1 Introduction

In this paper I will review Barrie (2007), his goals and the feature system he sketches out for his analysis of tonal contrast in Taishan and Cantonese. The first three sections of this paper discuss relevant background data; the first reviews how contour tones are analyzed in Chinese languages, the second introduces the contrastivist hypothesis and the third lays out Barrie’s system for tonal features.

In the fourth section of this paper I discuss issues which are specific to his analysis of Taishan and how Barrie’s system successfully captures tone alternations. In the third section of the paper I examine Cantonese Tone Coalescence, which Barrie does not mention. I show that his feature specification cannot account for the change and that no manipulation of the features he uses in a contrastive hierarchy can give the desired result. Finally I provide an additional case which cannot be easily handled by Barrie’s features: Tianjin dissimilation.
I conclude that our current understanding of features for tone are somehow flawed, at this point I do not suggest any new innovations but rather factors to keep in mind for future work.

## 2 Contour Tones

As early as Pike (1948), contour tones in Chinese languages were noticed to behave as unitary units. In the 1970’s and 80’s, work on African tone showed that contours in those languages were composed of level tones; this is sometimes referred to as a Tone Cluster Analysis. Barrie rejects tone cluster analysis of contour tones for Chinese languages. He motivates this with two main points: over prediction, and non-separability of clusters. I will review the arguments generally made for contour tones as privatives. As Bao (1999) points out “any postulation of underlying contour in the representation of tone must be empirically motivated.”

Barrie claims that if a language uses all and only those level tones present in its inventory to form contours we would expect a language with three level tones to have six contours (3 x 2 = 6), likewise in a language with four level tones we expect twelve contours (4 x 3 = 12). Languages with this distribution of level and contour tones are not found (Zhang, 2002). Cantonese, for instance, has four level tones: [55, 33, 22, 21] and only two\(^2\) or three contours [(53), 23, 35] (Yip, 2002; Hashimoto (Yue), 1972). Likewise, if all contour tones are formed from level tones, some processes should be able to “look inside” the composed cluster.

Barrie cites data from Wan and Jaeger (1998) on Mandarin speech errors; they found that no speakers ever flubbed the end points of a contour. All observed errors were the

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1. The low level tone tends to fall phonetically, as low tend to cross linguistically.
2. For young speakers and speakers of the Hong Kong dialect [55] and [53] are collapsed.
substitution of one tone for another. This provides evidence for the analysis in which each contour functions a single unit.

Yip (2002) provides counter evidence from modern Cantonese songs. Certain requirements on the tonal composition of stanzas shows that [13] and [33], and [35] and [55] are interchangeable. Yip argues that this is the case because they share end points, which means that at least some aspect of a contour tone must be decomposable. If we want to maintain Barrie’s position, we could argue for a contrastivist view of features in which this type of tonal replacement is governed by the swapping of single contrastive features. I will discuss this possibility in the third section of this paper.

Contour tone languages become even more difficult to tease apart when we bring in cases such as Tianjin dissimilation. The Tianjin tone inventory is given below, followed by the relevant data.

(1) Tone in Tianjin

<table>
<thead>
<tr>
<th>Low</th>
<th>High</th>
<th>Rise</th>
<th>Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>55</td>
<td>24</td>
<td>53</td>
</tr>
<tr>
<td>L</td>
<td>H</td>
<td>R</td>
<td>F</td>
</tr>
</tbody>
</table>

In the data below entire tone units are changed, however dissimilation is also sensitive to a paradigmatic OCP. Notice that while tone units are disallowed in sequence, the end point of the first tone is never the same as the start of the following tone, be it a contour or level tone.

