

# A probabilistic assessment of the Indo-Aryan Inner-Outer Hypothesis

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## Abstract

This paper uses a novel data-driven approach to address the century-old Inner-Outer hypothesis of Indo-Aryan. We develop a Bayesian hierarchical shared-admixture model to assess the validity of this hypothesis using a large data set of automatically extracted sound changes operating between Old Indo-Aryan and Modern Indo-Aryan speech varieties. We employ different prior distributions in order to model sound change probabilistically, one of which, the Logistic Normal distribution, has not received much attention in linguistics outside of Natural Language Processing, despite its many attractive features. We find evidence for cohesive dialect groups that have made their imprint on contemporary Indo-Aryan languages, and find that when a Logistic Normal prior is used, the distribution of dialect components across languages is largely compatible with a core-periphery similar to that of the Inner-Outer hypothesis.

## 1 Introduction

Many Indo-Aryan dialect groupings have been advanced in the literature, primarily on the basis of sound changes, but no single proposal has emerged as the clear winner. Millennia of contact, diglossia, migration, and cultural exchange greatly complicate the picture of relationships between Indo-Aryan speech varieties; this noise poses difficulties for the comparative method of historical linguistics, in its traditional form. The comparative method assumes that sound change within a language is systematic and regular, and that most apparent exceptions to regularity are due to language contact or analogical change. Under the comparative method, if exceptions to regular sound change (“residual forms”) are few in number, they can be addressed on a piece-by-piece basis and ascribed to a mechanism like the ones mentioned above (cf. Bloomfield 1933:360). However, it is not always clear how to proceed in the face of substantial irregularity and uncertainty. Additionally, it can be difficult to distinguish between shared genetic innovations and parallel developments,

though quantitative methods have helped in assessing whether the sharing of multiple features across languages is more likely than chance.

This paper seeks to enhance the comparative method with probabilistic tools in order to address an unresolved hypothesis regarding the history of the Indo-Aryan languages. We employ a data-driven Bayesian methodology in order to uncover shared dialectal patterns across a subset of these languages. In particular, we attempt to operationalize an old hypothesis (the so-called Inner-Outer hypothesis) that two large dialect groups existed, and that communication within these groups was greater historically than communication between them. The shared admixture model that we use attempts to reduce the dimensionality of a large set of linguistic features (consisting of sound changes operating between Old Indo-Aryan [OIA, i.e., Sanskrit] and modern Indo-Aryan languages) to two dimensions corresponding to two latent dialectal components, and assess whether individual languages draw most of their features from one of the two groups, or receive features uniformly from both. Additionally, we evaluate the degree to which the Inner-Outer hypothesis is recapitulated in the language-level distribution over component makeup. We find evidence for two dialect groups of considerable cohesion and integrity, and find partial evidence for the Inner-Outer hypothesis in the language-level distribution of dialect components. We discuss implications of this model and future research directions.

## **2 Background**

The Indo-Aryan languages arguably make up one of the best documented Indo-European subgroups, with a long history of scholarship. The following section summarizes the relevant literature, as well as the key studies that this paper engages with.

### **2.1 Indo-Aryan dialectal variation**

It is generally agreed that virtually all Indo-Aryan speech varieties descend directly from attested Old Indo-Aryan, though it is possible to encounter one-off, highly sporadic instances of what appear to be archaisms. These issues are discussed at length in a number of works (e.g., Emeneau 1966, Masica 1991, Smith 2017, Deo 2018). Peterson (2017) gives a thorough overview of typological features in Indo-Aryan in a broader South Asian areal context. Synopses of notable features of dialectal variation at each rough historical period of Indo-Aryan (with the exclusion of the pre-Old Indo Aryan words found in the Near Eastern Kikkuli horse treatises) are given below.

#### **2.1.1 Pre-Old Indo Aryan period**

Indo-Aryan is unlike its closest relative, Iranian, in that the Old Indo-Aryan corpus is quite large, whereas the Old Iranian corpus (consisting of Old Persian and Avestan) is much smaller; many middle and modern Iranian languages show archaisms not found in the oldest attested Iranian languages. In contrast, Emeneau (1966) concludes that virtually all

Indo-Aryan dialects can be accepted as the direct descendants of documented varieties of Old Indo-Aryan, and that there are virtually no archaisms among New Indo-Aryan dialects that would suggest that they descend from a more conservative sibling of Vedic Sanskrit. The author dismisses a number of ostensibly archaic forms and argues that they are secondary.

While there is no Middle (MIA) or New Indo-Aryan (NIA) language that shows regular unambiguously archaic behavior across the board, stray morphological and phonological archaisms can be met with on occasion. For instance, some MIA languages reflect a zero-grade form of the mediopassive participial suffix *-māna-* < PIE *\*-mh<sub>1</sub>no-*, against OIA *-māna-* (von Hinüber 2001:310). Additionally, while various voiced PIE clusters fell together as *kṣ* in Sanskrit (e.g., *\*g<sup>u</sup>ḡ<sup>h</sup>er-* > OIA *kṣar-* versus Avestan *γžar-* ‘flow’, Rix et al. 2001:213; Lipp 2009:II 269ff.), some MIA languages show voiced reflexes of these clusters, e.g., Pali *paggharati*, Prakrit *jharai*, though it is not clear whether this voicing is indeed archaic or secondary.

Curious behavior can be found in some Dardic languages spoken in northern Pakistan, most of which are known for being archaic, though not necessarily displaying systematic archaisms with respect to Vedic.<sup>1</sup> For instance, most IA languages (including Vedic) reflect a form *āṇḍá-* ‘egg, testicle’, itself likely from an earlier form *\*ānda-*. The form *ōndrak* ‘egg’ in the Dardic language Kalasha points to *\*āndra-*, perhaps a morphological variant agreeing with Slavic *\*jědro* ‘seed, testicle’ (Burrow 1975:72; Mayrhofer 1989-2001:I 162); if cognate to the Slavic etymon, Kalasha *ōndrak* is a remarkable archaism. It is also possible that this word is a loan, since Kalasha speakers have been in historical contact with speakers of the Nuristani languages, the third branch of Indo-Iranian. Though Nuristani words for egg are not nearly as transparent, they too appear to reflect a form with *\*-r-*.<sup>2</sup> Also notable is the Bangani language, which shows so-called *centum* treatment of the PIE palatovelars in a large portion of its vocabulary, as opposed to the *satem* treatment expected in Indo-Iranian. This behavior has been accounted for by some scholars by assuming that a population speaking a *centum* Indo-European dialect shifted to an Indo-Aryan speech variety and continued to use vocabulary items displaying centum treatment (Cardona & Jain 2007:25; Smith 2017:438). This analysis remains somewhat controversial, but the key point to be taken away from these examples is that apparent archaisms in middle and modern Indo-Aryan languages tend to be one-off phenomena, and are more likely to be due to contact with non-Indo-Aryan speech varieties than evidence of a conservative Indo-Aryan strain that systematically resisted innovations undergone by attested varieties of OIA.

### 2.1.2 Old Indo Aryan period

Pronounced dialectal variation appears in the Vedas, the oldest IA texts. The sociolinguistic situation is complicated by the fact that the texts were transmitted orally for millennia. Because of the context of polyglossia between the vernaculars spoken by the transmitters and

<sup>1</sup>The general scholarly consensus is that Dardic languages are Indo-Aryan; for an alternative view, see Kogan 2005.

<sup>2</sup>Curiously, among the Kalash and Nuristani ethnic groups, fowl and eggs have historically been subject to strict taboos.(cf. Parkes 1987:648).

the languages of the texts themselves, certain “Middle Indo-Aryanisms” imposed themselves upon the language of even the oldest text, the Rig Veda (Tedesco 1945, 1960, Elizarenkova 1989; though see Kuiper 1991 for an opposing point of view). For instance, vocalization of *r*, a tendency that is more or less complete by MIA times, is already observed in the Rig Veda (e.g., *śithirá*- ‘loose’ < \**śrthirá*-).

Regional dialectal variation is also present (see Witzel 1989 on dialectal features associated with different diaskeuastic schools). The Śatapatha Brāhmaṇa, a late Vedic text, contains quoted speech thought to represent an Eastern dialectal variety (Witzel 1989:99; Joshi 1989:268). The quotation in question concerns the substitution of *r* with *l*, the distribution of these two sounds being of interest to Indo-Aryan (and in fact, Indo-Iranian) dialectology as a whole. The sound *l* is far more frequent in the Atharva Veda (the second oldest Vedic text) than the Rig Veda, and often occurs in places where other Indo-European languages show *l* (and Rig Vedic has undergone a change to *r*). This has led scholars to propose more than one migration into South Asia during the Vedic period. Parpola (2002) argues, for instance, that the two texts are associated with different migrations into South Asia from the Bactria-Margiana Archaeological Complex, a site considered to be a staging ground for the dispersal of the Proto-Indo-Iranians.

Classical Sanskrit, more or less the chronological successor of Vedic Sanskrit, is written according to a codified standard; accordingly, much of the potential for dialectal diversity is neutralized.

### 2.1.3 Middle Indo Aryan period

The oldest physical non-fragmentary IA specimens are middle, rather than old, Indo-Aryan, found in the rock and pillar inscriptions of Aśoka (3rd century BCE), which range geographically from Afghanistan to South India and are not limited to Indo-Aryan — a handful are in Aramaic (Shaked 1969). Other MIA languages include the dramatic Prakrits (Maharāṣṭrī, Śaurasenī, and Māgadhi), codified by the native grammarians Hemacandra and Vararuci; Pali, the language of the Theravada Buddhist canon; Gandhārī Prakrit, a regional language of Northern Pakistan and Afghanistan and vehicle of Buddhist literature; various Central Asian Prakrits (e.g., of the Niya documents); Ardhamāgadhi, associated with the canon of the Śvetāmbara Jains; and Apabhraṃśa (late MIA)

Like Old Indo-Aryan, Middle Indo-Aryan shows a great deal of dialectal diversity; equally striking, however, are the similarities that MIA dialects display in their profiles. Most attested MIA varieties have undergone similar drastic changes from OIA, the most famous of which is the two-mora rule. In most attested MIA dialects, all consonant clusters, with the exception of homorganic nasal+stop clusters, have been fully assimilated. The two-mora rule ensures that no syllable is heavier than two moras (a constraint that did not operate in Sanskrit). Lenition of intervocalic singleton consonants is frequent, more so in non-Pali varieties.

Pali shows a conservative layer where consonant clusters are repaired via epenthesis rather than assimilation (e.g., Pa. *palavati* ~ *pavati*, Pkt. *pavāi* < OIA *plávate* ‘swims’; cf. Oberlies 2001:112–113). It also displays different instantiations of the two-mora rule, e.g., CVC ~ CVC (Hock 2016:33). But the structural pressure against consonant clusters is no

less apparent.

Varying reflexes of the sort listed below can be found, often within the same language:

$n, ṇ > ṇ \sim n$

$s, ś, ṣ > s \sim ś$  (the latter reflex is a regular feature of the Māgadhi Prakrit)

$r/rt > ṛṛ \sim tt$  (sporadic instances resembling both reflexes can be found already in the Rig Veda, e.g., *kitavá-* ‘gambler’ < *\*kṛtava-*, *vīkaṭa-* ‘deformed’ < *\*vikṛta-*)

$sm > mh \sim (s)s$  (e.g., *vismaya-* ‘wonder’ > Pa. *vimhaya*, *vismarati* ‘forgets’ > Pa. *vissarati* (Masica 1991:178))

$kṣ > kh \sim ch^3$

#### 2.1.4 New Indo Aryan period

It is generally assumed that non-peripheral languages of South Asia such as Hindi, Panjabi, Bengali, etc., all descend from speech varieties akin to those attested during the MIA period. At this point, many languages have begun to take on drastically individual characteristics, such as the Assamese sound change to  $x$  from the sibilant of its MIA predecessor. In particular, the singleton and geminate consonants brought about by the two-mora rule have been subjected to additional changes. Hindi, on one hand, typically undergoes the merger  $VCC, \bar{V}C > \bar{V}C$ , while Panjabi generally goes in the opposite direction. Among non-peripheral languages, some common trends can be found, such as the loss of final vowels. We discuss relevant changes in the following section, which deals with Indo-Aryan dialectal groups on the basis of innovations found in NIA languages.

## 2.2 Proposed Indo-Aryan dialectal groupings

Several dialectological schemata have been proposed over the last century and a half; many of these views are summarized in Masica 1991. These are discussed in brief below, while the views of Southworth (2005), the main focus of this paper, are discussed in detail. Hoernle (1880) proposes four groups nested within two higher-order groups. Grierson (1967 [1903-28]) provides a continuation of Hoernle’s view, arguing for an Outer (peripheral) and Inner (core) group of languages on the basis of shared features. Chatterji (1926) argues that virtually all of features proposed by Grierson are too recent to have weight in establishing subgrouping. Along similar lines, Zograf (1976) finds no evidence for Inner-Outer hypothesis in his typological study of the morphological structure of NIA languages. Masica (1991:460) provides a relatively agnostic view, and suggests conceiving of IA as a set of “overlapping

<sup>3</sup>Pischel (1900:221) attempted to explain this variation according to an archaism whereby the distinction between PIE *\*k̑s* and *\*k̑(u)s* was preserved in the dialect that gave rise to the Prakrits, though this hypothesis does not seem tenable (von Hinüber 2001:183).

genetic zones.” 20th-century scholarship on the Inner-Outer hypothesis has remained skeptical or (at best) inconclusive with regard to the validity of the Inner-Outer hypothesis.

Southworth (2005:126–192) (henceforth S) seeks to revive Grierson’s Inner-Outer hypothesis, adducing new evidence that Grierson did not or was unable to consider.<sup>4</sup> S fleshes out the picture sketched by Grierson of the past tense in *-l-* as found in the outer group, providing several new examples of the phenomenon from Dardic languages (Dardic languages are left out of Grierson’s schema; S shows that they share several innovations with the Outer group and a smaller number with the Inner group, but ultimately excludes them from consideration as well).

He notes that a number of outer languages have developed a future marker from the OIA gerundive suffix *-tavya-*, first seen in the Atharva Veda. It remains unclear exactly what this development says regarding the prehistory of the outer languages. The necessitative meaning of *-tavya-* persisted for most of the OIA period, though a few isolated examples with future meaning can be found. In any event, drift or slant-like changes in modal force among closely related languages are well documented (e.g., Yanovich 2016).

S draws attention to additional phonological isoglosses. He shows that OIA vocalic *r̥* is realized primarily as *a* in the Outer group and *i* in the Inner group, though reflexes are not entirely regular. He finds similar a geographic patterning of reflexes of *r̥* among the Aśokan inscriptions (cf. Berger 1955). S notes that in Outer languages, the phonemic distinction between *u/ū* and *i/ī* is neutralized, resulting in the allophonic conditioning of vowel length.

It is well known that Vedic Sanskrit had tonal contours governed by lexically specified word accent; this system apparently was still present in Pāṇini’s dialect (ca. 5th century BCE), though this information was lost in the textual transmission of his Grammar. Eventually, this pitch accent is thought to have given way to a stress-timed system. The exact nature of the stress rules in the system(s) is unknown.<sup>5</sup> S, building upon a proposal of Turner (1916), suggests that Inner languages placed stress on the rightmost non-final heavy syllable. Outer languages, on the other hand, had fixed stress on the initial syllable; Marathi and Bengali tend to show a long vowel in the location of this hypothetical stress.

S goes on to list additional putative Outer phonological innovations, such as the change *l > n* and loss of post-consonantal *h*. Discussion of the former phenomenon is somewhat oversimplified (pp. 142–5); the change *n > l*, also found in several IA languages, is briefly mentioned, but more detailed treatments of the interchange between *l* and *n* in eastern IA (particularly Maithili) and beyond (e.g., in Old Rajasthani) can be found in Jeffers 1976:223; Thiel-Horstmann 1978:76–77, though it is clear that speakers were aware of this alternation as far afield as medieval Kashmir (Slaje 2014:29, fn. 9). S admits that *l > n* changes in the

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<sup>4</sup>At the time of designing this paper’s research, an article by Zoller (2016) appeared, summarizing key points from his forthcoming book and presenting even more morphological and structural isoglosses in favor of the Inner-Outer divide. Zoller is largely dismissive of most of Southworth’s phonological isoglosses, and many of the innovations and archaisms he discusses are outside the scope of the current paper.

<sup>5</sup>It is not clear whether the Dardic languages descend from a stage of OIA where stress had replaced tone. Many Dardic languages have lexical tone, and while the relationship of these systems to that of Vedic Sanskrit remains poorly understood, there are several cases of agreement between Vedic and Dardic forms (Kümmel 2015).

Outer group are not a unified phenomenon, in terms of conditioning environments,<sup>6</sup> but concludes nevertheless that the developments are unlikely to be independent of each other.

Following a discussion of lexical items shared by the Outer group, S lists a number of isoglosses found among the Aśokan inscriptions that are compatible with the Inner-Outer hypothesis. The most notable of these involve the OIA sibilants, nasals, vocalic *r*, and interchange between *r* and *l*. He concludes this discussion by proposing (pp. 181–185) that the Outer group left the Vedic homeland in Northwest India at an early date, migrated first to Sindh, then further into the Subcontinent, moving along the Vindhya mountains into Eastern India, subsequently meeting back up with the Inner group, which undertook a later migration from the Vedic homeland into the Indo-Gangetic plain (this stands in contrast to previous views, which hypothesized that the Inner and Outer groups entered South Asia separately). The route along the Vindhya complex places the Outer group in the “tribal belt” of India for some period of time, suggesting that speakers of Outer IA had greater exposure to the non-IA languages of the area (which include Dravidian and Austro-Asiatic languages as well as isolates) than the Inner group, which may have shaped their linguistic profile.

S has selected evidence that he considers probative with respect to this hypothesis, namely evidence that he believes to be sufficiently archaic as to reflect the division between the two ancient groups. Other changes are not relevant: it doesn’t matter that Hindi and Panjabi, both members of the Inner group, differ in their treatment of VCC and  $\bar{V}C$  sequences, as these developments are conceivably of a post-MIA date. Alternations between *r* and *l*, on the other hand, can be found in the earliest chronological period of IA. However, this does not necessarily mean that every individual change involving  $r \sim l$  interchange is old; some could in fact be quite recent, e.g., OIA *pālāla*- ‘straw’ > Pali, Prakrit *palāla*, but Panjabi *parāl*, *palari* (though this example likely reflects liquid dissimilation rather than unconstrained  $l \sim r$  variation). It is not clear if every sound change considered deserves the diagnostic power ascribed to it by S. Although S envisions two sociolinguistic groups that experienced greater intra-group than inter-group communication, he also concedes that this integrity broke down at a later date, prior to the changes that began to distinguish NIA speech varieties from each other. It is not clear exactly when this cutoff is to be made, and there is some risk of rejecting isoglosses that are incompatible with the Inner-Outer hypothesis as postdating the “reconnection” (p. 186).

These concerns aside, the innovations presented are convincing; S’s approach is thorough and far from cavalier. However, arguments worded with probabilistic language (p. 148: “the number of detailed similarities makes independent innovation unlikely”) call for explicit probabilistic methodologies. We require a means of allocating credibility to the Inner-Outer hypothesis using a large body of data where individual features have not been selected by hand. We take to heart the observation of Masica (1991:457), however qualified, that one “non-arbitrary way of [establishing dialect groups] might appear to lie in giving priority to

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<sup>6</sup>Some examples of  $l \sim n$  interchange are in fact quite recent, such as dissimilation in Dhivehi *alanāsi* ‘pineapple’ ← Portuguese/Tupi-Guaraní *ananás*, (Fritz 2002:84). As far as very old examples are concerned, Vedic *nīmṇá*- ‘depth, low ground’, cognate to Greek *límṇē* ‘lake, marsh’, may attest a similar  $*l > n$  change, if the *l* is primary (following Frisk 1991:98–9) and not secondary (following Mayrhofer 1989–2001:II. 44).

phonology.” Sound changes are an ideal choice due to the availability of the relevant data, and the fact that in large numbers they are likely to represent a conservative diachronic signal, at least in the Indo-Aryan context (see discussion in ). By using a large number of Modern IA forms extracted from Turner’s (1962–1966) dictionary and a probabilistic methodology, we hope to alleviate some of the woes that the author lists on the same page (such as the problem of widespread dialect admixture). In order to ensure that we properly investigate the Inner-Outer hypothesis, we limit ourselves to types of change considered important by S and other authors, but consider a range of data that cannot be analyzed qualitatively.

### 3 Rationale

There are a number of ways in which to quantitatively test the Inner-Outer hypothesis. We seek to develop a generative Bayesian model which essentially allows us to tell a probabilistic story about how the data we observe were generated. A study which seeks support for the Inner-Outer hypothesis ought to (1) recapitulate an inner and outer group, more or less as defined by Grierson and Southworth; and (2) demonstrate that similarities within each group are greater than similarities between them. Below, we outline a model which we believe to address these issues explicitly.

#### 3.1 Bayesian models in linguistics and related fields

Bayesian methodologies are not uncommon in historical linguistics today. Phylogenetic tools imported from computational biology have enjoyed a large degree of application to historical linguistic problems to date, and aid in answering questions that the comparative method has difficulty addressing. It would in theory be possible to seek evidence for an Inner and Outer subgroup using such a methodology. But this method does not strike us as appropriate for the specific questions we address: phylogenetic models have no explicit means of accounting for areality; generally speaking, researchers appeal to areality only when there is some uncertainty in the phylogenetic output. Given the importance of areality (and the relative unimportance of highly articulated binary genetic trees) to the argument outlined above, it is not clear that a standard evolutionary model would match the central question of this paper — however, use of evolutionary models in addition to the models presented in this paper will aid to give us a fuller understanding of the South Asian historical situation.

ADMIXTURE and MIXED MEMBERSHIP models provide an alternative capable of modeling language contact. Chang & Michael (2014) use such an approach to infer whether a given language in an areal group exhibits a feature due to genetic inheritance or contact, based on the feature’s genetic and areal distribution. Models of this sort do not appeal directly to evolutionary processes; two languages could possess a feature due to parallel development, but the model requires the assumption that the feature is genetically stable or more or less invariant (i.e., the Hardy-Weinberg equilibrium). Since our linguistic feature of interest consists of a variable indicating the operation of a sound change affecting an OIA sound



in a specific environment, and that these developments are unlikely to have changed back and forth multiple times during the time interval of interest, we assume that our data set is relatively robust to these concerns.

## 3.2 Operationalizing the Inner-Outer Hypothesis

We develop a mixed-membership model that draws upon the methodology of LATENT DIRICHLET ALLOCATION (LDA, Blei et al. 2003), a popular method for TOPIC MODELING (a type of document classification). LDA was developed independently of the similar Structure algorithm of biology (Pritchard et al. 2000), which has enjoyed some use in linguistics (Reesink et al. 2009, Syrjänen et al. 2016). In the context of document classification, LDA assumes that each word instance in each document in a corpus has been generated by one abstract “topic” from a pre-specified number of topics.<sup>7</sup> The probability that the word instance was generated by topic  $k$  is proportional to (a) the probability that the topic occurs in the document times (b) the weight of association between the word and the topic in question. The probabilities are unknown, as are the topic “assignments” for each word instance; these parameters must be inferred conditional on the data. The probabilities are generally assumed to be drawn from the DIRICHLET DISTRIBUTION, a popular prior probability distribution which generates  $N$ -length probability simplices. An  $N$ -length probability simplex is a vector of probabilities of occurrence for each of  $N$  events; all probability masses in the simplex sum to 1. Probability simplices can be used to generate multinomial (if more than one sample is drawn) or categorical (if only one sample is drawn) data; we refer a simplex simply as a multinomial distribution if the number of draws from it is unspecified. The use of a Dirichlet prior simplifies inference, allowing for Gibbs Sampling (Geman & Geman 1984), the standard methodology for inferring the parameters of such models.<sup>8</sup> Over many iterations of Gibbs Sampling, the dimensionality of the data is greatly reduced, with frequently co-occurring elements grouped together.

We seek to carry out a similar procedure to reduce the dimensionality of our data set to two groups; working with a large, high-definition dataset of linguistic features (viz., sound changes relevant to the Inner-Outer distinction), we wish to see which features are most strongly associated with a given latent dialect group, and what the dialectal makeup of the languages under study is.

Our model is similar to both the LDA and Structure algorithms, but differs from them in crucial ways. LDA treats each component-feature distribution as a flat one-dimensional multinomial distribution. In Structure, in contrast, the component-feature distribution is a COLLECTION OF MULTINOMIAL DISTRIBUTIONS (in the sense of cf. Cohen & Smith

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<sup>7</sup>LDA has a non-parametric extension, the Hierarchical Dirichlet Process, which allows a potentially infinite number of topics (Teh et al. 2005).

<sup>8</sup>Collapsed Gibbs Sampling, a Markov chain Monte Carlo procedure, works as follows: each word instance in each document is randomly assigned to a topic; then, for many iterations of inference, each word instance is removed from its current assignment, and a new topic assignment is chosen proportional to the number of words in the current document currently assigned to the topic in question times the number of word instances of the same type assigned to the topic in question.

2009). Similarly, because we work with sound change, we also treat the component-feature distribution as a collection of multinomials, each pertaining to a particular OIA sound in a particular conditioning environment (e.g., OIA  $s > s$  vs.  $h$  vs.  $\emptyset$  vs. ... in the context  $a \_ a$ ), all of which sum to one.

We assume that most meaningful contact between Indo-Aryan languages takes place at the word level, and that lexical borrowing is the process by which admixture occurs. Hence, we depart from Structure and LDA in taking WORDS to be associated with dialect components on the basis of the SOUND CHANGES attested in them, introducing an additional hierarchical level to the model.<sup>9</sup> This is potentially an oversimplification; S appeals frequently to the mechanism of LEXICAL DIFFUSION of sound changes in Indo-Aryan dialect group formation (135, 139, 141–2, et passim). For instance, discussing the operation of a sound change of from OIA  $l$  to  $n$ , he identifies Maithili as exhibiting the highest rate of this behavior, and notes that "[t]he change appears to radiate...into Nepali" (144). In the context of diffusion, change takes place in the form of the imposition of phonological processes, perhaps with some sociolinguistic or stylistic meaning, and it is in theory possible for members of a language that has borrowed a sound change to generalize it at liberty.<sup>10</sup> If our model were identical to the Structure algorithm, individual sound changes would be generated by a dialect component, irrespective of the words in which they co-occur — that is to say, it would model diffusion and diffusion alone, with no appeal to wholesale lexical borrowing. Currently, we have no good way of combining these two contact processes within a single statistical model, and have chosen to privilege lexical borrowing as a contact mechanism.

Of the two criteria listed in the first paragraph of this section, the first (recapitulation of an inner and outer group) can be evaluated by visually projecting our results onto a map, and seeing whether a geographic core and periphery emerge. We seek to operationalize the second criterion (intra-group cohesion) by means of a parameter of our statistical inference procedure. As mentioned above, the Dirichlet distribution is the standard prior over the multinomial distributions employed by LDA. Symmetric Dirichlets, which we deal with exclusively in this paper (unless otherwise noted), have a single CONCENTRATION PARAMETER greater than zero. If this parameter is greater than 1, the probability simplices generated by the Dirichlet distribution are SMOOTH, or quasi-uniform; if it is below 1, the resulting distributions are increasingly SPARSE, with probability mass concentrated on one outcome. We believe that this characteristic of the Dirichlet distribution provides an explicit means for testing the cohesion of the Inner and Outer groups: if the concentration parameter of the distribution governing language-specific dialect group membership is low, it indicates higher intra-group than inter-group cultural exchange; if greater than 1, it indicates a smooth transition between dialect groups. Similar hyperparameter inference is carried out by Meylan et al. (2013, 2017) to model category learning.

