in CD. First, let us look at R1. It is found in our speech data that T1 retains its underlying high rising tone PW-initially but turns into a high level tone otherwise. See an example, given below.

N   N   Poss   N
[tɕ'i213.ɲie21] [tsʅ21.koŋ45][ni45][ɕy45. iau213]
(tɕ'i213.ɲie21)ᵥ(tsʅ21. koŋ55. ni55)ᵥ(ɕy45. iau21)ᵥ
'The needs of the workers of the firm'

/koŋ45/ shows up with a high level tone due to being in a non-PW-initial position. The syllable ɕy45 with an underlying T1 remains unchanged due to being PW-initial, which suggests that a PW boundary serves to block the application of R1. It would undergo R1 and end up with a high level tone, as occurs with koŋ45 in the preceding PW, if it were not preceded by a PW boundary. Moreover, higher prosodic boundaries such as the prosodic phrase boundary, the intonational phrase boundary and the utterance boundary are also found to block the application of R1. We come to the conclusion that PW constitutes the domain for the application of R1 and the latter can be taken to be a domain-span rule according to Selkirk [10]'s classification of prosodic rules. Therefore, R1 can be reformulated as follows.

R1 (revised)   MH→H/ [...T＿＿...]ᵥ

Now let us look at R2. It is found that it applies only within a PW. In other words, T3 does not apply across a PW boundary and above, as does R1. Since R2 changes a high falling T3 into a high level tone before any tone, it is predicted that all T3s except the last one in a PW will undergo R2 and surface with a high level tone. As far our speech data is concerned, this prediction is also confirmed.

Finally, let us look at R3, which changes a low rising T4 into a low tone. R4, like R1 and R2, is found to apply only within a PW. That is, it fails to apply across a PW boundary and above.

From the above discussion, we may come to the conclusion that all three tone sandhi rules discussed thus far apply within a PW. In other words, PW constitutes the convergent domain of the application of tone sandhi rules in CD.

4.2 PW as the domain of the application of segmental sandhi rules

This subsection aims to show that PW also serves as the application domain of some segmental sandhi rules in CD. In our spontaneous speech data, we find some segmental sandhi phenomena that rarely occur in those less natural speech data such as read speech. These include voicing, nasalization, assimilation and deletion. Typical examples are given below.

Voicing:	tsa.ko→ tsa.go 'how'
	ko.tu→ ko.du 'perspective'
Nasalization:	in.kai→in.ŋai'should'
	zən.tɕia→zən.ŋia 'people'
Assimilation:	koŋ.zən→ goŋ.ŋən 'worker'
	ɕiau.zən→ ɕiau.uən 'funny'
Deletion:	ŋo.mən→ŋom 'we'
	sɹ.xəu →səu 'time'

All of these rules are found to apply optionally within a PW but never across a PW boundary and above.

We have seen that PW constitutes the application domain of both tone sandhi rules and a few segmental sandhi rules in CD. This is a desirable result, since it helps us to avoid what Vogel [11] called the potential risk of circularity in establishing prosodic constituents. By the risk of circularity Vogel means, if I understand right, that the application of *one* phonological rule is used to construct a prosodic domain, which itself is employed to explain the application of this phenomenon. As far as the present study is concerned, the risk of circularity would arise if we constructed the prosodic constituent of PW by considering only one of the phenomena discussed thus far, e.g. one of the three tonal sandhi patterns or one of segmental sandhi phenomena. The fact that many phonological phenomena converge to apply within the same prosodic domain PW in CD ensures us that this potential risk does not exist in the present study.

5. Mismatches between morpho-syntactic constituents and PW

It can be seen from our speech data that a PW normally corresponds to a morpho-syntactic word (GW), in particular one belonging to a lexical category (adjective, noun and verb). However, mismatch occurs when a PW equals two or more function words. See an example below, where the function word [tɕiəu213] forms a PW with the preceding word [ŋo.mən].

Pronoun Adv   V   N
[ŋo.mən][tɕiəu] [tɕiɛn.ŋi] [tɕ'i.ŋie]
(ŋo.mən. tɕiəu)w (tɕiɛn.ŋi)w(tɕ'i.ŋie)w
'We   thus   advise   enterprise'

That the function word [tɕiəu213] forms a PW with the preceding word is supported by the fact that it undergoes R3 and surfaces with a low tone (21) due to being non-PW-initial.

We also find cases where a GW corresponds to more than one PW. The proper name [uən21. xua213.ta213.ke21.min213] 'Cultural Revolution', for example, is often pronounced as (uən21.xua21)w(ta213.ke21. min21)w with two PWs.

In CD there are both prefixes (e.g. nau53, ər213, ɕiau53) and suffixes (e.g. tsɹ53, t'əu21, tɕia45). A suffixed word always forms a single PW. For instance, the suffixed word [tso21.tsɹ53] 'table', which consists of the suffix [tsɹ53] and the stem [tso21], is phrased into a single PW (tso21.tsɹ31)w. That it forms a PW with the stem is supported by the fact that it shows up with a mid-falling tone (31) due to undergoing a tone sandhi rule, which usually applies to disyllabic reduplicates.

However, when a prefix, usually unstressed, is attached to a stem, the latter, which is stronger and longer, will form a PW on its own, whereas the former will form another either with a preceding word in an utterance or on its own in PPh-initial, IP-initial or U-initial positions, in which case it becomes somewhat stressed and lengthened, thus meeting the two moraic foot criteria of the Minimal Word [12]. For instance, the prefix /nau53/ 'ranking' is lengthened and forms a PW by itself when the affixed word [nau53.sɹ213] 'the fourth child in a family' occurs PPh-initially, IP-initially or U-initially. However, it may be attached to the preceding verb [ŋai] 'dote' to form a PW when occurring in the verb phrase [ŋai213].[nau53.sɹ213] 'dote on the fourth child in the family', which is phrased as (ŋai213.nau53)w(sɹ213)w. Given below are the morphological and prosodic structures of the prefixed word [nau53.sɹ213] when read in isolation and when following a verb in a verb phrase, which shows clearly the non-isomorphism between morphology and phonology.

