TONE SANDHI IN JIAONAN DIALECT: AN OPTIMALITY THEORETICAL ACCOUNT

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OUTLINE

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Purpose

Based on phonetic experiment, this paper aims at providing phonetic description on the tones and disyllabic tone sandhi in Jiaonan dialect, one of the sub-dialect of Shandong dialect, and then conducting an analysis within the framework of Optimality Theory (hereafter in short form OT) on the tone sandhi patterns of Jiaonan dialect.
Jiaonan, a county-level city of Qingdao, locates in the southeast of Shandong Peninsula. Jiaonan dialect (JND for short hereafter) belongs to Jiao Liao Mandarin, a sub-dialect of the northern Mandarin family.

According to Qian Zengyi, JND is one representative of Dongwei Region, one of the four parts of Shandong dialect (namely Xi Qi Region, Xilu Region, Donglai Region and Dongwei Region).

This picture is from Google Map. The dotted line shows the administrative boundary of Jiaonan.
Up until now, Qian’s *The Study of Shandong Dialect* (2001), an overall study on Shandong dialect and its sub-dialects enjoys more authorities in some aspects of JND. The collection of Wu Yonghuan’s study on tones provides great reference as well (2001).

Focusing on tone sandhi types, many contributions which are dedicated to the phonetic and phonological analyses in Chinese (different dialects) have been made over the last thirty years. To our best knowledge, the previous studies have explored Jiaonan tones on the basis of aural judgment and there are all descriptive-oriented other than explanatory ones. The main works include Wu Yonghuan, Jia Quanhong and Tangshun. In their studies, the citation tones and tone changes are illustrated as in the following tables.
Table 1. **Previous descriptions on tone changes in disyllabic sequences in JND**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>T1+T1</td>
<td>213+213 → 21+213</td>
<td>214+214 → 24+214</td>
<td>213+213 → 42+213</td>
</tr>
<tr>
<td>T2+T4</td>
<td>42+21 → 55+21</td>
<td>53+31 → 55+31</td>
<td></td>
</tr>
<tr>
<td>T3+T1</td>
<td>55+213 → 42+213</td>
<td>55+214 → 53+214</td>
<td>55+213 → 42+213</td>
</tr>
<tr>
<td>T3+T3</td>
<td>55+55 → 42+55</td>
<td>55+55 → 53+55</td>
<td>55+55 → 42+55</td>
</tr>
<tr>
<td>T4+T4</td>
<td>21+21 → 213+21</td>
<td>31+31 → 214+31</td>
<td></td>
</tr>
<tr>
<td>T4+T1</td>
<td></td>
<td></td>
<td>211+213 → 42+213</td>
</tr>
</tbody>
</table>

(T1=**yinping**; T2=**yangping**; T3=**shangsheng**; T4=**qusheng**)
PHONETIC EXPERIMENT

- Test words: chosen from *Fangyan Diaocha Zibiao* and *The Study of Shandong Dialect*, including 111 monosyllabic words in citation forms and 117 in disyllabic sequences.

- Equipments:
  - SAMSUNG BR-1640 digital recorder;
  - A portable computer (Lenovo X200I) and a microphone (Sennheiser PC 166). The recording software was CUHK-SIAT recording tool supplied by the Institute of Linguistics, Chinese Academy of Social Sciences (CASS).

- The speech waveform was sampled at a rate of 16,000 Hz and the resolution was 16 bit.

- Informants:
  - In 2009, one elder male and female in their middle age.
  - In 2011, 6 university students from Jiaonan.
Data Process:

- Annotation and pitch modification of the test syllables were done with the help of software Praat 4.4.20 and Praat 6.0. F_0 values and durations were extracted for the first hand through Praat scripts provided by CASS. 10 points of F_0 values for each syllable were measured at equal intervals from the onset to the end of the whole F_0 duration. Means of 10 points of pitch values for each tone type were obtained in SPSS 13.0.

