

# Variation in trilling: phonetic realizations of /r/ and /r̥/

Rémi Anselme<sup>1</sup>

<sup>1</sup>Laboratoire Dynamique du Langage UMR 5596 - Université Lumière Lyon 2

The aim of our study is to gain a better understanding of allophones of phonemic trills and taps at the alveolar place of articulation. Lindau (1985) stated that the “actual realization of an /r/ is not as common as might be expected from descriptions of languages” (p.161). Beyond just comparing the frequency of trills and taps using phonological databases such as PHOIBLE (Moran & McCloy, 2019), PBASE (<https://pbase.phon.chass.ncsu.edu/query>), LAPSYPD (Maddieson et al., 2013) and UPSID (Maddieson, 1984), we decided to investigate actual audio recordings from speakers of multiple languages around the world.

For the purpose of our investigation we have compiled articles and recordings from the *Journal of the International Phonetic Association*. We have focused on the articles published under the section *Illustrations of the IPA*, these articles highlighting the description of a language through the use of the symbols of the International Phonetic Alphabet. From 162 articles, where a trill and/or a tap was described, we could have access to 78 recordings of a short narrative story “The North Wind and the Sun”, whose duration is around one minute, attached to 72 articles published (some authors decided to record more than one person). In total 16 linguistic families are represented from all the world macroareas.

Based on the transcription given and the audio, we manually segmented and annotated allophones of trills and taps using Praat (Boersma & Weenink, 2001). We selected only phones that were articulated as a coronal trill or a coronal tap and separately and we also annotated fricative and approximant allophones. We harmonized the phoneme labelling in order to compare the data. This led us to a corpus of 1625 tokens from which 993 were tapped or trilled. The two panels of Figure 1 show that languages differ in the frequency of phonemic trill and tap. There is great variability in the number of trilled and tapped allophones. Some speakers use more trilled forms of /r/ and /r̥/ than others. Moreover our results offer a quantitative assessment that is in line with Lindau's comments “speakers that do [trill], have tap and approximant allophones as well as the trill” (1985, p.161).

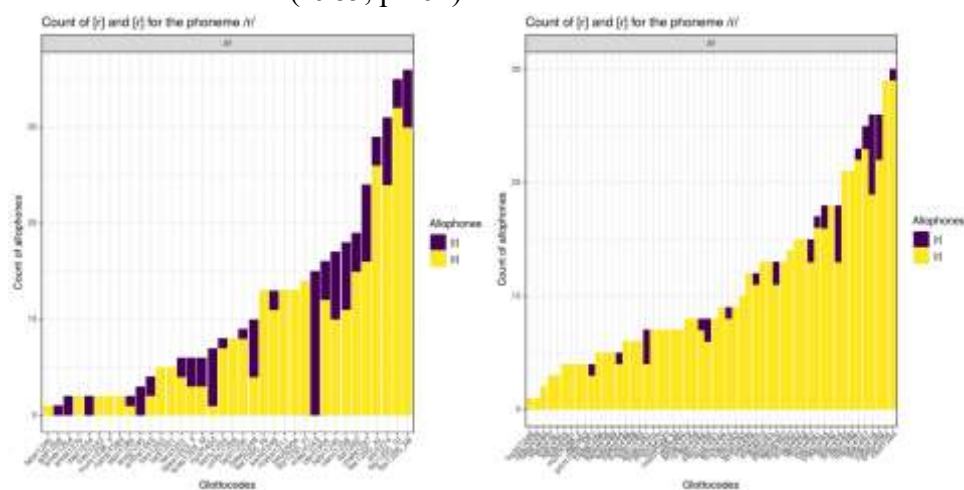


Figure 1 - Counts of trilled and tapped allophones per language and per phoneme. The /r/ phoneme is shown in the left panel, and /ɾ/ in the right; for both panels, dark blue represents realizations as [r] and yellow as [ɾ].

	Trill. allophone	Tap. allophone	Fric. allophone	App. allophone
/r/	99 (16%)	300 (47%)	22 (3%)	212 (34%)
/ɾ/	37 (4%)	557 (56%)	29 (3%)	339 (37%)

Table 1 - Summary of counts of the different allophones (rows) per phoneme (columns).

In conclusion, our data-driven work suggests that trilling is not that common as it could be expected even in the case of the phonemic trill. Overall, as shown in Table 1 [r] is more frequent. It is important to note that phonemic trills and taps cannot be straightforward to distinguish phonologically, since trilling can be found in /r/ and /ɾ/. Our results also show a significant difference in term of duration between the [r] and [ɾ] ( $t(92.733) = 20.511, p < .01$ ). Duration measurement confirm that cross-linguistically [r] are significantly longer than [ɾ] which is in line with studies done on specific languages (eg. Spanish (Blecua, 2002); Persian (Rafat, 2010)).

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