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<sup>9</sup>In assigning a label to a word on the basis of multiple sound changes attested in the word, this model has some commonalities with the Naïve Bayes Classifier.

<sup>10</sup>Neighboring Iranian languages show a significant degree of this type of behavior; the Gorani word *zil* 'heart' shows the operation of two different sound changes associated with entirely different dialect groups (MacKenzie 1961:77).

## 4 Data

We extracted all modern Indo-Aryan forms from Turner’s (1961–1966) *Comparative Dictionary of the Indo-Aryan Languages* (henceforth CDIAL),<sup>11</sup> along with the Old Indo-Aryan headwords from which these reflexes descend. Transcriptions of the data were normalized and converted to IPA. The OIA sequence  $kṣ = kṣ$  was treated as a single segment; while metrical evidence from Vedic texts suggests that  $kṣ$  was a heterosyllabic cluster, we found this analytical decision helpful in practice since a key question in Indo-Aryan dialectology asks whether  $kṣ$  changes to  $kh$  or  $ch$ . Systematic morphological mismatches between OIA headwords and reflexes were accounted for. The endings were stripped from all verbs, since citation forms for OIA verbs are in the 3sg present, while most NIA reflexes give the infinitive; NIA infinitives tend to come from deverbal nouns (cf. Oberlies 2005:44–5). We note that by excluding non-Indo-Aryan languages such as Newar, we run the risk of ignoring borrowings from Indo-Aryan into an unrelated language that might shed light on dialectal variation unattested in I-A varieties such as Nepali, but only a handful of such forms exist. We matched each dialect with corresponding languoids in Glottolog (Hammarström et al. 2017) containing geographic metadata, resulting in the merger of several dialects. After preprocessing (described in detail below), our data set consisted of 29014 words from 33 languages, summarized in Table 1.

## 5 Modeling sound change

This paper takes a data-driven approach to the question at hand, and requires a means of automatically extracting sound changes that have operated between Sanskrit words and their NIA reflexes. A number of candidate techniques exist. A popular method for aligning strings is the Needleman-Wunsch algorithm (Needleman & Wunsch 1970); this methodology originally designed for biological purposes can be used to align linguistic forms of different lengths. The algorithm takes a pair of strings, and determines whether two characters in the strings MATCH, or whether a character in either string corresponds to a GAP in the other. Matches can be determined based on a similarity metric; several authors have made use of pointwise mutual information (PMI) between characters as a similarity metric (Wieling et al. 2012), and have used expectation maximization (EM) to learn similarity weights. We convert the segments in each form in our data set to the sound classes described by List (2012) and learn similarity weights using the EM method described by Jäger (2013). This yields alignments of the following type: e.g., OIA /a:ntra/ ‘entrails’ > Nepali /a:n-ro/, where - indicates a gap. These aligned sequences can be used to extract sound changes as segmental rewrite rules of the form  $A > B / C \_ D$  which take into account the lefthand and righthand conditioning environment, e.g., OIA  $t > \text{Nepali } \emptyset / n \_ r$ .

There are several limitations of this representation of sound change (i.e., one-level rewrite rules operating between OIA and NIA languages). For one, we lack an explicit

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<sup>11</sup>Available online at <http://dsal.uchicago.edu/dictionaries/soas/>

Glottocode	Language name(s) as given by Turner (1961–1966)	<i>N</i>
assa1263	Assamese	1301
awad1243	Awadhī; Lakhīmpurī dialect of Awadhī	396
bagh1251	Bihārī	526
beng1280	Bengali (Baṅglā)	1625
bhad1241	Bhadrawāhī dialect of West Pahārī; Bhalesī dialect of West Pahārī; Bhiḍlāi sub-dialect of Bhadrawāhī dialect of West Pahārī; High Rudhārī sub-dialect of Khasālī dialect of West Pahārī; Khasālī dialect of West Pahārī; Low Rudhārī sub-dialect of Khasālī dialect of West Pahārī; Marmatī sub-dialect of Khasālī dialect of West Pahārī; Middle Rudhārī sub-dialect of Khasālī dialect of West Pahārī; Pāḍarī sub-dialect of Bhadrawāhī dialect of West Pahārī; Rudhārī sub-dialect of Khasālī dialect of West Pahārī; Śeuṭī sub-dialect of Khasālī dialect of West Pahārī	765
bhat1263	Bhaṭṭālī sub-dialect of Ḍogrī dialect of Panjābī	40
bhoj1244	Bhojpurī	423
braj1242	Brajbhāṣā	73
cham1307	Cameālī dialect of West Pahārī	64
chur1258	Curāhī dialect of West Pahārī	109
dhiv1236	Maldivian dialect of Sinhalese	464
dogr1250	Ḍogrī dialect of Panjābī	38
garh1243	Garhwālī	411
guja1252	Gujarātī; Ghisāḍī dialect of wandering blacksmiths in Gujarat; Kāṭhiyāvāḍī dialect of Gujarātī; Paṭṭanī dialect of Gujarātī; Sikalgārī (Mixed Gypsy Language: LSI xi 167)	2181
hind1269	Bāṅgarū dialect of Western Hindī; Hindī; Jāṭū sub-dialect of Bāṅgarū dialect of Western Hindī	2911
jaun1243	Jaunsārī dialect of West Pahārī	150
kach1277	Kacchī dialect of Sindhī	372
kang1280	Kāṅgrā sub-dialect of ḍogrī dialect of Panjābī	29
khet1238	Khetrānī dialect of Lahndā	86
konk1267	Koṅkaṇī	382
kuma1273	Gaṅgoī dialect of Kumaunī; Khasa dialect of Kumaunī; Kumaunī	1386
maha1287	North Jubbal dialect of West Pahārī; Kocī dialect of West Pahārī; Kiūthālī dialect of West Pahārī; Rohruī dialect of West Pahārī; Sōdōci dialect of West Pahārī; West Pahārī	194
mait1250	Maithilī	724
mar1378	Marāṭhī	2369
marw1260	Mārwārī	88
nepa1254	Nepālī	1686
oriy1255	Oṛiyā	2078
paha1251	Poṭhwārī dialect of Lahndā; Punchī dialect of Lahndā	20
pang1282	Paṅgwālī dialect of West Pahārī	55
panj1256	Ludhiānī dialect of Panjābī; Panjābī (Paṅjābī); Pōwādhī dialect of Panjābī	2168
sind1272	Lārī dialect of Sindhī; Sindhī	1927
sinh1246	Roḍiyā dialect of Sinhalese; Sinhalese	2380
west2386	Awāṅkāṛī dialect of Lahndā; Hazara Hindkī dialect of Lahndā; Kāchṛī dialect of Lahndā; Lahndā; Multānī dialect of Lahndā	1593

Table 1: Number of words in each language.

representation of intermediate stages of change between OIA and NIA languages (for approaches addressing this issue, see Bouchard-Côté et al. 2007, 2008 *et seq*); doing so would introduce an unmanageable and unwarranted degree of complexity into our model. As such, we cannot capture phenomena such as metathesis, non-local changes, or developments of the type /ke/ > /ca/, where palatalization and vowel lowering are in a counterbleeding relationship (see Koskeniemi 2017:58 on the potential for expressing changes which pose challenges for extremely basic rewrite grammars using finite-state automata). A potential solution is to use  $n$ -grams in lieu of rewrite rules, however, this greatly increases the feature space; furthermore, higher-order  $n$ -grams can violate the independence assumption that underlies many mixture model approaches. Changes of this sort, fortunately, are not central to our research question, but at the same time, the following isolated potentially critical phenomena cannot be captured:

1. Assamese /x/, the reflex of OIA  $s$ ,  $\acute{s}$ ,  $\$$ , is thought to develop from intermediate  $*\acute{s}$  (Kakati 1941:224). This isogloss would place it genetically alongside other languages (most of them its geographic neighbors) associated with the Māgadhī Prakrit. This intermediate stage is plausible given the fact that it is seen in neighboring Bengali, and has typological parallels in Slavic and Romance (though incidentally there is no direct evidence of this stage in the history of Assamese, to my knowledge).
2. Some instances of NIA  $bh$  likely come from an earlier  $*mh$  (Tedesco 1965:371; Oberlies 2005:48).
3. The Marathi change  $ch > s$  affects certain words containing MIA  $*ch < \text{OIA } k\acute{s}$  as well as OIA  $ch$  (Masica 1991:457);  $ch \sim kh < \text{OIA } \$$  variation is of importance to MIA and NIA dialectology (see above).

A tentative solution is to treat these phonemes as  $*\acute{s}$ ,  $*mh$ ,  $*ch$ , etc., but this sort of manipulation of the data can potentially have unintended effects. We leave data of this sort unchanged, and address problematic sound changes during the model criticism stage.

Many of the problems outlined above are alleviated by a linguistically informed approach based on sound changes considered to be probative to higher-order Indo-Aryan subgrouping, namely those mentioned by S as well as important sound changes in Modern Indo-Aryan listed by James W. Gair (*apud* Hock 2016:45). We limit ourselves to changes affecting a handful of OIA segments ( $\text{[}\acute{j}, \text{[}\text{ṇ}, \text{[}\text{ṇ}, \text{[}\text{ṣ}, \text{[}\text{ṛ}, \text{[}\text{h}, \text{[}\text{i}, \text{[}\text{i}\acute{:,} \text{[}\text{j}, \text{[}\text{k}\acute{s}, \text{[}\text{l}, \text{[}\text{n}, \text{[}\text{r}, \text{[}\text{s}, \text{[}\text{u}, \text{[}\text{u}\acute{:}$ ]).<sup>12</sup> We consider changes that occur more than 7 times across data set. While this underuse of the available data is less than ideal, this approach has a number of benefits, itemized below:

- Changes involving these sounds are segmental, and largely free of the complexities and problems described above.

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<sup>12</sup>Currently, we lack a means of marking stress in OIA, and cannot model sound changes that are prosodically conditioned.

- It makes our inference computationally feasible; reducing the space of sound change parameters to 1001 sound change probabilities within a collection of 391 sound change distributions (still a large number).
- It allows us to consider only changes considered to be relevant to the Inner-Outer hypothesis by S and excludes sound changes that serve as “background noise” (akin to excluding so-called stop-words like *the* in document classification, as such words are common to all document themes).

In short, while we have pre-specified the types of OIA sounds undergoing change, restricting our search to the sound specified above, our approach allows us to consider a wide array of conditioning environments, and a large number of tokens that cannot be easily analyzed via a qualitative procedure.

## 5.1 Prior distributions over sound change probabilities

As mentioned above, we represent sound change as a COLLECTION OF MULTINOMIAL DISTRIBUTIONS, as opposed to a flat model of sound change where each edit (e.g.,  $r > \emptyset / m\_a$ ,  $r > r / m\_a$ ) is treated as a feature that can be associated with a dialect component (this is the standard LDA/Structure model), which could potentially lead to a dialect group displaying highly variable behavior with respect to a particular sound-environment pair. A given distribution in the collection pertains to an OIA sound in a given conditioning environment (a SOUND-ENVIRONMENT PAIR, e.g.,  $k\varnothing$  in the context  $a\_a$ ), which has a finite number of REFLEXES (e.g.,  $k^h$ ,  $c^h$ ,  $s$ ) which can be realized with some probability, all of which sum to one. This data structure is ragged; sound-environment pairs do not always have the same number of reflexes associated with them. We exclude sound-environment pairs with only one possible reflex, as these features are uninformative with respect to other sound changes under a model that does not capture inter-dependent behavior between sound change distributions. The most obvious prior over this collection of distributions is the Dirichlet distribution, the prior of choice for multinomial distributions, as discussed above.

If we were to adopt a warped version of the Neogrammarian hypothesis that assumed regularity of sound change without analogical change, we would expect the probability of a single reflex to be equal to one, with probabilities of all other reflexes equal to zero. We relax this assumption to account for analogical and saltatory change, and for the simple reason that many OIA sound-environment pairs in our group have more than two (the number of dialect groups we assume) reflexes, creating a degree of uncertainty. When modeling sound change using the Dirichlet distribution, we fix the concentration parameter below 1 to encourage sparse multinomial distributions (see discussion in §3.2), as the effect of analogy and saltatory change should be minimal, drawing only a small bit of probability mass away from the “regular” reflex.<sup>13</sup> However, while this modeling decision is more likely to

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<sup>13</sup>It may be the case that this assumption is not always correct; extensive paradigmatic leveling and extension can lead to widespread irregularity in reflexes (cf. Jamison 1988), better approximated by our notion of a smooth distribution.

prevent linguistically unrealistic scenarios in which one dialectal component shows uniform outcomes for sound changes, it potentially allows for sound change patterns that are regular and logically possible, but still unrealistic. For example, *s* could change to *h* across 50% of environments, but remain unchanged across the other half. The Dirichlet, which has no explicit means of modeling covariance between outcomes, lacks a means of linking together conditioning environments in ways that traditional historical linguists do.

For this reason, the second prior we employ is the LOGISTIC NORMAL distribution (Aitchison 1986), which has previously been used to model correlations between topics in document collections (Blei et al. 2007), as well as in unsupervised grammar induction (Cohen et al. 2009, Cohen & Smith 2009). Draws from this prior come underlyingly from the multivariate Normal distribution, for which covariance can be straightforwardly expressed (in contrast to the Dirichlet distribution); these values are then transformed into probabilities summing to one via the SOFTMAX function. For a single distribution in the collection (e.g., *s* > *s* vs. *ṣ* vs. *x* in the context *a* *̄* *a*), it is thus possible to model a degree of constrained, low-level variation among reflexes for a particular dialectal group, essentially capable of accounting for the fact that Assamese *x* (most likely) reflects an earlier *\*ṣ*, if we treat *x* and *ṣ* as having greater similarity than *s* and other sounds. Additionally, the Partitioned Logistic Normal distribution allows for similarity to be captured not only within one distribution in a collection, but across distributions. We can thus link together similar sound changes within the entire collection on the basis of the sounds involved.

While the logistic normal distribution and its generalizations can express covariance, they cannot generate sparse distributions via parameterization in the same way that the Dirichlet can. The Logistic Normal distribution achieves sparsity only when variance is high and covariance is zero. We require non-zero covariance in order to model similarity across sound changes, but can encourage sparsity via high variance and by constraining covariance in outcomes BETWEEN distributions in the collection to be higher than that of outcomes WITHIN distributions.<sup>14</sup> Crucially, the use of these priors has nothing to say about WHERE probability mass is concentrated for each sound change in each dialect group — simply that sound change distributions resemble draws from the priors that we have stipulated.

To illustrate the difference between these distributions, Figure 1 shows the density contour plot for a sparse bivariate Dirichlet distribution alongside that of a bivariate Partitioned Logistic Normal distribution. Under the bivariate Dirichlet, all four possible combinations of outcomes are equally likely, whereas under the particular PLN distribution represented, probability mass is concentrated in the regions (0, 0) and (1, 1) but not (0, 1) or (1, 0).

## 6 Generative model

Here, we describe the generative stochastic process that we assume to underlie the observed data, that is to say, the sound changes operating between each Sanskrit word and all of its

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<sup>14</sup>In theory, logistic normal variates can be power transformed to allocate even more probability mass to the outcome with the most probability mass. Exponentiation of a multinomial distribution to a value below one results in a smoother distribution, while a power greater than one results in a more skewed one.

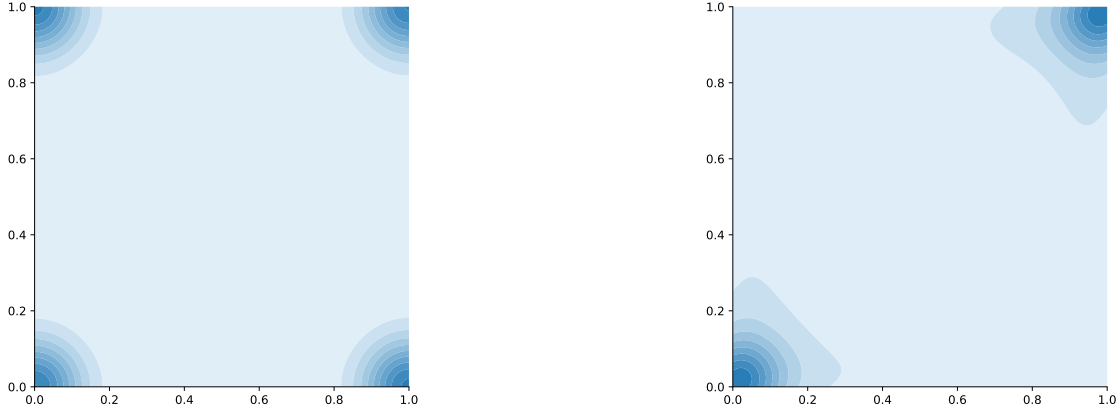


Figure 1: Density of a bivariate Dirichlet distribution (left) with concentration parameter of .01 and a bivariate Partitioned Logistic Normal distribution with positive covariance across partitions (right). Darker values indicate higher probability density.

NIA reflexes. This formal specification defines all of the parameters of interest, including the prior distributions that we place upon them.

- For each dialect group index  $k \in \{1, \dots, K\}$  ( $K = 2$ )  
 $\phi^k \sim \text{Dirichlet}(\alpha < 1) \text{ or Logistic Normal } (\mathbf{0}, \Sigma)$  [draw a group-level collection of multinomial distributions over sound changes]
- For each language index  $\ell \in \{1, \dots, L\}$   
 $\theta^\ell \sim \text{Dirichlet}(\beta)^{15}$  [draw a language-level distribution over dialect component makeup]
- For each word index  $i \in \{1, \dots, N\}$   
 $z_i \sim \text{Categorical}(\theta^{\ell[i]})$  [choose a dialect group from which the word comes on the basis of the dialect component makeup of the language to which the word belongs]
  - For each sound change index  $j \in \{1, \dots, J[i]\}$   
 $y_{ij} \sim \text{Categorical}(\phi_{x_{ij}}^{z_i})$  [generate the NIA sound  $y_{ij}$  according to parameters associated with  $z_i$ , conditioned on  $x_{ij}$ , the relevant sound/environment pair in the corresponding OIA etymon]

<sup>15</sup>Readers may note that since  $K = 2$ , this Dirichlet distribution is equivalent to the Beta distribution. We represent this distribution with a Dirichlet for the sake of generality.



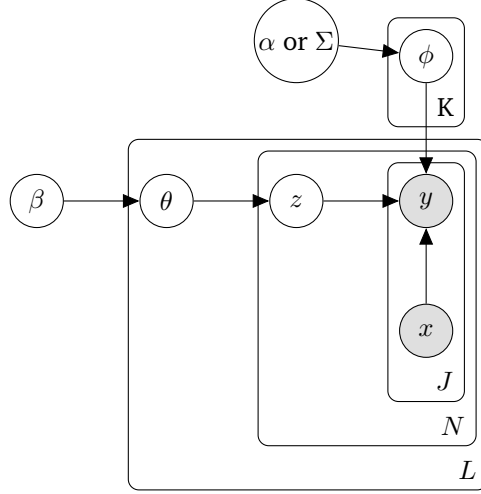


Figure 2: Plate diagram: dialectal components generate words in each language on the basis of sound changes attested in them.

The generative process introduces conditional dependencies between variables and parameters, and yields the following full probability of the model conditioned on the hyperparameters  $\alpha$  and  $\beta$  (for notational simplicity, we consider only the model with a Dirichlet prior over sound change below):

$$P(\mathbf{x}, \mathbf{y}, \mathbf{z}, \boldsymbol{\theta}, \boldsymbol{\phi} | \alpha, \beta) = \prod_{k=1}^K P(\phi^k | \alpha) \prod_{\ell=1}^L P(\theta^\ell | \beta) \prod_{i=1}^N \left[ P(z_i | \theta^{\ell[i]}) \prod_{j=1}^{J[i]} P(y_{ij} | \phi_{x_{ij}}^{z_i}) \right] \quad (1)$$

The POSTERIOR DISTRIBUTIONS of the parameters of interest need to be inferred. In theory, if we were to use parameter values of high posterior probability as input to our generative model, we would come very close to re-generating our observed data. Inverting the problem to infer these values is non-trivial. An iterative procedure such as Markov chain Monte Carlo (MCMC) or Variational Inference (VI) is used to approximate posterior distributions in cases where no analytic solution is available.

The hyperparameter  $\alpha$  (or in the case of the model with a logistic normal prior,  $\Sigma$ ) is fixed. Since our operationalization of S's hypothesis depends on the value of  $\beta$ , we infer this hyperparameter from the data.

## 7 Implementation and Inference

If we were to limit ourselves to a Dirichlet prior over the language-component and component-sound change distributions, we could infer our parameters via Collapsed Gibbs Sampling,

an efficient MCMC approach; however, every iteration of this procedure requires an iteration through every data point, which is unfeasible for large data sets. Additionally, this constrains our choice over priors. Incidentally, Mimno et al. (2008) describe a method for Gibbs Sampling in models using logistic normal priors of lower dimension than the priors required for this paper’s study; however, in the interest of flexibility and expandability, we opt for an approach that allows us to potentially toggle between a diverse set of priors.

Several powerful probabilistic programming languages exist, designed to allow specialists to specify complex Bayesian models and fit their parameters without having to carry out the complex math and computation involved in inverting the generative process. Notable members of this group include Stan (Carpenter et al. 2017), PyMC3 (Salvatier et al. 2016), and Edward (Tran et al. 2017). We use PyMC3 (version 3.3) because it allows us to represent our ragged collection of sound change distributions efficiently (in a way that Stan currently cannot) and because the inference can evaluate a user-defined custom log probability function (in a way that is not currently straightforward at the time of writing, to our knowledge, in Edward). PyMC3 supports Automatic Differentiation Variational Inference (ADVI, Kucukelbir et al. 2017). Variational Inference (VI), an alternative to MCMC, approximates the true posterior distribution with a fully factorized variational distribution, and seeks to minimize the Kullback-Leibler divergence, also known as the Evidence Lower Bound (ELBO), between the two distributions. For an overview, see Blei et al. 2017. ADVI uses first-order automatic differentiation to implement stochastic gradient descent in order to optimize the model’s parameters, allowing inference for mini-batches of manageable size.

ADVI can only infer values for continuous parameters, which it transforms to continuous real-valued space. Hence, the discrete categorical variable  $z$  must be MARGINALIZED out or summed over. The likelihood of an individual word in the dataset under a given dialect component assignment (i.e., value of  $z_i$ ) can be written as follows:

$$P(\mathbf{x}_i, \mathbf{y}_i, z_i = k | \phi, \theta) \propto P(z_i = k | \theta^{\ell[i]}) \prod_{j=1}^{J[i]} P(y_{ij} | \phi_{x_{ij}}^k) \quad (2)$$

With  $z_i$  marginalized out, the above term can be rewritten as follows:

$$P(\mathbf{x}_i, \mathbf{y}_i | \phi, \theta) \propto \sum_{k=1}^K \left[ P(z_i = k | \theta^{\ell[i]}) \prod_{j=1}^{J[i]} P(y_{ij} | \phi_{x_{ij}}^k) \right] \quad (3)$$

Following Srivastava & Sutton (2017:5–6), we use the Adam optimizer (Kingma & Ba 2015) to fit the variational parameters and set the learning rate  $\eta$  to .01 and vary the moment weight  $\beta_1$  uniformly between .7 and .8, which safeguards against identical parameters being inferred for different components (known as “component collapsing,” a problem that we experienced when these settings were left at their default values).

We carry out inference for two models: the first places a Dirichlet prior over sound change probabilities, while the second places a logistic normal prior over sound change

probabilities.<sup>16</sup> The parameter  $\alpha$  of the Dirichlet prior is fixed at .01. We fix the values of the cells in  $\Sigma$ , the variance-covariance matrix for the logistic normal prior, as well. This is a multistep process. First, for each pair of sound changes in our data set, we compute a dissimilarity score:

$$\delta(a_1 > b_1/c_1\_d_1, a_2 > b_2/c_2\_d_2) = \exp \left( - \sum_{d \in D} f^d(a_1, a_2; b_1, b_2) + f^d(c_1, c_2; d_1, d_2) \right)$$

The function  $f^d(x_1, x_2; y_1, y_1) = 0$  if  $x_1$  matches  $x_1$  and  $y_1$  matches  $y_1$  in terms of feature  $d \in D$  (we consider the features consonance, place of articulation, manner of articulation, voicing, and nasality, where relevant) and 1 otherwise. In other words, if input-reflex pairs and environments match across sound change for all features, their dissimilarity is taken to be very low. We multiply these scores by a dispersion parameter  $\eta$ , which is fixed at 4, only if the score pertains to two sound changes that are not in the same distribution (we wish to capture similarities across distributions in the collection but encourage within-distribution sparsity). Finally, a constant  $\sigma = 100$  is added to the diagonal rows of the matrix.<sup>17</sup>

We fit the model using mini-batches of 500 data points (i.e., words in our data set), a size recommended for mixture models (Kucukelbir et al. 2017).

VI tends to converge on local optima, which can be sensitive to initialization; we carry out the optimization procedure 4 times for each of our two models, and assess convergence by inspecting the ELBO for each procedure, as shown in Figure 3. For each parameter, we construct posterior traces by drawing 500 samples from the fitted variational distributions. To address the problem of label-switching (a common problem in mixture models where mixture components are given different labels across different inference regimes), we re-label the dialect components inferred during initializations 2 to 4 to minimize the relative entropy to the labels inferred during the first initialization.

We calculate the potential scale reduction factor  $\hat{R}$  for all model parameters from these traces. Since all of our model parameters are approximated with a Gaussian distribution, this convergence diagnostic, which compares the within-trace and between-trace variances, is appropriate (Gelman & Rubin 1992). Values of the hyperparameter  $\beta$  converge well for each model with  $\hat{R}$  equal to 1.008 and 1.024 for the Dirichlet and Logistic Normal models, respectively.  $\hat{R}$  values for each parameter within  $\theta$  and  $\phi$  are summarized in Table 2; not all  $\hat{R}$  values for the thousand-odd parameters summarized in the table are below 1.1, which allows us to identify regions of the model where misspecification has occurred.

<sup>16</sup>Code used for inference and analysis can be found at [https://github.com/chundrac/IA\\_dial/tree/master/JHL](https://github.com/chundrac/IA_dial/tree/master/JHL).

<sup>17</sup>The constants used here were chosen to yield positive definite covariance matrices. A perhaps more principled and fully Bayesian (but computationally intensive) way of generating covariance matrices is to use a Gaussian Process (Rasmussen & Williams 2006).

Parameter	Dirichlet model	Logistic Normal model
$\theta$	52/66	54/66
$\phi$	1978/2002	2002/2002

Table 2: Number of parameters for which  $\hat{R} < 1.5$

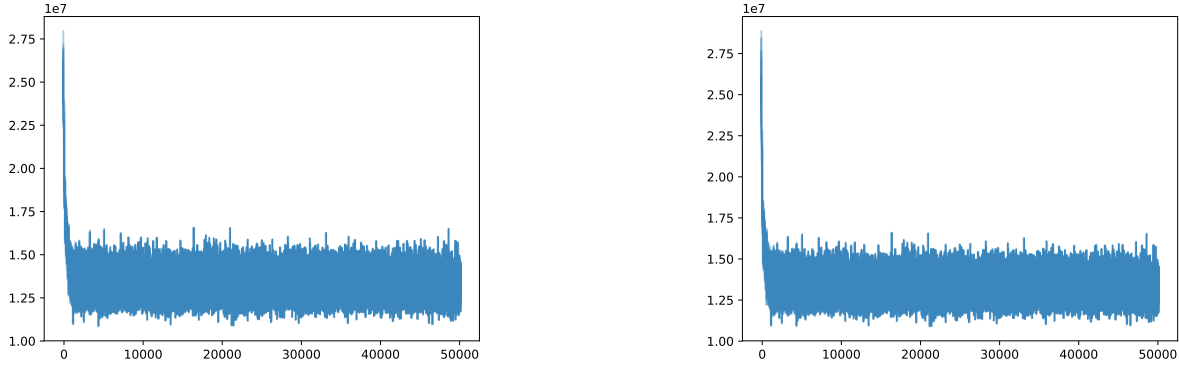


Figure 3: ELBO convergence for three inference runs for Dirichlet (left) and Logistic Normal (right) models

## 8 Results

### 8.1 Sparsity of language-group distributions

We chose to operationalize S’s hypothesis that “there was greater communication *within* each of these regions [inhabited by the Inner and Outer groups] than there was *between* them [emphasis in original]” (p. 148) via the hyperparameter  $\beta$  of the language-group distributions (we assume one global hyperparameter). Sparse language-component distributions indicate that a language receives the majority of its linguistic features probative to the Inner-Outer hypothesis from one latent dialect group. Values for  $\beta$  below 1 generate sparse symmetric Dirichlet distributions. As visible in Figure 4, posterior values for  $\beta$  are well below 1 for both the Dirichlet and Logistic Normal models, compatible with the view that there was greater intra-group than inter-group communication among the dialect groups we have inferred.

