

Biclass Segments

Consonants the IPA writes with one symbol and endolinguistics reads as two classes — a technical note on the IPA→OAS mapping

Alejandro Toledo Martínez

A brief technical note. It records an observation by the author about the IPA→class mapping and formulates it as a proposed, versioned revision of the correspondence inventory: certain single pulmonic IPA segments engage two articulatory regions at once and must contribute two OAS classes to the skeleton. Three groups are defined — the displaced sibilants ($\Sigma \cdot X$), the dorsal nasals ($\Xi \cdot X$), and the palatal lateral ($\Lambda \cdot X$) — each with threefold evidence (articulatory, diachronic, orthographic). The affricates are excluded from the biclass reading and given a category of their own (transition); the retroflex liquids are declared open. And because naive application of the rule has already produced errors in a corpus experiment, licensing conditions (L1–L4) are established: the decomposition is never applied blindly.

1. The observation

The IPA counts segments: one symbol, one sound. The OAS classes read regions: one class, one zone of the mouth. The two bookkeepings almost always agree — an *s* is one segment and one class; a *k*, likewise — and for that reason the IPA→class mapping has so far been treated as a one-to-one function.

But there is a handful of consonants where the bookkeepings do not agree: segments the IPA writes with a single symbol which, articulatorily, occupy two regions at once. Treating them as a single class — as the current mapping does — is not an error of detail: it makes part of the code invisible, and (as §6 shows) it breaks code conservation precisely between coderivatives where conservation ought to hold.

2. The principle: the biclass segment

Definition. A *biclass segment* is a single pulmonic IPA segment whose articulation simultaneously engages two class regions, and which therefore contributes two classes to the word's skeleton — not one.

Three converging criteria identify it, and their convergence should be demanded:

1. The articulatory criterion (the governing one). The segment has a *base* (its primary manner-region: sibilance, nasality, laterality) and a *dorsal displacement*: the gesture shifts toward the palatal/velar region — the region of class X. The two regions sound at the same time, not one after the other; this simultaneity is what distinguishes the biclass segment from the transition (§8).
2. The diachronic criterion. The segment arises historically from clusters of two consonants — one per class — and continues to alternate with those clusters across coderivatives. The fusion of the cluster into a segment did not destroy the code: it compressed it.

3. The orthographic criterion. Traditional writing systems — which are memory — spell these segments with digraphs, and the second letter of the digraph almost always belongs to the X region. The IPA compressed them into one symbol; the orthographies remember the composition.

When the three criteria point the same way, the biclass reading is not an analyst's licence: it is the restitution of a structure that the segmental level of the IPA had hidden. Where only the articulatory criterion holds (some of the doors of $\mathfrak{p}$, the geminate door of $\mathfrak{k}$), the articulatory one governs, and the diachronic works as frequent — not universal — confirmation.

3. Group 1 — the displaced sibilants: $\Sigma \cdot X$

Members. The postalveolar fricatives $\mathfrak{ʃ}$, $\mathfrak{ʒ}$ (the *sh* and the *zh*), and their retroflex $\mathfrak{ʂ}$, $\mathfrak{ʐ}$ and alveolo-palatal $\mathfrak{ɕ}$, $\mathfrak{ɟ}$ counterparts.

Reading. Sibillancy (Σ) with dorsal contact (X): class S + class K. The friction is that of the sibilant family; the place has shifted toward the velar-palatal region. One segment, two regions.

Diachronic evidence. The cluster *s+k* fuses into $\mathfrak{ʃ}$, and the alternation is still alive across cognatives:

- Germanic: Scandinavian keeps *skal* where English palatalized to *shall*; and within Scandinavian itself, *sk-* before front vowels is pronounced $\mathfrak{ʃ}$ — Norwegian says *ski* as "shee", in the very word English borrowed with *sk*. The same word, on either side of the border, alternates cluster and segment.
- Romance: Latin *piscem* ($\mathfrak{p} \cdot \mathfrak{s} \cdot \mathfrak{k}$) gave Italian *pesce* with $\mathfrak{ʃ}$ — the *sc* cluster compressed into a single sound.

And there is a second door that reinforces the reading: $\mathfrak{ʃ}$ is also born from the X side, by palatalization of the velar alone — Latin *cattus* → French *chat* with $\mathfrak{ʃ}$, *camera* → *chambre*. That $\mathfrak{ʃ}$ is historically reachable from $\Sigma + X$ and from X says precisely where it lives: at the meeting point of the two regions.

