1. Previous research

Functional motivations are meant to be the driving mechanism behind a phonological entity. Phonological (sonority, features, hierarchies) vs. phonetic (movement, duration, air flow)

The latter – predominant after the advent of Optimality Theory

Vowel harmony – Linebaugh (2008)

*[ŋ] - my (Oda’s) work

Applied languages - Dutch, German, French, Polish, Italian, Galician, Macedonian, Malayalam, Japanese, Korean, Marathi, Yoruba, etc.
2. The four dimensions of soft palate

Much lowering – velar nasal
Mid lowering – coronal and labial nasals, nasalized vowels
Mid raising – oral velar consonants
Much raising – oral sounds other than those with velar

Universality – contact with soft palate, air flow, etc.

The markedness constraint banning on onset velar nasals is grounded in the three degrees of the four dimensions.

Shared phonetic feature in the one-degreed movement (less marked)
Much lowering + mid lowering – air flow into nasal cavity
Much raising + mid raising – air flow into oral cavity
Mid lowering + mid raising – no articulation with firm contact

Shared phonetic feature in the two-degreed movement (less marked)
Much lowering + mid raising – the contact of velum with the back of the tongue
Mid lowering + much raising – the posture without the contact with the back

No shared phonetic feature in the three-degreed movement (marked)
3. Nasalized vowel

Vocalic nasalization by codas, not by onsets – accents of Japanese without onset velar nasal, assimilation and alternation in French, many Polish examples, Yoruba, etc.
Nasalized vowel + coda velar nasal – one degree
Onset velar nasal + oral vowel – three degrees

Onset velar nasal + nasalized vowel, if any, blocks the marked three-degreed movement.
Tokyo Japanese kagami ‘mirror’, ichigo ‘strawberry’
A daily used expression nominative ga-

Nasalized vowel – an assimilation
Total ban on onset velar nasal and total ban on onset-nucleus assimilation
American English
Nasalized vowel ban
Syllabic [r:] first, heard
Diphthongal rhotic your, pair
The ban on the three-degreed movement
4. Sequence

NC sequences as the velars
The phonetically smooth articulations – the degrees of the movements consist of one or two, but not three.

Fula *biDiGa* ‘big child’
The onset in the second syllable [ŋg] occurs despite the worse sonority contour than the singleton of the velar nasal.
It is because of the phonetic preference in favor of the one or two degrees relative to the three.

5. Intervocalic position

No resyllabification process in the majority, if not all, of the world’s languages

\[ V_ŋ.V > *V.ŋV \]

\[ V_ŋ.V – one degree + three degrees (the first vowel is nasalized) \]
\[ *V.ŋV – three degrees + three degrees (no nasalization) \]
6. Sequential typology

(a) The following long vowel
   The three-degreed movement becomes easier due to the three segments, instead of the two.
   Cantonese, Thai, Maori

(b) The germination
   The same effect as that of (a)
   Inuktitut, Malayalam

7. Four-dimensioned typology

(a) Onset velar nasal + nasalized vowel takes precedence on onset velar nasal + oral vowel
   Japanese, Spanish, Marathi

(b) The one or two-degreed movement takes precedence on the three-degreed movement.
   American English, French, Korean