In addition to inferring concentration parameters from the data, we randomly shuffled the data four times, breaking the association between languages and words belonging to them, and ran the same inference procedure for the Dirichlet and Logistic Normal models. The rationale here was to ensure that sparse language-component posterior distributions are an artifact of our dataset, and not our model, since there is a possibility that smooth language-component distributions are not expected even by chance. Our shuffled data sets produce significantly higher posterior values for  $\beta$ , most of which are greater than one. It is clear that

some of the posterior distributions for  $\beta$  inferred by the Dirichlet model using randomized data overlap with 1; however, values in the randomized posterior distributions are nowhere nearly as low as the values inferred from the true data set, according to one-tailed Z-tests carried out for each randomization (Dirichlet:  $z = -188.28, -204.69, -208.09, -216.71$ ,  $p < 1e - 10$ ; Logistic Normal:  $z = -190.43, -190.92, -197.41, -193.57$ ,  $p < 1e - 10$ ). This indicates that the degree of sparsity we have found is a legitimate artifact of the data, and unlikely to be due to chance.

According to our operationalization, we have found evidence for a strong degree of intra-group cohesion. However, further inspection is required to ascertain whether a core and peripheral group of languages have been recovered by our inference procedure. Additionally, it remains to be seen whether the sound change parameters inferred for each group are realistic from a historical phonological standpoint. These issues are discussed in upcoming sections.

## 8.2 Language-group distributions

While the values inferred for the hyperparameter  $\beta$  appear to indicate that the each Indo-Aryan language in our sample draws the vast majority of its linguistic features (here, particular sound changes) from one of two latent dialectal groups, this is still not a direct confirmation of the Inner-Outer hypothesis as formulated by S. We visualize the geographic distribution of languages and their component makeup in order to confirm whether the Inner and Outer groups envisioned by S and previous authors are in fact recapitulated. Figure 6 shows the language-group distributions that are expected following S. Figures 7 and 8 show the mean language-group distributions for each language averaged across different initializations for the Dirichlet and Logistic Normal models, respectively. Under the Dirichlet model, the majority of languages are overwhelmingly dominated by one component, with Marathi, Konkani, Gujarati, Marwari, and some Pahari languages of the Himalayas represented by the other component. The Logistic Normal model shows slightly less certainty in its language-component distributions, but displays a pattern that is more compatible with the Inner-Outer hypothesis; even so, Marathi, Konkani, Maithili, “Bihari”, Awadhi, and Bhojpuri, considered by S to belong to the Outer group, show more affinity with languages from the Inner group (e.g., Panjabi) as opposed to languages such as Bengali. The Pahari languages of the Himalayas are split between the two groups. It is worth noting that their status in the Inner-Outer schema is not entirely clear; though S considers them for the most part to be part of the Inner group, it has recently been suggested that these languages form a distinct branch closely related with to the Outer Languages (Zoller 2012).

At the same time, a cursory visual inspection is not sufficient to gauge agreement between the Inner-Outer hypothesis and the Logistic Normal model over the Dirichlet mode. For this reason, we use Jensen-Shannon divergence, a symmetric measure of difference between two probability distributions, to assess the similarity between the expected language-component distributions under S’s formulation of the Inner-Outer hypothesis and posterior values of  $\theta$  inferred for each model. The left plot in figure 5 shows that both models’ posteriors are

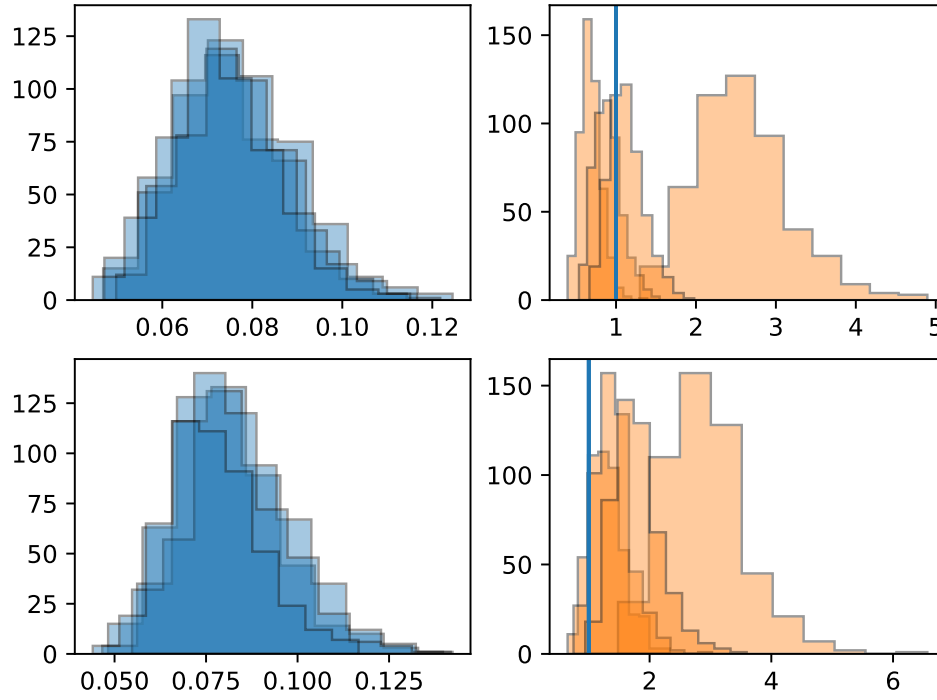


Figure 4: Posterior distributions of  $\beta$  for four inference runs for Dirichlet (top) and Logistic Normal (bottom) models. Lefthand posterior distributions were inferred from the actual data set, while righthand distributions were inferred from randomized versions of the data set, and display higher values. The righthand plots contain a vertical line at  $x = 1$ .

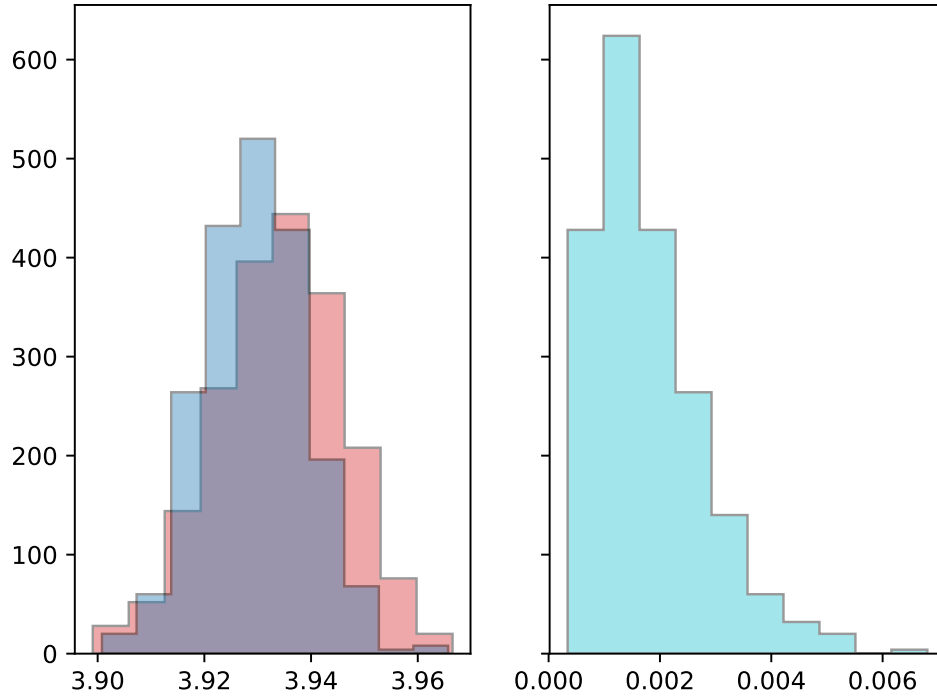


Figure 5: Jensen-Shannon divergences between the expected language-component distribution and posterior values of  $\theta$  for the Dirichlet model (blue), the expected language-component distribution and posterior values of  $\theta$  for the Logistic Normal model (red), and posterior values of  $\theta$  for the Dirichlet model and posterior values of  $\theta$  for the Logistic Normal model (cyan).

roughly equidistant from the expected language-component distribution; the right plot shows that both models' posteriors are strikingly similar to each other.

Ultimately, both qualitatively as well as probabilistically, our inferred language-component distributions do not show a high degree of agreement with the Inner-Outer hypothesis as envisioned by S. The Logistic Normal model does a slightly better job in recapitulating the Inner-Outer hypothesis than the Dirichlet model, though it classifies several Outer languages with Inner languages. A natural question emerges: is the Logistic Normal the correct model because it shows somewhat better agreement with the Inner-Outer hypothesis? This would serve as validation of the Logistic Normal model only if we assumed the Inner-Outer hypothesis to be correct, and a goal of this paper is to allocate credibility to the hypothesis, in which case it cannot be assumed. In order to avoid circularity, we not wish to treat this behavior alone as evidence that the Logistic Normal model is superior to the Dirichlet model, but seek to assess model performance by additional diagnostics discussed in following sections.

### 8.3 Sound change distributions

It is not possible to individually assess the plausibility of all 1001 ( $\times 2$  per dialect group) sound changes in our collection of 391 sound change distributions; these are summarized individually in the appendix/supplementary materials. Here, we give a handful of distributions exemplifying divergent as well as non-divergent, uniform behavior across dialect components (we average across inference runs).

Both the Dirichlet and Logistic Normal models find that reflexes of OIA  $k\text{ṣ}$  show divergent behavior across dialect components, at least in certain contexts. For instance, the change  $k\text{ṣ} > k^h / \# \_ o$  has high probability in one group, while  $k\text{ṣ} > c^h / \# \_ o$  has high probability in the other. The latter group, in particularly under the Logistic Normal model, corresponds to a component resembling the Outer group, and the change  $k\text{ṣ} > ch$  is identified as a key characteristic of this group.

Other reflexes are striking in their behavior. It is remarkable that both the Dirichlet model and Logistic Normal model capture trends in the behavior of OIA sounds across conditioning environments and even natural classes. For instance, one group shows consistent alveolar/dental outcomes for OIA  $n$ ,  $l$ , and  $\text{ṇ}$ , while the other shows retroflex ones. This holds even for the Dirichlet model, which cannot explicitly model correlations across distributions in a collection. It may be the case that the model picks up strongly on these trends on the basis of strong associations between similar sound changes co-occurring within and across individual words in a given language. A perhaps troubling aspect of the retroflexion described above is the fact that the group showing the strongest tendency toward retroflexion of the sounds listed above is associated with languages such as Hindi, which does not frequently display this behavior. This may either be an artifact of data collection, or due to a meaningful pattern learned by our inference procedure (itself dependent on other features in the dataset). Sound change distributions pertaining to the loss of the length distinction in OIA  $u/\bar{u}$ ,  $i/\bar{i}$  can show a degree of higher uncertainty. This is likely due to our neglect in coding prosodic features; some instances of variation between  $u/\bar{u}$ ,  $i/\bar{i}$  may



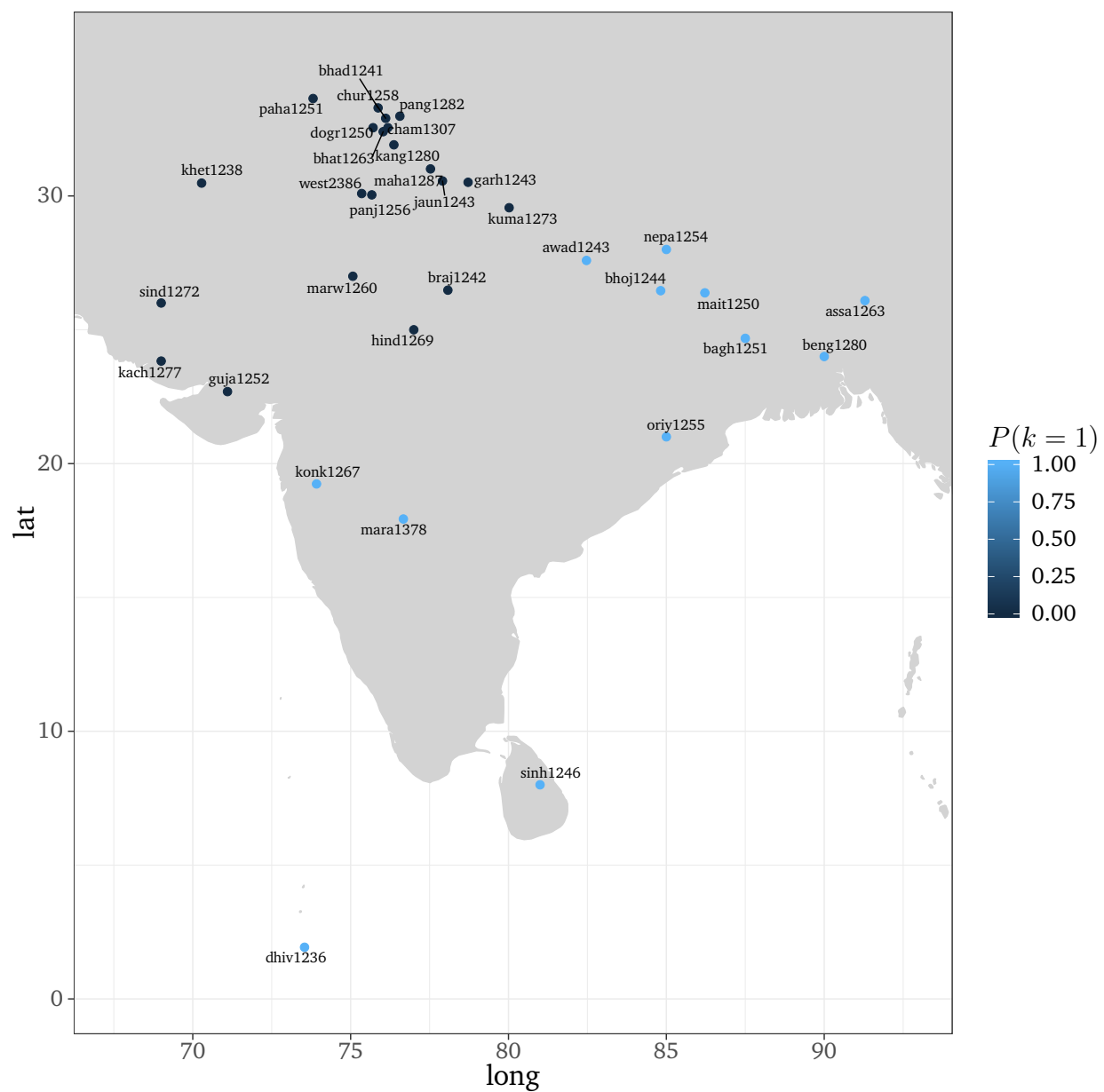


Figure 6: Dialect component distribution map expected under Inner-Outer hypothesis. Darker values indicate inner group ( $k = 0$ ); lighter values indicate outer group ( $k = 1$ )

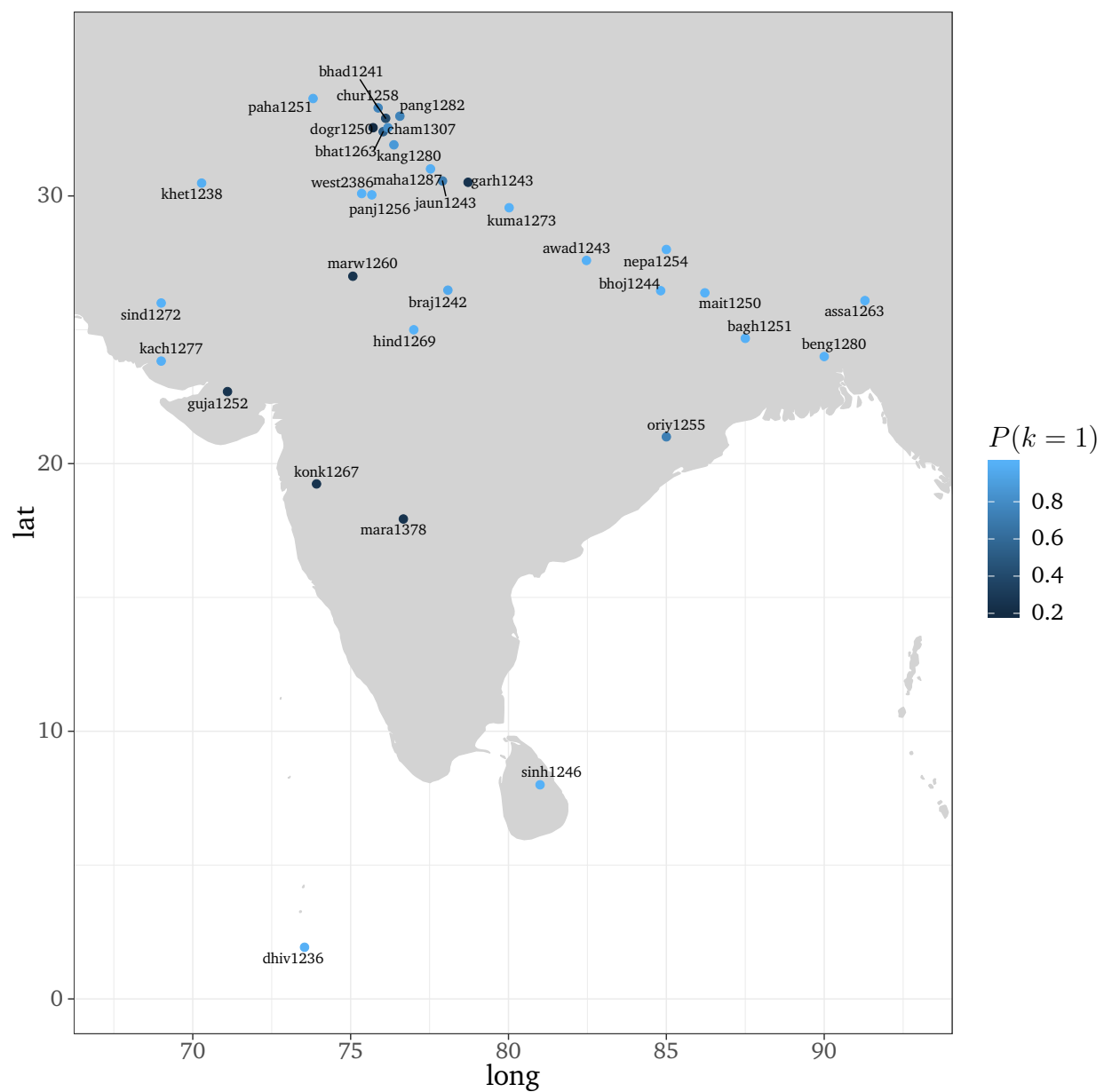


Figure 7: Dialect component distribution map for Dirichlet model; mean values for each language are averaged across initializations.

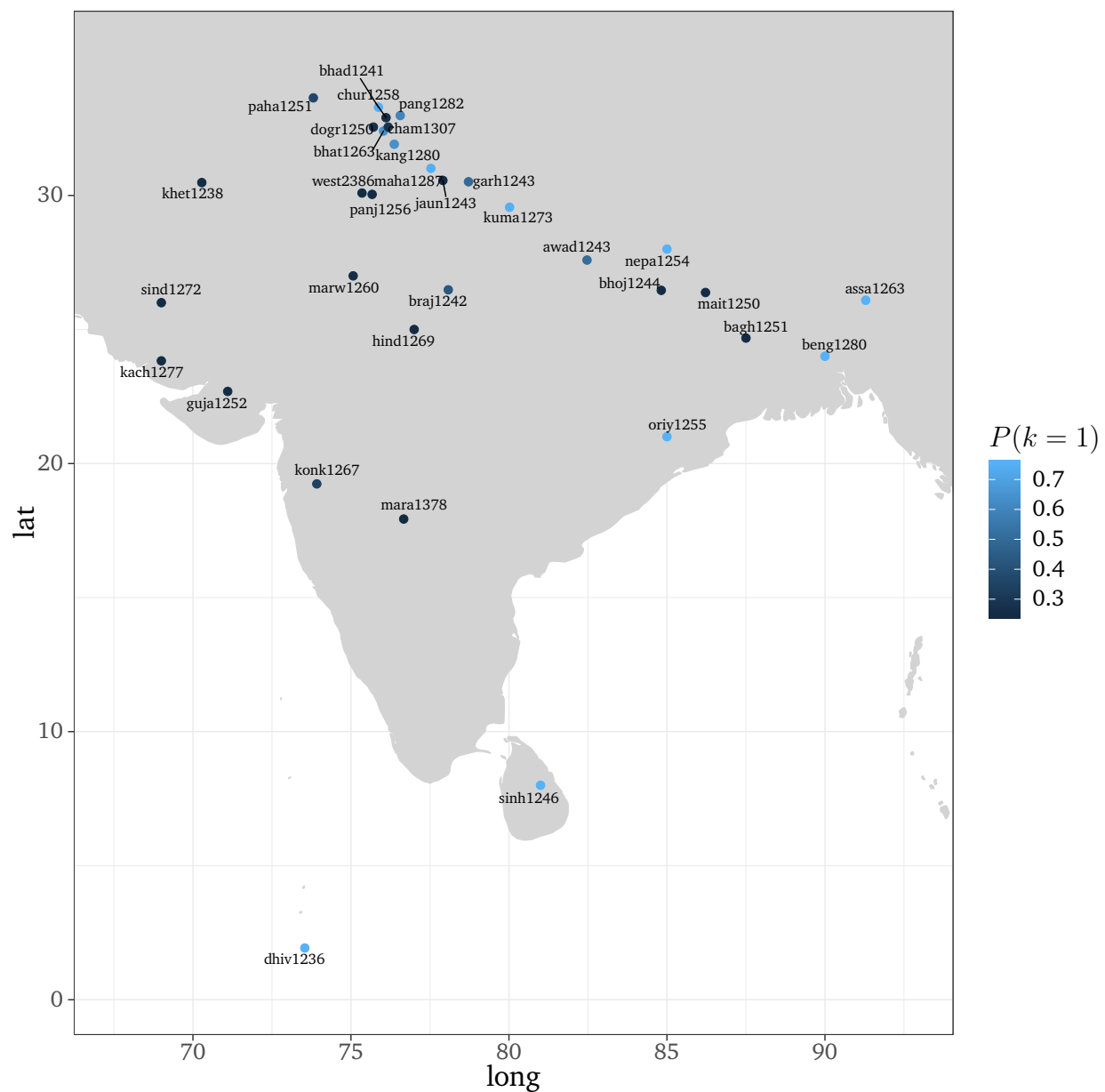


Figure 8: Dialect component distribution map for Logistic Normal model; mean values for each language are averaged across initializations. Note that the color gradient is not scaled between 0 and 1.

change	initialization 1		initialization 2		initialization 3		initialization 4	
	$k = 0$	$k = 1$	$k = 0$	$k = 1$	$k = 0$	$k = 1$	$k = 0$	$k = 1$
$n > \eta / a: \underline{\quad} a:$	1.0000	0.0001	1.0000	0.0000	1.0000	0.0000	1.0000	0.0000
$n > n / a: \underline{\quad} a:$	0.0000	0.9999	0.0000	1.0000	0.0000	1.0000	0.0000	1.0000
$l > l / u \underline{\quad} u$	0.8012	0.0000	0.8000	0.0000	0.8005	0.0002	0.8007	0.0000
$l > l / u \underline{\quad} u$	0.1988	1.0000	0.2000	1.0000	0.1995	0.9998	0.1993	1.0000
$\eta > \eta / a \underline{\quad} a:$	0.9817	0.0000	0.9812	0.0001	0.9830	0.0000	0.9781	0.0000
$\eta > n / a \underline{\quad} a:$	0.0183	1.0000	0.0188	0.9999	0.0170	1.0000	0.0219	1.0000
$k\text{̥} > c^h / \# \underline{\quad} o$	0.7184	0.4056	0.7168	0.4059	0.7163	0.4057	0.7151	0.4054
$k\text{̥} > k^h / \# \underline{\quad} o$	0.2816	0.5944	0.2832	0.5941	0.2837	0.5943	0.2849	0.5946
$r > l / \# \underline{\quad} a$	0.0253	0.0331	0.0252	0.0330	0.0252	0.0329	0.0252	0.0332
$r > r / \# \underline{\quad} a$	0.9747	0.9669	0.9748	0.9670	0.9748	0.9671	0.9748	0.9668
$u > o / \# \underline{\quad} t$	0.0453	0.0365	0.0454	0.0364	0.0454	0.0364	0.0454	0.0365
$u > u / \# \underline{\quad} t$	0.9547	0.9635	0.9546	0.9636	0.9546	0.9636	0.9546	0.9635
$r > a / \int \underline{\quad} \eta$	0.1733	0.0862	0.1728	0.0864	0.1731	0.0858	0.1726	0.0860
$r > a: / \int \underline{\quad} \eta$	0.2282	0.0561	0.2281	0.0561	0.2266	0.0559	0.2280	0.0561
$r > i / \int \underline{\quad} \eta$	0.5161	0.6212	0.5165	0.6202	0.5175	0.6207	0.5167	0.6204
$r > i: / \int \underline{\quad} \eta$	0.0824	0.2366	0.0826	0.2373	0.0829	0.2375	0.0826	0.2374
$h > \emptyset / \# \underline{\quad} a:$	0.0655	0.1146	0.0659	0.1146	0.0658	0.1146	0.0664	0.1143
$h > h / \# \underline{\quad} a:$	0.9345	0.8854	0.9341	0.8854	0.9342	0.8854	0.9336	0.8857

Figure 9: Posterior means for divergent (top) and non-divergent (bottom) sound change parameters for Dirichlet model, for each initialization of 4

change	initialization 1		initialization 2		initialization 3		initialization 4	
	$k = 0$	$k = 1$	$k = 0$	$k = 1$	$k = 0$	$k = 1$	$k = 0$	$k = 1$
$n > \eta / a \underline{\quad} i:$	0.9999	0.0001	0.9999	0.0000	1.0000	0.0000	0.9999	0.0001
$n > n / a \underline{\quad} i:$	0.0001	0.9999	0.0001	1.0000	0.0000	1.0000	0.0001	0.9999
$\eta > \eta / r \underline{\quad} a$	0.9999	0.0355	1.0000	0.0354	0.9999	0.0350	0.9999	0.0357
$\eta > n / r \underline{\quad} a$	0.0001	0.9645	0.0000	0.9646	0.0001	0.9650	0.0001	0.9643
$l > l / u \underline{\quad} u$	0.8123	0.0002	0.8123	0.0001	0.8106	0.0000	0.8116	0.0001
$l > l / u \underline{\quad} u$	0.1877	0.9998	0.1877	0.9999	0.1894	1.0000	0.1884	0.9999
$k\text{̥} > c^h / \# \underline{\quad} o$	0.7387	0.3944	0.7369	0.3963	0.7395	0.3945	0.7375	0.3954
$k\text{̥} > k^h / \# \underline{\quad} o$	0.2613	0.6056	0.2631	0.6037	0.2605	0.6055	0.2625	0.6046
$s > h / a \underline{\quad} a:$	0.1250	0.1613	0.1244	0.1613	0.1250	0.1608	0.1248	0.1602
$s > s / a \underline{\quad} a:$	0.8750	0.8387	0.8756	0.8387	0.8750	0.8392	0.8752	0.8398
$l > l / \# \underline{\quad} a:$	0.9369	0.9024	0.9371	0.9024	0.9369	0.9025	0.9365	0.9025
$l > n / \# \underline{\quad} a:$	0.0631	0.0976	0.0629	0.0976	0.0631	0.0975	0.0635	0.0975
$h > \emptyset / o \underline{\quad} a$	0.2042	0.1538	0.2048	0.1544	0.2041	0.1544	0.2039	0.1544
$h > h / o \underline{\quad} a$	0.7958	0.8462	0.7952	0.8456	0.7959	0.8456	0.7961	0.8456
$\text{̥} > h / o \underline{\quad} a$	0.2364	0.2339	0.2377	0.2330	0.2369	0.2327	0.2386	0.2319
$\text{̥} > s / o \underline{\quad} a$	0.7636	0.7661	0.7623	0.7670	0.7631	0.7673	0.7614	0.7681

Figure 10: Posterior means for divergent (top) and non-divergent (bottom) sound change parameters for Logistic Normal model, for each initialization of 4

be secondary, conditioned by stress. However, if individual languages’ stress patterns show any degree of recent development, it would pose great difficulties for representation in a modified version of our model.