Orthographic evidence. English *sh* = $\mathfrak{s} + \mathfrak{h}$ (and $\mathfrak{h}$ is X-region). German *sch* = $\mathfrak{s} + \mathfrak{ch}$. Italian *sci*. All three spellings spell out $\Sigma \cdot X$.

The IPA's own internal witness. The symbol $\mathfrak{ɰ}$ — the Swedish sound of *sjuk* — is defined by the IPA itself as "simultaneous $\mathfrak{ʃ}$ and $\mathfrak{x}$ ": in that corner, the phonetic alphabet admits that one segment can be two frictions at once. The proposal of this note merely generalizes what that symbol already confesses.

4. Group 2 — the dorsal nasals: $\Xi \cdot X$

Members. The retroflex $\mathfrak{ɳ}$, palatal $\mathfrak{ɲ}$, velar $\mathfrak{ŋ}$ and uvular $\mathfrak{ɴ}$ nasals. (The uvular enters in its own right: its region is dorsal; its rarity in corpora does not change its reading.)

Reading. Nasality (Ξ) realized in the dorsal region (X): class N + class K. The dental-alveolar *n* is pure Ξ ; its sisters further back additionally carry the X region in their place of articulation.

Diachronic evidence.

- $\mathfrak{ŋ}$ is born from the cluster *n+g* / *n+k* and goes on living beside it: English *sing* had an audible *g* before absorbing it; Spanish produces it before velars (*banco*, *tengo*) exactly where the velar is still present.

- η has three historical doors, and all three should be stated: the cluster *gn* (Latin *lignum* → Spanish *leño*, "log"; *agnellum* → French *agneau*), where the X sits in the donor; the cluster *n+yod* (*vinea* → *viña*, *senior* → *señor*), where the palatal element is dorsal-region; and the geminate *nn* (*annus* → *año*, "year"), where the palatality emerges with no segmental donor. Two of the three doors bring the X from a cluster; the third generates it — consistent with §2: the articulatory criterion governs.

Orthographic evidence. The digraph *ng* — English, German, Tagalog — spells out $\Xi \cdot X$ letter by letter. Italian writes η as *gn*; Portuguese, *nh*; Catalan and Hungarian, *ny*. In every case: the nasal plus a letter of the dorsal or palatal region.

5. Group 3 — the palatal lateral: $\Lambda \cdot X$

Member. The palatal lateral Λ (the historical Spanish *ll*, the Italian *gli*, the Portuguese *lh*).

Reading. Flowing laterality (Λ) realized in the palatal region (X): class L + class K.

Diachronic evidence. The cluster doors are *cl*, *gl* and the geminate *ll*:

- *clavem* → *llave* ("key"), *clamare* → *llamar* ("to call"): the $k+l$ cluster compressed into Λ .
- Italian *gli* (the $g+l$ cluster in the very spelling) realizes Λ ; *gl*-type clusters alternate with the palatal lateral across Romance.
- The geminate *ll* (*caballum* → *caballo*, "horse"): like the *nn* of *año*, the palatality emerges without a dorsal donor — the articulatory criterion governing once again.

Honest record of the known complication: Spanish also produced Λ from *pl*- and *fl*- (*pluvia* → *lluvia*, "rain"; *flamma* → *llama*, "flame"), where the donor is not dorsal. The adopted reading resolves this as in the other donorless doors: the X of Λ records the palatal place of the resulting segment, not the class of the lost donor — and the C0** trace preserves the source cluster in any case, for whoever wishes to study that loss.

Orthographic evidence. Italian *gli* ($g = X$ region), Portuguese *lh*, Catalan and Hungarian *ll/ly*: the lateral plus a dorsal-palatal letter.

This group's gift. *Clavem* ($k \cdot l \cdot v$) yields the skeleton $X \cdot \Lambda \cdot \Phi$. Under the one-to-one mapping, *llave* ($\Lambda \cdot v$) would yield Λ, Φ — a different code for the same word. Under the biclass reading, *llave* = $X \cdot \Lambda \cdot \Phi$ (order by provenance, §7): identical to *clavem*. Code conservation is repaired here as well.

6. Why it matters: code conservation

The central consequence is not a matter of counting but of structure, and one example shows it.

Under the current mapping ($\jmath =$ plain Σ), English *shall* yields the skeleton Σ, Λ and Scandinavian *skal* yields Σ, X, Λ : two different codes for the same word — a direct violation of the principle that translation between coderivatives conserves the code. Under the biclass reading, *shall* = $\Sigma \cdot X \cdot \Lambda$ and *skal* = $\Sigma \cdot X \cdot \Lambda$: the code is conserved, and the apparent exception is revealed as what it was — an artifact of the IPA's segmental level, not a fact of the language.