(2) Tianjin tone dissimilation

<table>
<thead>
<tr>
<th>R.R</th>
<th>H.R</th>
</tr>
</thead>
<tbody>
<tr>
<td>F.F</td>
<td>L.F</td>
</tr>
<tr>
<td>L.L</td>
<td>R.L</td>
</tr>
</tbody>
</table>

The alternation between tonemes in this dissimilation process is difficult to capture in terms of features. I will return to this data later in the paper.
I believe that we should be treating contour tones in some languages as unitary; however, as I have illustrated above, there are still some factors that seem to blur the line between tone clusters and unitary contours. For the purpose of this paper I take it to be correct that in the languages analyzed contour tones are not tone clusters.

3 Contrast

In this paper I will assume the definition of contrast described in Dresher (in press). The most significant effect of adopting this view is that only features which are contrastive can be phonologically active. The theory of the Contrastive Hierarchy provides a systematic approach to determining which features are contrastive on which segments.

The Contrastive Hierarchy approach assumes that all segments are allophones of one phoneme and then differentiates out segments by dividing the inventory, one feature at a time, until all segments have been described by their contrastive features. The technical formulation of this idea is called the Successive Division Algorithm (SDA) which I will not spell out here. One important consequence of this approach to contrast is that a segment has multiple logical contrastive specifications; in order to obtain the correct specification we must additionally have information about the activity of a feature. I represent the feature divisions described above using tables with the order of the division on the right hand side reading from the top down.

4 Features

Barrie (2007) uses three features to define contour tones. These are based primarily on Yip (2001) with some slight modifications. He retains the Register and Pitch features, which divide the pitch range into a higher and lower half successively, forming four pos-
possible levels. This is problematic, as Yip (2002) admits; there are attested languages with more than four underlying level tones, such as “Black Miao”. Barrie’s constellation of features will only ever be able to provide four levels. The addition of a third dividing feature would provide eight possible level tones, which is far higher than the maximum of five level tones that are (infrequently) attested. As Yip (2002) points out, this is not necessarily a problem, the third dividing feature need not apply to all previous divisions, nor need it be a purely tonal feature. She compares the hypothetical feature to $[\pm \text{ATR}]$ in the vowel domain. I have attempted to provide one hypothetical hierarchy for “Black Miao”; note that without having a good description of phonological rules in “Black Miao” the feature cuts are largely unmotivated.

(3) “Black Miao” tone Inventory

a. Level Tones: 5, 4, 3, 2, 1

b. Contour Tones: 35, 13, 51

(4) Upper $>$ Pitch $>$ Contour $>$ $??$ – Hypothetical Contrastive Division for tones in “Black Miao”

If we take contrast seriously then describing a five level tone system would not be especially challenging; we would only need to introduce one extra feature which is contrastive on two tones. The challenge is motivating the additional feature, notated as $[??]$ above.

Departing from Yip (2001), Barrie introduces $[\text{contour}]$. The feature $[\text{contour}]$ is a
privative feature which determines if a tone is a contour, but not which direction it changes; that is, it will let you know that something is not level but it will not tell you if it falls or rises. Barrie states that a contour tone cannot rise above or fall below its register value. Therefore, the direction of a contour is predictable from the values for Register and Pitch; for example, a [Upper, hi, contour] must be falling since it is defined as being in the high portion of the upper register and the only place for it to glide to from there is downwards. This system does not allow for contour with identical starting points but differing targets. I do not know of any Chinese languages\(^3\) where this is the case; however, there are such cases in Central American languages. For these cases, Yip (2002) uses a combination of contours and cluster tone analysis. In any case, neither Yip nor Barrie are readily equipped to deal with these cases in the same way that they can explain the data reviewed in this paper.

The major payoff of adopting [contour] in place of Yip’s two tonal units attached to one node is that we capture the typological fact that contours ought to be more marked, whereas in Yip’s system contours are less marked since they are described by fewer features than level tones.