## 8.4 Posterior predictive checks

Model criticism is a key part of Bayesian inference. Posterior predictive checks (PPCs) assess the goodness of fit of a single statistical model by measuring discrepancies between the observed data and data simulated using the posterior distributions of the model’s parameters (Box 1980, Gelman et al. 1996). Discrepancy functions can be developed for virtually any metric of interest. For our study, we are interested in two discrepancy measures. First, we are interested in the ENTROPY of dialect component assignment probabilities for each word; this discrepancy has been proposed for mixed membership models (Mimno et al. 2015), with high uncertainty regarding assignment taken as an indicator of model misspecification. We are additionally interested in the degree of ACCURACY with which the fitted model can regenerate the data in our data set (PPCs ideally are tested on new or held-out data, but cross-validation is not practicable for a model like this paper’s, nor is it particularly feasible given the data available). We expect some degree of inaccuracy, but compare the performance of our model in re-generating our dataset against a series of random baselines. This allows us to scrutinize areas of the model, e.g., languages and sound changes, where misspecification has occurred. The baselines can employ any combination as needed of the stochastic variables  $\beta, \theta, \phi, z$  or the fitted posterior distributions  $\hat{\beta}, \hat{\theta}, \hat{\phi}, \hat{z}$  (when sampling from fitted posterior distributions, we draw all parameter values simultaneously from the same index in the trace).

### 8.4.1 Entropy

Recall that during inference, the variable  $z$ , representing the per-word component assignments, was marginalized out. For each word in the dataset, we reconstruct the distribution over  $\hat{z}_i$  as follows:

$$P(\hat{z}_i = k | \hat{\theta}, \hat{\phi}) \propto P(z_i = k | \hat{\theta}^{\ell[i]}) \prod_{j=1}^{J[i]} P(y_{ij} | \hat{\phi}_{x_{ij}}^k) \quad (4)$$

For both the Dirichlet and Logistic Normal models, we sample  $\hat{\theta}$  and  $\hat{\phi}$  from the trace of inferred posterior values with replacement over 100 iterations, and compute assignment probabilities for each word as in (4), yielding 100 sampled probability distributions for each of 29014 words.

First, we compute mean values for  $p(\hat{z}_i)$  for each word, and compute the entropy of these averaged probabilities. Figure 11 shows these values; it is clear that while most words have relatively low entropy in their average assignments, a small number show a higher degree of uncertainty (with entropy values greater than .6). This is either because each distribution  $p(\hat{z}_i)$  sampled for these particular words has high uncertainty, or because the average over

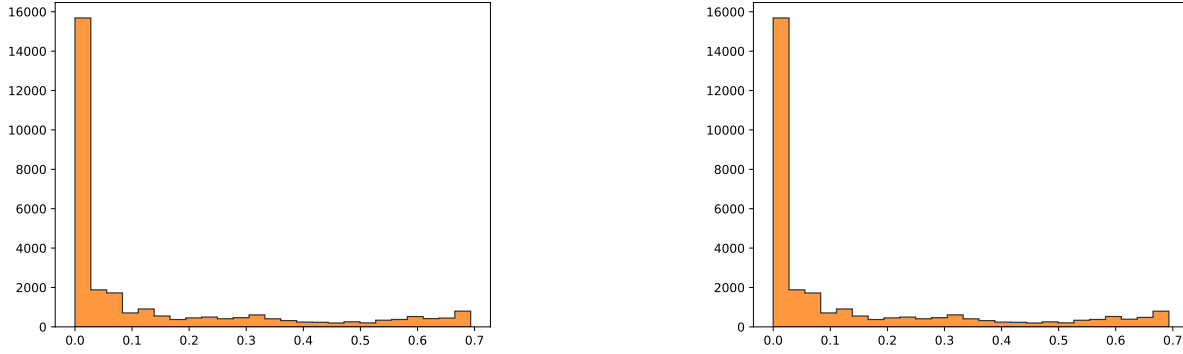


Figure 11: Entropy of average of  $p(z_i)$ : entropy of average (across 100 iterations) of each word assignment probability  $p(z_i)$ , for Dirichlet (left) and Logistic Normal (right) models (mean = 0.1303, 0.1322)

$p(\hat{z}_i)$  is computed from distributions that have low uncertainty, but concentrate probability mass toward different values of  $k$  depending to a high degree on sampled values of  $\hat{\theta}$  and  $\hat{\phi}$ .

Subsequently, we compute the entropy of  $p(\hat{z}_i)$  for each of 29014 words, and average these values across 100 iterations. As shown in Figure 12, these values' distribution is unimodal, indicating that probability distributions have low entropy at each sampling iteration, but that some distributions are highly sensitive to sampled values of  $\hat{\theta}$  and  $\hat{\phi}$ . However, these problematic words are vastly outnumbered by words for which the dialect component assignments can be constructed with extremely high certainty.

#### 8.4.2 Accuracy

A common discrepancy measure for posterior predictive checks is the accuracy of data simulated using the fitted model parameters. We measure the per-word accuracy (i.e., the proportion of simulated data points that are correct) for two models based on our fitted posterior distributions, simulating data for 100 iterations. The model `POSTERIOR WITH ASSIGNMENT` draws samples of  $z$  conditional on  $\hat{\theta}$  and  $\hat{\phi}$  at each step, and then simulates sound changes for each word conditional on the relevant OIA sounds in the etymon from which the word descends. In the procedure `POSTERIOR WITHOUT ASSIGNMENT`,  $z$  is sampled conditional on  $\hat{\theta}$  alone. As a baseline, we also include two simulations based on draws from the prior distributions of all parameters. In the procedure `FULL PRIOR`,  $\beta$  is drawn uniformly from all positive reals, and  $\theta$  is drawn from  $\text{Dirichlet}(\beta)$ ; the procedure `SPARSE PRIOR` fixes  $\beta$  at .1. Average per-word accuracy is given in Figure 14. The mean values of the full prior, sparse prior, posterior without assignment and posterior with assignment simulations shown in Figure 14 are 0.3342, 0.3341, 0.6526, and 0.6524 and 0.3310, 0.3333, 0.6526, and

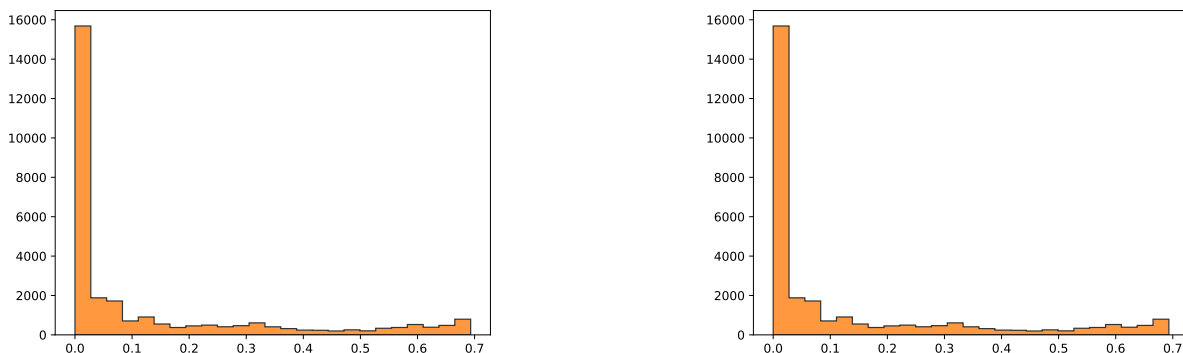


Figure 12: Average of entropy of  $p(z_i)$ : entropy of each word assignment probability  $p(z_i)$ , averaged across 100 iterations, for Dirichlet (left) and Logistic Normal (right) models (mean = 0.1303, 0.1303)

0.6526 for the Dirichlet and Logistic Normal models, respectively. While accuracy scores for procedures based on fitted model parameters do not exceed 0.6577 and 0.6581 (for the Dirichlet and Logistic Normal models, respectively), it is clear that the fitted model parameters improve model accuracy considerably over draws from the prior.

Table 3 gives mean per-word accuracy scores for each language in our data set (henceforth we refer only to accuracy scores from posterior with assignment simulations). While there is variation across languages, no clearly interpretable pattern emerges. Jaunsari, the language with the lowest mean per-word accuracy, is somewhat poorly represented ( $N = 150$ ). But Marwari, which is even more poorly attested ( $N = 88$ ), has one of the highest mean accuracy values. Well-attested languages, where there is greater room for error in re-generating the data, also show relatively good performance. It is possible that these scores have something to do with the sound changes in the words included for each language, but any further understanding of this relationship remains elusive.

In addition to per-word accuracy values, we compute accuracy scores for each sound change distribution. These are found in the Appendix. We can observe a great deal of variation in the accuracy of OIA sounds, across different environments, as evidenced by sound changes pertaining to OIA  $n$  in Table 4. Accuracy scores averaged across environments for each sound are given in Table 4. In general, despite the fact that changes involving retroflexion of  $n$  do not jibe entirely with received wisdom, these changes do not point to model misspecification, at least from the standpoint of posterior predictive checks.

In short, the posterior predictive checks carried out here do not bear out the specific fears of model misspecification discussed in §8.3 and elsewhere. The two models fare more or less equally according to the entropy and accuracy metrics explored above.

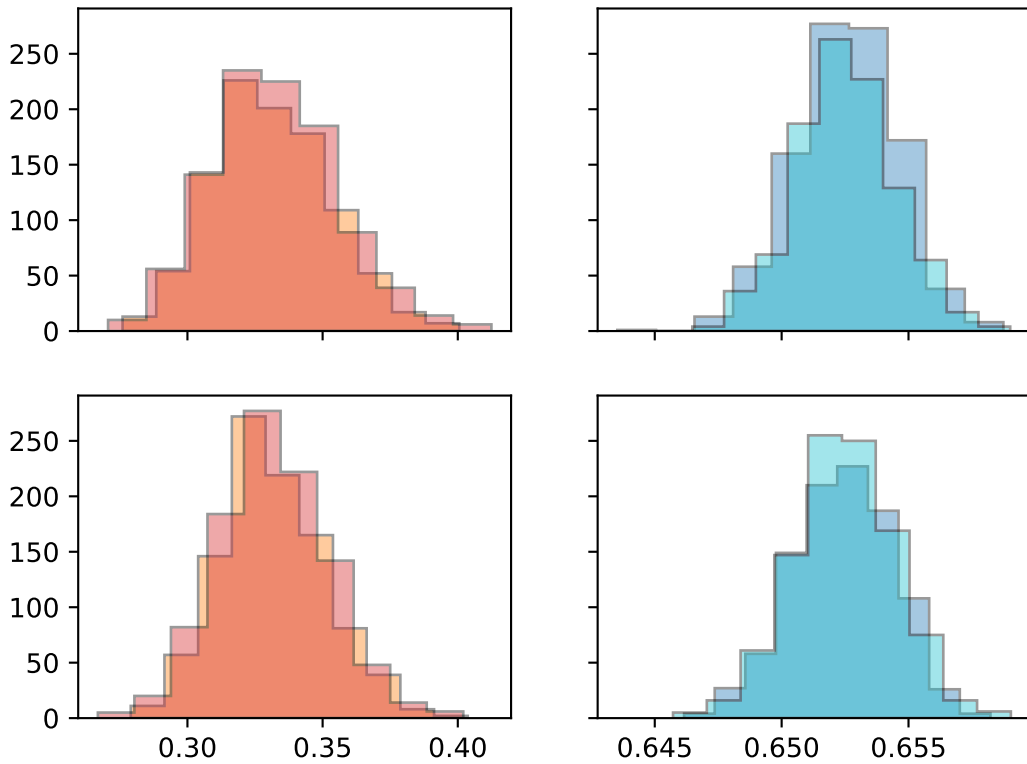


Figure 13: Histograms of average per-word accuracy over 100 simulations for full prior (orange), sparse prior (red), posterior without assignment (blue), and posterior with assignment (cyan) simulation procedures, for Dirichlet (top) and Logistic Normal (bottom) models



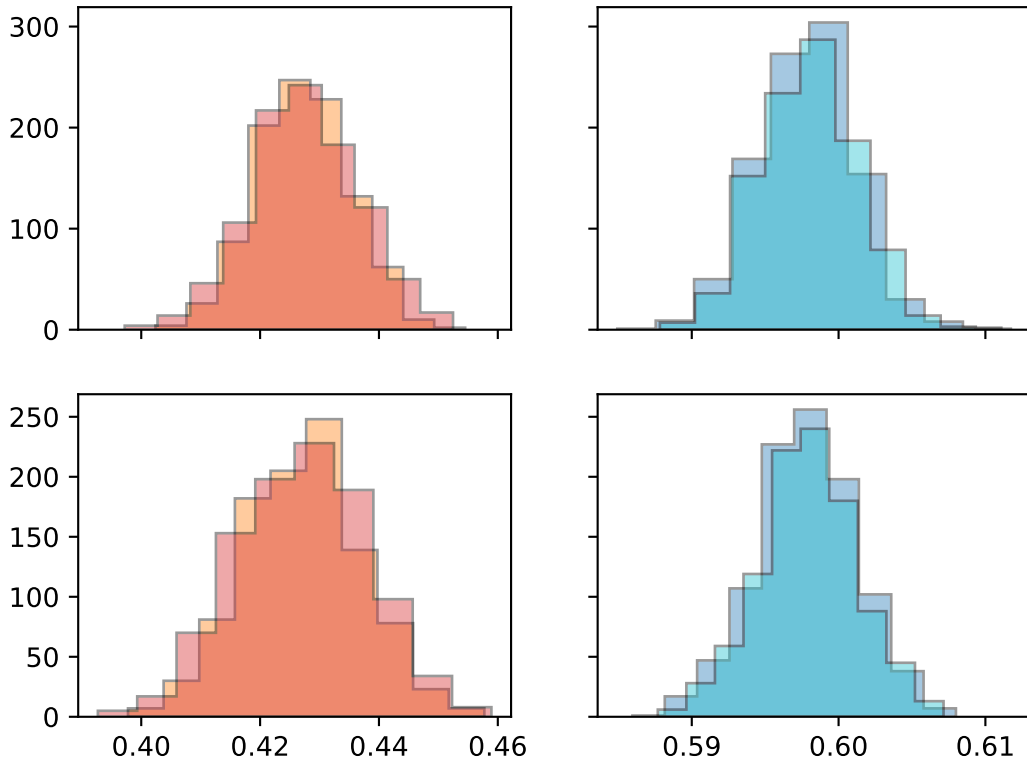


Figure 14: Histograms of average per-sound change distribution accuracy over 100 simulations for full prior (orange), sparse prior (red), posterior without assignment (blue), and posterior with assignment (cyan) simulation procedures, for Dirichlet (left) and Logistic Normal (right) models

language	avg. acc. (Dir)	avg. acc. (LN)
assa1263	0.6287	0.6289
awad1243	0.6523	0.6519
bagh1251	0.6757	0.6758
beng1280	0.7312	0.7308
bhad1241	0.5417	0.5417
bhat1263	0.6251	0.6321
bhoj1244	0.6644	0.6624
braj1242	0.6517	0.6515
cham1307	0.5835	0.5822
chur1258	0.5866	0.5863
dhiv1236	0.5971	0.5970
dogr1250	0.5617	0.5629
garh1243	0.6161	0.6163
guja1252	0.6515	0.6513
hind1269	0.7041	0.7045
jaun1243	0.5573	0.5563
kach1277	0.5634	0.5627
kang1280	0.5980	0.6001
khet1238	0.5648	0.5649
konk1267	0.6331	0.6333
kuma1273	0.6190	0.6196
maha1287	0.5585	0.5585
mait1250	0.6795	0.6789
mara1378	0.6574	0.6566
marw1260	0.6639	0.6630
nepa1254	0.7186	0.7175
oriy1255	0.6516	0.6514
paha1251	0.5907	0.5917
pang1282	0.5832	0.5815
panj1256	0.5976	0.5986
sind1272	0.6494	0.6498
sinh1246	0.6812	0.6813
west2386	0.6078	0.6077

Table 3: Mean per-word accuracy for each language for Dirichlet and Logistic Normal models

	Dirichlet	Logistic Normal
n / e _ a	0.7944	0.8004
n / e _ d	0.5218	0.5239
n / h _ a	0.5578	0.5547
n / i _ a	0.8396	0.8444
n / i _ a:	0.9205	0.9198
n / i _ d	0.5697	0.5725
n / i _ d <sup>fi</sup>	0.4996	0.4938
n / i _ i:	0.7864	0.7797
n / i _ n	0.5858	0.5839
n / i: _ a	0.8251	0.8280
n / o _ a	0.8752	0.8773
n / s _ a:	0.6644	0.6625
n / u _ a	0.8527	0.8540
n / u _ d	0.5163	0.5128
n / u: _ a	0.7410	0.7337

Sound	Dirichlet	Logistic Normal
f	0.6066	0.6062
ɲ	0.4802	0.4782
ŋ	0.6501	0.6504
ʃ	0.6100	0.6092
ɾ	0.4414	0.4401
h	0.6415	0.6428
i	0.5496	0.5511
i:	0.5269	0.5280
j	0.6076	0.6067
kʃ	0.5283	0.5278
l	0.6070	0.6066
n	0.6862	0.6855
r	0.6876	0.6869
s	0.6782	0.6790
u	0.5763	0.5757
u:	0.5470	0.5460

Table 4: Accuracy scores for select sound change distributions for (left) and averaged across environments (right); in both tables, values for the Dirichlet model are on the left, while values for the Logistic Normal model are on the right

## 9 Discussion and Outlook

Our results provide strong support for the idea that if two major Indo-Aryan speech groups are assumed to have existed historically in South Asia, then they experienced greater intra-group cultural exchange than inter-group contact, and we find at least vague support for an areal core and periphery in terms of the per-language distribution over dialect components. We find that representing sound changes using a Logistic Normal distribution produces results similar to that of a Dirichlet distribution in terms of posterior predictive checks. Surprisingly, the latter distribution fares surprisingly well in uncovering dependencies between similar types of sound change, even though it is not designed to do so.

As noted above, certain sound changes, particularly those involving retroflexion, show unexpected behavior. This behavior may be an artifact of this paper’s feature selection. It may also be an effect of the level of sparsity that we have assumed to be appropriate for a distribution representing sound change. It may be worthwhile to relax this assumption in future work.

The model used in this paper has a number of limitations (aside even from the exclusion of morphosyntactic features), some of which are addressed below. First, prosody is not represented explicitly. In general, we have avoided dealing with prosodically conditioned changes, although at least one such change has been proposed to differentiate between the Inner and Outer groups. In future work, this can be addressed by coding primary and secondary stress on the Old Indo-Aryan forms found in Turner, though the range of variation in OIA stress patterns is not fully understood, and the analytical decisions to be made require some care, not to mention liberal assumptions.

Additionally, intermediate stages are not represented explicitly. We have used one-level rewrite rules as our linguistic features, something that we were able to do given the nature of the sound changes thought to be probative to the Inner-Outer hypothesis. This may not be appropriate if we seek to expand our data set, or wish to generalize this methodology to other dialectological phenomena. As noted above,  $n$ -grams may serve to capture a number of telescoped sound changes, but will greatly expand the dimensionality of the parameter space (and in the case of higher-order  $n$ -grams, will violate the independence assumption of many mixture model approaches). Furthermore, they might fail to identify important characteristics of earlier stages of the language that are obscured by “feeding” changes (e.g., OIA  $kṣ$ ,  $ch > *ch > \text{Marathi } s$ ). Bouchard-Côté et al. (2007, 2008, 2009, 2013) describe methods for reconstructing intermediate stages for linguistic forms that are efficient when ancestry between nodes is fixed on a phylogenetic tree; it is not clear that this method will be practicable for a model like ours, where forms can be generated by one of two ancestral lineages pertaining to the Inner and Outer groups.

Finally, the available data are underused. Given the underlying structure of our model, care was taken to ensure that our inference procedure was computationally tractable; this involved selecting linguistically informed features and discarding features below a certain cutoff such that the parameter space was manageable. Not only did the inference procedure have to infer values for each sound probability, but also to ensure that values within a

distribution in our collection summed to one, and fulfilled other computationally intensive criteria. While this still allowed us to work within a large parameter space ( $1001 \times 2$ ), it is desirable to use the fully available data set. Possible solutions exist, though they do not fully satisfy (in our current understanding of them). Approaches that incorporate or mimic neural network architectures (cf. Kingma & Welling 2013; Ranganath et al. 2015) provide a method for compressing large data sets and reducing dimensionality, and could potentially allow us to expand the feature set considered; however, it is not clear that we could preserve the hierarchical, relatively easy-to-interpret collection of sound change distributions employed in this paper. Additionally, a radical method for inferring hyperparameters in models with a large parameter space has been proposed by Norton et al. (2017), who advocate marginalizing out all model parameters (in our case,  $\theta$  and  $\phi$ , leaving only  $\beta$ ). While this might make inference more efficient, the parameters  $\theta$  and  $\phi$  are of key interest to us as linguists, and are crucial for evaluating the performance of our model, even though the hyperparameter  $\beta$  was our main means of operationalizing the Inner-Outer hypothesis.

Resolving many of these issues will steer this research program into the realm of deep learning, which strikes us as being better suited for the purpose of evaluation (e.g., of a natural language processing task) rather than the interpretation of model parameters (though this is by no means impossible) in a linguistically meaningful sense, as we have done in this paper. The model employed here not only incorporated high-definition data, but its output can be qualitatively evaluated by a historical linguist, as well as quantitatively evaluated (via posterior predictive checks).

Further work is needed to see how additional pieces of evidence converge in favor of or against the Inner-Outer hypothesis. This paper assumed a fixed number of components, and naturally the number of historical dialect groups in Indo-Aryan is an open question as well. An obvious future direction is to address this issue using the Hierarchical Dirichlet Process, which makes no prior assumption regarding the number of clusters, but makes other problematic assumptions (Williamson et al. 2010).

Model criticism, both qualitative and quantitative, is needed to see how all pieces of evidence fit together. While we did not find overwhelming support for Southworth’s version of the Inner-Outer hypothesis, it may be possible to find evidence more in line with Zoller’s formulation of the hypothesis. On the quantitative side, experimentation is required not only at the computational level, in Marr’s (1982) terminology, but at the algorithmic level. This paper used mean-field ADVI due to its ease of implementation, but it may be worthwhile to make use of full-rank ADVI as well, which is said to perform better in uncovering correlations among high-dimensional posterior distributions (Kucukelbir et al. 2017).

## 10 Conclusion

This paper presented a novel hierarchical mixed membership model to investigate dialectal patterns within Indo-Aryan; while the Dirichlet distribution has been previously used to model sound change (Bouchard-Côté et al. 2007), this paper is the first of its kind to use the Logistic Normal distribution for this purpose. The data culled for analysis in this paper

was taken from a publicly available electronic resource, and minimal linguistically informed pre-processing was needed to turn it into a computationally tractable dataset. It is hoped that we have provided a new way of looking at dialectology and linguistic affiliation that can generalize to new linguistic scenarios, and can be modified to address additional outstanding questions within Indo-Aryan. It is hoped that methodologies of this sort will shed additional light on thorny problems relating to the interplay of regularly conditioned sound change, language contact, and perhaps analogy as well.

