

Yaps: Designer’s Notes

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What is Yaps?

- Yaps is a featural phonetic script. Graphic marks of Yaps glyphs map directly to phonetic features of the sounds they represent.
- Yaps is somewhat iconic: the graphic marks are intended to be visually suggestive of the underlying articulation.
- Yaps is non-language-specific, and seeks to represent most or all of the speech-sounds (phones) found in human languages.

What is Yaps *not*?

- Yaps is *not* a “universal” script. It makes no claim to represent *all* auditory communication, nonhuman languages, or nonverbal communication (e.g. sign language).
- Yaps is *not* designed as primary orthography for any natural or constructed language – though it could potentially be used as such for languages with a standard or official pronunciation. However, it would be *inefficient* as an orthography, since it represents far more phonemes than are found in any typical language.

Principles

A Yaps glyph generally consists of three layers, representing the *shape*, *closure*, and *voice* of the phone it represents.

- *Shape* refers broadly to the position of the tongue and lips when making the sound: in phonetic terminology, the *backness* and *roundness* of vowels, or the *place of articulation* of consonants.
- *Closure* refers to restriction or resonance of the airstream through the oral and (sometimes) nasal cavities: the *height* and *nasalization* of vowels, and the *manner of articulation* of consonants. This is indicated by a raised stem and/or diacritics above the main glyph.

- *Voice* refers to the involvement of the throat (larynx) in forming and modulating the sound: it is indicated by a descending stem and/or diacritics under the main glyph. In most languages this is used to indicate whether a consonant is “voiced” or “unvoiced”, but can represent other forms of phonation, airstream mechanism, tone, etc.

Yaps writing runs from left to right, but may be mirror-written right to left simply by reflecting each character. Since nearly all Yaps glyphs (with the exception of the central vowel and some ideograms) are distinguishable under reflection, this will not introduce any ambiguity.

Consonants

The *place of articulation* of a consonant is represented by a shape layer of 1 ex height and usually 1 ex width. Lingual consonants have a curved shape suggestive of the tongue’s position, forming a sequence from back to front. Labials are distinguished by a dot, dentals by a crossbar. Glottals and epiglottals have a different shape indicating articulation at the back of the throat.

The *manner of articulation* is indicated by an ascender whose height and shape suggests the degree of closure or obstruction, with approximants having the simplest (and lowest) stem. Occlusives have a crossbar indicating stoppage of the airflow. Nasals have a raised tilde representing flow through the nasal cavity. Whistles, sibilants, and fricatives have curved stems, forming a sequence from greater to lesser turbulence. Taps and trills have one or more dot diacritics indicating intermittent stoppages. Lateral airflow is represented by a horizontal line.

While the International Phonetic Alphabet (IPA) often uses different symbols to represent voiced and unvoiced consonants, Yaps uses a descender to indicate (lack of) voicing, along with other types of phonation and airstream mechanism, including ejectives, implosives, and clicks. See *Voicing*, below.

Linguistically, pure phonation (the “h” sound) is treated as a consonant with glottal articulation, even though, in terms of articulatory mechanics, it does not exhibit the same kind of airflow restrictions as other consonants. The “soft” h of English can be represented as a voiceless glottal approximant, while the “harder” h of Arabic may be a true glottal fricative. The *creaky-voiced glottal approximant* from the IPA chart can be represented as an h with creaky phonation (see *Voicing*, below).

Complex consonants, broadly including affricates, aspirated stops, doubly-articulated consonants, and consonants with secondary articulation, are indicated by joining two separate consonant characters together: see *Compound Characters*. This includes *nasalized* consonants that have a single place of articulation with both nasal and oral airflow. By contrast, true *nasal fricatives* involve turbulent airflow through the nasal cavity, with no oral airflow; these are indicated as a distinct manner of articulation.

Yaps does not require a mark for syllabic versus non-syllabic consonants: any continuant can be syllabic depending on phonological context. However, stress

or tone marks are normally placed under syllable nuclei (see *Voicing*, below): a syllabic consonant may thus be indicated by a stress or tone mark, including a “null” tone mark for otherwise unstressed or non-tonal syllables.