The same holds for *pesce/piscem*, for *leño/lignum*, for *llave/clavem*, for *sing* against its own history. In every case, the biclass decomposition repairs code conservation exactly where it seemed to fail. That is the mark of a good instrument correction: it adds no new structure; it recovers the structure the instrument was losing.

The corresponding prediction is hereby declared, for when the corpus permits: measured over coderivative pairs that cross the cluster↔segment border ($sk \leftrightarrow f$, $gn \leftrightarrow j$, $ng \leftrightarrow \eta$, $cl \leftrightarrow \Lambda$), code conservation must increase when the biclass decomposition is applied, relative to the one-to-one mapping. It is a pre-registrable prediction; this note declares it and does not run it.

7. The internal order of the segment

The decomposition fixes the nucleus with certainty: Σ, X , Ξ, X , Λ, X by group. The order inside the segment is a separate question, resolved by a two-step convention:

- Where the provenance is known, the order is read from the source cluster: $sk \rightarrow f$ inherits $\Sigma \cdot X$; $gn \rightarrow j$ inherits $X \cdot \Xi$; $n+yod \rightarrow j$ inherits $\Xi \cdot X$; $cl/gl \rightarrow \Lambda$ inherit $X \cdot \Lambda$. Note that one and the same segment can thus carry the same nucleus under two orders according to its history — which is information, not noise.
- Where the provenance is unknown (or there is no donor: $nn \rightarrow j$, $ll \rightarrow \Lambda$), the default convention is base first, dorsal colouring second ($\Sigma \cdot X$, $\Xi \cdot X$, $\Lambda \cdot X$).
- In both cases variant traceability (C0★★) applies: the original IPA segment and its projected decomposition are both recorded, so that no ordering decision is irreversible.

8. What is decided and what remains open

The extension questions posed in the first version of this note were resolved by the author, except one: The affricates $tʃ$, $dʒ$ are NOT biclass. The author's reading: the affricate is a transition — a passing from the dental region toward the alveolar and postalveolar; a movement from Θ toward Σ , not two regions sounding at once. This introduces a category of its own, distinct from the biclass segment:

Transition segment. A segment whose gesture *traverses* two regions in time, rather than engaging them simultaneously. It is read by its destination: the affricates $tʃ$, $dʒ$ remain in class Σ , understood as dental→sibilant transitions.

The distinction is clean and sharpens the definition of the biclass segment by contrast: in f the two regions are *simultaneous* (hence two classes); in $tʃ$ they are *successive within the gesture* (hence one class, the class of arrival). Whether the transition deserves to be recorded as a skeleton-level trait (skeleton level, not class level), the way friction is, is left as a refinement for the future.

The uvular nasal ɴ is included in group 2 (already reflected in §4).

The retroflex liquids $ɭ$, $ɮ$ remain open. The author declares them, in their present state, a mystery: neither the biclass reading nor the simple one seems to him justified yet. This is placed on record and not decided — the correspondence inventory tolerates declared gaps better than premature decisions.

A transversal consequence to watch: the biclass reading increases the number of classes per word, and words that previously fit a ternary may now exceed three classes and fall under the compound rule (separate into morphemes; never truncate). This is not a defect — it is the rule operating on more faithful data — but it will change counts and must be declared when comparing with earlier analyses.

9. Licensing conditions: when to read biclass — and when not to

The rule of §10 cannot be applied blindly, and we know this from direct experience: in an IPA corpus-generation experiment, naive application of the decomposition produced errors. Those errors do not invalidate the proposal; they teach its conditions. Two failure modes, and the licences that block them.

First failure mode: counting the same X twice. A segment's dorsality can be its own or borrowed from its neighbour. In Spanish *banco* ("bank/bench") [baŋko], the ŋ is not a phoneme: it is /n/ assimilated to the velar that follows — the X region is already in the /k/, and decomposing the ŋ would count it twice ($\Phi \cdot \Xi \cdot X \cdot X$ where the code is $\Phi \cdot \Xi \cdot X$). In English *sing* [sɪŋ], by contrast, the ŋ stands alone, finally, and contrasts lexically (*sin* ≠ *sing*): there the dorsality belongs to the segment. Hence:

L1 — Ownership, not borrowing. The biclass decomposition applies only when the dorsal colouring is the segment's *own* — contrastive, lexical, stable without the neighbour. When it is *predictable from context* (assimilation before a X-class consonant), it is skeleton-level variation and only the base is read. It is the same architecture as the friction rule: what is conditioned lives in the skeleton; what is owned lives in the class.