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# Appendix (supplementary material)

## Dirichlet model sound change probabilities

The symbol  $_N$  represents nasality on the preceding vowel.

change	initialization 1		initialization 2		initialization 3		initialization 4	
	$k = 0$	$k = 1$	$k = 0$	$k = 1$	$k = 0$	$k = 1$	$k = 0$	$k = 1$
s > h / e _a	0.3396	0.3400	0.3370	0.3399	0.3370	0.3403	0.3382	0.3408
s > s / e _a	0.6604	0.6600	0.6630	0.6601	0.6630	0.6597	0.6618	0.6592
u > u / # _s	0.5966	0.5936	0.5975	0.5942	0.5982	0.5939	0.5960	0.5936
u > u: / # _s	0.4034	0.4064	0.4025	0.4058	0.4018	0.4061	0.4040	0.4064
j > ∅ / v _a	0.8779	0.8807	0.8781	0.8814	0.8779	0.8812	0.8779	0.8815
j > d / v _a	0.1221	0.1193	0.1219	0.1186	0.1221	0.1188	0.1221	0.1185
u > o / t _n	0.3933	0.3884	0.3942	0.3882	0.3939	0.3886	0.3939	0.3879
u > u / t _n	0.6067	0.6116	0.6058	0.6118	0.6061	0.6114	0.6061	0.6121
u > o / m _s	0.3827	0.3890	0.3820	0.3885	0.3833	0.3886	0.3836	0.3884
u > u / m _s	0.6173	0.6110	0.6180	0.6115	0.6167	0.6114	0.6164	0.6116
ɤ > h / a: _a	0.4504	0.4619	0.4516	0.4612	0.4499	0.4605	0.4501	0.4618
ɤ > s / a: _a	0.5496	0.5381	0.5484	0.5388	0.5501	0.5395	0.5499	0.5382
i > i / h _k	0.5760	0.5641	0.5747	0.5625	0.5748	0.5637	0.5764	0.5623
i > i: / h _k	0.4240	0.4359	0.4253	0.4375	0.4252	0.4363	0.4236	0.4377
i > i / l _k	0.5470	0.5598	0.5459	0.5595	0.5468	0.5592	0.5465	0.5597
i > i: / l _k	0.4530	0.4402	0.4541	0.4405	0.4532	0.4408	0.4535	0.4403
ɤ > h / o _a	0.2278	0.2156	0.2276	0.2146	0.2276	0.2154	0.2278	0.2151
ɤ > s / o _a	0.7722	0.7844	0.7724	0.7854	0.7724	0.7846	0.7722	0.7849
r > ∅ / a _f	0.6183	0.6390	0.6190	0.6387	0.6181	0.6388	0.6185	0.6384
r > r / a _f	0.3817	0.3610	0.3810	0.3613	0.3819	0.3612	0.3815	0.3616
ʃ > t <sup>h</sup> / a _j	0.1995	0.2173	0.1990	0.2174	0.1999	0.2173	0.1992	0.2175
ʃ > s / a _j	0.8005	0.7827	0.8010	0.7826	0.8001	0.7827	0.8008	0.7825
u > o / # _t	0.0453	0.0365	0.0454	0.0364	0.0454	0.0364	0.0454	0.0365
u > u / # _t	0.9547	0.9635	0.9546	0.9636	0.9546	0.9636	0.9546	0.9635
r > l / # _a	0.0253	0.0331	0.0252	0.0330	0.0252	0.0329	0.0252	0.0332
r > r / # _a	0.9747	0.9669	0.9748	0.9670	0.9748	0.9671	0.9748	0.9668
ɲ > ∅ / i _c	0.3980	0.3750	0.3979	0.3751	0.3990	0.3744	0.3988	0.3758
ɲ > ɲ / i _c	0.6020	0.6250	0.6021	0.6249	0.6010	0.6256	0.6012	0.6242
r > ∅ / u: _d <sup>h</sup>	0.7942	0.8155	0.7940	0.8150	0.7939	0.8158	0.7942	0.8166
r > ɲ / u: _d <sup>h</sup>	0.2058	0.1845	0.2060	0.1850	0.2061	0.1842	0.2058	0.1834
l > ∅ / l _a	0.0514	0.0399	0.0513	0.0400	0.0513	0.0400	0.0516	0.0399
l > l / l _a	0.9486	0.9601	0.9487	0.9600	0.9487	0.9600	0.9484	0.9601
u: > o / b _l	0.6227	0.5958	0.6238	0.5961	0.6233	0.5961	0.6227	0.5970
u: > u / b _l	0.3773	0.4042	0.3762	0.4039	0.3767	0.4039	0.3773	0.4030
s > ɲ / a _j	0.1707	0.1924	0.1709	0.1927	0.1704	0.1921	0.1709	0.1921
s > s / a _j	0.8293	0.8076	0.8291	0.8073	0.8296	0.8079	0.8291	0.8079
u > a / g _r	0.3500	0.3765	0.3484	0.3759	0.3481	0.3761	0.3492	0.3762
u > u / g _r	0.6500	0.6235	0.6516	0.6241	0.6519	0.6239	0.6508	0.6238
u > u / d _g	0.7216	0.7476	0.7225	0.7457	0.7223	0.7488	0.7238	0.7499
u > u: / d _g	0.2784	0.2524	0.2775	0.2543	0.2777	0.2512	0.2762	0.2501
r > l / a _j	0.4978	0.4679	0.4958	0.4689	0.4964	0.4675	0.4967	0.4669
r > r / a _j	0.5022	0.5321	0.5042	0.5311	0.5036	0.5325	0.5033	0.5331
h > ∅ / a _a:	0.3543	0.3273	0.3540	0.3266	0.3541	0.3264	0.3544	0.3266
h > h / a _a:	0.6457	0.6727	0.6460	0.6734	0.6459	0.6736	0.6456	0.6734
i > i / ɲ _n	0.4376	0.4686	0.4394	0.4678	0.4384	0.4682	0.4382	0.4680
i > i: / ɲ _n	0.5624	0.5314	0.5606	0.5322	0.5616	0.5318	0.5618	0.5320
ɾ > a / b <sup>h</sup> _s	0.3939	0.3650	0.3943	0.3656	0.3944	0.3637	0.3936	0.3652
ɾ > u / b <sup>h</sup> _s	0.6061	0.6350	0.6057	0.6344	0.6056	0.6363	0.6064	0.6348
i: > ∅ / r _j	0.3144	0.3108	0.3142	0.3105	0.3137	0.3113	0.3145	0.3114
i: > i / r _j	0.3336	0.3601	0.3338	0.3612	0.3342	0.3603	0.3335	0.3592

i: > i: / r _ j	0.3520	0.3291	0.3520	0.3283	0.3521	0.3284	0.3520	0.3294
ʃ > Ø / # _ l	0.5449	0.5762	0.5463	0.5764	0.5453	0.5769	0.5453	0.5755
ʃ > s / # _ l	0.4551	0.4238	0.4537	0.4236	0.4547	0.4231	0.4547	0.4245
r > Ø / a: _ j	0.7510	0.7211	0.7502	0.7208	0.7503	0.7210	0.7508	0.7208
r > n / a: _ j	0.2490	0.2789	0.2498	0.2792	0.2497	0.2790	0.2492	0.2792
ɾ > Ø / n _ t	0.2608	0.2828	0.2600	0.2834	0.2599	0.2831	0.2602	0.2831
ɾ > a / n _ t	0.2713	0.2417	0.2703	0.2404	0.2716	0.2422	0.2715	0.2418
ɾ > a: / n _ t	0.4680	0.4755	0.4697	0.4762	0.4685	0.4747	0.4683	0.4751
i > i / s _ d	0.6990	0.7357	0.6991	0.7358	0.6994	0.7356	0.6996	0.7360
i > i: / s _ d	0.3010	0.2643	0.3009	0.2642	0.3006	0.2644	0.3004	0.2640
i > Ø / p _ t	0.1193	0.1462	0.1183	0.1463	0.1186	0.1463	0.1184	0.1460
i > i / p _ t	0.8807	0.8538	0.8817	0.8537	0.8814	0.8537	0.8816	0.8540
s > Ø / # _ n	0.8555	0.8253	0.8555	0.8264	0.8557	0.8254	0.8555	0.8253
s > s / # _ n	0.1445	0.1747	0.1445	0.1736	0.1443	0.1746	0.1445	0.1747
i > i / b <sup>h</sup> _ t	0.5670	0.5278	0.5673	0.5283	0.5752	0.5276	0.5687	0.5288
i > i: / b <sup>h</sup> _ t	0.4330	0.4722	0.4327	0.4717	0.4248	0.4724	0.4313	0.4712
i > i / v _ d	0.8583	0.8275	0.8585	0.8282	0.8585	0.8285	0.8586	0.8281
i > i: / v _ d	0.1417	0.1725	0.1415	0.1718	0.1415	0.1715	0.1414	0.1719
u > Ø / d _ h	0.3491	0.3083	0.3491	0.3093	0.3488	0.3099	0.3482	0.3087
u > u / d _ h	0.6509	0.6917	0.6509	0.6907	0.6512	0.6901	0.6518	0.6913
ɕ > Ø / e _ a	0.2097	0.1871	0.2100	0.1873	0.2091	0.1869	0.2097	0.1875
ɕ > h / e _ a	0.2056	0.1805	0.2059	0.1804	0.2061	0.1799	0.2057	0.1809
ɕ > s / e _ a	0.5847	0.6323	0.5841	0.6323	0.5848	0.6333	0.5846	0.6316
u: > u / # _ r	0.7909	0.7492	0.7915	0.7491	0.7910	0.7494	0.7914	0.7494
u: > u: / # _ r	0.2091	0.2508	0.2085	0.2509	0.2090	0.2506	0.2086	0.2506
u > o / t _ l	0.1508	0.1167	0.1508	0.1165	0.1506	0.1161	0.1511	0.1167
u > u / t _ l	0.8492	0.8833	0.8492	0.8835	0.8494	0.8839	0.8489	0.8833
i > i / n _ d	0.6579	0.7051	0.6570	0.7041	0.6568	0.7042	0.6573	0.7043
i > i: / n _ d	0.3421	0.2949	0.3430	0.2959	0.3432	0.2958	0.3427	0.2957
j > Ø / a _ a:	0.7667	0.7208	0.7672	0.7213	0.7676	0.7201	0.7673	0.7206
j > j / a _ a:	0.2333	0.2792	0.2328	0.2787	0.2324	0.2799	0.2327	0.2794
i > Ø / t _ ŋ	0.3812	0.3300	0.3824	0.3305	0.3828	0.3304	0.3829	0.3302
i > i / t _ ŋ	0.6188	0.6700	0.6176	0.6695	0.6172	0.6696	0.6171	0.6698
n > n / u _ d	0.5525	0.6065	0.5538	0.6064	0.5530	0.6069	0.5527	0.6071
n > n / u _ d	0.4475	0.3935	0.4462	0.3936	0.4470	0.3931	0.4473	0.3929
s > h / a _ a:	0.1254	0.1647	0.1254	0.1639	0.1252	0.1642	0.1255	0.1642
s > s / a _ a:	0.8746	0.8353	0.8746	0.8361	0.8748	0.8358	0.8745	0.8358
n > Ø / # _ a	0.0193	0.0291	0.0194	0.0293	0.0194	0.0291	0.0194	0.0291
n > l / # _ a	0.0202	0.0348	0.0201	0.0348	0.0202	0.0348	0.0202	0.0348
n > n / # _ a	0.9605	0.9361	0.9605	0.9359	0.9605	0.9360	0.9604	0.9361
i > i / j _ h	0.5647	0.5049	0.5648	0.5052	0.5651	0.5062	0.5649	0.5065
i > i: / j _ h	0.4353	0.4951	0.4352	0.4948	0.4349	0.4938	0.4351	0.4935
h > Ø / a: _ a:	0.1916	0.2426	0.1902	0.2426	0.1910	0.2430	0.1909	0.2435
h > h / a: _ a:	0.8084	0.7574	0.8098	0.7574	0.8090	0.7570	0.8091	0.7565
n > n / i _ d <sup>h</sup>	0.4827	0.5485	0.4838	0.5422	0.4861	0.5493	0.4826	0.5519
n > n / i _ d <sup>h</sup>	0.5173	0.4515	0.5162	0.4578	0.5139	0.4507	0.5174	0.4481
u > o / m _ t	0.6322	0.5667	0.6331	0.5648	0.6318	0.5672	0.6325	0.5679
u > u / m _ t	0.3678	0.4333	0.3669	0.4352	0.3682	0.4328	0.3675	0.4321
h > Ø / o _ a	0.2073	0.1546	0.2075	0.1550	0.2075	0.1548	0.2073	0.1551
h > h / o _ a	0.7927	0.8454	0.7925	0.8450	0.7925	0.8452	0.7927	0.8449
h > Ø / u _ i	0.7362	0.7973	0.7347	0.7962	0.7369	0.7973	0.7366	0.7966
h > h / u _ i	0.2638	0.2027	0.2653	0.2038	0.2631	0.2027	0.2634	0.2034
u: > Ø / r _ p	0.1268	0.0919	0.1269	0.0920	0.1271	0.0921	0.1265	0.0917
u: > u / r _ p	0.3995	0.3694	0.4002	0.3713	0.3993	0.3696	0.4000	0.3693
u: > u: / r _ p	0.4737	0.5387	0.4729	0.5367	0.4737	0.5383	0.4736	0.5390
i > i / c _ n	0.6353	0.7071	0.6345	0.7074	0.6357	0.7080	0.6360	0.7079
i > u / c _ n	0.3647	0.2929	0.3655	0.2926	0.3643	0.2920	0.3640	0.2921
h > Ø / a: _ u	0.2896	0.3619	0.2899	0.3616	0.2896	0.3624	0.2891	0.3616
h > h / a: _ u	0.7104	0.6381	0.7101	0.6384	0.7104	0.6376	0.7109	0.6384
u: > u / p _ r	0.5763	0.6524	0.5772	0.6523	0.5771	0.6523	0.5767	0.6521

u: > u: / p _ r	0.4237	0.3476	0.4228	0.3477	0.4229	0.3477	0.4233	0.3479
r̄ > ∅ / k _ t	0.5518	0.4739	0.5525	0.4720	0.5521	0.4716	0.5521	0.4720
r̄ > a / k _ t	0.4482	0.5261	0.4475	0.5280	0.4479	0.5284	0.4479	0.5280
u > ∅ / # _ p	0.4088	0.4824	0.4083	0.4828	0.4085	0.4827	0.4088	0.4821
u > o / # _ p	0.2403	0.1883	0.2407	0.1881	0.2403	0.1885	0.2404	0.1884
u > u / # _ p	0.3509	0.3293	0.3510	0.3291	0.3512	0.3288	0.3508	0.3295
i > e / v _ s	0.1972	0.1363	0.1967	0.1365	0.1975	0.1364	0.1971	0.1367
i > i / v _ s	0.8028	0.8637	0.8033	0.8635	0.8025	0.8636	0.8029	0.8633
l > l / # _ a:	0.9345	0.8881	0.9348	0.8881	0.9347	0.8880	0.9346	0.8881
l > n / # _ a:	0.0655	0.1119	0.0652	0.1119	0.0653	0.1120	0.0654	0.1119
l > ∅ / a _ l	0.6671	0.7430	0.6672	0.7428	0.6672	0.7424	0.6669	0.7432
l > l / a _ l	0.3329	0.2570	0.3328	0.2572	0.3328	0.2576	0.3331	0.2568
h > ∅ / e _ a	0.3951	0.3140	0.3940	0.3142	0.3944	0.3137	0.3949	0.3135
h > h / e _ a	0.6049	0.6860	0.6060	0.6858	0.6056	0.6863	0.6051	0.6865
h > ∅ / # _ a:	0.0655	0.1146	0.0659	0.1146	0.0658	0.1146	0.0664	0.1143
h > h / # _ a:	0.9345	0.8854	0.9341	0.8854	0.9342	0.8854	0.9336	0.8857
kʂ > c <sup>h</sup> / # _ u	0.2274	0.3030	0.2273	0.3036	0.2276	0.3033	0.2274	0.3026
kʂ > k <sup>h</sup> / # _ u	0.7726	0.6970	0.7727	0.6964	0.7724	0.6967	0.7726	0.6974
u > ∅ / # _ l	0.1591	0.2293	0.1591	0.2290	0.1590	0.2292	0.1592	0.2292
u > u / # _ l	0.8409	0.7707	0.8409	0.7710	0.8410	0.7708	0.8408	0.7708
ŋ > ∅ / kʂ _ a	0.7231	0.6382	0.7234	0.6381	0.7237	0.6383	0.7242	0.6372
ŋ > n / kʂ _ a	0.2769	0.3618	0.2766	0.3619	0.2763	0.3617	0.2758	0.3628
r > ∅ / a _ a	0.0104	0.0100	0.0104	0.0101	0.0104	0.0100	0.0104	0.0100
r > r̄ / a _ a	0.0049	0.0058	0.0049	0.0057	0.0049	0.0058	0.0049	0.0058
r > n / a _ a	0.0125	0.0031	0.0125	0.0031	0.0125	0.0031	0.0125	0.0031
r > l / a _ a	0.0262	0.0201	0.0262	0.0202	0.0262	0.0202	0.0263	0.0201
r > n / a _ a	0.0011	0.0090	0.0000	0.0090	0.0000	0.0090	0.0000	0.0090
r > r / a _ a	0.9450	0.9520	0.9460	0.9519	0.9460	0.9519	0.9460	0.9520
u > o / s _ v	0.4345	0.5289	0.4335	0.5285	0.4337	0.5282	0.4356	0.5286
u > u / s _ v	0.5655	0.4711	0.5665	0.4715	0.5663	0.4718	0.5644	0.4714
i > i / kʂ _ n	0.3311	0.4217	0.3306	0.4220	0.3304	0.4222	0.3293	0.4227
i > i: / kʂ _ n	0.6689	0.5783	0.6694	0.5780	0.6696	0.5778	0.6707	0.5773
i > i / t <sup>h</sup> _ n	0.5453	0.6423	0.5440	0.6384	0.5452	0.6387	0.5459	0.6396
i > i: / t <sup>h</sup> _ n	0.4547	0.3577	0.4560	0.3616	0.4548	0.3613	0.4541	0.3604
h > ∅ / a _ a	0.2883	0.1999	0.2890	0.2002	0.2888	0.2000	0.2880	0.1998
h > h / a _ a	0.7117	0.8001	0.7110	0.7998	0.7112	0.8000	0.7120	0.8002
r > ∅ / a _ j	0.8855	0.9435	0.8859	0.9436	0.8859	0.9435	0.8858	0.9433
r > j / a _ j	0.1145	0.0565	0.1141	0.0564	0.1141	0.0565	0.1142	0.0567
r > l / i: _ a	0.0174	0.0566	0.0174	0.0566	0.0175	0.0566	0.0174	0.0566
r > r / i: _ a	0.9826	0.9434	0.9826	0.9434	0.9825	0.9434	0.9826	0.9434
i: > e / v _ r	0.2032	0.2616	0.2031	0.2621	0.2035	0.2619	0.2033	0.2616
i: > i / v _ r	0.3465	0.3918	0.3475	0.3910	0.3471	0.3929	0.3488	0.3922
i: > i: / v _ r	0.4503	0.3466	0.4494	0.3469	0.4494	0.3452	0.4479	0.3461
i > ∅ / v _ t	0.3819	0.2799	0.3820	0.2807	0.3822	0.2801	0.3826	0.2801
i > i / v _ t	0.6181	0.7201	0.6180	0.7193	0.6178	0.7199	0.6174	0.7199
u: > u / c _ r	0.4250	0.3204	0.4252	0.3209	0.4252	0.3208	0.4270	0.3202
u: > u: / c _ r	0.5750	0.6796	0.5748	0.6791	0.5748	0.6792	0.5730	0.6798
kʂ > k / i _ a:	0.2098	0.3043	0.2085	0.3040	0.2091	0.3050	0.2082	0.3041
kʂ > k <sup>h</sup> / i _ a:	0.7902	0.6957	0.7915	0.6960	0.7909	0.6950	0.7918	0.6959
u > u / # _ c	0.8704	0.7893	0.8715	0.7886	0.8710	0.7900	0.8711	0.7884
u > u: / # _ c	0.1296	0.2107	0.1285	0.2114	0.1290	0.2100	0.1289	0.2116
j > ∅ / i: _ a	0.6921	0.6719	0.6919	0.6722	0.6920	0.6720	0.6914	0.6722
j > j / i: _ a	0.1614	0.2329	0.1615	0.2324	0.1618	0.2325	0.1621	0.2330
j > j / i: _ a	0.1466	0.0952	0.1466	0.0955	0.1462	0.0955	0.1465	0.0949
u > a / p _ r	0.2127	0.1247	0.2124	0.1252	0.2122	0.1254	0.2120	0.1250
u > u / p _ r	0.7873	0.8753	0.7876	0.8748	0.7878	0.8746	0.7880	0.8750
u: > u / b <sup>h</sup> _ t	0.7075	0.5951	0.7080	0.5948	0.7069	0.5947	0.7063	0.5957
u: > u: / b <sup>h</sup> _ t	0.2925	0.4049	0.2920	0.4052	0.2931	0.4053	0.2937	0.4043
i: > i / j _ r	0.3429	0.4656	0.3419	0.4662	0.3411	0.4658	0.3424	0.4656
i: > i: / j _ r	0.6571	0.5344	0.6581	0.5338	0.6589	0.5342	0.6576	0.5344

n > ∅ / j _ a	0.3055	0.4282	0.3066	0.4262	0.3060	0.4281	0.3063	0.4283
n > n / j _ a	0.6945	0.5718	0.6934	0.5738	0.6940	0.5719	0.6937	0.5717
i > a / n _ r	0.1159	0.0471	0.1156	0.0472	0.1156	0.0472	0.1158	0.0472
i > i / n _ r	0.8841	0.9529	0.8844	0.9528	0.8844	0.9528	0.8842	0.9528
u > o / k _ d	0.3050	0.4273	0.3050	0.4289	0.3052	0.4281	0.3048	0.4285
u > u / k _ d	0.6950	0.5727	0.6950	0.5711	0.6948	0.5719	0.6952	0.5715
i > ∅ / v _ b <sup>h</sup>	0.4514	0.5815	0.4524	0.5813	0.4515	0.5805	0.4521	0.5818
i > a / v _ b <sup>h</sup>	0.5486	0.4185	0.5476	0.4187	0.5485	0.4195	0.5479	0.4182
u > u / j _ g	0.7336	0.6104	0.7340	0.6100	0.7314	0.6096	0.7334	0.6107
u > u: / j _ g	0.2664	0.3896	0.2660	0.3900	0.2686	0.3904	0.2666	0.3893
j > ∅ / j _ a	0.2757	0.4010	0.2754	0.4011	0.2770	0.4010	0.2754	0.4021
j > j / j _ a	0.7243	0.5990	0.7246	0.5989	0.7230	0.5990	0.7246	0.5979
r > ∅ / a _ v	0.7491	0.8533	0.7467	0.8536	0.7468	0.8536	0.7477	0.8535
r > b / a _ v	0.2509	0.1467	0.2533	0.1464	0.2532	0.1464	0.2523	0.1465
ŋ > n / s _ a	0.3745	0.5073	0.3745	0.5072	0.3740	0.5063	0.3746	0.5089
ŋ > n <sup>h</sup> / s _ a	0.6255	0.4927	0.6255	0.4928	0.6260	0.4937	0.6254	0.4911
u > o / m _ d	0.1388	0.1072	0.1389	0.1070	0.1387	0.1069	0.1390	0.1071
u > u / m _ d	0.7066	0.6299	0.7065	0.6304	0.7066	0.6310	0.7058	0.6298
u > u: / m _ d	0.1546	0.2629	0.1546	0.2626	0.1547	0.2621	0.1552	0.2631
u > o / k _ s	0.4614	0.5964	0.4612	0.5974	0.4630	0.5967	0.4616	0.5967
u > u / k _ s	0.5386	0.4036	0.5388	0.4026	0.5370	0.4033	0.5384	0.4033
s > h / a: _ i	0.3367	0.2138	0.3373	0.2139	0.3369	0.2144	0.3360	0.2143
s > s / a: _ i	0.6633	0.7862	0.6627	0.7861	0.6631	0.7856	0.6640	0.7857
i > i / d <sup>h</sup> _ n	0.5740	0.4360	0.5750	0.4371	0.5742	0.4367	0.5745	0.4367
i > i: / d <sup>h</sup> _ n	0.4260	0.5640	0.4250	0.5629	0.4258	0.5633	0.4255	0.5633
i > e / t _ n	0.1878	0.3032	0.1886	0.3031	0.1867	0.3028	0.1872	0.3028
i > i / t _ n	0.4769	0.3816	0.4768	0.3811	0.4769	0.3813	0.4775	0.3819
i > i: / t _ n	0.3354	0.3152	0.3346	0.3158	0.3363	0.3159	0.3353	0.3152
n > ∅ / a _ n	0.7932	0.8955	0.7940	0.8951	0.7940	0.8952	0.7938	0.8950
n > n / a _ n	0.2068	0.1045	0.2060	0.1049	0.2060	0.1048	0.2062	0.1050
ŋ > ∅ / o _ t <sup>h</sup>	0.9624	0.8887	0.9623	0.8890	0.9618	0.8889	0.9624	0.8886
ŋ > n / o _ t <sup>h</sup>	0.0376	0.1113	0.0377	0.1110	0.0382	0.1111	0.0376	0.1114
j > ∅ / r _ a	0.5735	0.7101	0.5746	0.7110	0.5744	0.7113	0.5741	0.7106
j > j / r _ a	0.4265	0.2899	0.4254	0.2890	0.4256	0.2887	0.4259	0.2894
s > ∅ / t _ a	0.0758	0.1213	0.0757	0.1209	0.0760	0.1213	0.0757	0.1209
s > c <sup>h</sup> / t _ a	0.6993	0.5624	0.6992	0.5625	0.6990	0.5624	0.6995	0.5621
s > s / t _ a	0.2249	0.3164	0.2251	0.3166	0.2250	0.3163	0.2248	0.3169
i > a / t _ r	0.3493	0.2187	0.3493	0.2193	0.3491	0.2198	0.3490	0.2190
i > i / t _ r	0.6507	0.7813	0.6507	0.7807	0.6509	0.7802	0.6510	0.7810
i > ∅ / h _ t	0.3387	0.3178	0.3399	0.3171	0.3398	0.3171	0.3399	0.3175
i > e / h _ t	0.0942	0.1891	0.0938	0.1890	0.0936	0.1894	0.0937	0.1888
i > i / h _ t	0.2788	0.2721	0.2791	0.2723	0.2788	0.2716	0.2786	0.2722
i > i: / h _ t	0.2883	0.2210	0.2872	0.2215	0.2878	0.2219	0.2878	0.2215
i > e / # _ j	0.6232	0.7571	0.6217	0.7590	0.6227	0.7568	0.6243	0.7578
i > i / # _ j	0.3768	0.2429	0.3783	0.2410	0.3773	0.2432	0.3757	0.2422
i > a / g _ r	0.5050	0.6520	0.5056	0.6529	0.5058	0.6532	0.5065	0.6528
i > a: / g _ r	0.4950	0.3480	0.4944	0.3471	0.4942	0.3468	0.4935	0.3472
h > ∅ / a _ i	0.6176	0.4694	0.6171	0.4685	0.6177	0.4687	0.6181	0.4689
h > h / a _ i	0.3824	0.5306	0.3829	0.5315	0.3823	0.5313	0.3819	0.5311
i > i / d <sup>h</sup> _ k	0.5411	0.6871	0.5412	0.6871	0.5415	0.6874	0.5412	0.6875
i > i: / d <sup>h</sup> _ k	0.4589	0.3129	0.4588	0.3129	0.4585	0.3126	0.4588	0.3125
r > ∅ / a _ s	0.4306	0.5503	0.4313	0.5506	0.4311	0.5504	0.4305	0.5511
r > n / a _ s	0.0682	0.0579	0.0678	0.0578	0.0679	0.0578	0.0679	0.0577
r > r / a _ s	0.4274	0.3676	0.4273	0.3674	0.4272	0.3678	0.4280	0.3671
r > s / a _ s	0.0739	0.0242	0.0736	0.0241	0.0738	0.0241	0.0736	0.0242
j > ∅ / l _ a	0.7740	0.8858	0.7738	0.8856	0.7738	0.8855	0.7738	0.8858
j > h / l _ a	0.0881	0.0526	0.0883	0.0528	0.0884	0.0522	0.0882	0.0525
j > l / l _ a	0.1379	0.0616	0.1378	0.0616	0.1378	0.0623	0.1379	0.0617
u: > u / j _ t	0.5632	0.7131	0.5657	0.7145	0.5643	0.7138	0.5666	0.7125

