A Consideration of the Consonant Chart in the International Phonetic Alphabet

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Abstract

In this paper we outline various problems with the current IPA consonant chart, based on the study of an ever-increasing number of languages. We propose a revised version of the chart, which has many similarities with the pre-1989 version of the chart, but which at the same time shows innovations. We particularly focus on the glottal/laryngeal sounds; the epiglottal and pharyngeal sounds; the retroflexes; the sibilant fricatives; and the semi-vowels/approximants. We hope that our discussion will be useful to both researchers and pedagogues, and we hope that our proposed revisions are logical from the phonetic and phonological points of view.

Introduction

Human speech sounds are complex, with some sounds (such as vowels) existing more in a gradient space, and some sounds (such as some consonant contrasts) being more categorical. Stops and fricatives might be said to be more categorical in manner of articulation, in that if a speech sound involves full blockage of airflow, it is a stop; and if the sound involves sustained noise shaped by the oral cavity, it is a fricative. There cannot be said to be an intermediate state where the sound is between a stop and a fricative in acoustic or articulatory terms. At the same time, one could argue that some contrasts of place are more gradient, since one could describe a sound as being "more velar" or "more uvular", or "more palatal".

Given such complexity in speech sounds, it is perhaps not surprising that over the decades, the chart of the International Phonetic Alphabet (IPA) has been revised several times, as phoneticians' understanding of speech is improved, partly through the use of instrumental techniques, and partly through the study of a greater variety of languages – historical IPA charts are given at https://www.internationalphoneticassociation.org/content/ipa-chart. We assume that the reader is familiar with the most recent chart of the IPA. However, throughout this paper we will refer to the 1951 chart of the IPA (which is also available at the above website), since this was the most recent chart before the significant reforms of the Kiel Convention in 1989 (International Phonetic Association 1989).

In this paper we consider some problems with the current IPA consonant chart, based on current knowledge of articulations in a variety of languages, and based on our own classroom experience of the most confusing aspects of the chart when teaching these sounds. We offer a possible alternative solution to the consonant chart, and while we recognize that our suggestions are not perfect, we hope that it is conceptually clearer and more accurate than the current chart, and that it will stimulate further discussion around the chart. Our draft revision of the IPA chart is included in the Appendix below.

Some issues with place of articulation

We begin by considering some problems with the consonant chart in terms of place of articulation:

Glottal

The Glottal column contains only a voiceless "plosive" and two "fricatives", with every other cell greyed out because the articulations are impossible (e.g. a glottal lateral). The existing symbols are problematic in terms of their voicing, in that the glottal stop [ʔ] almost never involves full closure (and nothing that could really be termed a "burst", as other plosives almost always have). Therefore, it may not be appropriate to place [ʔ] with other "voiceless" "stop" consonants. Glottal stop also does not pattern with other voiceless plosives in blocking the spread of nasality or vowel features in phonological harmony. The characteristic lack of a full closure is consistent with the frequent patterning of [ʔ] as a prosodic feature rather than a consonant phonologically, e.g. in weight-sensitive stress systems (Gordon 2006). A recent survey found a similar phonetic realization for glottal "fricatives" [h ɦ], whereby the voicing for both sounds is largely predictable by

context: the voiced glottal fricative is more common intervocalically, and the voiceless more common at utterance edges. Although this conditioning environment can be said to apply for other stop and fricative places of articulation (e.g. [p b]), the glottals are different in that contrasts between /h/ and /ɦ/ are controversial and likely reflect phonetic and phonological features other than voicing (Garellek, Chai, Huang & van Doren 2023). This is in stark contrast to the many languages that are known to have contrasts in stop or fricative voicing.

At the same time, the glottal "fricatives" are problematic as fricatives, if we consider frication to be turbulent noise that is generated by a constriction in the vocal tract. For glottal "fricatives", noise is generated when the vocal folds are held apart – this is closer to the definition of an approximant. In addition, acoustically the intensity of the noise is not comparable to the intensity of the oral fricatives. Indeed, the glottal /h/ is often described as the voiceless version of the adjacent vowel. Overall, the glottal fricatives are not easily defined from an articulatory or even an acoustic point of view. Instead, it is perhaps more appropriate to say that [h ɦ] is glottal spreading, and [ʔ] (which is very often not a stop) is glottal constriction (Garellek *et al.* 2023, Ladefoged 1990).