Vowels

Vowels have a shape layer indicating the *backness/frontness* of the vowel, mostly having a similar shape and sequence as the lingual consonants.

Vowels are distinguished from consonants by their lack of ascenders. Instead, the closure layer of vowels consists of diacritics indicating their *height* (amount of closure), forming a sequence suggestive of a raised or lowered tongue. A fully-open vowel has no diacritics, representing a minimally-obstructed airstream.

Further constrictions/articulations may be represented as co-articulated consonants (see *Extended Characters*, below), but a few articulations are indicated by adding marks to the vowel’s shape or closure layer. A central circle indicates vowel roundness (and can be thought of as analogous to the dot in labial consonants), a left hook indicates pharyngealization or retracted tongue root (analogous to a co-articulated epiglottal approximant), a right hook indicates advanced tongue root, and a raised tilde indicates nasalization (analogous to a co-articulated nasal occlusive). Rhoticized vowels are normally indicated as a syllabic post-alveolar approximant (syllabic-*r*), rather than a distinct vowel character.

Diphthongs may be indicated by joining two separate vowel characters together with a tie (see *Extended Characters*, below), but this is optional; one can simply write the vowels in sequence, per IPA style. Semivowels (sharp vowel transitions associated with syllable boundaries) are typically represented as approximant consonants followed by vowels, rather than vowel diphthongs, due to the greater vocal closure associated with the transition.

Like consonants, vowels may have a descender to indicate (lack of) voicing, although this rarely has phonemic significance. See *Voicing*, below.

Voicing

The layer below the main glyph is used for representing other aspects of vocalization, including phonation, airstream mechanism, and tone. Phonation is usually “voiced” (technically *modal voice*) or “unvoiced”, though some languages distinguish other forms of phonation.

Both consonants and vowels can have voice indicators, although it is rare for voiceless vowels to have any linguistic significance. For this reason, modal voice is the default phonation, indicated by the *lack* of a descender. Other forms of voicing from the lungs (*pulmonic egressives*) have varying amounts of glottal closure, from completely loose (voiceless) to very tight (creaky-voiced). and are indicated by a sequence of curved descenders.

Ejectives (*glottalic egressives*) are indicated by using a mark representing a closed glottis. (An ejective is distinguished from a consonant with glottal-stopped onset, because the latter initiates airflow from the lungs by *releasing* a glottal stop, while in the former the glottis remains closed, and the airstream is initiated by forcing the glottis upward.)

Ingressives create sound by creating negative pressure between two points of articulation, then releasing the forward point to draw air in abruptly. Phonetically, they are divided into implosives (*glottalic ingressive*) formed between the tongue and a closed glottis, and clicks (*lingual ingressive*) formed between a velar or uvular stop and another stop further forward. In Yaps these are indicated by joining the glottal, uvular, or velar glyph to the forward articulation glyph with a co-articulation bar; see *Extended Characters*, below. The forward articulation phonation stem has a crossbar to indicate reverse airflow over that articulator, and its manner may be either a stop or a fricative depending on the length and turbulence of the airflow. The rear articulation character may be voiced, unvoiced, or nasal.

Percussive consonants generate sound without airflow, through the actual impact of articulators at the specified point or articulation. They are indicated by a double-barred phonation stem. The only attested percussives are bilabial (lip-smacking without airflow), bidental (teeth-chattering), and alveolar (tongue-clucking), and only the last has been identified as a linguistic phoneme.

Tonal languages use pitch changes or *tone* to distinguish phonemes. This is indicated by diacritics under the glyph representing the syllable nucleus, which may be a vowel or a syllabic consonant. Yaps provides five basic tone marks, which may be combined in sequences (generally no more than 3 per syllable) to give tone *contours*. A sixth “null” tone mark may be used to indicate the syllable nucleus if that is ambiguous (e.g. in the case of a syllabic consonant) and the syllable has no other tone.