- Accordingly, the shape and mean pitch values of each tone type can be seen in Figure 1. Since the primary sources on the tones of JND adopted the five-scale system of Chao Yuen-Ren, I refer to the same method for convenience.
Figure 1: $F_0$ Contours of the Four Citation Tones in JND
(Horizontal axis: ten points of $F_0$; Vertical axis: five scales)

Discrepancies between our result of T2 (51) and the previous results of Wu’s and Jia’s 42 and Tang’s 53 makes distinctions. So that of T4. But 41 may lead to totally different tonal representation from that of 21 or 31 in Wu and Tang. The differences between the two high falling tones (T2 and T4) need further explanation.
Given the four-citation-tone system of JND, there are 16 combinational possibilities shown in four figures below.
Assumption: An assumption would be probably efficient to explain the merging of T4 into T2, for which rich evidence is available from Wu’s study on discussing the splitting and merging of the origins of tonal categories in Middle Chinese system. Tone sandhi plays a crucial role in the course of transition and the merging of some tone sandhi patterns will eventually result in the merging of the citation tones.

Here, the merging of T4 into T2 is an obvious tendency, or there would have been three citation tones in JND?

But, from disyllable combinations, it is reasonable to take the four tones of second syllable as the base tones, on which six tone changes can also be well explained.
Table 2. *Tonal values of four base tones*

<table>
<thead>
<tr>
<th>Tone Type</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pitch Value</td>
<td>213</td>
<td>51</td>
<td>44</td>
<td>31</td>
</tr>
</tbody>
</table>

Table 3. *Tone changes*

<table>
<thead>
<tr>
<th>S1+S2</th>
<th>S2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T1</td>
</tr>
<tr>
<td>T1</td>
<td>42+T</td>
</tr>
<tr>
<td>T2</td>
<td>T+T</td>
</tr>
<tr>
<td>T3</td>
<td>52+T</td>
</tr>
<tr>
<td>T4</td>
<td>T+T</td>
</tr>
</tbody>
</table>

("T" represents the unchanged ones.)
PHONOLOGICAL ANALYSIS

- **Tonal Representation**

To illustrate the tonal structure directly and clearly, Bao’s tonal representation model is employed to serve as a reference here, taking syllable as the TBU and Yip’s $[\pm U]$ indicating the high and low registers.

- Six tone sandhi changes in Jiaonan dialect can be represented as follows:
  - $[+U, HH][-U, LH] \rightarrow [+U, HL][-U, LH]$
  - $[+U, HH][+U, HH] \rightarrow [+U, HL][+U, HH]$
  - $[+U, HH][+U, HL] \rightarrow [-U, LH][+U, HL]$
  - $[+U, HL][-U, HL] \rightarrow [+U, LH][-U, HL]$
  - $[-U, HL][-U, HL] \rightarrow [+U, HH][-U, HL]$
Here, several crucial points about disyllabic tone sandhi features of Jiaonan dialect can be concluded:

- Firstly, the tone sandhi forms of disyllabic sequences show Jiaonan dialect belongs to right prominent tone sandhi.

- Secondly, two identical registers are not allowed in adjacent position and the left one is bound to alter. However, the sandhi form of adjacent high level tones is an exception. Thirdly, two identical tones are prohibited in a sequence and tone in the initial position may undergo changes. This is essentially attributed to the motivation of OCP.

- Last but not least, the final toneme of the first syllable and the initial toneme of the second syllable should be identical, unless they are both of upper register, with an exception that when preceding a high level tone, the high toneme would alter into its counterpart.

- In addition, it is obvious to get the truth that if the register changes, the contour must change simultaneously, but not vice versa.
OT Explanation

Based on the five points resulted from the tonal representation, the three faithfulness constraints and five markedness constraints for the tone sandhi patterns in JND can be set as follows:

(4) Faithfulness Constraints:
- (4a) RM-IDENT-IO-T: The feature of the tone in the right position keeps unchanged.
- (4b) IDENT-IO-T(R): The register of the output tones are identical to that of input correspondents.
- (4c) IDENT-IO-T(C): The output contours are identical to that of input correspondents.

(5) Markedness Constraints:
- (5a) *[±U] [±U]: Two adjacent H/L-registered tones are prohibited.
- (5b) OCP-T: Avoid adjacent identical tones at the tone level.
- (5c) *LEVEL: High/Lower level tones are not allowed.
- (5d) *X.Y ((X,Y ∈ {H.L},X≠Y): The final toneme and the initial toneme of the adjacent syllables should be identical.
- (5e) *H.HH: The final toneme of the first syllable should not be high when followed by a high level tone.
As the constraints have been assembled, the next step is to fix the ranking hierarchy to obtain the optimal output from the set of candidate outputs. By examining interactions of constraints in comparative tableau format introduced by Prince & Smolensky, the constraints are supposed to be put in the following ranking hierarchy.