Studies involving direct imaging of [ʔ] have also shown that glottal constriction is usually produced with supraglottal laryngeal constriction, especially of the ventricular folds but also of general epilaryngeal constriction. If this supraglottal constriction is deemed criterial for producing a glottal stop, then [ʔ] could be called "laryngeal" instead of "glottal" (Esling, Moisik, Benner & Crevier-Buchman 2019). This would be a return to a label used in the early days of the IPA (e.g. in 1900, 1903, 1905, and 1921 – Udomkesmalee 2018) and would find support in phonological feature geometric classifications that place the glottal sounds under a "Laryngeal" node (Clements 1985, McCarthy 1988). At the same time, it is worth noting that the supraglottal constriction has yet to be deemed criterial: a glottal stop produced with minimal supraglottal constriction (e.g. only slight ventricular incursion) is found even in imaging studies of hyperarticulated speech (Garellek 2013).

Perhaps more importantly, glottal consonants pattern differently from other consonants in many phonological processes across the world's languages. For instance, in Sundanese, a process spreading nasalization across the word is blocked by a non-nasal consonant – however, glottals are transparent for this purpose (i.e. they do not behave as a consonant in this regard – Robins 1957, Cohn 1990). Similarly, glottals characteristically stand out from other consonants in allowing complete harmony (i.e. vowel copying) between vowels in adjacent syllables, e.g. in Mesoamerican languages (Bennet 2016, Rogers 2014). Glottals also behave as transparent segments, unlike other consonants, in child language phonology (Stemberger 1993). Even in English, the allomorphic rule assigning the indefinite article to a noun phrase treats the /h/ as transparent (i.e. as a non-consonant) for some speakers – e.g. /ən hɪstɔɹɪk əvent/. All of these observations are in line with the above-mentioned feature geometry approach to phonology, where glottal sounds are located within their own node "Laryngeal", quite separate from the node "Place".

For all of the above reasons, <u>we suggest that the glottal column be labelled "Glottal Laryngeal".</u> This is in line with the Laryngeal Articulator Model (Esling *et al.* 2019) that treats glottal stop as involving multiple laryngeal structures. We suggest retaining “Glottal” in the column for several reasons: continuity with the current chart; the still unanswered question of whether glottal stops, in spontaneous speech, can be produced with glottal constriction but without supraglottal constriction; and the fact that the conventional name of the symbol [ʔ] is likely to remain as “glottal stop” even if the chart redefines it as “glottal or laryngeal constriction”. Moreover, in order to respect the unusual status of these sounds with respect to all of the other consonants in the chart, we add a thicker line between the laryngeal column and the rest of the consonant chart, in order to highlight the fact that although glottals/laryngeals often pattern as consonants, there are many occasions where they are transparent to phonological processes that apply to (all) other consonants. In addition, <u>we have removed the cell boundaries in the Glottal Laryngeal column</u>, so as to make it explicit that the symbols in this column represent a continuum of constriction – there is thus a visual distance between [ʔ] and [h ɦ] which is indicative of this continuum. The removal of cell boundaries also represents the fact that the standard supra-laryngeal manner definitions (e.g. lateral, flap) are not relevant for

laryngeal sounds. Nonetheless, we place [ʔ] in the plosive row and [h ɦ] in the approximant row, in order to denote that these articulatory gestures involve constriction and spreading respectively.

In line with proposals and subsequent discussion following the Kiel Convention (Ladefoged 1990, Catford, 1990), we have considered simply removing the laryngeals from the consonant chart altogether, and placing them on their own separate line outside of the chart. However, we felt that this choice would be more problematic in terms of backward compatibility of the chart, and more importantly, would also deny the glottal laryngeals a status of (albeit imperfect) consonants. For this reason we choose the thicker line and the deleted cell boundaries as the preferable option.

Pharyngeal and Epilaryngeal

In the present IPA chart, the column "Pharyngeal" has only two symbols listed, namely the voiced and voiceless fricatives [ħ ʕ]. However, the voiced pharyngeal [ʕ] is more often realized as an approximant rather than a fricative. Indeed, the chart allows the possibility of a pharyngeal approximant, as well as a voiceless pharyngeal plosive, and also a trill, tap or flap. At the same time, the voiceless and voiced epiglottal fricatives [ʜ ʢ], and the epiglottal plosive [ʡ] are listed under "Other symbols" beneath the main consonant chart. It should be noted that the epiglottal plosive [ʡ] has been characterized as a pharyngealized glottal stop (Esling *et al.* 2019).

