

When Opacified Allophony Creates Variable Derived-Environment Effects: Sanskrit Velar-Palatal Alternations

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This paper investigates the relationship between phonologization, restructuring, and the pertinacity of opacified phonological processes through a large-scale quantitative analysis of alternations between palatal and velar obstruents in root-final position in Sanskrit. We contend that the synchronically observable alternations [k]~[c] and [g]~[j] at the root + affix boundary are attributable to different root- and affix-specific propensities to select — and even productively generate — a given root allomorph. Sanskrit data in (1) suggest that different roots exhibit different patterns in the context of the same word-formation affixes (see [Whitney 1885](#), [Werba 1997](#); glosses after [Whitney 1885](#); see [Wackernagel and Debrunner 1954](#) on Sanskrit word-formation affixes). How can such velar-palatal alternations be modeled in a synchronic phonological grammar, and what relation does that grammar bear to the historical developments that gave rise to it?

(1) Velar–Palatal Allomorphy across Word-formation Suffixes in Sanskrit

Root	Gloss	Word-formation Suffixes					
		[-ə-]	[-ənə-]	[-mə-]	[-mən-]	[-rə-]	Other
1. <i>śak</i>	[çək-] ‘be able’	[çókə-]	—	[çəgmá-]	[çókmən-]	[çəkrá-]	[çóc-i-]
2. <i>ruc</i>	[ruc-] ‘shine’	[ró:kə-]	[ro:cənə-]	[rukṃá-]	—	—	[ruc-a-]
3. <i>arc</i>	[ərc-] ‘shine’	[rcə-]/[ərkə-]	[ərcənə-]	—	—	—	[rk-uá-]
4. <i>vij</i>	[vij-] ‘tremble’	[vé:ga-]	[ue:jənə-]	—	—	[vigrá-]	[ue:j-əkə-]
5. <i>vaj</i>	[vəj-] ‘be strong’	[vəjə-]	[vəjənə-]	—	[o:jmán-]	[ugrá-]	[ó:j-əs-]
6. <i>aj</i>	[əj-] ‘drive’	[əjə-]	[əjənə-]	[əjmá-]	[əjmən-]	[əjrə-]/[əgrə-]	[əj-uin-]

The sound changes responsible for producing the state of affairs underlying the data exemplified in (1) are well known (see, i.a., [Wackernagel 1896](#), [Kobayashi 2004](#), [Lubotsky 2018](#)): in Proto-Indo-Iranian (PIIr.), velar stops underwent palatalization preceding [+front] vocoids (*[e(:), i(:), j]); this process was subsequently counterbled on environment by the merger of [–high] vowels as short [ə] and long [a:], leading to an unpredictable distribution of velars and palatalized velars (> Skt. palatals [c] and [j]) preceding non-high vowels. A further confound in Sanskrit is the fact that the voiced PIIr. palato-alveolar affricate *j, distinct from the PIIr. palatalized velar, likewise yields a palatal stop [j] preceding [+sonorant] segments (see 6. *aj* in (1)). To better describe the patterning and distribution of palatal and velar root allomorphs, we collected all nominal and adjectival derivatives given in [Whitney 1885](#) in which the leftmost segment of the derivational suffix is a [+sonorant] segment, for all roots given with a final palatal or velar segment that attest velar-palatal allomorphy ($N = 697$). A binomial Bayesian logistic regression model ([Gelman et al. 2009](#), [Gelman et al. 2013](#)) with the categorical predictor variables ROOT and SUFFIX and response variable FINAL_SEGMENT (palatal = 1, velar = 0) was generated. Results indicate that palatals represent the default outcome before sonorants: 534/697 (~76.6%) of all derivatives contain a root-final palatal, and the the INTERCEPT in the model thus significantly prefers a palatal outcome. Meanwhile, 12 suffixes, representing ~55% of all types in the data, exhibit statistically significant propensities (nine towards a velar outcome). The affix /-ə-/ (< */-o-/; 117 tokens) exhibits a strong velar propensity in accord with its historical origin, so that novel velar allomorphs may appear with this suffix to roots that otherwise consistently show a palatal (e.g., *yāg-a-* to *yaj*; see [von Böhtlingk and Roth 1855](#); s. v. *yāga*). These conclusions imply that many Sanskrit roots are subject to a process of variable PALATAL VELARIZATION in the context of certain word-formation suffixes; this would constitute a species of rule inversion ([Vennemann 1972](#)) vis-à-vis the Indo-Iranian process of velar palatalization. Furthermore, since there is no general process of velarization preceding [+sonorant] segments, velar vs. palatal allomorph selection/generation in Sanskrit may be characterized as a (variable and affix-specific) Derived-Environment Effect (DEE; [Kiparsky 1973](#), [Mascaró 1978](#)): the same phonological context internal to a root or stem may condition a different outcome across a morpheme boundary. The Sanskrit situation thus parallels the variable velar palatalization triggered by suffixes in Slovenian ([Jurgec 2016](#)) or *rendaku* in Japanese ([Ito and Mester 2003](#)).