Even non-tonal languages (such as English) may use *stress* and *intonation* to convey meaning, which can be represented with tone marks. *Phonemic stress*, similar to tone, can sometimes distinguish between similar-sounding words, such as the verb “import” /ɪmˈpɔːrt/ ʈᵇᵇᵇᵇᵇᵇ and the noun /ˈɪm.pɔːrt/ ʈᵇᵇᵇᵇᵇᵇ. Other forms of intonation in English include rising intonation to indicate a question, dropping intonation for an interjection, lowered intonation for sarcasm or irony. Tone marks can be employed as needed to incorporate such details. They can also represent *simple* nonverbal intonations, such as the questioning “mmm?” ʈᵇᵇᵇᵇᵇᵇ, the satisfied “mmm!” ʈᵇᵇᵇᵇᵇᵇ, or a “wolf whistle” ʈᵇᵇᵇᵇᵇᵇ.

If finer distinctions of pitch are required, e.g. to represent melodic speech or singing, then the voice layer may be used for this as well. At present, however, the Yaps writing system has no specifications for musical notation.

Extended Characters

The International Phonetic Alphabet has a general prescription for using subscripted or superscripted letters to represent sounds that combine the features

of more basic phones. The systematic vertical structure of Yaps glyphs does not naturally lend itself to super- or subscripting; instead, glyphs are simply connected with a small “tie” loop. This may be considered *optional* in the case where the compound represents the onset or release of a consonant, or the glide of a vowel: there is little distinction *phonetically* in this case between a conjoined character and sequential characters. This includes, for instance, affricates (stop followed by a fricative with the same place of articulation), aspirates (stop followed by an h-sound), and diphthongs (one vowel gliding to another).

An explicit tie *bar* is required for *simultaneously co-articulated* phones, including doubly-articulated consonants (two places of articulation with the same manner) and nasalized consonants (a single place of articulation with simultaneous oral and nasal airflow). This can also be used for more precise representation of sounds that are intermediate between the canonical IPA phones; i.e. they can serve the function of IPA “relative articulation” diacritics (fronted, backed, raised, lowered, etc.). The tie bar indicates that the sounds occur simultaneously irrespective of the sequence in which the characters happen to be written. Conventionally, when transcribing these sounds, the characters are written with the more “back” character preceding the more “front” character.

Lengthened continuants (especially long vowels) can be indicated by repeating the character, or by attaching a lengthening marker. In principle the lengthening marker may also be repeated for very prolonged continuants, but this generally does not have phonemic significance.

Special condensed notations address some common combinations.

1. *Affricates* have a stop followed by a fricative/sibilant with the same place of articulation. In this case the shape layer is redundant: one can simply write the sequence of stems (joined with a tie) followed by the shape layer. Note that *prenasalized* stops, or stops with *nasal release*, may similarly have redundant shape layers, but in this case there is no space saving by writing just the sequence of stems, due to the width of the nasal mark; these are usually represented as a sequence of two full glyphs (with an optional tie).
2. *Nasalized* sounds may similarly be written as a nasal occlusive *co-articulated* with the other sound. However, in the case of vowels and approximants, the nasal mark may optionally be placed directly above the vowel or approximant character.
3. *Rounded* vowels, and vowels with retracted/advanced tongue root, similarly have specialized articulation marks, as noted earlier; this takes the place of explicitly co-articulating them with a bilabial, epiglottal, or other approximant.
4. *Clicks* are properly written as a voiced, unvoiced, or nasal uvular or velar consonant, co-articulated with a more forward point of articulation (which may be either a stop or fricative), with an ingressive marker on the phonation of the forward articulator. Since the majority of clicks are

velar, one may dispense with the velar shape layer, assuming velar to be the default unless uvular is explicitly indicated. The condensed character has a single phonation stem that may be voiced or unvoiced, and a stop, nasal, or fricative, with an ingressive marker, followed by the shape layer of the forward articulator.

Such condensed notations are optional; one may choose to write out the sequential or co-articulated glyphs in full, with appropriate ties or bars.

Suprasegmentals and Punctuation

Pauses in speech are not considered phonemes, but often do convey meaning. Furthermore, transcriptions typically insert spaces or other characters to break up words and morphemes, even when these do not correspond to any vocalic pauses. Yaps provides a few symbols and conventions in this regard.