u: > u: / j _ t	0.4368	0.2869	0.4343	0.2855	0.4357	0.2862	0.4334	0.2875
i > i / p _ p	0.8870	0.7700	0.8861	0.7698	0.8861	0.7701	0.8861	0.7700
i > i: / p _ p	0.1130	0.2300	0.1139	0.2302	0.1139	0.2299	0.1139	0.2300
u: > u / j _ r	0.4877	0.6420	0.4879	0.6429	0.4879	0.6421	0.4876	0.6399
u: > u: / j _ r	0.5123	0.3580	0.5121	0.3571	0.5121	0.3579	0.5124	0.3601
r > Ø / a _ ŋ	0.8515	0.9452	0.8518	0.9456	0.8518	0.9455	0.8518	0.9455
r > n / a _ ŋ	0.1485	0.0548	0.1482	0.0544	0.1482	0.0545	0.1482	0.0545
i > e / c <sup>h</sup> _ d	0.2234	0.3600	0.2227	0.3607	0.2236	0.3613	0.2243	0.3608
i > i / c <sup>h</sup> _ d	0.5534	0.4919	0.5534	0.4916	0.5532	0.4913	0.5524	0.4897
i > i: / c <sup>h</sup> _ d	0.2232	0.1480	0.2240	0.1477	0.2231	0.1475	0.2232	0.1496
ŋ > ŋ / r _ a	0.0601	0.1588	0.0601	0.1586	0.0599	0.1588	0.0600	0.1584
ŋ > n / r _ a	0.9399	0.8412	0.9399	0.8414	0.9401	0.8412	0.9400	0.8416
ɲ > Ø / o _ c <sup>h</sup>	0.6833	0.5238	0.6823	0.5234	0.6820	0.5231	0.6831	0.5237
ɲ > n / o _ c <sup>h</sup>	0.3167	0.4762	0.3177	0.4766	0.3180	0.4769	0.3169	0.4763
u > a / p _ n	0.4166	0.2620	0.4160	0.2621	0.4171	0.2622	0.4171	0.2624
u > u / p _ n	0.5834	0.7380	0.5840	0.7379	0.5829	0.7378	0.5829	0.7376
n > n / s _ a:	0.7032	0.8401	0.7034	0.8392	0.7030	0.8401	0.7016	0.8400
n > n <sup>fi</sup> / s _ a:	0.2968	0.1599	0.2966	0.1608	0.2970	0.1599	0.2984	0.1600
i: > i / d _ p	0.6663	0.8118	0.6663	0.8112	0.6657	0.8118	0.6668	0.8121
i: > i: / d _ p	0.3337	0.1882	0.3337	0.1888	0.3343	0.1882	0.3332	0.1879
n > Ø / a _ d <sup>h</sup>	0.0489	0.0811	0.0489	0.0809	0.0488	0.0809	0.0489	0.0811
n > n / a _ d <sup>h</sup>	0.4396	0.4310	0.4391	0.4307	0.4392	0.4300	0.4398	0.4308
n > n / a _ d <sup>fi</sup>	0.4722	0.3756	0.4727	0.3756	0.4727	0.3761	0.4721	0.3753
n > n <sup>fi</sup> / a _ d <sup>fi</sup>	0.0393	0.1123	0.0393	0.1129	0.0393	0.1129	0.0392	0.1128
h > Ø / a: _ a	0.3280	0.1822	0.3276	0.1819	0.3280	0.1826	0.3279	0.1825
h > h / a: _ a	0.6720	0.8178	0.6724	0.8181	0.6720	0.8174	0.6721	0.8175
u: > u / b <sup>fi</sup> _ m	0.5163	0.6798	0.5154	0.6812	0.5149	0.6815	0.5151	0.6799
u: > u: / b <sup>fi</sup> _ m	0.4837	0.3202	0.4846	0.3188	0.4851	0.3185	0.4849	0.3201
i: > i / n _ t	0.5686	0.7300	0.5694	0.7308	0.5699	0.7302	0.5699	0.7309
i: > i: / n _ t	0.4314	0.2700	0.4306	0.2692	0.4301	0.2698	0.4301	0.2691
s > Ø / a: _ a	0.1033	0.0519	0.1033	0.0518	0.1034	0.0520	0.1031	0.0519
s > h / a: _ a	0.2829	0.1785	0.2834	0.1786	0.2834	0.1784	0.2829	0.1785
s > s / a: _ a	0.6139	0.7696	0.6133	0.7696	0.6132	0.7696	0.6140	0.7695
s > Ø / a _ a	0.0330	0.0949	0.0329	0.0952	0.0331	0.0950	0.0331	0.0949
s > h / a _ a	0.2008	0.1100	0.2008	0.1101	0.2009	0.1101	0.2008	0.1101
s > s / a _ a	0.7199	0.7319	0.7196	0.7316	0.7195	0.7317	0.7196	0.7320
s > t / a _ a	0.0463	0.0632	0.0467	0.0631	0.0466	0.0632	0.0466	0.0631
u: > u / s _ k	0.3442	0.5162	0.3445	0.5168	0.3440	0.5161	0.3451	0.5186
u: > u: / s _ k	0.6558	0.4838	0.6555	0.4832	0.6560	0.4839	0.6549	0.4814
l > Ø / # _ a	0.0110	0.0247	0.0111	0.0247	0.0111	0.0248	0.0110	0.0247
l > h / # _ a	0.0151	0.0291	0.0151	0.0292	0.0151	0.0291	0.0153	0.0291
l > l / # _ a	0.9524	0.8555	0.9523	0.8553	0.9525	0.8550	0.9521	0.8555
l > n / # _ a	0.0214	0.0907	0.0214	0.0908	0.0213	0.0911	0.0216	0.0906
i > e / n _ m	0.1839	0.3370	0.1839	0.3368	0.1839	0.3357	0.1838	0.3368
i > i / n _ m	0.8161	0.6630	0.8161	0.6632	0.8161	0.6643	0.8162	0.6632
ʂ > Ø / a _ t	0.8304	0.8054	0.8303	0.8058	0.8306	0.8056	0.8304	0.8057
ʂ > t / a _ t	0.1559	0.1128	0.1560	0.1124	0.1558	0.1126	0.1559	0.1125
ʂ > n / a _ t	0.0138	0.0818	0.0137	0.0818	0.0136	0.0818	0.0137	0.0817
i > i / c _ t	0.9444	0.8377	0.9446	0.8379	0.9448	0.8379	0.9451	0.8375
i > i: / c _ t	0.0556	0.1623	0.0554	0.1621	0.0552	0.1621	0.0549	0.1625
u > o / t _ ʂ	0.1580	0.0526	0.1580	0.0525	0.1575	0.0526	0.1581	0.0522
u > u / t _ ʂ	0.8420	0.9474	0.8420	0.9475	0.8425	0.9474	0.8419	0.9478
h > Ø / # _ a	0.0139	0.0898	0.0140	0.0896	0.0139	0.0898	0.0140	0.0897
h > h / # _ a	0.9861	0.9102	0.9860	0.9104	0.9861	0.9102	0.9860	0.9103
r > Ø / a _ p	0.8470	0.8518	0.8477	0.8517	0.8473	0.8520	0.8475	0.8517
r > n / a _ p	0.0592	0.1233	0.0589	0.1232	0.0592	0.1231	0.0591	0.1233
r > p / a _ p	0.0937	0.0249	0.0934	0.0251	0.0935	0.0249	0.0934	0.0249
l > Ø / u _ l	0.6186	0.7839	0.6191	0.7835	0.6185	0.7831	0.6182	0.7840
l > l / u _ l	0.3814	0.2161	0.3809	0.2165	0.3815	0.2169	0.3818	0.2160
u: > u / m _ l	0.4025	0.5885	0.4025	0.5881	0.4016	0.5871	0.4025	0.5879



u: > u: / m _ l	0.5975	0.4115	0.5975	0.4119	0.5984	0.4129	0.5975	0.4121
r > Ø / a: _ a	0.0204	0.0100	0.0204	0.0100	0.0204	0.0100	0.0204	0.0100
r > l / a: _ a	0.0178	0.0000	0.0178	0.0000	0.0178	0.0000	0.0178	0.0000
r > r / a: _ a	0.0092	0.0026	0.0092	0.0026	0.0092	0.0026	0.0092	0.0025
r > l / a: _ a	0.0027	0.0388	0.0027	0.0388	0.0027	0.0387	0.0027	0.0388
r > r / a: _ a	0.9498	0.9486	0.9499	0.9487	0.9497	0.9487	0.9499	0.9486
i > i / d _ k	0.3100	0.4929	0.3090	0.4933	0.3081	0.4944	0.3100	0.4939
i > i: / d _ k	0.6900	0.5071	0.6910	0.5067	0.6919	0.5056	0.6900	0.5061
i: > i / s _ s	0.4266	0.6159	0.4278	0.6171	0.4275	0.6160	0.4276	0.6158
i: > i: / s _ s	0.5734	0.3841	0.5722	0.3829	0.5725	0.3840	0.5724	0.3842
u > Ø / # _ d	0.0609	0.0980	0.0609	0.0979	0.0609	0.0978	0.0609	0.0979
u > o / # _ d	0.0223	0.0878	0.0223	0.0881	0.0223	0.0880	0.0225	0.0878
u > u / # _ d	0.8904	0.7577	0.8904	0.7576	0.8904	0.7577	0.8902	0.7580
u > u: / # _ d	0.0264	0.0564	0.0263	0.0564	0.0263	0.0564	0.0263	0.0563
h > Ø / a: _ i	0.3861	0.5751	0.3841	0.5753	0.3848	0.5759	0.3851	0.5762
h > h / a: _ i	0.6139	0.4249	0.6159	0.4247	0.6152	0.4241	0.6149	0.4238
u: > u / d _ r	0.4183	0.6084	0.4175	0.6091	0.4185	0.6092	0.4185	0.6089
u: > u: / d _ r	0.5817	0.3916	0.5825	0.3909	0.5815	0.3908	0.5815	0.3911
i > e / n _ k	0.2069	0.0959	0.2056	0.0955	0.2064	0.0954	0.2060	0.0961
i > i / n _ k	0.4644	0.6372	0.4635	0.6383	0.4633	0.6373	0.4633	0.6371
i > i: / n _ k	0.3287	0.2668	0.3309	0.2662	0.3304	0.2673	0.3307	0.2667
i > i / s _ k	0.4152	0.6116	0.4156	0.6095	0.4154	0.6106	0.4153	0.6111
i > i: / s _ k	0.5848	0.3884	0.5844	0.3905	0.5846	0.3894	0.5847	0.3889
r̥ > a / m _ s	0.3800	0.2017	0.3797	0.2015	0.3796	0.2015	0.3797	0.2019
r̥ > i / m _ s	0.6200	0.7983	0.6203	0.7985	0.6204	0.7985	0.6203	0.7981
i > Ø / p _ t	0.1903	0.1925	0.1917	0.1937	0.1919	0.1937	0.1917	0.1934
i > e / p _ t	0.2758	0.4542	0.2747	0.4540	0.2743	0.4537	0.2739	0.4541
i > i / p _ t	0.5339	0.3533	0.5336	0.3524	0.5338	0.3526	0.5344	0.3525
i > Ø / r _ d	0.4459	0.6135	0.4460	0.6133	0.4459	0.6138	0.4457	0.6122
i > a / r _ d	0.1766	0.0659	0.1761	0.0655	0.1755	0.0653	0.1761	0.0660
i > i / r _ d	0.3775	0.3206	0.3780	0.3212	0.3786	0.3208	0.3782	0.3218
i > i / f _ k	0.7611	0.5665	0.7600	0.5664	0.7608	0.5673	0.7610	0.5682
i > i: / f _ k	0.2389	0.4335	0.2400	0.4336	0.2392	0.4327	0.2390	0.4318
i > Ø / v _ k	0.1456	0.1083	0.1457	0.1088	0.1454	0.1079	0.1454	0.1087
i > e / v _ k	0.2220	0.0929	0.2217	0.0929	0.2219	0.0930	0.2218	0.0929
i > i / v _ k	0.5257	0.7036	0.5257	0.7032	0.5258	0.7039	0.5267	0.7034
i > i: / v _ k	0.1067	0.0953	0.1068	0.0951	0.1069	0.0952	0.1061	0.0950
i > e / v _ h	0.1847	0.3694	0.1847	0.3695	0.1833	0.3693	0.1847	0.3701
i > i / v _ h	0.8153	0.6306	0.8153	0.6305	0.8167	0.6307	0.8153	0.6299
j > Ø / i _ a:	0.5273	0.3205	0.5268	0.3203	0.5268	0.3210	0.5266	0.3206
j > j / i _ a:	0.4727	0.6795	0.4732	0.6797	0.4732	0.6790	0.4734	0.6794
u: > u / t _ r	0.5836	0.7780	0.5829	0.7781	0.5825	0.7783	0.5837	0.7777
u: > u: / t _ r	0.4164	0.2220	0.4171	0.2219	0.4175	0.2217	0.4163	0.2223
r > Ø / m _ a	0.5971	0.7894	0.5954	0.7900	0.5962	0.7899	0.5973	0.7893
r > b / m _ a	0.4029	0.2106	0.4046	0.2100	0.4038	0.2101	0.4027	0.2107
i: > i / p _ t	0.6063	0.3942	0.6079	0.3966	0.6060	0.3968	0.6068	0.3968
i: > i: / p _ t	0.3937	0.6058	0.3921	0.6034	0.3940	0.6032	0.3932	0.6032
r > Ø / e _ a	0.0747	0.1985	0.0742	0.1983	0.0741	0.1985	0.0732	0.1985
r > l / e _ a	0.1924	0.2474	0.1928	0.2465	0.1929	0.2463	0.1930	0.2463
r > r / e _ a	0.7329	0.5541	0.7331	0.5552	0.7330	0.5552	0.7338	0.5553
n > Ø / a _ d	0.0272	0.1406	0.0272	0.1403	0.0272	0.1403	0.0274	0.1404
n > n / a _ d	0.4752	0.4031	0.4756	0.4037	0.4755	0.4036	0.4753	0.4032
n > n / a _ d	0.4976	0.4564	0.4972	0.4560	0.4973	0.4561	0.4973	0.4565
ʂ > h / a: _ a:	0.6093	0.3964	0.6088	0.3967	0.6094	0.3963	0.6096	0.3961
ʂ > s / a: _ a:	0.3907	0.6036	0.3912	0.6033	0.3906	0.6037	0.3904	0.6039
u: > u / ʃ _ r	0.3564	0.5702	0.3569	0.5692	0.3548	0.5710	0.3575	0.5705
u: > u: / ʃ _ r	0.6436	0.4298	0.6431	0.4308	0.6452	0.4290	0.6425	0.4295
r > Ø / t _ i:	0.6007	0.8000	0.6019	0.7997	0.6006	0.7996	0.6024	0.7999
r > r / t _ i:	0.3993	0.2000	0.3981	0.2003	0.3994	0.2004	0.3976	0.2001
s > Ø / a _ t	0.7119	0.8720	0.7116	0.8718	0.7125	0.8719	0.7117	0.8724

s > h / a _ t	0.0977	0.0712	0.0977	0.0712	0.0973	0.0713	0.0977	0.0708
s > t / a _ t	0.1904	0.0568	0.1907	0.0570	0.1902	0.0568	0.1906	0.0568
r > Ø / a _ c	0.5054	0.7181	0.5044	0.7176	0.5039	0.7172	0.5039	0.7177
r > n / a _ c	0.4946	0.2819	0.4956	0.2824	0.4961	0.2828	0.4961	0.2823
u > o / k _ ŋ	0.0278	0.1496	0.0278	0.1493	0.0278	0.1491	0.0278	0.1492
u > u / k _ ŋ	0.7801	0.6935	0.7799	0.6933	0.7800	0.6931	0.7806	0.6938
u > u: / k _ ŋ	0.1920	0.1569	0.1923	0.1574	0.1922	0.1578	0.1916	0.1570
u > u / b _ s	0.5826	0.7889	0.5827	0.7897	0.5816	0.7889	0.5827	0.7881
u > u: / b _ s	0.4174	0.2111	0.4173	0.2103	0.4184	0.2111	0.4173	0.2119
u > a / g _ l	0.1560	0.1276	0.1561	0.1282	0.1560	0.1291	0.1554	0.1278
u > u / g _ l	0.6667	0.8252	0.6663	0.8249	0.6667	0.8239	0.6671	0.8255
u > u: / g _ l	0.1773	0.0472	0.1776	0.0469	0.1772	0.0470	0.1775	0.0467
r > Ø / a _ t	0.8269	0.9276	0.8266	0.9275	0.8268	0.9276	0.8269	0.9275
r > t / a _ t	0.0936	0.0108	0.0938	0.0108	0.0936	0.0108	0.0935	0.0108
r > n / a _ t	0.0140	0.0311	0.0139	0.0311	0.0139	0.0312	0.0140	0.0313
r > r / a _ t	0.0655	0.0305	0.0656	0.0305	0.0657	0.0305	0.0656	0.0304
i > a / n _ s	0.1200	0.0148	0.1200	0.0146	0.1197	0.0146	0.1195	0.0147
i > e / n _ s	0.0825	0.0703	0.0827	0.0700	0.0830	0.0701	0.0833	0.0700
i > i / n _ s	0.7975	0.9149	0.7973	0.9153	0.7973	0.9152	0.7972	0.9153
i > i / m _ t	0.8839	0.7021	0.8847	0.7016	0.8844	0.7035	0.8848	0.7029
i > i: / m _ t	0.1161	0.2979	0.1153	0.2984	0.1156	0.2965	0.1152	0.2971
u > o / l _ d	0.6223	0.3937	0.6225	0.3986	0.6220	0.3940	0.6218	0.3939
u > u / l _ d	0.3777	0.6063	0.3775	0.6014	0.3780	0.6060	0.3782	0.6061
r > Ø / i _ a	0.0364	0.0332	0.0361	0.0333	0.0363	0.0334	0.0362	0.0334
r > l / i _ a	0.0000	0.0737	0.0000	0.0737	0.0000	0.0737	0.0000	0.0737
r > r / i _ a	0.9635	0.8931	0.9639	0.8929	0.9637	0.8929	0.9638	0.8929
i > i / j _ t	0.4820	0.7062	0.4820	0.7062	0.4823	0.7061	0.4819	0.7057
i > i: / j _ t	0.5180	0.2938	0.5180	0.2938	0.5177	0.2939	0.5181	0.2943
u: > u / # _ n	0.8619	0.9795	0.8623	0.9795	0.8621	0.9796	0.8620	0.9795
u: > u: / # _ n	0.1381	0.0205	0.1377	0.0205	0.1379	0.0204	0.1380	0.0205
i > i / m _ n	0.3558	0.5825	0.3551	0.5842	0.3551	0.5837	0.3559	0.5841
i > i: / m _ n	0.6442	0.4175	0.6449	0.4158	0.6449	0.4163	0.6441	0.4159
i > e / v _ d <sup>h</sup>	0.4824	0.2601	0.4815	0.2598	0.4800	0.2599	0.4819	0.2596
i > i / v _ d <sup>fi</sup>	0.5176	0.7399	0.5185	0.7402	0.5200	0.7401	0.5181	0.7404
i: > Ø / f _ t	0.6797	0.8511	0.6805	0.8513	0.6803	0.8511	0.6798	0.8509
i: > i / f _ t	0.1367	0.0296	0.1358	0.0295	0.1362	0.0296	0.1359	0.0298
i: > i: / f _ t	0.1836	0.1193	0.1837	0.1191	0.1836	0.1193	0.1843	0.1193
j > j / # _ u	0.8475	0.6457	0.8481	0.6462	0.8480	0.6455	0.8484	0.6461
j > t / # _ u	0.1525	0.3543	0.1519	0.3538	0.1520	0.3545	0.1516	0.3539
i: > i / t _ r	0.3362	0.5727	0.3335	0.5737	0.3328	0.5743	0.3336	0.5720
i: > i: / t _ r	0.6638	0.4273	0.6665	0.4263	0.6672	0.4257	0.6664	0.4280
u: > u / m _ t	0.4757	0.7125	0.4763	0.7121	0.4766	0.7118	0.4765	0.7125
u: > u: / m _ t	0.5243	0.2875	0.5237	0.2879	0.5234	0.2882	0.5235	0.2875
u > u / p _ t	0.8765	0.6781	0.8765	0.6780	0.8756	0.6774	0.8765	0.6770
u > u: / p _ t	0.1235	0.3219	0.1235	0.3220	0.1244	0.3226	0.1235	0.3230
n > n / e _ d	0.3939	0.6347	0.3923	0.6342	0.3941	0.6342	0.3937	0.6342
n > n / e _ d	0.6061	0.3653	0.6077	0.3658	0.6059	0.3658	0.6063	0.3658
r > Ø / a _ i	0.0959	0.0333	0.0958	0.0333	0.0957	0.0333	0.0958	0.0333
r > l / a _ i	0.0418	0.0045	0.0417	0.0045	0.0417	0.0045	0.0418	0.0045
r > h / a _ i	0.0256	0.0360	0.0256	0.0360	0.0256	0.0358	0.0256	0.0357
r > l / a _ i	0.0221	0.0958	0.0222	0.0956	0.0222	0.0957	0.0222	0.0958
r > r / a _ i	0.8146	0.8304	0.8146	0.8307	0.8148	0.8306	0.8147	0.8307
n > Ø / u _ d <sup>h</sup>	0.2175	0.4218	0.2175	0.4213	0.2167	0.4220	0.2173	0.4207
n > ŋ / u _ d <sup>fi</sup>	0.2689	0.1397	0.2684	0.1400	0.2693	0.1392	0.2684	0.1401
n > n / u _ d <sup>fi</sup>	0.3117	0.3107	0.3116	0.3115	0.3120	0.3111	0.3107	0.3118
n > n / u _ d <sup>fi</sup>	0.2020	0.1278	0.2025	0.1273	0.2020	0.1277	0.2036	0.1274
ʂ > ʃ / # _ a	0.0821	0.0000	0.0824	0.0000	0.0825	0.0000	0.0822	0.0000
ʂ > c <sup>h</sup> / # _ a	0.6970	0.6980	0.6970	0.6979	0.6970	0.6979	0.6970	0.6979
ʂ > s / # _ a	0.2209	0.3019	0.2206	0.3021	0.2205	0.3021	0.2208	0.3021
r > Ø / u: _ v	0.6301	0.8526	0.6316	0.8526	0.6313	0.8526	0.6310	0.8526

r > r / u: _v	0.3699	0.1474	0.3684	0.1474	0.3687	0.1474	0.3690	0.1474
ʃ > Ø / r: _t <sup>h</sup>	0.6666	0.8790	0.6672	0.8795	0.6670	0.8800	0.6684	0.8802
ʃ > t / r: _t <sup>h</sup>	0.3334	0.1210	0.3328	0.1205	0.3330	0.1200	0.3316	0.1198
s > s / # _u	1.0000	0.9069	1.0000	0.9068	1.0000	0.9067	1.0000	0.9068
s > x / # _u	0.0000	0.0931	0.0000	0.0932	0.0000	0.0933	0.0000	0.0932
j > Ø / e: _a	0.3147	0.5715	0.3149	0.5724	0.3148	0.5725	0.3145	0.5721
j > j / e: _a	0.6853	0.4285	0.6851	0.4276	0.6852	0.4275	0.6855	0.4279
r > Ø / v: _t	0.3603	0.1544	0.3615	0.1540	0.3613	0.1547	0.3580	0.1563
r > a / v: _t	0.3906	0.4096	0.3903	0.4090	0.3902	0.4085	0.3919	0.4082
r > u / v: _t	0.2491	0.4360	0.2482	0.4371	0.2485	0.4368	0.2501	0.4355
r > Ø / t: _a	0.9607	0.7964	0.9609	0.7963	0.9614	0.7965	0.9604	0.7968
r > r / t: _a	0.0393	0.2036	0.0391	0.2037	0.0386	0.2035	0.0396	0.2032
r > Ø / u: _c	0.6574	0.3981	0.6582	0.3964	0.6579	0.3967	0.6571	0.3956
r > n / u: _c	0.3426	0.6019	0.3418	0.6036	0.3421	0.6033	0.3429	0.6044
ʃ > Ø / a: _u	0.2305	0.0869	0.2304	0.0863	0.2299	0.0856	0.2301	0.0861
ʃ > h / a: _u	0.3242	0.2233	0.3240	0.2233	0.3242	0.2241	0.3238	0.2237
ʃ > s / a: _u	0.4453	0.6898	0.4456	0.6903	0.4459	0.6903	0.4461	0.6902
n > Ø / i: _n	0.5448	0.7917	0.5456	0.7916	0.5464	0.7916	0.5451	0.7927
n > n / i: _n	0.4552	0.2083	0.4544	0.2084	0.4536	0.2084	0.4549	0.2073
h > Ø / o: _i	0.2154	0.4648	0.2159	0.4643	0.2146	0.4637	0.2145	0.4633
h > h / o: _i	0.7846	0.5352	0.7841	0.5357	0.7854	0.5363	0.7855	0.5367
r > Ø / p: _a	0.9213	0.9415	0.9213	0.9415	0.9213	0.9415	0.9214	0.9415
r > a / p: _a	0.0787	0.0071	0.0787	0.0071	0.0787	0.0071	0.0786	0.0071
r > i / p: _a	0.0000	0.0514	0.0000	0.0514	0.0000	0.0514	0.0000	0.0514
u > a / c: _l	0.3042	0.0966	0.3033	0.0968	0.3036	0.0964	0.3036	0.0967
u > u / c: _l	0.5264	0.6506	0.5277	0.6509	0.5274	0.6511	0.5267	0.6509
u > u: / c: _l	0.1694	0.2529	0.1690	0.2523	0.1691	0.2525	0.1697	0.2523
n > n / h: _a	0.7753	0.5212	0.7749	0.5202	0.7738	0.5206	0.7744	0.5200
n > n <sup>fi</sup> / h: _a	0.2247	0.4788	0.2251	0.4798	0.2262	0.4794	0.2256	0.4800
i > i / h: _ʃ	0.6780	0.8948	0.6776	0.8947	0.6770	0.8944	0.6778	0.8947
i > i: / h: _ʃ	0.3220	0.1052	0.3224	0.1053	0.3230	0.1056	0.3222	0.1053
i > i / h: _n	0.5029	0.7640	0.5045	0.7634	0.5041	0.7644	0.5031	0.7637
i > i: / h: _n	0.4971	0.2360	0.4955	0.2366	0.4959	0.2356	0.4969	0.2363
kʃ > Ø / a: _i	0.2880	0.4212	0.2886	0.4198	0.2886	0.4194	0.2889	0.4196
kʃ > h / a: _i	0.0890	0.2168	0.0890	0.2176	0.0887	0.2175	0.0889	0.2168
kʃ > k <sup>h</sup> / a: _i	0.6230	0.3619	0.6224	0.3626	0.6227	0.3631	0.6222	0.3636
ʃ > Ø / r: _a	0.2011	0.0608	0.2018	0.0608	0.2016	0.0603	0.2009	0.0607
ʃ > h / r: _a	0.2452	0.1442	0.2450	0.1450	0.2449	0.1445	0.2457	0.1442
ʃ > s / r: _a	0.5537	0.7950	0.5532	0.7942	0.5535	0.7952	0.5534	0.7952
u > Ø / t: _h	0.5147	0.2513	0.5149	0.2499	0.5146	0.2507	0.5148	0.2502
u > u / t: _h	0.4853	0.7487	0.4851	0.7501	0.4854	0.7493	0.4852	0.7498
i > i / n: _n	0.2881	0.5574	0.2866	0.5561	0.2870	0.5568	0.2875	0.5571
i > i: / n: _n	0.7119	0.4426	0.7134	0.4439	0.7130	0.4432	0.7125	0.4429
r > l / a: _i	0.1923	0.0266	0.1918	0.0269	0.1919	0.0269	0.1921	0.0269
r > l / a: _i	0.3067	0.3632	0.3066	0.3631	0.3067	0.3632	0.3067	0.3631
r > r / a: _i	0.5010	0.6102	0.5016	0.6099	0.5014	0.6100	0.5011	0.6100
r > Ø / g: _a	0.8590	0.9929	0.8582	0.9929	0.8584	0.9929	0.8588	0.9930
r > a / g: _a	0.1410	0.0071	0.1418	0.0071	0.1416	0.0071	0.1412	0.0070
r > Ø / a: _d <sup>fi</sup>	0.8445	0.9303	0.8446	0.9300	0.8448	0.9301	0.8462	0.9303
r > d / a: _d <sup>fi</sup>	0.1098	0.0000	0.1095	0.0000	0.1096	0.0000	0.1087	0.0000
r > r / a: _d <sup>fi</sup>	0.0457	0.0697	0.0459	0.0700	0.0456	0.0699	0.0451	0.0697
ʃ > Ø / r: _t	0.7435	0.9429	0.7439	0.9433	0.7441	0.9433	0.7438	0.9433
ʃ > t / r: _t	0.2565	0.0571	0.2561	0.0567	0.2559	0.0567	0.2562	0.0567
i > Ø / t <sup>h</sup> : _t	0.2248	0.0634	0.2245	0.0634	0.2246	0.0632	0.2250	0.0632
i > i / t <sup>h</sup> : _t	0.4034	0.6456	0.4029	0.6446	0.4036	0.6447	0.4030	0.6446
i > i: / t <sup>h</sup> : _t	0.3718	0.2910	0.3725	0.2920	0.3718	0.2921	0.3720	0.2922
u > o / ʃ: _ŋ	0.1508	0.2428	0.1500	0.2447	0.1505	0.2442	0.1500	0.2447
u > u / ʃ: _ŋ	0.6904	0.4120	0.6915	0.4113	0.6912	0.4114	0.6911	0.4112
u > u: / ʃ: _ŋ	0.1588	0.3452	0.1584	0.3440	0.1583	0.3444	0.1589	0.3442
u > u / ʃ: _k	0.6734	0.9051	0.6748	0.9052	0.6745	0.9055	0.6738	0.9052