We propose to merge the categories pharyngeal and epiglottal into a single column, labelled "Pharyngeal Epilaryngeal". Note that we write "Epilaryngeal" instead of "Epiglottal", to highlight the role that the superior larynx plays in producing lower-pharyngeal/epiglottal constriction (Esling *et al.* 2019). The voiceless stop in this column is [ʡ], with no voiced stop counterpart, in line with the view that it is an epilaryngeal (or 'pharyngealized glottal') stop. We propose two trills for this column, voiceless [ʜ] and voiced [ʢ], in line with the typical realization of these two epiglottals (see for example Figure 5.23 on page 168 of Ladefoged & Maddieson 1996, which shows clear trilling for [ʜ] in the North Caucasian language Agul). We note that this will be the first voiceless member of the trill manner row (though they occur quite often phonetically as variants of the voiced trills). The voiceless pharyngeal fricative [ħ] occupies the fricative cell in this column, and the voiced pharyngeal [ʕ] occupies the approximant cell in this column.

A short note on the uvular and velar places of articulation

We recognize that the uvular fricatives, like pharyngeals, are also often not realized as fricatives: the voiceless [χ] is often realized as a voiceless trill, and the voiced [ʁ] is often realized as an approximant. However, we do not propose any changes at this stage, and acknowledge that the post-velar region of the consonant space is still comparatively poorly understood. Despite the existence of languages (such as in the Caucasus and in parts of the Americas) that treat velar and uvular stops as separate phonemes (Ladefoged & Maddieson 1996), we note the usefulness of treating velar-uvular as a continuum, varying according to vowel context, or according to language-internal forces (Butcher & Tabain 2004). Indeed, Catford's (2001) reference to velar and uvular being an "octave" apart can serve as a useful analogy for the gradient nature of this contrast.

On a final short note regarding the velar place of articulation, we wonder if it is entirely accurate to include the velar lateral [ʟ] as a speech sound, given that empirical investigation of Mee has suggested that this sound is highly variable, and could in most cases be characterized simply as the sequence [gl] (Staroverov & Tebay 2022). Similar variability has been noted for Mid Waghi and Archi (Ladefoged & Maddieson 1996, chapter 6). It is also not clear how the posterior portion of the tongue can maintain a velar closure at the same time as the sides of the tongue allow lateral airflow (cf. Perrier, Payan, Zandipour & Perkell 2003).

Retroflex

In terms of place of articulation, the "retroflex" stands out as being particularly odd. This is the one lingual "place" of articulation that is not actually a place – it refers to an idealized tongue configuration (perhaps

characterized as sub-apico post-alveolar) that may, or may not, be necessary to produce the particular sounds in this column. We have re-labelled the "retroflex" column as "postalveolar" in order to be more consistent in the naming of the columns, but have kept the same symbols. In our teaching experience, it is difficult to explain the retroflex "place" of articulation and to distinguish it from postalveolar. More importantly, to our ears, it is almost impossible to hear the difference between a properly retroflex sub-apico postalveolar, and an apical post-alveolar; indeed, a perfectly acceptable "retroflex" sound may be produced simply by retracting the tongue tip into the correct region, without necessarily retroflexing the tongue. Several Indo-Aryan languages such as Hindi, Nepali, and Bengali, which are often described as having retroflex consonants, can be analysed as having retracted alveolars (non-retroflex postalveolars) instead (Ladefoged & Maddieson 1996, Khatiwada 2009, Khan 2010). Similar observations have also been made for Australian Aboriginal languages (Butcher, unpublished manuscript). For further discussion of variability in retroflex production, the reader is referred to Hamann (2003).

Palato-alveolar and alveolo-palatal

There are two "places" of articulation that existed in the 1951 version of the chart that were removed in 1989. A column "palato-alveolar" containing only the fricatives [ʃ ʒ] was removed, as was a column "alveolo-palatal" containing only the fricatives [ɕ ʑ]. The fricatives [ʃ ʒ] were re-labelled as "postalveolar", and are now the only sounds that occur in that column. As we discussed above, the distinction between "postalveolar" and "retroflex" is problematic, since a stop, nasal or lateral sound that is produced at the postalveolar place of articulation, with a retroflexed tongue tip, is auditorily very difficult to distinguish from a sound produced at that same place of articulation, but without a retroflexed tongue tip.

