# Backness Agreement in Consonant + Glide Onsets in Mandarin

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## 1 Introduction

Most languages have restrictions on Consonant + Glide (CG) sequences, and Mandarin has a particularly complex system. An inventory of Mandarin CG sequences can be found in (1).[1]

(1) Mandarin CG sequences[2]

| | | j Dor [-ba] | ɥ Lab,Dor [-ba] | w Lab,Dor [+ba] |
|---|---|---|---|---|
| Lab [0ba] | p | | | |
| | pʰ | | | |
| | m | | | |
| | f | | | |
| Cor [0ba] | t | | | |
| | tʰ | | | |
| | n | | | |
| | l | | | |
| | ts | | | |
| | tsʰ | | | |
| | s | | | |
| | tʂ | | | |
| | tʂʰ | | | |
| | ʂ | | | |
| | ʐ | | | |
| Pal (Cor,Dor) [-ba] | tɕ | | | |
| | tɕʰ | | | |
| | ɕ | | | |
| Dor [+ba] | k | | | |
| | kʰ | | | |
| | x | | | |

Many linguists study CG restrictions by focusing on articulator features: Labial, Coronal, Dorsal (Duanmu 2000, Hume 1990, Kochetov 2016), and Duanmu (2000: 32) argues that restrictions on Mandarin CG onsets can be accounted for by the Articulator Dissimilation Principle[3]: "Identical articulators cannot

[1] Shaded cells mean that CG sequence is absent.
[2] The consonant [ʐ] has been analyzed as an obstruent or a sonorant (Duanmu 2000). We analyze it as a voiced fricative since it behaves more like an obstruent than a sonorant: (i) all initial sonorants in Mandarin can be followed by [j], yet [ʐ] + [j] is missing; (ii) no non-palatal fricatives + [j] sequences are allowed, and neither is *[ʐj].
[3] See also Yi & Duanmu (2015) and Gong, S. & Zhang, J. (2019) for Articulator Dissimilation.


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occur in succession." However, this proposal does not cover all onset data. Mandarin onsets like [fj] are ungrammatical even though the initial consonant [f] and the following glide [j] have different articulators. What constraints penalize [fj]? Furthermore, Duanmu does not discuss Mandarin palatals [t͡ɕ, t͡ɕʰ, ɕ]. What constraints penalize palatals + [w], but not palatals + [j, ɥ]? In this paper, we discuss restrictions on Mandarin CG onsets and show the need for both articulator features and backness agreement.

## 2 OCP and Backness Agreement Constraints

We propose that the presence and absence of particular CG sequences in Mandarin can be accounted for using two types of constraints: an OCP constraint (CG: *LabLab) and a group of backness agreement constraints (CG: backness agreement).

(2) CG: *LabLab - labial consonant and a labial glide sequence are not legal
(3) CG: backness agreement - a consonant + glide sequence must have the same backness feature specification

The OCP constraint (2) is in line with Duanmu's (2000) Articulator Dissimilation Principle, so that a labial consonant ([p, pʰ, f, m]) followed by a labial glide ([ɥ, w]) is not a legal sequence. The constraint would rule out sequences such as *[pw] but not [pj] or [tw].[4]

In order to motivate the backness agreement constraints, we have to clarify the backness feature specifications for consonants and glides. Since [back] is a subfeature of the DORSAL node, only velar consonants, palatal consonants, and vowels/glides have a backness feature. Following Riggle (2011), we specify the palatal consonants [ɕ, t͡ɕʰ, t͡ɕ] as [-back], and the velar consonants [kʰ, k, x, ŋ] as [+back]. Furthermore, we follow Duanmu (2000), Hayes (2011), Kenstowicz (1994), Riggle (2011), and others in analyzing all vowels, and therefore glides, as having a DORSAL place node: [j, ɥ] are [-back], [w] is [+back].[5] The labial consonants and non-palatal coronal consonants do not have a back feature specification ([0back]).