u > u: / ʃ _ k	0.3266	0.0949	0.3252	0.0948	0.3255	0.0945	0.3262	0.0948
ʃ > h / a _ a	0.3507	0.1109	0.3511	0.1106	0.3507	0.1109	0.3511	0.1106
ʃ > s / a _ a	0.6493	0.8891	0.6489	0.8894	0.6493	0.8891	0.6489	0.8894
u > ∅ / d _ k	0.3927	0.6805	0.3903	0.6842	0.3869	0.6828	0.3928	0.6818
u > u: / d _ k	0.6073	0.3195	0.6097	0.3158	0.6131	0.3172	0.6072	0.3182
ʃ > ∅ / r _ c	0.4975	0.7784	0.4972	0.7791	0.4972	0.7798	0.4969	0.7790
ʃ > c / r _ c	0.5025	0.2216	0.5028	0.2209	0.5028	0.2202	0.5031	0.2210
r > ∅ / a _ k	0.6883	0.7953	0.6892	0.7954	0.6890	0.7954	0.6887	0.7947
r > n / a _ k	0.0633	0.1156	0.0631	0.1153	0.0631	0.1154	0.0633	0.1157
r > k / a _ k	0.1488	0.0891	0.1484	0.0893	0.1485	0.0893	0.1485	0.0897
r > r / a _ k	0.0997	0.0000	0.0993	0.0000	0.0994	0.0000	0.0996	0.0000
i > ∅ / t _ k	0.1533	0.2037	0.1531	0.2041	0.1534	0.2035	0.1534	0.2039
i > i / t _ k	0.2607	0.4978	0.2611	0.4978	0.2607	0.4982	0.2606	0.4977
i > i: / t _ k	0.5860	0.2985	0.5858	0.2981	0.5859	0.2983	0.5860	0.2984
ɲ > ∅ / j _ a:	0.2973	0.1392	0.2963	0.1389	0.2967	0.1387	0.2968	0.1392
ɲ > ɲ / j _ a:	0.2068	0.0812	0.2067	0.0811	0.2066	0.0812	0.2071	0.0811
ɲ > n / j _ a:	0.4960	0.7796	0.4971	0.7799	0.4967	0.7801	0.4961	0.7797
i > ∅ / ɲ _ j	0.4063	0.1407	0.4071	0.1416	0.4042	0.1412	0.4063	0.1413
i > i / ɲ _ j	0.5937	0.8593	0.5929	0.8584	0.5958	0.8588	0.5937	0.8587
u > o / c _ t	0.2671	0.5189	0.2657	0.5211	0.2676	0.5195	0.2678	0.5199
u > u / c _ t	0.3039	0.3005	0.3048	0.2983	0.3048	0.3010	0.3043	0.3002
u > u: / c _ t	0.4290	0.1806	0.4295	0.1806	0.4276	0.1795	0.4279	0.1799
s > c <sup>h</sup> / t _ j	0.9053	0.6585	0.9054	0.6590	0.9057	0.6584	0.9053	0.6571
s > s / t _ j	0.0947	0.3415	0.0946	0.3410	0.0943	0.3416	0.0947	0.3429
u: > u / # _ ʃ	0.3187	0.6227	0.3182	0.6242	0.3190	0.6223	0.3191	0.6245
u: > u: / # _ ʃ	0.6813	0.3773	0.6818	0.3758	0.6810	0.3777	0.6809	0.3755
j > ∅ / a: _ a	0.8738	0.6075	0.8737	0.6076	0.8744	0.6076	0.8744	0.6070
j > j <sup>fi</sup> / a: _ a	0.0351	0.1193	0.0350	0.1191	0.0349	0.1192	0.0348	0.1192
j > j / a: _ a	0.0911	0.2732	0.0913	0.2733	0.0907	0.2732	0.0908	0.2738
u > ∅ / k _ t	0.2309	0.0420	0.2310	0.0421	0.2309	0.0421	0.2308	0.0421
u > a / k _ t	0.0801	0.0384	0.0799	0.0383	0.0800	0.0384	0.0803	0.0382
u > o / k _ t	0.0645	0.1081	0.0644	0.1079	0.0647	0.1080	0.0646	0.1079
u > u / k _ t	0.6245	0.8114	0.6246	0.8116	0.6244	0.8116	0.6243	0.8118
r > ∅ / a _ d	0.7859	0.7488	0.7856	0.7486	0.7861	0.7485	0.7856	0.7480
r > d / a _ d	0.0790	0.0161	0.0791	0.0162	0.0789	0.0162	0.0793	0.0162
r > n / a _ d	0.0761	0.1085	0.0762	0.1084	0.0760	0.1085	0.0761	0.1087
r > l / a _ d	0.0590	0.0295	0.0591	0.0296	0.0589	0.0297	0.0590	0.0295
r > r / a _ d	0.0000	0.0971	0.0000	0.0972	0.0000	0.0972	0.0000	0.0975
s > ∅ / # _ a:	0.0164	0.0708	0.0163	0.0709	0.0164	0.0708	0.0161	0.0711
s > s / # _ a:	0.9836	0.8221	0.9837	0.8224	0.9836	0.8227	0.9839	0.8223
s > x / # _ a:	0.0000	0.1071	0.0000	0.1067	0.0000	0.1065	0.0000	0.1066
kʃ > c <sup>h</sup> / # _ o	0.7184	0.4056	0.7168	0.4059	0.7163	0.4057	0.7151	0.4054
kʃ > k <sup>h</sup> / # _ o	0.2816	0.5944	0.2832	0.5941	0.2837	0.5943	0.2849	0.5946
j > ∅ / n _ a	0.8625	1.0000	0.8615	1.0000	0.8614	1.0000	0.8619	1.0000
j > j / n _ a	0.1375	0.0000	0.1385	0.0000	0.1386	0.0000	0.1381	0.0000
j > ∅ / i _ a	0.9128	0.6593	0.9132	0.6573	0.9129	0.6583	0.9126	0.6596
j > j / i _ a	0.0872	0.3407	0.0868	0.3427	0.0871	0.3417	0.0874	0.3404
i > i / b _ n	0.4550	0.7624	0.4543	0.7644	0.4525	0.7630	0.4546	0.7632
i > u / b _ n	0.5450	0.2376	0.5457	0.2356	0.5475	0.2370	0.5454	0.2368
u: > o / c _ d	0.2645	0.0944	0.2639	0.0946	0.2644	0.0943	0.2635	0.0949
u: > u / c _ d	0.1984	0.4680	0.1989	0.4661	0.1984	0.4685	0.1985	0.4676
u: > u: / c _ d	0.5371	0.4376	0.5372	0.4393	0.5372	0.4372	0.5381	0.4374
i > i / b <sup>h</sup> _ kʃ	0.2830	0.6001	0.2862	0.6011	0.2856	0.6011	0.2862	0.6024
i > i: / b <sup>fi</sup> _ kʃ	0.7170	0.3999	0.7138	0.3989	0.7144	0.3989	0.7138	0.3976
ʃ > n / i _ a	0.2337	0.2696	0.2320	0.2701	0.2325	0.2698	0.2322	0.2696
ʃ > h / i _ a	0.4333	0.1526	0.4335	0.1530	0.4332	0.1529	0.4345	0.1527
ʃ > s / i _ a	0.3329	0.5778	0.3345	0.5769	0.3343	0.5773	0.3333	0.5778
u: > u / d <sup>h</sup> _ m	0.5017	0.8047	0.4992	0.8037	0.5000	0.8051	0.5003	0.8037
u: > u: / d <sup>fi</sup> _ m	0.4983	0.1953	0.5008	0.1963	0.5000	0.1949	0.4997	0.1963
s > c <sup>h</sup> / # _ u:	0.0000	0.1443	0.0000	0.1447	0.0000	0.1446	0.0000	0.1439

s > s / # _u:	1.0000	0.8557	1.0000	0.8553	1.0000	0.8554	1.0000	0.8561
i: > ∅ / j _v	0.1462	0.0526	0.1460	0.0528	0.1466	0.0526	0.1459	0.0532
i: > i / j _v	0.3908	0.7112	0.3896	0.7114	0.3914	0.7109	0.3920	0.7108
i: > i: / j _v	0.4630	0.2362	0.4644	0.2358	0.4621	0.2365	0.4621	0.2360
s > h / h _a	0.3296	0.6565	0.3302	0.6552	0.3295	0.6565	0.3296	0.6567
s > s / h _a	0.6704	0.3435	0.6698	0.3448	0.6705	0.3435	0.6704	0.3433
r > ∅ / a: _g	0.5552	0.6283	0.5544	0.6280	0.5545	0.6291	0.5546	0.6286
r > ŋ / a: _g	0.3923	0.1544	0.3928	0.1549	0.3924	0.1548	0.3925	0.1547
r > n / a: _g	0.0526	0.2173	0.0528	0.2171	0.0531	0.2161	0.0529	0.2167
f > s / # _o	1.0000	0.8492	1.0000	0.8497	1.0000	0.8502	1.0000	0.8493
f > x / # _o	0.0000	0.1508	0.0000	0.1503	0.0000	0.1498	0.0000	0.1507
f > ∅ / a _a	0.3893	0.3035	0.3892	0.3026	0.3890	0.3029	0.3894	0.3034
f > f / a _a	0.0649	0.0149	0.0651	0.0150	0.0651	0.0150	0.0649	0.0149
f > n / a _a	0.0672	0.0000	0.0671	0.0000	0.0673	0.0000	0.0672	0.0000
f > h / a _a	0.2229	0.2107	0.2231	0.2107	0.2232	0.2107	0.2231	0.2106
f > r / a _a	0.0398	0.0263	0.0399	0.0264	0.0399	0.0264	0.0400	0.0263
f > s / a _a	0.2158	0.4445	0.2155	0.4453	0.2155	0.4451	0.2155	0.4448
i > i / # _s	0.6114	0.2815	0.6125	0.2821	0.6114	0.2813	0.6110	0.2815
i > i: / # _s	0.3886	0.7185	0.3875	0.7179	0.3886	0.7187	0.3890	0.7185
r > l / a _u	0.0000	0.1541	0.0000	0.1537	0.0000	0.1542	0.0000	0.1541
r > r / a _u	1.0000	0.8459	1.0000	0.8463	1.0000	0.8458	1.0000	0.8459
r̥ > a / f _ŋ	0.1733	0.0862	0.1728	0.0864	0.1731	0.0858	0.1726	0.0860
r̥ > a: / f _ŋ	0.2282	0.0561	0.2281	0.0561	0.2266	0.0559	0.2280	0.0561
r̥ > i / f _ŋ	0.5161	0.6212	0.5165	0.6202	0.5175	0.6207	0.5167	0.6204
r̥ > i: / f _ŋ	0.0824	0.2366	0.0826	0.2373	0.0829	0.2375	0.0826	0.2374
n > ∅ / a: _t	0.0982	0.3629	0.0981	0.3624	0.0981	0.3628	0.0981	0.3633
n > n / a: _t	0.6410	0.5174	0.6411	0.5173	0.6404	0.5168	0.6409	0.5168
n > n / a: _t	0.2609	0.1197	0.2608	0.1203	0.2615	0.1204	0.2610	0.1198
n > n / i _d	0.5311	0.2062	0.5307	0.2065	0.5311	0.2076	0.5308	0.2064
n > n / i _d	0.4689	0.7938	0.4693	0.7935	0.4689	0.7924	0.4692	0.7936
h > ∅ / # _i	0.0423	0.2812	0.0427	0.2824	0.0425	0.2815	0.0422	0.2815
h > h / # _i	0.9577	0.7188	0.9573	0.7176	0.9575	0.7185	0.9578	0.7185
r̥ > ∅ / d _f	0.6633	0.3262	0.6638	0.3253	0.6624	0.3260	0.6634	0.3263
r̥ > i / d _f	0.3367	0.6738	0.3362	0.6747	0.3376	0.6740	0.3366	0.6737
i > i / p _s	0.3218	0.6591	0.3195	0.6588	0.3217	0.6578	0.3214	0.6579
i > i: / p _s	0.6782	0.3409	0.6805	0.3412	0.6783	0.3422	0.6786	0.3421
s̥ > ∅ / i _t	0.7192	0.9583	0.7190	0.9581	0.7190	0.9581	0.7190	0.9582
s̥ > t / i _t	0.2808	0.0417	0.2810	0.0419	0.2810	0.0419	0.2810	0.0418
u: > u / m _r	0.5051	0.8231	0.5052	0.8241	0.5050	0.8244	0.5047	0.8242
u: > u: / m _r	0.4949	0.1769	0.4948	0.1759	0.4950	0.1756	0.4953	0.1758
j > j / # _a	0.9908	0.8035	0.9908	0.8033	0.9908	0.8033	0.9907	0.8032
j > j / # _a	0.0092	0.1358	0.0092	0.1360	0.0092	0.1358	0.0093	0.1360
j > z / # _a	0.0000	0.0608	0.0000	0.0607	0.0000	0.0609	0.0000	0.0608
j > ∅ / a: _a:	0.7399	0.4106	0.7393	0.4133	0.7391	0.4121	0.7394	0.4113
j > n / a: _a:	0.1203	0.1922	0.1205	0.1917	0.1203	0.1910	0.1207	0.1920
j > j / a: _a:	0.1398	0.3971	0.1401	0.3950	0.1406	0.3968	0.1399	0.3967
j > ∅ / a _a	0.7274	0.5461	0.7263	0.5465	0.7268	0.5466	0.7268	0.5464
j > v / a _a	0.0203	0.0573	0.0203	0.0573	0.0203	0.0574	0.0203	0.0571
j > ɾ / a _a	0.0371	0.0124	0.0369	0.0125	0.0371	0.0124	0.0371	0.0124
j > n / a _a	0.0838	0.0185	0.0841	0.0185	0.0840	0.0185	0.0841	0.0185
j > j / a _a	0.0526	0.2017	0.0529	0.2014	0.0527	0.2014	0.0527	0.2016
j > l / a _a	0.0172	0.0226	0.0173	0.0226	0.0173	0.0226	0.0173	0.0226
j > n / a _a	0.0304	0.1046	0.0307	0.1043	0.0305	0.1046	0.0303	0.1046
j > r / a _a	0.0313	0.0367	0.0315	0.0368	0.0314	0.0366	0.0314	0.0367
i > ∅ / r _t	0.5428	0.2099	0.5415	0.2098	0.5420	0.2099	0.5426	0.2109
i > i / r _t	0.4572	0.7901	0.4585	0.7902	0.4580	0.7901	0.4574	0.7891
l > ∅ / a _u:	0.3898	0.7289	0.3877	0.7287	0.3879	0.7285	0.3866	0.7319
l > l / a _u:	0.6102	0.2711	0.6123	0.2713	0.6121	0.2715	0.6134	0.2681
k̥s̥ > k / a: _a	0.1382	0.4480	0.1367	0.4487	0.1365	0.4485	0.1372	0.4471
k̥s̥ > k <sup>h</sup> / a: _a	0.8618	0.5520	0.8633	0.5513	0.8635	0.5515	0.8628	0.5529

r̥ > ∅ / g <sup>h</sup> _ t	0.2389	0.5777	0.2388	0.5784	0.2395	0.5790	0.2396	0.5768
r̥ > i / g <sup>h</sup> _ t	0.7611	0.4223	0.7612	0.4216	0.7605	0.4210	0.7604	0.4232
s > f / # _ i:	0.1671	0.0000	0.1670	0.0000	0.1670	0.0000	0.1667	0.0000
s > s / # _ i:	0.8329	1.0000	0.8330	1.0000	0.8330	1.0000	0.8333	1.0000
ʃ > f / # _ u	0.1121	0.0386	0.1123	0.0386	0.1123	0.0386	0.1120	0.0387
ʃ > s / # _ u	0.8879	0.8130	0.8877	0.8130	0.8877	0.8128	0.8880	0.8127
ʃ > x / # _ u	0.0000	0.1484	0.0000	0.1484	0.0000	0.1486	0.0000	0.1486
i > i / t _ k	0.1863	0.5208	0.1858	0.5211	0.1863	0.5219	0.1863	0.5218
i > i: / t _ k	0.8137	0.4792	0.8142	0.4789	0.8137	0.4781	0.8137	0.4782
i: > e / v _ t	0.0610	0.3031	0.0609	0.3039	0.0611	0.3038	0.0611	0.3041
i: > i / v _ t	0.3860	0.3972	0.3846	0.3978	0.3862	0.3969	0.3857	0.3965
i: > i: / v _ t	0.5530	0.2996	0.5545	0.2984	0.5527	0.2993	0.5532	0.2994
i > ∅ / c _ k	0.3708	0.2378	0.3715	0.2370	0.3712	0.2377	0.3710	0.2378
i > i / c _ k	0.2725	0.6175	0.2726	0.6182	0.2722	0.6180	0.2726	0.6176
i > i: / c _ k	0.3567	0.1447	0.3559	0.1448	0.3566	0.1444	0.3565	0.1446
ŋ > ∅ / a _ d	0.0874	0.2421	0.0873	0.2433	0.0873	0.2435	0.0874	0.2425
ŋ > ŋ / a _ d	0.3508	0.1281	0.3502	0.1280	0.3506	0.1279	0.3510	0.1280
ŋ > n / a _ d	0.3376	0.5195	0.3375	0.5186	0.3373	0.5184	0.3376	0.5192
ŋ > n / a _ d	0.2242	0.1103	0.2250	0.1101	0.2248	0.1102	0.2240	0.1103
i > i / r _ n	0.2568	0.6145	0.2559	0.6148	0.2559	0.6148	0.2567	0.6159
i > i: / r _ n	0.7432	0.3855	0.7441	0.3852	0.7441	0.3852	0.7433	0.3841
u: > u / s _ t	0.4087	0.7654	0.4094	0.7666	0.4099	0.7663	0.4092	0.7657
u: > u: / s _ t	0.5913	0.2346	0.5906	0.2334	0.5901	0.2337	0.5908	0.2343
n > p / a _ j	0.1816	0.0000	0.1816	0.0000	0.1816	0.0000	0.1814	0.0000
n > n / a _ j	0.8184	1.0000	0.8184	1.0000	0.8184	1.0000	0.8186	1.0000
u: > o / l _ k	0.2139	0.3892	0.2136	0.3890	0.2133	0.3898	0.2135	0.3904
u: > u / l _ k	0.3188	0.4717	0.3188	0.4720	0.3183	0.4711	0.3184	0.4704
u: > u: / l _ k	0.4672	0.1391	0.4675	0.1390	0.4684	0.1391	0.4680	0.1392
r̥ > a / k _ s̥	0.1221	0.4221	0.1216	0.4231	0.1219	0.4222	0.1220	0.4211
r̥ > a: / k _ s̥	0.3285	0.3068	0.3279	0.3049	0.3299	0.3072	0.3282	0.3076
r̥ > i / k _ s̥	0.5493	0.2711	0.5504	0.2719	0.5481	0.2706	0.5498	0.2712
ŋ > ∅ / a: _ d	0.0172	0.1566	0.0175	0.1564	0.0171	0.1566	0.0171	0.1566
ŋ > ŋ / a: _ d	0.3269	0.0982	0.3264	0.0986	0.3268	0.0986	0.3266	0.0983
ŋ > n / a: _ d	0.4739	0.5977	0.4733	0.5976	0.4732	0.5974	0.4738	0.5974
ŋ > n / a: _ d	0.1821	0.1475	0.1828	0.1474	0.1829	0.1474	0.1825	0.1477
u > u / g _ s̥	0.4684	0.8185	0.4695	0.8189	0.4684	0.8198	0.4691	0.8186
u > u: / g _ s̥	0.5316	0.1815	0.5305	0.1811	0.5316	0.1802	0.5309	0.1814
i: > i / k _ l	0.3012	0.6714	0.3031	0.6711	0.3019	0.6714	0.3015	0.6714
i: > i: / k _ l	0.6988	0.3286	0.6969	0.3289	0.6981	0.3286	0.6985	0.3286
ʃ > ∅ / a: _ a	0.2106	0.2982	0.2106	0.2979	0.2105	0.2981	0.2106	0.2985
ʃ > j / a: _ a	0.1162	0.0000	0.1163	0.0000	0.1162	0.0000	0.1163	0.0000
ʃ > n / a: _ a	0.0775	0.0944	0.0776	0.0942	0.0773	0.0944	0.0776	0.0939
ʃ > h / a: _ a	0.2099	0.0756	0.2095	0.0756	0.2101	0.0757	0.2100	0.0756
ʃ > n / a: _ a	0.0515	0.0337	0.0516	0.0338	0.0518	0.0338	0.0515	0.0337
ʃ > s / a: _ a	0.3344	0.4981	0.3344	0.4985	0.3342	0.4980	0.3340	0.4984
r̥ > i / p _ s̥	0.4080	0.4812	0.4078	0.4815	0.4081	0.4817	0.4078	0.4827
r̥ > i: / p _ s̥	0.1736	0.4046	0.1738	0.4044	0.1737	0.4043	0.1740	0.4038
r̥ > u / p _ s̥	0.4184	0.1142	0.4184	0.1141	0.4183	0.1140	0.4182	0.1135
ʃ > f / # _ a:	0.1376	0.0134	0.1373	0.0134	0.1382	0.0134	0.1376	0.0134
ʃ > s / # _ a:	0.8624	0.8626	0.8627	0.8624	0.8618	0.8625	0.8624	0.8625
ʃ > x / # _ a:	0.0000	0.1240	0.0000	0.1242	0.0000	0.1240	0.0000	0.1240
r > ∅ / t _ a:	0.7070	0.9711	0.7074	0.9711	0.7072	0.9710	0.7068	0.9712
r > r / t _ a:	0.2930	0.0289	0.2926	0.0289	0.2928	0.0290	0.2932	0.0288
i: > i / b <sup>h</sup> _ r	0.2664	0.6455	0.2681	0.6465	0.2673	0.6452	0.2676	0.6455
i: > i: / b <sup>h</sup> _ r	0.7336	0.3545	0.7319	0.3535	0.7327	0.3548	0.7324	0.3545
i > ∅ / r _ k	0.2509	0.2595	0.2510	0.2592	0.2509	0.2593	0.2507	0.2596
i > i / r _ k	0.1925	0.5150	0.1925	0.5158	0.1928	0.5155	0.1927	0.5150
i > i: / r _ k	0.5566	0.2254	0.5564	0.2250	0.5563	0.2253	0.5567	0.2254
s > ∅ / # _ a	0.0036	0.0686	0.0036	0.0686	0.0036	0.0686	0.0036	0.0686
s > f / # _ a	0.0267	0.0016	0.0267	0.0017	0.0267	0.0017	0.0266	0.0017

s > c <sup>h</sup> / # _a	0.0092	0.0027	0.0092	0.0027	0.0092	0.0027	0.0092	0.0027
s > h / # _a	0.0027	0.0626	0.0027	0.0625	0.0027	0.0625	0.0027	0.0626
s > s / # _a	0.9578	0.7823	0.9578	0.7825	0.9578	0.7825	0.9579	0.7821
s > x / # _a	0.0000	0.0821	0.0000	0.0821	0.0000	0.0820	0.0000	0.0823
i > i / ŋ _k	0.4629	0.8291	0.4630	0.8287	0.4628	0.8289	0.4627	0.8294
i > i: / ŋ _k	0.5371	0.1709	0.5370	0.1713	0.5372	0.1711	0.5373	0.1706
ʃ > ʃ / # _v	0.2030	0.0000	0.2033	0.0000	0.2031	0.0000	0.2029	0.0000
ʃ > s / # _v	0.7970	1.0000	0.7967	1.0000	0.7969	1.0000	0.7971	1.0000
ʃ > h / a _a:	0.0475	0.3423	0.0481	0.3424	0.0479	0.3425	0.0479	0.3423
ʃ > s / a _a:	0.9525	0.6577	0.9519	0.6576	0.9521	0.6575	0.9521	0.6577
i: > i / t _j	0.3314	0.7172	0.3309	0.7159	0.3308	0.7152	0.3312	0.7175
i: > i: / t _j	0.6686	0.2828	0.6691	0.2841	0.6692	0.2848	0.6688	0.2825
ʂ > Ø / e _t	0.9769	0.7104	0.9762	0.7112	0.9757	0.7103	0.9768	0.7109
ʂ > n / e _t	0.0231	0.2896	0.0238	0.2888	0.0243	0.2897	0.0232	0.2891
u: > u / k _t	0.2442	0.6296	0.2434	0.6288	0.2445	0.6296	0.2445	0.6308
u: > u: / k _t	0.7558	0.3704	0.7566	0.3712	0.7555	0.3704	0.7555	0.3692
r > Ø / a _b <sup>h</sup>	0.6818	0.9684	0.6823	0.9686	0.6822	0.9684	0.6822	0.9683
r > b / a _b <sup>h</sup>	0.3182	0.0316	0.3177	0.0314	0.3178	0.0316	0.3178	0.0317
i: > i / s _m	0.4931	0.8629	0.4920	0.8601	0.4927	0.8602	0.4927	0.8610
i: > i: / s _m	0.5069	0.1371	0.5080	0.1399	0.5073	0.1398	0.5073	0.1390
u > o / g _p <sup>h</sup>	0.1238	0.4870	0.1239	0.4866	0.1245	0.4871	0.1240	0.4859
u > u / g _p <sup>h</sup>	0.8762	0.5130	0.8761	0.5134	0.8755	0.5129	0.8760	0.5141
i: > i / ʃ _r	0.1868	0.5722	0.1876	0.5741	0.1874	0.5731	0.1879	0.5725
i: > i: / ʃ _r	0.8132	0.4278	0.8124	0.4259	0.8126	0.4269	0.8121	0.4275
j > Ø / d <sup>h</sup> _a:	0.1482	0.5237	0.1475	0.5244	0.1469	0.5255	0.1466	0.5250
j > j <sup>h</sup> / d <sup>h</sup> _a:	0.8518	0.4763	0.8525	0.4756	0.8531	0.4745	0.8534	0.4750
u: > u / k _r	0.8703	0.5003	0.8705	0.4994	0.8700	0.5000	0.8705	0.5000
u: > u: / k _r	0.1297	0.4997	0.1295	0.5006	0.1300	0.5000	0.1295	0.5000
ʃ > Ø / # _a	0.0037	0.0456	0.0037	0.0456	0.0035	0.0458	0.0038	0.0456
ʃ > ʃ / # _a	0.1452	0.0159	0.1451	0.0159	0.1450	0.0159	0.1451	0.0159
ʃ > c <sup>h</sup> / # _a	0.0288	0.0324	0.0288	0.0328	0.0287	0.0326	0.0288	0.0325
ʃ > h / # _a	0.0000	0.0428	0.0000	0.0428	0.0000	0.0428	0.0000	0.0427
ʃ > s / # _a	0.8222	0.7704	0.8224	0.7700	0.8228	0.7703	0.8223	0.7704
ʃ > x / # _a	0.0000	0.0929	0.0000	0.0928	0.0000	0.0926	0.0000	0.0929
u > Ø / k _l	0.1669	0.0676	0.1668	0.0673	0.1666	0.0676	0.1672	0.0675
u > a / k _l	0.0927	0.0468	0.0926	0.0467	0.0926	0.0467	0.0926	0.0467
u > o / k _l	0.1498	0.0562	0.1500	0.0562	0.1497	0.0561	0.1495	0.0564
u > u / k _l	0.4221	0.8069	0.4224	0.8071	0.4224	0.8070	0.4219	0.8069
u > u: / k _l	0.1684	0.0226	0.1683	0.0226	0.1687	0.0226	0.1688	0.0226
l > l / i _a:	0.4520	0.8458	0.4532	0.8450	0.4522	0.8453	0.4534	0.8462
l > r / i _a:	0.5480	0.1542	0.5468	0.1550	0.5478	0.1547	0.5466	0.1538
i > e / n _j	0.6992	0.2839	0.6977	0.2830	0.6992	0.2834	0.6986	0.2843
i > i / n _j	0.3008	0.7161	0.3023	0.7170	0.3008	0.7166	0.3014	0.7157
j > Ø / d _a	0.2310	0.1982	0.2308	0.1984	0.2308	0.1981	0.2308	0.1984
j > j / d _a	0.7690	0.5559	0.7692	0.5564	0.7692	0.5566	0.7692	0.5566
j > d / d _a	0.0000	0.2459	0.0000	0.2452	0.0000	0.2452	0.0000	0.2449
i > i / l _n	0.3290	0.7564	0.3291	0.7568	0.3289	0.7571	0.3296	0.7569
i > i: / l _n	0.6710	0.2436	0.6709	0.2432	0.6711	0.2429	0.6704	0.2431
i > e / v _f	0.2574	0.0000	0.2567	0.0000	0.2569	0.0000	0.2574	0.0000
i > i / v _f	0.7426	1.0000	0.7433	1.0000	0.7431	1.0000	0.7426	1.0000
u > Ø / t _r	0.1964	0.0497	0.1960	0.0497	0.1961	0.0497	0.1964	0.0498
u > o / t _r	0.2056	0.0246	0.2059	0.0247	0.2057	0.0247	0.2054	0.0246
u > u / t _r	0.5385	0.9163	0.5387	0.9162	0.5387	0.9161	0.5388	0.9162
u > u: / t _r	0.0596	0.0094	0.0594	0.0094	0.0595	0.0095	0.0594	0.0094
i: > i / kʂ _r	0.2209	0.6622	0.2191	0.6621	0.2221	0.6624	0.2214	0.6622
i: > i: / kʂ _r	0.7791	0.3378	0.7809	0.3379	0.7779	0.3376	0.7786	0.3378
ʃ > ʃ / # _r	0.2666	0.0000	0.2672	0.0000	0.2664	0.0000	0.2662	0.0000
ʃ > s / # _r	0.7334	1.0000	0.7328	1.0000	0.7336	1.0000	0.7338	1.0000
i > Ø / l _t	0.6901	0.2461	0.6891	0.2456	0.6899	0.2451	0.6930	0.2451
i > i / l _t	0.3099	0.7539	0.3109	0.7544	0.3101	0.7549	0.3070	0.7549