First, phonemes (syntactically meaningful phones) are written as distinct glyphs with a small separation, except in the cases of explicit compound glyphs (above). Typically this space is between zero and half the width of a typical glyph (standard spacing is $\frac{1}{4}$ of a glyph width).

Words are separated by spaces at least half the width of a standard glyph (standard spacing is $\frac{3}{4}$ of a glyph width). Separate components of compound words have a centred dot between two glyphs, functioning like a hyphen in the Latin alphabet.

A short pause in speech (i.e. a comma) is indicated by a dot on the baseline, followed by a space. A full stop (i.e. a period) uses a downward slash on the baseline, while a question mark is a downward-pointing wedge and an exclamation mark is an upward-pointing wedge. These marks visually reflect a common (but by no means universal) intonation pattern: lowered intonation at the end of a declarative sentence, rising intonation for a question, raised and dropping for an exclamation. Note, however, that these are *semantic*, not phonetic, transcription marks, and do not indicate any explicit intonation (in the same way that the question mark in “Who are you?” does not necessarily denote a rising tone). Explicit intonation is given by marks in the voicing layer.

At present, Yaps does not specify other punctuation: things such as parentheses and quotation marks may be imported from other scripts (e.g. the common Latin characters).

Baseline spacing is normally specified by the typesetter, not the font. In their normal aspect ratio, Yaps characters span a maximum range from $-w$ below to $+2w$ above the baseline. Assuming a standard inter-glyph spacing between the lowest descender and the next line’s highest ascender, this means at least a $3.25w$ baseline spacing. However, for languages that identify only voiced and voiceless phonation, the lowest descenders are unused, and a $3w$ baseline spacing will suffice.

Ideograms

Ideograms are a commonly-encountered feature of *orthography*, but are not normally a part of *phonetic* transcription. However, many ostensibly phonetic alphabets include orthographic aspects, especially ideograms for numerals and other shorthand. Yaps follows in this tradition, with its own symbols representing basic arithmetic. The arithmetic operations and relations can also refer to Boolean and set algebra, which can lead to their use as semantic shorthands: e.g. the addition/union symbol can function as an ampersand.

Yaps ideograms are designed to fit with the sizing and spacing of other Yaps glyphs, but graphically have a different appearance that distinguishes them from phonemes. Yaps numerals, like phonetic glyphs, are *featural*, consisting of a base stroke for the numeral 0, and long or short vertical strokes representing individual bits: i.e. adding 1, 2, 4, or 8. Combining these marks can generate any hexadecimal digit; however, only numerals up to 9 are shown, since most users will be using decimal coding by default. The radix point is a raised dot identical to a Yaps “hyphen”. For large numbers or tiny fractions with following or leading zeroes, additional symbols represent groups of two or three zeroes at a time: this generally avoids the need to group trios of digits using punctuation.

Mathematical operation symbols are based on set-theoretic concepts. The union ideograph symbolizes an inclusive whole, and the same symbol can be used for mathematical addition and Boolean inclusive “or”. Confusingly, there is some dissonance between the Boolean and common linguistic use of these terms: in a sentence, the union operation can function as an ampersand (“and”) symbol, indicating *inclusion* of several elements in a group.

Arithmetic negation (additive inversion) and set inversion both use a symbol that visually suggests the swapping of two groups. Subtraction is represented as addition with a bar to indicate negation of the second component.

The intersection operation represents the convergence or overlap of two groups, and this symbol can be used for Boolean “and” as well as arithmetic multiplication (since in “fuzzy” Boolean or set algebra, intersection is represented by multiplying two truth or set-membership values). Again somewhat confusingly, the word “and” in everyday language usually represents expansion rather than restriction of a set; this symbol can be used in a sentence to represent the word “but”.

Division is multiplication with the multiplicative inverse, and uses a construction similar to that of subtraction. In this case the bar is above the operation symbol, suggestive of the conventional notation for a fraction.

Powers use a raising symbol. Base-10 exponentiation places this symbol over a zero numeral (representing raising the base 10 to a power, or, conceptually, appending zeroes). This is commonly used for exponential (“scientific”) notation.