At the same time as [ʃ ʒ] were moved to postalveolar, [ɕ ʑ] were demoted to the Other Symbols category, despite how common these sounds are in many languages of the world, particularly in the languages of East and Southeast Asia. We propose to re-introduce the sounds [ɕ ʑ] into the regular consonant chart. One possibility is to re-introduce these sounds in a column alveolo-palatal, and to also include the stops, nasals and laterals [ʈ͡ɕ ɖ͡ʑ ɳ̟ ɭ̟], which are used by many scholars of Chinese and other languages. The stop symbols [ʈ͡ɕ ɖ͡ʑ] are also used by authors who consider the palatals [c ɟ] to be more akin to the sequence [kj] rather than the sequence [tj] (i.e. they see the palatal symbols as being more akin to a fronted velar than a properly [alveolo-] palatal sound, the latter being typically associated with extensive affrication of the stops). Whilst the inclusion of an alveolo-palatal place of articulation might be helpful for authors who wish to distinguish [ʈ͡ɕ ɖ͡ʑ] from [c ɟ] along these lines, our main concern is that there is no such auditory distinction between the sounds [ɲ ʎ] and [ɳ̟ ɭ̟]. We cannot hear a reliable difference between a palatal nasal or lateral, and an alveolo- palatal nasal or lateral. In the case of nasals, this may in part be because the acoustics of nasal consonants are determined by the backmost point of contact for the consonant, rather than the frontmost point of contact, with both a regular palatal and an alveolo-palatal involving a very large degree of tongue-palate contact (although we acknowledge that formant transitions into the vowel do involve the cavity anterior to the constriction – Fant 1970).

In the case of laterals, a lack of difference between [ʎ] and [ɭ̟] may be due to insufficient degrees of freedom in the tongue tip-blade-body complex: the lowering of the jaw and/or narrowing of the tongue required for lateral production may lead to the constraint that the central tip/blade closure cannot be located further back than the pre-palatal region, without leading to retroflexion and the production of /ɭ/ instead of a palatal lateral. In addition, to our knowledge no phonetician has ever proposed an alveolo-palatal glide that is separate from the palatal /j/, yet this could be considered a logical extension to a system that has alveolo-palatal stops, nasals and laterals.

We therefore consider that if the alveolo-palatal place of articulation is added to the chart, it should at most include the stop manners of articulation (in addition to the fricatives). Even the individual authors of this submission cannot agree on the inclusion of alveolo-palatal stops, and we therefore do not include them in the chart, in large part because their inclusion would involve a re-consideration of the value of the regular palatals [c ɟ].

We return to the issue of how best to describe the contrast between [ʃ ʒ] and [ɕ ʑ] when we consider the overall system of fricatives further below – to pre-empt the discussion, we propose to re-label /ɕ ʑ/ as "pre-palatal" and /ʃ ʒ/ as "pre-palatal (labial)".

Dentals

Our revised chart makes clearer the separation between dental, alveolar and postalveolar by marking the boundaries between them for all manners of articulation. In addition, separate symbols have been created for the dental consonants. Dentals should be explicitly characterized as laminal, and alveolars as apical, for two reasons: firstly, this provides for maximum acoustic distinction; and secondly, it reflects the situation for the passive articulator in languages where a dental/alveolar contrast exists (e.g. Australian Aboriginal languages – Dixon 1980).

The dental symbols are taken from the (Ashoka) Brahmi tradition, since we thought it important to include symbols from non-European languages. Ashoka is the oldest Brahmic script (and thus thought to be the ancestor to all present-day Indian scripts). It was chosen because it is an alphabetic system that is relatively easy to write, and does not have the horizontal line above each letter (like the Devanagari script, for example). This use also acknowledges the contribution of Indian languages (and the general Sanskrit tradition) to modern phonetic understanding.

Fricatives

A particularly difficult aspect of the chart is the fricatives, more precisely the coronal fricatives. The problems can be divided into two categories: one relating to the place-of-articulation distinctions, the other relating to the paradigm of manner differences.

Problems with place

That place of articulation is a problem for coronal fricatives is shown by the confusion surrounding the terms alveolo-palatal and palato-alveolar (traditionally [ɕ] and [ʃ] respectively), with the latter being re-labelled "postalveolar" in the modern version of the chart. We believe this terminological confusion arises largely because place of articulation is not a sufficient criterion for describing and differentiating these sounds – the extent of grooving (constriction width as well as length) and airflow rate are just as crucial. For instance, in a real-time MRI study of 10 speakers, Yoshinaga, Maekawa & Iida (2021) found that Japanese palatal [ç] and alveolo-palatal [ɕ] had almost identical places of articulation. Using articulatory modelling, they found that these sounds were differentiated once constriction width and airflow rate were considered.