(5) Level and Contour tones using Barrie (2007)’s feature system

\[\text{a. High Level Tone} \quad \text{b. High Falling Tone}\]

\[\begin{align*}
\text{Tone} & \quad \text{Tone} \\
\text{Register} & \quad \text{Register} \\
\text{Upper} & \quad \text{Upper} \\
\text{Pitch} & \quad \text{h} \\
\end{align*}\]

\[\begin{align*}
\text{Tone} & \quad \text{Tone} \\
\text{Register} & \quad \text{Register} \\
\text{Upper} & \quad \text{Upper} \\
\text{h} & \quad \text{h} \\
\text{[contour]} & \quad \text{[contour]} \\
\end{align*}\]

\(^3\)Except perhaps Chaoyang of the Min dialect group, a contrastive analysis of which I will leave for another paper.
In the arrangement shown in (6a) and (6b), a contour tone is described by a single pitch feature with an undefined end point. In contrast, the pair in (5a) and (5b) show the contour as being more marked since it makes use of a Pitch value and [contour] whereas the level tones only relies on Pitch.

In addition, we obtain an interesting asymmetry between the left edge and right edge of contours. Since end points are left unspecified we expect that they cannot be active in the phonology. Barrie claims that anticipatory rules are more common in tone than progressive ones. He attributes this to the fact that the left edge of a contour is active while the endpoint is not. Recall the Tianjin data presented in the previous section; we see that the dissimilation is always progressive, the first tone is always the one which undergoes a change. However, in those cases previously shown, the dissimilation is always between identical segments; I will pick up this issue when I return to Tianjin.

We are also not left with many options for capturing downstep phenomena which seem to have potentially infinite pitch decline. Though this may be restricted to African languages, it would be desirable if we could at least share features between the systems, if not share the arrangement of features.

Barrie lays out a powerful set of features for describing unitary contour tones. He does not depart drastically from other such approaches; indeed, his system improves some as-
pects of Yip (2001). On the other hand, the system is strictly designed to handle languages with a maximum of four level tones and without any iterative processes such as downstep or upstep. One possibly dangerous consequence of [contour] is that only the starting points of contours are phonologically active. If we can find enough data to show that both start and end points need to be active then adopting [contour] is far less attractive.

5 Taishan

Taishan is one of the most widely spoken Yue dialects, second to Cantonese. It is similar but not mutually intelligible with Cantonese. Below I have given the tonemic inventory of Taishan. The data is taken from Cheng (1973).

(7) Tones in Taishan

High 66 HL ma ‘mother’
High-falling 52 HF haw ‘back’
Mid 44 ML i ‘to know’
Mid-falling 31 MF haw ‘thick’
Low 22 LL p’i ‘skin’

Taking a contrastive approach, we need to decide how feature cuts should be made. We know that HL and LL will need to be in the Upper and Lower register respectively. We also know that HF needs to be in the Upper register. The status of the MF tone could be questionable; however, if it were a Upper register low tone with the contour feature it would necessarily be a rise since the only available space in the Upper register would be higher then low Pitch.

Therefore, the only real decision to be made is the status of the ML tone, which could potentially be in the Upper register with a low pitch or the Lower register with a high pitch. As we will see the activity of the ML tone informs it’s placement. For now we follow
Barrie who ranks Register>Pitch>Contour, giving the following contrastive division.

(8) Contrastive Specification for Taishan Tone (Barrie, 2007)

<table>
<thead>
<tr>
<th>Register</th>
<th>Upper</th>
<th>Lower</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pitch</td>
<td></td>
<td>high</td>
</tr>
<tr>
<td>Contour</td>
<td>[contour]</td>
<td>[contour]</td>
</tr>
<tr>
<td>Tone</td>
<td>HL</td>
<td>HF</td>
</tr>
</tbody>
</table>

5.1 Taishan Tone Sandhi

Taishan has two alternations that need to be considered in describing tonal features; both are morphologically conditioned. They are schematized below.