GW   GW   GW   Morphological structure
nau53.sɹ213   ŋai213.nau53.sɹ213]
PW PW   PW   PW   Prosodic structure
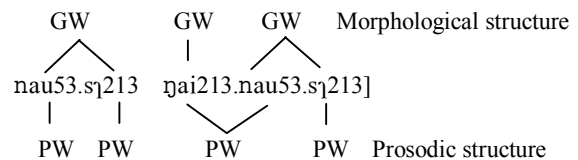
Note that the different prosodic status of the prefix /nau53/ in these two cases is cued by 1) a longer duration in the former case than in the latter, and by 2) an unchanged high falling tone in both cases. Should it form a PW with the following stem, the prefix /nau53/ would undergo R2 and show up with a high level tone. Prefixes of this sort include /ər213/ 'ranking second' and /ɕ'iau53/ 'little, with a sense of closeness'.

In some cases, a prefix may form a PW with the following stem. For instance, /nau53/ may also form a PW with the following stem as in [nau53.sɹ45] 'teacher' and [nau53.p'o21] 'wife', pronounced as (nau55.sɹ55)w and (nau55. p'o21)w, respectively. Note that there is a minute difference of meaning between two uses of the 'same' prefix. That is, while it has an abstract meaning of respect or closeness in [nau53.sɹ45] 'teacher' and [nau53.p'o21] 'wife', it has a concrete meaning of ranking in [nau53.sɹ213] 'the fourth child of the family'.

That a PW may correspond to a stem or a prefix or a stem plus an affix (prefix/suffix) or a whole affixed word constitutes evidence for the non-isomorphism between morphology and phonology in CD. A natural question arises as to why a suffix can not form a PW on its own, given that either a stem or a prefix can. The reason is not quite clear at present. For now we only speculate that it may have something to do with 1) the bimoraic foot criteria of a Minimal Word and 2) the canonical duration pattern of PW, which has a strong influence over the PW formation. A suffix, weak and short, would need to be

lengthened to a certain extent before it could form a PW. In fact, it does not need bother to do so, since it is quite convenient for it to form one PW with the canonical duration pattern with the preceding stem, which is normally strong and long. The close relation between a stem and a suffix is witnessed by a frequent occurrence of both tone sandhi and segmental sandhi phenomena on the latter. For instance, the suffix /tsɻ53/ often shows up with a voiced onset [z] and a mid-falling tone in spontaneous speech, as in the suffixed words (xai21.zɻ31) 'shoe' and (tse213.iaŋ21.zɻ31) 'in this way'. Thus, a prefix-suffix asymmetry exists in term of their prosodic status in CD. While a suffix always forms a PW with the preceding stem, a prefix may form one on its own. The complex corresponding relation between a PW and subparts of an affixed word constitutes evidence for the non-isomorphism between phonology and morphology. In fact, one reduplicate with more three syllables may equal multiple PWs. For limitation of space, we won't be able to provide more examples here.

Thus there is an abundant amount of mismatch between a PW and the morpho-syntactic word. On the one hand, one PW may correspond to two or more morpho-syntactic words. On the other, one morpho-syntactic word may match two or more PWs.

6. Concluding remarks

This paper has argued for the existence of PW in CD by showing 1) that PW, as defined perceptually as an inseparable entity, constitutes the convergent domain of the application of a few tone and segmental sandhi rules, and 2) that PW can not be matched with any constituent in morpho-syntactic hierarchy, and 3) the domain of the application of these sandhi rules can not be stated in morpho-syntactic terms.

The methodology of this research is based on the basic assumption that perceptual break plays an important role in conveying various kinds of meanings, linguistic or extra-linguistic: while the speaker employs different levels of perceptual break to express various kinds of intention, the listener tries to reach the speaker's intention through paying attention to these different levels of perceptual break. The different levels of perceptual break can be created by various kinds of prosodic means, including, for example, not only change of duration, pitch and intensity among neighboring linguistic units, but also various kinds of segmental and tone sandhi phenomena. We assume that the different levels of the perceptual break correspond to different levels of the prosodic hierarchy as claimed in prosodic phonology [1] [2] [3]. The assumption is supported by the present study in the sense that PW, as defined as one level of perceptual break, is shown to be the common domain of a few sandhi rules in CD, which can not be stated in morpho-syntactic terms. In other words, the perceptual notion PW does play a linguistic role in CD.

Besides, the present study has one methodological advantage over many previous studies in prosodic phonology.

That is, it obtains the different levels of prosodic constituent independent of any pre-existing linguistic theoretical orientation held by individual linguists of different theoretical background. In prosodic phonology, the controversy over the existence of Clitic Group, originally proposed by Hayes [4] as one constituent in the prosodic hierarchy, is in fact derived mainly from the different theoretical assumptions held by different researchers. The present study avoids this problem by obtaining the prosodic constituent boundaries *perceptually* free from any potential risk of being affected by any a priori theoretical assumption held by individual researchers.

The present study has a theoretical implication for prosodic phonology. That is, the fact that a PW in CD may contain two or more terminal elements of the morpho-syntactic tree, as can be seen in the PW (ŋo.mən.tɕiəu), which consists of two grammatical words [ŋo.mən] 'we' and [tɕiəu] 'thus', implies that Nespor and Vogel [2][3]'s claim that a PW never exceeds the terminal element of a syntactic tree may be too strong.

7. References

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