The question of constriction location, width/length and flow-rate is intimately tied to the question of whether a sound is a sibilant or not. It is well understood that the English fricatives [s z ʃ ʒ] are sibilants, and it has been suggested that an important aspect of their articulation is the central groove directing airflow towards the teeth – the end result being an increased intensity of spectral noise prominence (Shadle 1985). It is also generally understood that the English fricatives [f v θ ð] are non-sibilants, in the sense that they are not as loud, and in the sense that there is no central groove directing airflow towards the teeth (indeed, this may be impossible for sounds that are labio-dental and dental). Moreover, the sibilant versus non-sibilant distinction is well established in English morpho-phonological rules.

However, when it comes to the other fricatives in the chart, it is not so clear what is sibilant and what is non-sibilant. Yoshinaga *et al.* (2021) initially considered [ɕ] as sibilant and [ç] as non-sibilant based on previous literature. But they subsequently found it difficult to determine an articulatory/acoustic basis for this description, in that the jet of air produced by the constriction reached the edge of the upper incisors in the models for both sounds. This is just one study, and the important point is that there is not the volume of work on non-English fricatives that is needed in order for phoneticians to better understand this class of speech sounds. As expert phoneticians, none of us can confidently say which of the non-English fricatives on the chart is sibilant and which is non-sibilant; we feel that in the absence of a great volume of articulatory and

acoustic studies, phonological evidence from a variety of languages is the best evidence we could expect in this regard (but see below for another possible approach to the question of sibilance).

Finally, it might be noted that [ʂ] may or may not involve retroflexion of the tongue tip, as noted above regarding the plosives at the postalveolar place of articulation.

Problems with manner

The other important problem with the fricatives is that not all fricatives can be derived through articulatory lenition from the corresponding stop place of articulation; and by extension, they cannot themselves be lenited to an approximant at the same place of articulation. If we consider [s], it has a very different tongue shape from [t] (including but not limited to the grooving described above). Indeed, when we speak of a lenited [t] in Australian English, we use the lowering diacritic beneath the stop symbol [t̞]. By extension, one does not speak of /s/ being lenited to /ɹ/. Similar observations could be made for [ʃ ʂ ɕ]. By contrast, the other fricatives operate very well in the stop-fricative-approximant lenition continuum, namely (working with the voiced obstruents for this example) [ɻ ʝ j], [ɡ ɣ ɰ] and [ɢ ʁ]. One would even include dental [d̪ ð ð̪] in this set.

Thus, one could treat the class of sibilants as fricative sounds that cannot be derived by articulatory lenition from a corresponding stop, or strengthening from a corresponding approximant. Indeed, phonological accounts of lenition argue that lenition of stops invariably results in non-sibilant fricatives (Kirchner 1998, 2004). Sibilant sounds are produced with a very special tongue configuration that may include significant grooving.

In order to respect the fact that sibilants cannot be derived by articulatory lenition from stops, we mark these sibilant fricatives on the chart with a special double line around the set, in order to offset them.

We include the previous alveolo-palatal and palato-alveolar places of articulation in this new set, as per the pre-1989 chart, but are very conscious that these place labels do not fully describe the articulations of all speakers. For any speech sound, there is a tremendous amount of inter-speaker variability in terms of active articulator used and in terms of precise place of articulation – careful examination of individual data in any articulatory study cannot fail to highlight this. In the case of fricatives, differences between speakers are all the more salient, as this is a class of sounds where the spectral shape of the output noise generated at the constriction is crucial, and the location/shape of this constriction may be highly dependent on individual morphology. However, the acoustic output is highly consistent across speakers despite differences in articulatory input, and as is ultimately the case in all phonetics, it is the acoustic output that is most important.

In addition, it is important to point out that lip rounding plays a role in the production of the palato-alveolars [ʃ ʒ]. This has been remarked upon in many articulatory-to-acoustic modelling studies and even mentioned in textbooks (e.g. Johnson 2012, page 159). This is particularly relevant in the consideration of the difference between these sounds and the so-called alveolo-palatal [ɕ ʑ]: many speakers can produce [ɕ ʑ] as the unrounded version of [ʃ ʒ], despite Catford's (2001) suggestion that [ɕ] can be treated as [ʃ] + [j]. For all the above reasons, we choose to label both [ʃ ʒ] and [ɕ ʑ] as "pre-palatal", but add "(labial)" to the description for [ʃ ʒ]. We therefore remove the terms "alveolo-palatal" and "palato-alveolar" altogether, which we feel were particularly confusing.