(9) ML $\rightarrow$ MF

(10) T $\rightarrow$ T+EHL

a. L $\rightarrow$ L+EHL  
   b. M $\rightarrow$ M+EHL  
   c. ML $\rightarrow$ ML+EHL  
   d. HL $\rightarrow$ HL+EHL

The first alternation, shown in (9) is productively used in pluralization of nouns and forming deverbal nouns. This can be illustrated by the pronominal paradigm, given below.

(11) Taishan Pronouns (Cheng, 1973)

<table>
<thead>
<tr>
<th>Person</th>
<th>Singular</th>
<th>Plural</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>ȵoy</td>
<td>ML ȵoy MF</td>
</tr>
<tr>
<td>2nd</td>
<td>ni</td>
<td>ML nek MF</td>
</tr>
<tr>
<td>3rd</td>
<td>k’uy</td>
<td>ML k’ek MF</td>
</tr>
</tbody>
</table>

This alternation motivates the ML tone being in the Lower register since it alternates with MF. The rule need only add the [contour] feature to the ML tone, as shown below.

4Where T=any tone and EHL=extra high level tone.
The rule schematized above would only apply to tones in the Lower register since the Pitch division is only applied at that level. No Upper register tone is specified for tone and only the mid-level tone bears the high Pitch feature. This leaves Barrie to create a story for why the Upper register [contour] tone is a fall and not a rise. Recall from the previous discussion that the Pitch within a Register will determine which direction a contour must change in. The best answer is simply that typologically falling tones are more common and therefore we may take falls to be the default. In this case the Upper register [contour] defaults to a falling high tone.

The second alternation, given in (10) above, functions in a variety of derivational nominal morphology. Cheng (1973) suggests that the the rising tone pattern may appear to be an underlying toneme for a researcher working without the benefit of Cantonese and Middle Chinese data. I will follow Cheng and assume that the rising tones are derived. It should also be noted that rising tones in Taishan seem to have a higher end point then the level high tone, Cheng represents this by using the tone number 7, called “extra-high”. She further claims that the target is “always reached”, implying that the extra-high level does not become neutralized sentence finally or medially between low tones.

We assume that the appended tone is the HL tone since it cannot be added to a morpheme that already has the HL tone. An OCP process must obscure any trace of the appended HL if it follows a HL, otherwise we might expect a HL+EHL sequence. Presumably we could also have added in a fourth level tone, but given the very limited distribution and the fact that it only occurs in a morphologically derived environment it is not the best position to propose a marked four level tone system in order to account for the data.
As we have seen in Taishan, the alternations presented by Barrie are possible to account for with only minor stipulations such as the identity of the extra high tone and claiming that falling is the default direction for a contour tone with no contrastive Pitch. One of the most interesting properties of this system is illustrated by the second sandhi rule. The output of the rule is a tone cluster composed of a unitary contour tone plus a high level tone. This nicely captures Bao (1999)’s claim that contour tone languages should be able to display the same phenomenon as level tone languages.

6 Cantonese

Cantonese is also a Yue dialect; there is an additional distinction between Hong Kong Cantonese and Guangzhou Cantonese. The data I present below is representative of the Guangzhou variety which maintains an additional toneme that the Hong Kong dialect has neutralized. The inventory data comes from Yip (2002), slightly modified to match the pitch number given in Barrie (2007).

(13) Tones in Cantonese (Guangzhou)

<table>
<thead>
<tr>
<th>Tone Type</th>
<th>Pitch</th>
<th>Tone</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Level</td>
<td>55</td>
<td>HL</td>
<td>‘poem’</td>
</tr>
<tr>
<td>Mid Level</td>
<td>33</td>
<td>ML</td>
<td>‘to try, taste’</td>
</tr>
<tr>
<td>Low Level</td>
<td>22</td>
<td>LL</td>
<td>‘affair, understanding’</td>
</tr>
<tr>
<td>Extra Low Level</td>
<td>21</td>
<td>ELL</td>
<td>‘time’</td>
</tr>
<tr>
<td>High Falling</td>
<td>53</td>
<td>HF</td>
<td>‘silk’</td>
</tr>
<tr>
<td>High Rising</td>
<td>35</td>
<td>HR</td>
<td>‘to cause’</td>
</tr>
<tr>
<td>Low Rising</td>
<td>23</td>
<td>LR</td>
<td>‘market, city’</td>
</tr>
</tbody>
</table>

