The status of phoneme inventories: The role of contrastive feature hierarchies

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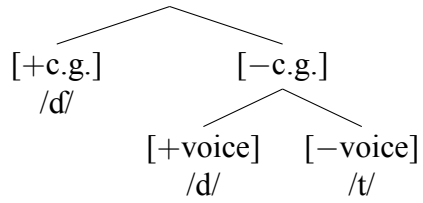
Introduction. Databases such as UPSID (Maddieson 1984), P-base (Mielke 2008), and PHOIBLE (Moran & McCloy 2019) represent phonological inventories as sets of IPA symbols, with each symbol standing for a phonetic description akin to a set of fully specified distinctive features (as in Chomsky & Halle 1968). Valuable though these resources are, we contend that this approach obscures the fundamental role of the phoneme as a unit in a language-specific system of contrasts. We argue that phoneme inventories are best understood in terms of contrastive feature specifications, assigned in language-specific hierarchies by the Successive Division Algorithm (SDA; Dresher 2009). In the SDA, features are assigned so as to divide the inventory recursively into smaller subsets until each phoneme has a distinct representation; no feature is assigned unless it serves to mark some phonemic contrast that has not already been encoded. Specification by the SDA accounts for phonological processes that ignore non-contrastive features, while avoiding problems with other forms of underspecification (see Archangeli 1988). Understanding phoneme inventories in terms of contrastive hierarchies of features has consequences for what kinds of typological generalizations can meaningfully be made about them. The phonetic shapes of inventories and their phonological feature specifications mutually constrain each other, but neither wholly determines the other:

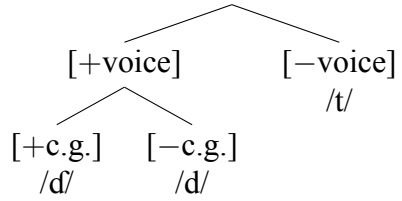
Phonetic shapes of inventories constrain (but don't dictate) feature specifications. The SDA does not stipulate an ordering of features (cf. Clements 2009). This means that phonetically similar inventories may be phonologically distinct, even if the same features are used to specify them.

For example, consider Mackenzie's (2013: §2.1) analysis of laryngeal harmony in Ngizim and Hausa. Each language has a three-way contrast among plain voiceless, plain voiced, and implosive stops. Ngizim prohibits voiced pulmonic obstruents from following voiceless ones (*t…d), but the phonetic voicing of implosives is ignored (✓t…ɗ). Hausa disallows homorganic pulmonic and implosive voiced obstruents from co-occurring (*ɗ…d), but allows voiceless obstruents to occur with implosives (✓ɗ…t). This can be attributed to the different contrastive hierarchies in (1) and (2). In Ngizim (1), the harmonizing feature [±voice] is specified only on [−constricted glottis] obstruents; in Hausa (2), [±c.g.] is specified only on [+voice] obstruents. Harmony in each language ignores segments unspecified for the harmonizing feature. In an inventory with ejectives as well as the segments in (1) and (2), [±voice] and [±c.g.] would fully cross-classify, and neither could be underspecified. But an asymmetrical inventory allows different orders of features to yield different specifications.

(1) Ngizim: /ɗ d t/



(2) Hausa: /ɗ d t/



Feature specifications constrain (but don't dictate) phonetic shapes of inventories. The SDA can also account for typological patterns in segment inventories, particularly ones that have been attributed to dispersion (e.g., Flemming 2004). As Hall (2011) points out, features assigned by the SDA can only specify how segments differ: no two phonemes can have the same value for a feature unless that feature serves to distinguish them from some other phoneme(s), and any two phonemes must have contrasting values for at least one feature. E.g., there is no set of specifications that could be assigned to the unattested vowel inventory */ɨ ɘ ʉ/ that could not also characterize the inventory /i a u/. To the extent that the phonetic implementation tends to enhance phonological feature specifications (Stevens & Keyser 1989), inventories will tend to be phonetically dispersed, even in the absence of any mechanism that explicitly evaluates or enforces phonetic distinctness.

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