Finally, we must point out that the extent to which our knowledge of fricative production (articulatory and acoustic) is imperfect cannot be overstated.

Some problems with the manners of articulation

Approximants

The current chart contains a row for approximants, which includes the semi-vowels [j ɰ], as well as the rhotics [ɹ ɻ] and the labiodental [ʋ]. Curiously, the labio-velar [w], one of the most common consonant sounds in the languages of the world (Gordon 2016), was demoted to "Other Symbols" in the 1989 revision to the chart. Previously it was located in the "Bilabial" column, in the row "Frictionless Continuants and Semi-vowels", sharing a cell with the labio-palatal [ɥ]. [w] also appeared in brackets in the velar column in the same row, and [ɥ] appeared in brackets in the palatal column. Significantly, this row was at the bottom of the chart, closest to the vowel chart, as a signal that the semi-vowels were acoustically, articulatorily and phonologically linked to the vowels. Indeed, the vowel chart pre-1989 was clearly aligned with the palatal and velar columns of the consonant chart, sending a very clear signal of the relationship between the vowels and the palatal and velar approximants.

Conceptually, we would suggest that it would be wise to return to the pre-1989 situation regarding the semi-vowels, especially so given that (with the addition of the velar glide [ɰ]) we now recognize four semi-vowels that can be derived from/related to the four high (corner) vowels – namely [j ɥ ɰ w], derived from [i y ɯ u] respectively. We have therefore adopted this approach in our proposed chart in the Appendix. However, we go further, in that our chart lists a separate row for "Semi-vowels" below the row for approximants. We do this to explicitly show the relationship between the vowels and the semi-vowels – however, we note that the two rows (semi-vowels and approximants) could be combined, and the non-semi-vowels simply offset with a double line, as was done with the sibilant fricatives. This solution would be entirely possible, since (at present) combining the two rows would not result in any overlap of cells. However, if one were to introduce a separate symbol for the lenited bilabial fricative [β̞], as is found in Spanish, then in that case there would be a bilabial derived from vowels (the semivowel [w]) and a bilabial derived from regular lenition (the approximant [β̞]). We also note that a separate symbol for an alveolar or dental approximant may be desirable (e.g. ð̞ as occurs in Danish), though this would not impinge on the overlap between approximants and semi-vowels.

Finally in this section, we briefly need to consider the rhotics [ɹ ɻ] under the approximants label. Although we do not propose any changes to these symbols/sounds, we do note that discerning the difference between them is very difficult in practice. The first author simply tells students that [ɻ] sounds darker than [ɹ], presumably reflecting a balance of energy weighted towards the lower part of the spectrum. In principle [ɻ] should be produced further back in the oral cavity than [ɹ], and according to the LAPSyD database, there is only one language that contains a contrast between the two sounds, Wiyot (https://lapsyd.huma-num.fr/lapsyd/index.php?data=view&code=602). It has moreover been suggested that [ɹ] and [ɻ] often involve frication: for example in Beijing Mandarin Chinese the onset/initial postalveolar rhotic varies between approximant and fricative realizations (see discussion in Xing 2021). Indeed, in the previous version of the chart, [ɹ] appeared in both the fricative and the frictionless continuants [i.e. approximants] row. This is another example of where the boundary between fricative and approximant is blurred (in contrast to the boundary between stop and fricative).

Some notes on other symbols not already mentioned

Here we briefly discuss some individual symbols that strike us as problematic in some way. We do not always suggest that these symbols should be removed – however, we wish to bring these problems to the foreground, so that there is a better appreciation of the inaccuracies and difficulties of the chart.
Firstly, it is curious that there is a special symbol for the voiceless labial-velar fricative [ʍ], which could equally well be represented by [w̥]. We do not suggest that the symbol should be removed, but instead simply note that it is a relic of the history of the IPA chart, which was in its early days heavily influenced by the study of the European languages. What is particularly strange, however, is that the sound is labelled as a fricative, when its counterpart [w] is labelled as an approximant. Does this mean that the noise is supra-laryngeal only? Or is the noise source both glottal and supra-laryngeal? Is it a spread-glottis or breathy-voiced version of the approximant, i.e. [w̤], as found in some North American and south-east Asian languages? Is it simply a sequence of [h] plus [w], as in English? None of this is quite clear.