Again, we take a contrastive approach to assigning features. As in Taishan, Register divides the inventory first. Pitch then allows us to capture all four level tones. Finally we make a third cut to separate the Upper register tones (both high and low Pitch) and the Lower
register low Pitch tones. The only tone that is not contrastive for [contour] is the level low tone. I have reproduced Barrie’s specifications for tones in Cantonese along with the tone numbers.

(14) Contrastive Specification for Cantonese (Guangzhou) Tone  Barrie (2007)

<table>
<thead>
<tr>
<th>Register</th>
<th>Upper</th>
<th>Lower</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pitch</td>
<td>hi</td>
<td>lo</td>
</tr>
<tr>
<td>Contour</td>
<td>[contour]</td>
<td>[contour]</td>
</tr>
<tr>
<td>Tone</td>
<td>HF</td>
<td>HL</td>
</tr>
<tr>
<td></td>
<td>53</td>
<td>55</td>
</tr>
</tbody>
</table>

### 6.1 Cantonese Tone Sandhi

Cantonese, like Taishan, has few sandhi processes. The sandhi rule which Barrie presents transforms the high falling tone into a high level tone before any Upper register high Pitch tone; this is schematized below.

(15) Cantonese High Tone Assimilation

\[
/53/ \rightarrow [55] / \quad \{53, 55\}
\]

\[[\text{Upper, hi, contour}] \quad [\text{Upper, hi}] \quad [\text{Upper, hi}]\]

Yip (2002) notes that this is clearly the assimilation of the 3 to the surrounding 5s. She notes that the rule cannot be a simple assimilation in all contexts of a [535] string, it occurs in exactly and only the cases in which a HF tone is followed by HF or HL. For instance, we do not see the possibilities below.

(16) Non-Occurring High Tone Assimilation

a. HL.HR $\not\rightarrow$ HL.HL

b. HL.ML.HL $\not\rightarrow$ HL.HL.HL
If we adopt Barrie’s feature system then there is no way to make reference to the end point of the 53 contour. He casts the rule as one of neutralization: the [contour] feature is neutralized in clusters of Upper register high Pitch tones.

In addition, Cantonese has an elision process in which certain words bearing a high or rising high tone can be elided, leaving their respective tones to effect a preceding tone; this is usually cited to exemplify the autosegmental status of tone. The relevant data is given below. I have taken my examples from Bao (1999).

(17) Deletion of the perfective marker tsɔ 35

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>mai</td>
<td>tsɔ</td>
<td>→</td>
<td>mai</td>
</tr>
<tr>
<td></td>
<td>23</td>
<td>35</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>iau</td>
<td>tsɔ</td>
<td>→</td>
<td>iau</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>35</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>pin</td>
<td>tsɔ</td>
<td>→</td>
<td>pin</td>
</tr>
<tr>
<td></td>
<td>33</td>
<td>35</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>d.</td>
<td>tsou</td>
<td>tsɔ</td>
<td>→</td>
<td>tsou</td>
</tr>
<tr>
<td></td>
<td>22</td>
<td>35</td>
<td>35</td>
<td></td>
</tr>
</tbody>
</table>

“have bought”

(18) Deletion of iat 5 “one”