(4) [back] specification

| | | |
|---|---|---|
| palatal consonants | [ɕ, t͡ɕʰ, t͡ɕ] | [-back] |
| velar consonants | [kʰ, k, x, ŋ] | [+back] |
| front glides | [j, ɥ] | [-back] |
| back glide | [w] | [+back] |

The backness agreement constraint in (3) does not apply to all CG sequences in Mandarin. It is sub-specified for certain types of consonants and glides only, as defined in (5a-5c).

(5) backness agreement
(a) Agree[back]:DorG - An initial dorsal consonant (palatal or velar) and any following glide ([j ɥ w]) must have the same backness value.
(b) Agree[back]:$C_{[-son]}$ ɥ - An initial obstruent and the following glide [ɥ] must have the same backness value: [-back]
(c) Agree[back]:$C_{[-son, +cont]}$ j - A [-son, +cont] consonant (affricate or fricative) and the following glide [j] must have the same backness value: [-back][6]

[4] OCP-based phonotactic constraints contribute to Mandarin non-word judgment (Gong, Shuxiao. & Zhang, Jie. 2019).
[5] The glides [ɥ] and [w] also have a LABIAL feature, and Duanmu (2000) claims that [w] is LAB but not DOR. Some have argued that the front glides [j, ɥ] can also be analyzed as having a CORONAL articulator (Broselow & Niyondagara 1991, Hume 1994).
[6] We analyze affricates as both [-cont] and [+cont] following Riggle (2011) and others. However, others label affricates as [-cont] (Hayes 2011).

The backness agreement constraints in (5) are always violated if the consonant does not have a backness feature specification. Hence, the relevant labial consonant + glide sequences or non-palatal coronal consonant + glide sequences always violate these constraints.

## 3 Legal and Illegal Cj, Cɥ and Cw Sequences

In order to account for the attested and unattested Cj sequences, we need two constraints: Agree[back]:$C_{[-son, +cont]}$j and Agree[back]:DorG. The former rules out all fricatives and affricates followed by [j], except the palatal consonants followed by [j] since they share a [-back] feature specification. The latter constraint rules out the velar consonant + [j] sequences since velar consonants are [+back] and [j] is [-back]. Note that we need both constraints because the velar consonants are not all covered by the first constraint since [k, $k^h$] are [-cont]. All other Cj sequences involving stops and sonorants are legal.

What about Cɥ sequences? Two constraints allow us to account for the attested and unattested forms: *LabLab and Agree[back]:$C_{[-son]}$ɥ. The OCP constraint rules out labial consonants ([p, $p^h$, m, f]) followed by [ɥ]. The agreement constraint rules out all obstruents followed by [ɥ] that do not share a backness feature, i.e., all of the non-palatal obstruents since only the palatal obstruents share the [-back] feature specification with [ɥ]. Note that another agreement constraint also applies to some of these sequences: Agree[back]:DorG also applies in some of the same contexts as Agree[back]:$C_{[-son]}$ɥ because all dorsals in Mandarin are [-son] (obstruents); however, Agree[back]:DorG would not allow us to account for the absence of the non-palatal coronal obstruent + [ɥ] sequences.

In order to account for Cw sequences, we need two constraints: *LabLab and Agree[back]:DorG. The first one rules out all cases of [w] preceded by a labial consonant. The second one rules out all cases of [w] ([+back]) preceded by a palatal consonant ([-back]). All other sequences are allowed.

## 4 Conclusion

Duanmu (2000)'s Articulator Dissimilation claim is not explanatory enough for Mandarin onsets. Articulator features and backness values are both needed for the four constraints on Mandarin CG sequences: *CG-LabLab, Agree[back]:DorG, Agree[back]:$C_{[-son]}$ɥ and Agree[back]:$C_{[-son, +cont]}$j. Mandarin requires both OCP and anti-OCP constraints: dissimilation of major articulator features for distinctiveness of phonetic cues, and agreement of dependent features like backness for ease of articulation.

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