Another symbol that clearly shows the bias of the early days of the IPA is [ɧ], described as a simultaneous [ʃ] and [x]. Students find this sound very challenging and in our experience most instructors skip over it, saying that it only occurs in Swedish, and that even there it varies greatly dialectally (Ladefoged & Maddieson 1996). A sound that occurs in only one language and shows a lot of variation should cause (phonetic) concern, and to our ears the Swedish sound may best be described as a labialized/rounded velar fricative [x] or [xʷ] (i.e. with a rounded diacritic beneath the fricative or with a labialization superscript). The symbol [ɧ] is perhaps best removed from the chart since it suggests a sound that does not exist.

Another symbol that is listed under "Other Symbols" is the "alveolar lateral flap" [ɺ]. It is posited as a phoneme in 30 languages in LAPSyD, particularly in languages of South America and Papua New Guinea, where articulatory and acoustic phonetic description is scarce. Notably, however, there are no languages that contrast this sound with the retroflex flap [ɽ] or with the retroflex lateral [ɭ]. Moreover, although [ɭ] is not classified as a flap, it is possible to produce this sound as a flap with the tongue tip moving forward during closure. To flap the sides of the tongue would involve an unrealistic degree of control (cf. [ʟ] above). Recent acoustic phonetic study (Tabain, Fedden, Gregory & Beare, under review) suggests that this sound may simply be a lateral that is shorter in duration, with a closure duration in between that of a typical lateral and that of a tap/flap. It therefore seems that the "alveolar lateral flap" may need to be re-considered as well.

Conclusions

Our proposal for a revised version of the chart is shown in the Appendix below. Whilst we hope that it is an improvement on the present chart, we also hope that our discussions in this paper have shown that it is far from perfect. We hope that we have highlighted some of the problems that are inherent to the nature of the IPA chart. It is sometimes assumed that the chart is perfect, and in some way analogous to the chart of chemical symbols or the chart of astronomical objects. However, since the IPA chart is based on human behaviour, this cannot be so. So much about articulation is assumed by a symbol, even when that assumption is idealistic or even at times false. The use of symbols leaves little room for phonetic underspecification, unless the symbols themselves are underspecified (a discussion we have not entered into). We have tried to point out some of the issues with the chart, in the hope that users will not take its theoretical assumptions for granted. As eloquently noted by an anonymous reviewer, "we are just trying to carve up a continuum in one way versus another into categories and there will always be remaining problems and issues".

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References

Bennett, Ryan. 2016. Mayan phonology. *Language and Linguistics Compass* 10(10), 469–514.

Butcher, Andrew. n.d. *The sounds of Australian languages*. Unpublished manuscript.

Butcher, Andrew & Marija Tabain. 2004. On the back of the tongue: Dorsal sounds in Australian languages. *Phonetica* 61, 22–52.

Catford, J. C. 1990. Glottal consonants… another view. *Journal of the International Phonetic Association* 20(2), 25–26.

Catford, J. C. 2001. *A practical introduction to phonetics*, 2nd edn. New York: Oxford University Press.

Clements, G. N. 1985. The geometry of phonological features. *Phonology* 2, 225–252.

Cohn, Abigail. 1990. *Phonetic and phonological rules of nasalization*. Ph.D. dissertation, University of California, Los Angeles (UCLA Working Papers in Phonetics 76).

Dixon, Robert M. W. 1980. *The languages of Australia*. Cambridge: Cambridge University Press.

Esling, John H., Scott R. Moisik, Allison Benner & Lise Crevier-Buchman. 2019. *Voice quality: The laryngeal articulator model* (Cambridge Studies in Linguistics 162). Cambridge: Cambridge University Press.

Fant, Gunnar. 1970. *Acoustic theory of speech production*, 2nd edn. The Hague: Mouton.

Garellek, Marc. 2013. *Production and Perception of glottal stops*. Ph.D. dissertation, UCLA.

Garellek, Marc, Yuan Chai, Yaqian Huang & Maxine Van Doren. 2023. Voicing of glottal consonants and non-modal vowels. *Journal of the International Phonetic Association* 53(2), 305–332.

Gordon, Matthew. 2006. *Syllable weight: Phonetics, phonology, typology*. New York: Routledge.

Gordon, Matthew. 2016. *Phonological typology*. Oxford: Oxford University Press.

Hamann, Silke. 2003. *The phonetics and phonology of retroflexes*. Ph.D. dissertation, Utrecht University (LOT Press).