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>iat</td>
<td>t’am</td>
<td>iat</td>
<td>t’am</td>
<td>→</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>23</td>
<td>5</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>iat</td>
<td>hɔŋ</td>
<td>iat</td>
<td>hɔŋ</td>
<td>→</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>21</td>
<td>5</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>iat</td>
<td>ts’yn</td>
<td>iat</td>
<td>ts’yn</td>
<td>→</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>33</td>
<td>5</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>d.</td>
<td>iat</td>
<td>tam</td>
<td>iat</td>
<td>tam</td>
<td>→</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>22</td>
<td>5</td>
<td>22</td>
<td></td>
</tr>
</tbody>
</table>

“puddle by puddle”

“line by line”

“bunch by bunch”

“mouthful by mouthful”
It is not readily clear to me what features trigger this elision or what change occurs. Chen (2000) describes the rule as tonal association which will link a floating tone to the preceding TBU when it is not utterance final, as shown in (19a); however if the resulting cluster is complex (rising-falling or falling-rising) then an additional rule of complex cluster simplification will apply where only the end points of the complex cluster are retained, as in (19b) MLH→MH. I have not converted Chen’s notation into the one used throughout the paper; his notation seems to assume something like a tone cluster analysis.

(19) Cantonese Ellision and Tone Coalescence (Chen, 2000)

a. 
\[
\begin{array}{cccccc}
\sigma_1 & (\sigma)_2 & \sigma_3 & \overset{\sigma_1}{\longrightarrow} & \sigma_2 \\
M & H & H & M & H & H
\end{array}
\]

b. 
\[
\begin{array}{cccccc}
\sigma_1 & (\sigma)_2 \ldots & \sigma_1 & \overset{\sigma_1}{\longrightarrow} & \sigma_1 \\
M & L & H & *M & L & H & M & H
\end{array}
\]

Notice that this analysis relies on having the end point of the contour specified. He suggests that in example (19b) the reason that *MLH simplifies to MH and not ML is because the coalescence rule retain contour end points.

If we attempt to formalize a simple transformational rule using only contrastive features we will discover that there is no natural class that contains the candidates. I have reproduced the table of contrastive specifications and shaded in the candidates for assimilation.
The problem would be solved if we could place three level tones in one register, namely ML, LL and ELL all in the Lower register. However there is no mechanism for this given the system we adopted. It is even more difficult to specify a class based on Pitch since every tone is specified for a value and both values are candidates. Of the three contour tones only one is a candidate for elision so we clearly cannot use [contour] as the relevant feature.

Before drawing any conclusions let us also take a look at the tone alternations in Cantonese songs, mentioned pervious. I have schematized the alternation below.

(21) Tone Alternation in Cantonese Songs

<table>
<thead>
<tr>
<th>Tone</th>
<th>Upper</th>
<th>Lower</th>
</tr>
</thead>
<tbody>
<tr>
<td>LF</td>
<td>35</td>
<td>33</td>
</tr>
<tr>
<td>LL</td>
<td>22</td>
<td></td>
</tr>
</tbody>
</table>

Recall that the relevant claim about this alternation is that the participating tones have identical endpoints. This claim is problematic for our system since there is no feature which refers to the end point of a contour. It would seem that a simple rule would add or remove the [contour] feature; however that leaves aside that the low rising contour is in the Lower register while it alternates with the mid level tone in the Upper register.
Examining both of these issues we can see that the mid level tone appears to participate in Lower register activity. As I laid out previously we cannot postulate that the mid level tone is actually in the Lower register if we use this feature system; at least not contrastively. We are left with two possible conclusions: some non-contrastive features are at play in the alternations described above, or the feature system cannot adequately describe Cantonese tone alternations. Since I would like to preserve the idea of contrast I will choose to argue against Barrie’s tone features. In the next section I will present another case in which they cannot be used to adequately describe an alternation.

7 Tianjin

Tianjin is a Mandarin dialect spoken in the port city of Tianjin; it has a smaller tone inventory then the Yue dialects previously examined. There appear to be multiple descriptions of the pitch of Tianjin tones where some level tones are actually slightly falling or rising, I do not consider these. Below I give the Tianjin tone inventory again.