L2 — No duplication. Operational corollary: in a cluster [biclass-candidate + X-class consonant], the X region is counted once. Never $\eta k \rightarrow \Xi \cdot X \cdot X$.

Second failure mode: the phantom segments of transition. Speech is a continuous gesture, and in passing from one consonant to the next the mouth traverses intermediate configurations that a fine transcription can hear as segments: the sequence n→k sometimes sounds as if it inserted a g ("ngk"); the sequence n→s produces an intrusive t (*prince* sounds like [prints]). These bridges are not segments of the lexicon: they are the seam between two gestures, promoted to a symbol by the transcription — discretization failing before the flow. And yet history teaches that a bridge can turn to stone: Latin *hominem* gave Spanish *hombre* ("man") — the b was born as a transition between m and r, and today it is a segment with full rights. Hence:

L3 — The excrescence guard. An intermediate segment counts only if the lexical form *owns* it (stable, contrastive, established: the b of *hombre* counts); it does not count if it is a predictable bridge between its two neighbours (the g of the transcription [ŋg] does not count). In skeleton normalization, predictable bridges are removed before lifting to classes; and where a bridge has lexicalized, its provenance is recorded — it is a transition made flesh, and that is information, not noise.

And the licence that governs the others. All of the above is verified, not decreed:

L4 — Genealogical licence. The biclass reading obeys genealogy. Within a coderivative field, the decomposition applies where the field attests the cluster↔segment alternation (*shall*↔*skal*, *llave*↔*clavem*, *leño*↔*lignum*); where no coderivative field is available, the reading rests on L1 (phonemic ownership) and is marked provisional. The biclass segment is not declared from the table: it is confirmed in the descent.

The bottom of the matter: rhythm. Why does discretization fail exactly here? Because the segment is a cut imposed on a flow, and there are places where the flow resists the cut: fusions (two regions in one segment — the biclass), traversals (one region on its way to another — the $\Theta \rightarrow \Sigma$ transition of §8), bridges (a phantom segment between two gestures — excrescence). The three phenomena are one thing seen three times: the seam between the continuous and the discrete. And what governs that seam is rhythm — position in the syllable, the tempo of the gesture, the offset between velum, tongue and lips: ŋ became phonemic in English when the final g fell; sk→ʃ happened in syllable onsets; the b of *hombre* was born because the velum and the lips do not change state at the same instant. Said in the discipline's vocabulary: this is the exact point where the qualic domain (the flow, the endorhythm)

touches the quantific domain (the segment, the class). The note leaves it marked as what it is — a major topic, not resolved here — with a single practical consequence: every discretization rule in this zone is a modelling decision over a continuum, and for that reason it is declared with licences instead of being applied blindly. Great care and great methodological caution: that is, in this zone, the first rule.

10. Operative rule (proposed versioned revision)

For the skeleton pipeline, the proposal condenses as follows:

Biclass rule (with licences). In skeleton extraction: the segments $\int$, $\mathfrak{z}$, $\mathfrak{s}$, $\mathfrak{z}_\ell$, $\mathfrak{c}$, $\mathfrak{z}$ contribute the classes $\Sigma \cdot X$; the segments η , $\mathfrak{p}$, η , $\mathfrak{N}$ contribute $\Xi \cdot X$; the segment λ contributes $\Lambda \cdot X$ — only under licence: dorsality owned and not borrowed from the neighbour (L1), without duplicating a cluster's X (L2), with transcription bridges removed (L3), and with genealogical confirmation where a coderivative field exists — provisional where none does (L4). Order is read from provenance when known; base $\cdot X$ by default. The affricates $\mathfrak{t}\mathfrak{f}$, $\mathfrak{d}\mathfrak{z}$ are not decomposed: they read Σ ($\Theta \rightarrow \Sigma$ transitions). The retroflex liquids remain without a rule, as a declared gap. The original IPA segment is preserved alongside its decomposition and the licence applied (C0**).

In accordance with the protocol, this change to the mapping is a versioned revision of the correspondence inventory (C0): it is declared before being used in any new analysis, it receives a version number, and earlier analyses are cited with the version under which they were made. Nothing already published is silently reinterpreted.

Context: this note refines the methodology's IPA $\rightarrow$ class mapping (fricatives by place, S = sibilants only) and the canonical-skeleton normalization. The observation, the three groups and the decisions of §8 are the author's; the note systematizes them and places the declared gap on record.