RM-IDENT-IO-T >> *H.HH, OCP-T, *[±U] [±U] >> *LEVEL >> *X.Y >> IDENT-IO-T(R), IDENT-IO-T(C)

No matter whether tone sandhi occurs or not, possible disyllabic patterns should go through the same set of ranked constraints. Thus, it is clear to see if the optimal output corresponds to the attested data from the procedure of evaluation.
Table 4. T1+T1

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>RM- IDENT</td>
<td>IO- T</td>
</tr>
<tr>
<td>a.[+U, LH] [-U, LH]</td>
<td></td>
</tr>
<tr>
<td>b.[+U, LL] [-U, LH]</td>
<td></td>
</tr>
<tr>
<td>c.[+U, HL] [-U, LH]</td>
<td></td>
</tr>
<tr>
<td>d.[-U, LH] [-U, LH]</td>
<td></td>
</tr>
<tr>
<td>f.[-U, LH] [+U, HL]</td>
<td>***!</td>
</tr>
</tbody>
</table>

| (c) win over the other candidates listed in the above tableau, for it performs better in satisfying the constraint hierarchy, while the other competitors violate the higher-ranked constraints. |
Table 5. T3+T3

Input: [+U, HH] [+U, HH]  
Output: [+U, HL] [+U, HH]

<table>
<thead>
<tr>
<th>Input: [+U, HH] [+U, HH]</th>
<th>RM-IDENT-IO-T</th>
<th>*H.HH</th>
<th>OCP-T</th>
<th>*[+U][+U]</th>
<th>*L</th>
<th>*X.Y</th>
<th>IDENT-IO-T(R)</th>
<th>IDENT-IO-T(C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. [+U, HH] [+U, HH]</td>
<td></td>
<td></td>
<td>*!</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. [+U, LH] [+U, HH]</td>
<td>*!</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>c. [+U, HL] [+U, HH]</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. [-U, LH] [+U, HH]</td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. [-U, HH] [+U, HH]</td>
<td>*!</td>
<td></td>
<td>*!</td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. [-U, HL] [+U, HL]</td>
<td>*!</td>
<td></td>
<td>*!</td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td>**</td>
</tr>
</tbody>
</table>

Comparing with the optimal outputs listed in the tableau (4), (c) in Table 5 gets more violation marks, and the number equals to that of (b) and (d). But the later two both violate the even higher-ranked constraint *H.HH at a time. (c) should be the chosen as the optimal output.
The unchanged patterns can also be attested with the same constraint ranking. Table 6 shows that those disyllabic sequences that do not undergo tone sandhi fit the constraints ranking hierarchy as well. Some violate no constraints, while some stay with the least violations.
CONCLUSION

- The paper presents a detailed phonetic description of tonal information in Jiaonan dialect and a phonological explanation of the experimental results within the framework of Optimality Theory.

- Acoustic experiment is the basis of the study. The results suggest that both of *yangping* and *qusheng* are high falling tones in citation forms and they are assumed to be in the same category, according to the trend of transition from the four-tone system to the three-tone system in Jiao Liao dialect. In the process of analyzing the six kinds of disyllabic tone sandhi, totally eight constraints are involved, all of which have been proved by other scholars, or can be found in many other languages (for example: OCP, IDENT-IO) or in some northern Mandarin language (for example: *[±U][±U], *H.HH for Yantai Dialect), exhibiting the universality. Through the interaction of the eight constraints, the tone sandhi phenomena are well explained, showing the universal explanatory power of OT and may contribute to analysis of tone sandhi in Chinese topolects.
FUTURE FOCUS

- The transition from four-tone system to the three-tone system in Jiaonan Dialect.
- The neutral-tone disyllabic compounds are examined in the experiment, but neither the phonetic analysis nor the theoretical explanation has been done.
- Systematic descriptions and analysis of the sandhi patterns in trisyllabic or even quadrisyllabic sequences should be covered for an overview study of one dialect.
REFERENCES


Acknowledgements:

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Thank you for your attention!