(22) Tone in Tianjin (Chen, 2000)

<table>
<thead>
<tr>
<th>Low</th>
<th>High</th>
<th>Rise</th>
<th>Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>55</td>
<td>24</td>
<td>53</td>
</tr>
<tr>
<td>L</td>
<td>H</td>
<td>R</td>
<td>F</td>
</tr>
</tbody>
</table>

The first thing to notice about this inventory as compared to the Yue tone inventories is that we only need two features to describe all four tones. They are unambiguously Register and [contour]. For the one alternation we will consider it turns out that neither Register > [contour] nor [contour] > Register will allow us to capture it in a satisfactory

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5 Though it could have also been the case that the rise and fall were clearly in one Register, in which case we would need to use Pitch. As it turns out we cannot really determine which Register the contour tones should fall into.
manner. Nevertheless, I will give a contrastive feature specification for Tianjin as a point of reference.

(23) Contrastive Specification for Tianjin Tone

<table>
<thead>
<tr>
<th>Register</th>
<th>Upper</th>
<th>Lower</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contour</td>
<td>[contour]</td>
<td>[contour]</td>
</tr>
<tr>
<td>Tone</td>
<td>H</td>
<td>F</td>
</tr>
</tbody>
</table>

Also note that if we adopt this specification seriously then we have to explain why the Lower register [contour] tone is a rising contour and not a falling one. See Barrie’s account of the Upper register [contour] tone in Taishan.

### 7.1 Tianjin Tone Sandhi

We are now returning to the alternation previously described. Recall that Tianjin prevents identical tone clusters as well as barring the start point of a contour to be identical to the end point of the preceding tone.

(24) Tianjin tone dissimilation (Yip, 2002)

\[
\begin{align*}
R.R & \rightarrow H.R \\
F.F & \rightarrow L.F \\
L.L & \rightarrow R.L
\end{align*}
\]

We are left without the adequate tools to capture this change. The rising tone is in alternation with both the high and low tone. This is problematic because it requires not only a change in [contour] but also a change in Register. No rule using these features will be able to capture the generalization correctly. Consider this final fact about dissimilation; sequences of falling tones followed by low tones are resolved into high low sequences as schematized below.

[6] This process is actually far more complicated and applies to three syllable clusters as well. The data becomes more difficult to untangle, but see for a comprehensive discussion and analysis.
Tianjin Tone Absorption

F.L → H.L

This process is eerily similar to tonal absorption of African languages, but in those cases the contours are actually decomposable into level tones. Evidently the feature system that Barrie has described for Chinese languages cannot capture this alternation, nor those described in Cantonese.

8 Conclusion

In this paper I have reviewed Barrie (2007)’s model for contour tones in Chinese languages. I examined arguments in favor of unitary contours and presented a brief introduction to the theory of the Contrastive Hierarchy. I examined how Barrie’s model succeeds in capturing sandhi facts about Taishan and then presented data from Cantonese and Tianjin which cannot be accounted for using his system.

In general, we see that alternations which make reference to contour end points are not possible to formulate in terms of Barrie’s model. Additionally cluster simplification cannot be adequately described since unitary contours do not behave in the desired way with respect to concatenation. Indeed we can notice that the key difference in Taishan and Cantonese with respect to clusters is that Taishan tolerates derived complex clusters while Cantonese will assimilate them.

Though the Contrastive Hierarchy provides us with a powerful tool to pare down our feature representations, we seem to have an inadequate understanding of contour tones to begin with. Since the failure seems to be related to what our features can describe and not how many features we can refer to I do not make the strong claim that the Contrastivist Hypothesis is disproven by this data.

It is clear then that further research is needed. Particular focus must be paid to alterna-
tions that refer to targets within contours, as these are undeniably relevant. We must also not revert to a cluster tone analysis; as I have shown there is ample evidence that Chinese languages treat contours as unitary.

**References**