International Phonetic Association. 1989. Report on the 1989 Kiel Convention. *Journal of the International Phonetic Association* 19(2), 67–80.

Johnson, Keith. 2012. *Acoustic and auditory phonetics*, 3rd edn. Malden, MA: Wiley-Blackwell.

Khan, Sameer ud Dowla. 2010. Bengali (Bangladeshi Standard). *Journal of the International Phonetic Association* 40(2), 221–225.

Khatiwada, Rajesh. 2009. Nepali. *Journal of the International Phonetic Association* 39(3), 373–380.

Kirchner, Robert. 1998. *An effort-based approach to consonant lenition*. Ph.D. dissertation, University of California, Los Angeles.

Kirchner, Robert. 2004. Consonant lenition. In Bruce Hayes, Robert Kirchner & Donca Steriade (eds.), *Phonetically based phonology*, 313–345. New York: Cambridge University Press.

Ladefoged, Peter. 1990. Some proposals concerning glottal consonants. *Journal of the International Phonetic Association* 20(2), 24–25.

Ladefoged, Peter & Ian Maddieson. 1996. *The sounds of the world's languages*. Oxford: Blackwell.

McCarthy, John. 1988. Feature geometry and dependency: A review. *Phonetica* 45, 84–108.

Perrier, Pascal, Yohan Payan, Majid Zandipour & Joseph Perkell. 2003. Influences of tongue biomechanics on speech movements during the production of velar stop consonants: A modelling study. *The Journal of the Acoustical Society of America* 114, 1582–1599.

Robins, R. H. 1957. Vowel nasality in Sundanese: A phonological and grammatical study. In J. R. Firth (ed.), *Studies in linguistics*, 87–103. Oxford: Basil Blackwell.

Rogers, Chris. 2014. Vowel harmony in Meso-American languages. In Nancy Ritter & Harry van der Hulst (eds.), *The Oxford handbook of vowel harmony*, 691–699. New York: Oxford University Press.

Shadle, Christine. 1985. *The acoustics of fricative consonants*. Ph.D. dissertation, Massachusetts Institute of Technology.

Staroverov, Peter & Sius Biem Tebay. 2022. Velar lateral allophony in Mee (Ekari). *Journal of the International Phonetic Association* 52(2), 278–308.

Stemberger, Joseph. 1993. Glottal transparency. *Phonology* 10, 107–138.

Tabain, Marija, Marc Garellek & Matthew Gordon. 2024. A consideration of the consonant chart in the International Phonetic Alphabet. *19th Australasian International Conference on Speech Science and Technology.* Melbourne: Australia, 1–6. ISSN 2207-1296

Tabain, Marija, Sebastian Fedden, Adele Gregory & Richard Beare. Under review. An acoustic study of the single liquid in Mian.

Udomkesmalee, Natalie. 2018. Historical charts of the International Phonetic Alphabet. internationalphoneticassociation.org (retrieved 10 November 2026).

Xing, Kaiyue. 2021. *Phonetic and phonological perspectives on rhoticity in Mandarin*. Ph.D. dissertation, University of Manchester.

Yoshinaga, Tsukasa, Kikuo Maekawa & Akiyoshi Iida. 2021. Aeroacoustic differences between the Japanese fricatives [ɕ] and [ç]. *The Journal of the Acoustical Society of America* 149, 2426–2436.

<u>Proposed revision of IPA Consonant Chart</u> – 17th November 2026

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	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Pre-palatal (labial)	Pre-palatal	Palatal	Velar	Uvular	Pharyngeal Epilaryngeal	Glottal Laryngeal
Plosive	p b		ʞ ɔ	t d	ʈ ɖ			c ɟ	k g	q ɢ	ʔ	ʔ
Nasal	m	ɱ	⊥	n	ɳ			ɲ	ŋ	ɴ		
Trill	ʙ			r						ʀ	ʜ ʢ	
Tap/flap		ⱱ		ɾ	ɽ							
Fricative	ɸ β	f v	θ ð	s z	ʂ ʐ	ʃ ʒ	ɕ ʑ	ç ʝ	x ɣ	χ ʁ	ħ	
Lateral fricative				ɬ ɮ								
Lateral Approximant			↺	l	ɭ			ʎ	ʟ			
Approximant		ʋ		ɹ	ɻ						ʕ	h ɦ
Semi-vowels	w | ɥ							j (ɥ)	ɯ̟ (w)			