Relation ideograms are visually similar to standard set notation. The “contained in” symbol is similar to the subset symbol, but can also be used to represent “an element of” or numerical “less than”. Conversely for the “contains” symbol. Similarly, the “equal” symbol can also be used for the semantic

concept “same as”, unless finer discrimination of identity relations are required (e.g. “assigned the value of”, “numerically equivalent to”, “identical to”), in which case additional symbols may be employed.

ASCII Mapping

Since there are far more phonemes than ASCII characters, it makes sense to map individual *features* to ASCII characters, with each Yaps glyph being written as a short sequence of ASCII characters. The default mapping shown follows the following general prescriptions:

- Uppercase ASCII characters advance the insertion point of the Yaps glyph sequence, lowercase characters do not. Thus an individual glyph typically consists of a sequence of lowercase characters (representing the closure and voicing layers), followed by an uppercase character (representing the shape layer). This allows one to immediately identify individual glyphs within the ASCII sequence.
- Where possible, the ASCII characters *usually* have some relation to the phonetic feature they encode: the same place or manner of articulation, resemblance to an IPA character associated with that feature, or some other mnemonic similarity.
- The figure indicates which ASCII characters should *precede* the main (uppercase) glyph shape code, marked by a green box; which characters should *follow* the main glyph shape code; and which should appear *between* glyphs. Characters that precede the green box do not advance the insertion point, and can be specified in any order. Characters following the green box *do* advance the insertion point, and should be given in their meaningful order.
- A { character indicates that the preceding character should *not* advance the insertion point (assuming it is a character that otherwise would). The standard way to accomplish this is by defining ??? as a *ligature*, replacing an advancing character ??? with another character having an identical glyph appearance but no rightward advance. This requires the typesetting software to recognize ligatures (and have them enabled!).
- The ‘, [,], and } characters provide fine-tuning spaces of $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, and 1 times the standard glyph width. These characters, along with the { character above, may be used to fine-tune the placement of marks within composite glyphs; see below.
- Most glyphs are a standard width w , but the pharyngeal consonants are only $\frac{1}{2}w$ wide. Centering diacritics on half-wide glyphs may therefore require spacing adjustments as noted above. E.g. to create the character ḥ , representing IPA $/\text{h}/$, one would enter `m‘vH`. Since the ‘ character

would normally increase the normal advance from the previous character by $\frac{1}{4}w$, style purists may *manually* kern the sequence by placing { } after the preceding character.

- Tones have a special treatment, to allow for tone contours of arbitrary length. Single tones have non-advancing marks that may be specified with an ASCII character *preceding* the syllable nucleus. For contours, successive tone marks must advance the insertion point; the convention is to place a { character (above) after the syllable nucleus, and to *follow* it with the tone mark sequence, with ‘ characters between each tone. The final character shown in the chart ([,] , or }) advances the insertion point to where it would have been otherwise.
- Numerals are entered in a featural manner. Each digit is entered as 0 *preceded* by zero or more of 1, 2, 4, or 8. The 0 character marks the end of the digit, whose value is the sum of the preceding numbers (if any). While not a particularly compact notation, this allows each ASCII character to specify a particular feature of the glyph, and allows any hexadecimal digit to be encoded with just these five characters. The ‘5’ and ‘6’ characters can then be used for the compactified notation for leading/trailing zeroes.
- Relations and operations are encoded using their usual ASCII characters, save for the use of _ for subtraction (to distinguish it from negation), and % for division (since / is already used for a tone mark).
- The d character encodes the “dental” bar, used in the ???, ???, and ??? glyphs. This is not shown in the chart, as the dental mark occurs *only* in these glyphs, and it was considered more straightforward to assign each place of articulation its own uppercase ASCII character.
- The ’ and " characters are specifically avoided, since many word processors attempt to replace these ASCII characters with “smart quotes”, which messes up Yaps font typesetting. Additionally, the G, L, M, N, T, W, 3, 7, and 9 characters are not needed to encode any Yaps phoneme or ideogram. For completeness, the Yaps font encoding assigns these characters default glyphs that depict their hexadecimal values.
- Yaps font encoding does not require control characters, non-ASCII Latin extensions, or any other character that would not appear on a standard US keyboard.