ʃ > Ø / u _ a	0.3646	0.0554	0.3639	0.0552	0.3638	0.0558	0.3640	0.0552
ʃ > h / u _ a	0.2524	0.1437	0.2515	0.1447	0.2525	0.1429	0.2542	0.1406
ʃ > s / u _ a	0.3830	0.8008	0.3846	0.8001	0.3837	0.8013	0.3818	0.8042
ŋ > Ø / u _ d	0.1478	0.2675	0.1476	0.2678	0.1475	0.2679	0.1480	0.2676
ŋ > ŋ / u _ d	0.2856	0.0305	0.2852	0.0304	0.2855	0.0305	0.2853	0.0304
ŋ > ɳ / u _ d	0.2661	0.5628	0.2663	0.5627	0.2662	0.5626	0.2663	0.5626
ŋ > n / u _ d	0.3005	0.1393	0.3010	0.1391	0.3008	0.1390	0.3004	0.1394
r > Ø / d _ a	0.5407	0.9275	0.5412	0.9274	0.5417	0.9275	0.5401	0.9276
r > a / d _ a	0.0669	0.0000	0.0671	0.0000	0.0670	0.0000	0.0668	0.0000
r > l / d _ a	0.0818	0.0350	0.0816	0.0350	0.0817	0.0349	0.0819	0.0349
r > r / d _ a	0.3106	0.0375	0.3100	0.0376	0.3096	0.0376	0.3111	0.0375
u > Ø / r _ ʃ	0.2662	0.0937	0.2663	0.0933	0.2657	0.0938	0.2656	0.0940
u > u / r _ ʃ	0.7180	0.5663	0.7181	0.5658	0.7169	0.5647	0.7156	0.5685
u > u: / r _ ʃ	0.0158	0.3399	0.0156	0.3408	0.0174	0.3415	0.0188	0.3375
ɲ > Ø / a _ c	0.1130	0.1972	0.1130	0.1976	0.1130	0.1975	0.1128	0.1974
ɲ > ɲ / a _ c	0.4081	0.0364	0.4082	0.0365	0.4079	0.0364	0.4080	0.0363
ɲ > ɳ / a _ c	0.2603	0.4598	0.2601	0.4595	0.2602	0.4591	0.2608	0.4597
ɲ > i / a _ c	0.0101	0.0367	0.0101	0.0368	0.0103	0.0366	0.0101	0.0368
ɲ > n / a _ c	0.2084	0.2700	0.2086	0.2696	0.2087	0.2704	0.2082	0.2699
ʃ > Ø / r _ a	0.1969	0.0749	0.1974	0.0757	0.1976	0.0754	0.1974	0.0749
ʃ > h / r _ a	0.4049	0.0748	0.4051	0.0747	0.4046	0.0748	0.4043	0.0744
ʃ > s / r _ a	0.3982	0.8503	0.3975	0.8496	0.3977	0.8498	0.3984	0.8507
i > a / k _ r	0.3045	0.0000	0.3042	0.0000	0.3045	0.0000	0.3046	0.0000
i > i / k _ r	0.6955	1.0000	0.6958	1.0000	0.6955	1.0000	0.6954	1.0000
r > Ø / d _ a:	0.5450	0.9325	0.5458	0.9326	0.5452	0.9326	0.5450	0.9324
r > a / d _ a:	0.1578	0.0000	0.1574	0.0000	0.1580	0.0000	0.1578	0.0000
r > r / d _ a:	0.2972	0.0675	0.2968	0.0674	0.2968	0.0674	0.2972	0.0676
ɲ > ɲ / u _ j	0.4892	0.0698	0.4891	0.0700	0.4895	0.0694	0.4896	0.0694
ɲ > ɳ / u _ j	0.5108	0.9302	0.5109	0.9300	0.5105	0.9306	0.5104	0.9306
u > a / d _ r	0.2914	0.0130	0.2898	0.0130	0.2911	0.0127	0.2902	0.0130
u > u / d _ r	0.4474	0.8486	0.4485	0.8495	0.4475	0.8495	0.4483	0.8488
u > u: / d _ r	0.2612	0.1384	0.2617	0.1375	0.2615	0.1378	0.2615	0.1382
i > i / h _ ŋ	0.8427	0.3771	0.8424	0.3747	0.8410	0.3758	0.8416	0.3763
i > i: / h _ ŋ	0.1573	0.6229	0.1576	0.6253	0.1590	0.6242	0.1584	0.6237
h > Ø / a _ u	0.4166	0.0330	0.4174	0.0332	0.4165	0.0342	0.4170	0.0339
h > h / a _ u	0.5834	0.9670	0.5826	0.9668	0.5835	0.9658	0.5830	0.9661
s > ʃ / # _ i	0.2233	0.0000	0.2235	0.0000	0.2235	0.0001	0.2234	0.0000
s > s / # _ i	0.7767	0.8788	0.7765	0.8787	0.7765	0.8787	0.7766	0.8788
s > x / # _ i	0.0000	0.1212	0.0000	0.1213	0.0000	0.1212	0.0000	0.1212
u > Ø / ʃ _ r	0.5370	0.0952	0.5358	0.0951	0.5369	0.0946	0.5368	0.0949
u > u / ʃ _ r	0.4630	0.9048	0.4642	0.9049	0.4631	0.9054	0.4632	0.9051
ɾ > Ø / m _ t	0.3124	0.2061	0.3113	0.2063	0.3123	0.2061	0.3123	0.2065
ɾ > a / m _ t	0.0595	0.3514	0.0585	0.3514	0.0590	0.3519	0.0591	0.3518
ɾ > a: / m _ t	0.1727	0.2762	0.1731	0.2755	0.1729	0.2762	0.1732	0.2757
ɾ > i / m _ t	0.2804	0.0351	0.2805	0.0354	0.2805	0.0348	0.2804	0.0348
ɾ > u / m _ t	0.1750	0.1312	0.1765	0.1315	0.1753	0.1310	0.1750	0.1313
i > Ø / g _ n	0.4901	0.1841	0.4912	0.1848	0.4908	0.1837	0.4906	0.1840
i > e / g _ n	0.2763	0.0919	0.2758	0.0917	0.2761	0.0923	0.2764	0.0918
i > i / g _ n	0.2335	0.7240	0.2330	0.7235	0.2331	0.7239	0.2329	0.7242
ɲ > Ø / a _ j	0.0626	0.2457	0.0626	0.2457	0.0626	0.2456	0.0626	0.2456
ɲ > ɲ / a _ j	0.4035	0.1073	0.4022	0.1075	0.4021	0.1076	0.4029	0.1076
ɲ > ɳ / a _ j	0.5339	0.4938	0.5352	0.4935	0.5353	0.4938	0.5345	0.4935
ɲ > n / a _ j	0.0000	0.1532	0.0000	0.1533	0.0000	0.1531	0.0000	0.1532
j > Ø / t _ a	0.3233	0.3382	0.3223	0.3384	0.3233	0.3383	0.3232	0.3387
j > c / t _ a	0.5593	0.2383	0.5605	0.2379	0.5603	0.2378	0.5606	0.2380
j > j / t _ a	0.1174	0.1474	0.1172	0.1469	0.1164	0.1469	0.1163	0.1478
j > s / t _ a	0.0000	0.2761	0.0000	0.2768	0.0000	0.2769	0.0000	0.2756
i > Ø / r _ v	0.8409	0.3542	0.8411	0.3543	0.8409	0.3540	0.8411	0.3544
i > e / r _ v	0.0872	0.2957	0.0872	0.2951	0.0876	0.2948	0.0870	0.2951
i > i / r _ v	0.0719	0.3500	0.0717	0.3506	0.0715	0.3512	0.0719	0.3506



i > ∅ / k <sub>s</sub> _ k	0.3958	0.8773	0.3942	0.8776	0.3949	0.8778	0.3951	0.8776
i > i: / k <sub>s</sub> _ k	0.6042	0.1227	0.6058	0.1224	0.6051	0.1222	0.6049	0.1224
r > ∅ / g _ a:	0.6606	1.0000	0.6612	1.0000	0.6603	1.0000	0.6613	1.0000
r > r / g _ a:	0.3394	0.0000	0.3388	0.0000	0.3397	0.0000	0.3387	0.0000
n > ∅ / a _ t	0.1175	0.4238	0.1177	0.4242	0.1176	0.4246	0.1175	0.4235
n > n <sub>l</sub> / a _ t	0.0556	0.0000	0.0551	0.0000	0.0550	0.0000	0.0551	0.0000
n > n / a _ t	0.3135	0.4532	0.3140	0.4528	0.3141	0.4529	0.3136	0.4533
n > n / a _ t	0.5133	0.1230	0.5132	0.1229	0.5132	0.1225	0.5138	0.1231
u > u / m _ k <sup>h</sup>	0.6578	1.0000	0.6583	1.0000	0.6583	1.0000	0.6596	1.0000
u > u: / m _ k <sup>h</sup>	0.3422	0.0000	0.3417	0.0000	0.3417	0.0000	0.3404	0.0000
i: > i / c _ r	0.1272	0.6178	0.1283	0.6182	0.1282	0.6172	0.1269	0.6167
i: > i: / c _ r	0.8728	0.3822	0.8717	0.3818	0.8718	0.3828	0.8731	0.3833
ɸ > ɸ / # _ r	0.2305	0.0000	0.2308	0.0000	0.2307	0.0000	0.2305	0.0000
ɸ > s / # _ r	0.7695	0.8331	0.7692	0.8328	0.7693	0.8328	0.7695	0.8326
ɸ > x / # _ r	0.0000	0.1669	0.0000	0.1672	0.0000	0.1672	0.0000	0.1674
j > j / # _ a:	1.0000	0.6504	1.0000	0.6512	1.0000	0.6510	1.0000	0.6509
j > j / # _ a:	0.0000	0.3496	0.0000	0.3488	0.0000	0.3490	0.0000	0.3491
s > ∅ / u _ t	0.6559	0.8469	0.6560	0.8472	0.6558	0.8472	0.6554	0.8472
s > t / u _ t	0.3169	0.0000	0.3166	0.0000	0.3168	0.0000	0.3170	0.0000
s > n / u _ t	0.0272	0.1531	0.0274	0.1528	0.0274	0.1528	0.0276	0.1528
i > ∅ / t _ s	0.6225	0.1233	0.6222	0.1233	0.6204	0.1237	0.6219	0.1238
i > a: / t _ s	0.1423	0.3754	0.1420	0.3745	0.1433	0.3746	0.1427	0.3744
i > i / t _ s	0.2352	0.5013	0.2358	0.5022	0.2363	0.5017	0.2354	0.5018
i > i / v _ n	0.1689	0.6940	0.1690	0.6941	0.1688	0.6938	0.1691	0.6936
i > i: / v _ n	0.8311	0.3060	0.8310	0.3059	0.8312	0.3062	0.8309	0.3064
i > ∅ / r _ j	0.2522	0.1225	0.2527	0.1230	0.2522	0.1218	0.2517	0.1228
i > i / r _ j	0.1522	0.6708	0.1526	0.6714	0.1522	0.6718	0.1525	0.6713
i > i: / r _ j	0.5956	0.2067	0.5947	0.2056	0.5955	0.2064	0.5957	0.2059
ɸ > ɸ / # _ i:	0.5010	0.0421	0.5007	0.0423	0.5015	0.0424	0.5014	0.0424
ɸ > s / # _ i:	0.4990	0.9579	0.4993	0.9577	0.4985	0.9576	0.4986	0.9576
n <sub>l</sub> > ∅ / a _ t	0.0552	0.2082	0.0552	0.2087	0.0551	0.2083	0.0552	0.2081
n <sub>l</sub> > n <sub>l</sub> / a _ t	0.5770	0.0872	0.5770	0.0868	0.5770	0.0871	0.5769	0.0868
n <sub>l</sub> > n / a _ t	0.3678	0.7046	0.3678	0.7045	0.3679	0.7046	0.3679	0.7051
i > ∅ / r _ n <sub>l</sub>	0.4465	0.6979	0.4461	0.6975	0.4452	0.6985	0.4464	0.6977
i > a / r _ n <sub>l</sub>	0.3850	0.0000	0.3859	0.0000	0.3863	0.0000	0.3851	0.0000
i > i / r _ n <sub>l</sub>	0.1685	0.3021	0.1681	0.3025	0.1685	0.3015	0.1685	0.3023
k <sub>s</sub> > n / a _ a	0.0347	0.0879	0.0347	0.0876	0.0347	0.0877	0.0346	0.0877
k <sub>s</sub> > c <sup>h</sup> / a _ a	0.0674	0.0000	0.0674	0.0000	0.0672	0.0000	0.0674	0.0000
k <sub>s</sub> > k / a _ a	0.0076	0.3345	0.0078	0.3341	0.0074	0.3343	0.0077	0.3347
k <sub>s</sub> > k / a _ a	0.1197	0.0206	0.1200	0.0207	0.1198	0.0207	0.1197	0.0207
k <sub>s</sub> > k <sup>h</sup> / a _ a	0.7236	0.5176	0.7230	0.5183	0.7236	0.5180	0.7235	0.5175
k <sub>s</sub> > s / a _ a	0.0471	0.0394	0.0471	0.0393	0.0473	0.0394	0.0471	0.0394
r > ∅ / t _ i	0.3219	0.8147	0.3222	0.8146	0.3224	0.8144	0.3215	0.8144
r > a / t _ i	0.0735	0.0000	0.0736	0.0000	0.0738	0.0000	0.0736	0.0000
r > r / t _ i	0.5839	0.1363	0.5835	0.1365	0.5831	0.1365	0.5841	0.1367
r > t / t _ i	0.0207	0.0490	0.0207	0.0489	0.0208	0.0490	0.0208	0.0489
ɸ > ɸ / # _ i	0.3305	0.0058	0.3299	0.0058	0.3302	0.0058	0.3301	0.0058
ɸ > c <sup>h</sup> / # _ i	0.0811	0.0606	0.0810	0.0606	0.0814	0.0606	0.0810	0.0606
ɸ > s / # _ i	0.5884	0.7889	0.5891	0.7886	0.5884	0.7887	0.5888	0.7886
ɸ > x / # _ i	0.0000	0.1448	0.0000	0.1451	0.0000	0.1449	0.0000	0.1451
k <sub>s</sub> > n / a _ i	0.0474	0.4812	0.0474	0.4820	0.0471	0.4823	0.0470	0.4815
k <sub>s</sub> > k / a _ i	0.2284	0.2621	0.2283	0.2621	0.2293	0.2610	0.2288	0.2625
k <sub>s</sub> > k <sup>h</sup> / a _ i	0.7243	0.2568	0.7244	0.2559	0.7236	0.2567	0.7242	0.2560
u: > u / d <sup>h</sup> _ n	0.4393	0.9402	0.4376	0.9400	0.4377	0.9399	0.4389	0.9401
u: > u: / d <sup>h</sup> _ n	0.5607	0.0598	0.5624	0.0600	0.5623	0.0601	0.5611	0.0599
i: > i / n _ l	0.1024	0.6416	0.1024	0.6415	0.1025	0.6413	0.1025	0.6414
i: > i: / n _ l	0.8976	0.3584	0.8976	0.3585	0.8975	0.3587	0.8975	0.3586
l > l / i: _ a	0.2907	0.0000	0.2905	0.0000	0.2906	0.0000	0.2906	0.0000
l > l / i: _ a	0.5222	0.9730	0.5218	0.9731	0.5219	0.9730	0.5223	0.9731

l > r / i: _a	0.1871	0.0270	0.1877	0.0269	0.1875	0.0270	0.1871	0.0269
j > j / d <sup>h</sup> _a	0.4145	0.0617	0.4148	0.0615	0.4140	0.0615	0.4142	0.0615
j > j <sup>fi</sup> / d <sup>fi</sup> _a	0.5855	0.6570	0.5852	0.6578	0.5860	0.6577	0.5858	0.6573
j > d / d <sup>fi</sup> _a	0.0000	0.2813	0.0000	0.2807	0.0000	0.2808	0.0000	0.2812
r > Ø / d _o	0.5813	1.0000	0.5818	1.0000	0.5811	1.0000	0.5808	1.0000
r > r / d _o	0.4187	0.0000	0.4182	0.0000	0.4189	0.0000	0.4192	0.0000
ɲ > Ø / u _c	0.1322	0.3851	0.1328	0.3821	0.1329	0.3853	0.1322	0.3826
ɲ > ɲ / u _c	0.5819	0.0557	0.5803	0.0564	0.5806	0.0559	0.5812	0.0561
ɲ > n / u _c	0.2859	0.5592	0.2869	0.5615	0.2866	0.5588	0.2866	0.5613
i > i / r _N	0.1546	0.7343	0.1541	0.7338	0.1543	0.7344	0.1546	0.7339
i > i: / r _N	0.8454	0.2657	0.8459	0.2662	0.8457	0.2656	0.8454	0.2661
ɲ > ɲ / i _d	0.2681	0.2484	0.2683	0.2483	0.2676	0.2484	0.2691	0.2485
ɲ > n / i _d	0.3255	0.7516	0.3257	0.7517	0.3258	0.7516	0.3249	0.7515
ɲ > n / i _d	0.4064	0.0000	0.4060	0.0000	0.4066	0.0000	0.4059	0.0000
l > Ø / u: _a	0.0496	0.0773	0.0500	0.0774	0.0499	0.0775	0.0493	0.0776
l > l / u: _a	0.4374	0.0000	0.4364	0.0000	0.4366	0.0000	0.4373	0.0000
l > l / u: _a	0.3407	0.7369	0.3404	0.7366	0.3402	0.7367	0.3399	0.7371
l > r / u: _a	0.1723	0.1858	0.1732	0.1861	0.1733	0.1857	0.1735	0.1853
l > l / i _a	0.2477	0.0000	0.2480	0.0000	0.2480	0.0000	0.2479	0.0000
l > l / i _a	0.4899	0.9648	0.4902	0.9646	0.4907	0.9647	0.4897	0.9649
l > l / i _a	0.0923	0.0352	0.0921	0.0354	0.0920	0.0353	0.0924	0.0351
l > r / i _a	0.1700	0.0000	0.1697	0.0000	0.1694	0.0000	0.1700	0.0000
r > Ø / t _a	0.4278	0.9240	0.4271	0.9241	0.4271	0.9239	0.4277	0.9239
r > l / t _a	0.0480	0.0000	0.0480	0.0000	0.0481	0.0000	0.0481	0.0000
r > a / t _a	0.1005	0.0033	0.1007	0.0033	0.1007	0.0033	0.1005	0.0033
r > e / t _a	0.0277	0.0225	0.0278	0.0223	0.0277	0.0224	0.0277	0.0222
r > i / t _a	0.0133	0.0221	0.0133	0.0221	0.0134	0.0221	0.0134	0.0221
r > l / t _a	0.0090	0.0094	0.0090	0.0094	0.0090	0.0094	0.0091	0.0094
r > r / t _a	0.3000	0.0093	0.3004	0.0093	0.3004	0.0093	0.3001	0.0093
r > t / t _a	0.0611	0.0069	0.0611	0.0069	0.0611	0.0070	0.0611	0.0070
r > u / t _a	0.0125	0.0027	0.0125	0.0027	0.0125	0.0027	0.0125	0.0027
i: > e / p _d	0.0445	0.3820	0.0465	0.3799	0.0446	0.3824	0.0452	0.3821
i: > i / p _d	0.3074	0.5152	0.3056	0.5168	0.3061	0.5147	0.3060	0.5154
i: > i: / p _d	0.6480	0.1029	0.6479	0.1032	0.6493	0.1029	0.6488	0.1026
l > Ø / a _a:	0.0278	0.0623	0.0277	0.0624	0.0277	0.0623	0.0278	0.0623
l > l / a _a:	0.4730	0.0000	0.4736	0.0000	0.4736	0.0000	0.4729	0.0000
l > l / a _a:	0.3884	0.7610	0.3878	0.7609	0.3880	0.7611	0.3881	0.7611
l > r / a _a:	0.1108	0.1767	0.1109	0.1767	0.1107	0.1766	0.1112	0.1766
u > o / t _n	0.0970	0.6956	0.0970	0.6961	0.0964	0.6935	0.0970	0.6959
u > u / t _n	0.9030	0.3044	0.9030	0.3039	0.9036	0.3065	0.9030	0.3041
l > l / o _a	0.4695	0.0000	0.4695	0.0000	0.4700	0.0000	0.4693	0.0000
l > l / o _a	0.4007	0.8556	0.4012	0.8554	0.4003	0.8558	0.4010	0.8556
l > r / o _a	0.1298	0.1444	0.1292	0.1446	0.1298	0.1442	0.1297	0.1444
u > Ø / n _ɕ	0.2051	0.2107	0.2060	0.2108	0.2053	0.2110	0.2049	0.2102
u > i / n _ɕ	0.0583	0.5167	0.0581	0.5160	0.0592	0.5163	0.0589	0.5174
u > u / n _ɕ	0.2559	0.2218	0.2555	0.2222	0.2552	0.2215	0.2550	0.2224
u > u: / n _ɕ	0.4807	0.0509	0.4804	0.0511	0.4804	0.0512	0.4812	0.0500
n > ɲ / a _a:	0.4849	0.0000	0.4844	0.0000	0.4844	0.0000	0.4848	0.0000
n > n / a _a:	0.5151	1.0000	0.5156	1.0000	0.5156	1.0000	0.5152	1.0000
u > Ø / m _k	0.7274	0.1230	0.7270	0.1238	0.7263	0.1230	0.7276	0.1226
u > a / m _k	0.1172	0.5283	0.1182	0.5270	0.1175	0.5277	0.1173	0.5283
u > u / m _k	0.1554	0.3487	0.1548	0.3492	0.1561	0.3493	0.1551	0.3490
ɲ > ɲ / a _i:	0.9020	0.2935	0.9010	0.2941	0.9016	0.2932	0.9015	0.2936
ɲ > n / a _i:	0.0980	0.7065	0.0990	0.7059	0.0984	0.7068	0.0985	0.7064
ɲ > Ø / a: _j	0.0000	0.4960	0.0000	0.4964	0.0000	0.4962	0.0000	0.4968
ɲ > n / a: _j	0.6766	0.3620	0.6763	0.3621	0.6763	0.3618	0.6764	0.3621
ɲ > n / a: _j	0.3234	0.1420	0.3237	0.1415	0.3237	0.1420	0.3235	0.1411
ʃ > Ø / n _a	0.3744	0.0061	0.3742	0.0062	0.3741	0.0062	0.3744	0.0061
ʃ > ʃ / n _a	0.0572	0.0168	0.0571	0.0168	0.0571	0.0169	0.0572	0.0168
ʃ > h / n _a	0.1944	0.0579	0.1944	0.0577	0.1944	0.0577	0.1946	0.0578

$\int > s / \_N \_a$	0.3741	0.8289	0.3743	0.8290	0.3745	0.8288	0.3739	0.8290
$\int > x / \_N \_a$	0.0000	0.0902	0.0000	0.0903	0.0000	0.0905	0.0000	0.0902
$l > \_l / \_e \_a$	0.6238	0.0422	0.6232	0.0426	0.6237	0.0412	0.6231	0.0430
$l > l / \_e \_a$	0.3762	0.9578	0.3768	0.9574	0.3763	0.9588	0.3769	0.9570
$n > \emptyset / \_a \_t^h$	0.1320	0.3864	0.1321	0.3863	0.1317	0.3852	0.1323	0.3863
$n > \_n / \_a \_t^h$	0.2499	0.0000	0.2498	0.0001	0.2499	0.0000	0.2494	0.0000
$n > \_N / \_a \_t^h$	0.2703	0.5846	0.2706	0.5846	0.2708	0.5858	0.2707	0.5847
$n > n / \_a \_t^h$	0.3477	0.0290	0.3474	0.0290	0.3476	0.0290	0.3475	0.0290
$l > \_l / \_e \_a:$	0.5418	0.0000	0.5403	0.0000	0.5408	0.0000	0.5397	0.0000
$l > l / \_e \_a:$	0.2030	0.3839	0.2041	0.3832	0.2034	0.3839	0.2042	0.3821
$l > r / \_e \_a:$	0.2552	0.6161	0.2556	0.6168	0.2559	0.6161	0.2561	0.6179
$l > \emptyset / \_a: \_a$	0.0500	0.0109	0.0501	0.0109	0.0501	0.0109	0.0500	0.0110
$l > v / \_a: \_a$	0.0303	0.0000	0.0302	0.0000	0.0304	0.0000	0.0303	0.0000
$l > \_l / \_a: \_a$	0.4807	0.0000	0.4806	0.0000	0.4806	0.0000	0.4805	0.0000
$l > l / \_a: \_a$	0.3027	0.7959	0.3029	0.7960	0.3028	0.7961	0.3028	0.7957
$l > r / \_a: \_a$	0.1363	0.1932	0.1361	0.1931	0.1361	0.1930	0.1364	0.1933
$l > \emptyset / \_a \_i$	0.1563	0.0307	0.1563	0.0306	0.1562	0.0305	0.1563	0.0306
$l > \_l / \_a \_i$	0.4266	0.0000	0.4271	0.0000	0.4268	0.0000	0.4266	0.0000
$l > l / \_a \_i$	0.2895	0.8570	0.2889	0.8571	0.2894	0.8572	0.2896	0.8570
$l > r / \_a \_i$	0.1276	0.1124	0.1278	0.1123	0.1276	0.1123	0.1275	0.1124
$l > \_l / \_u \_a$	0.6083	0.0175	0.6078	0.0176	0.6079	0.0177	0.6085	0.0177
$l > l / \_u \_a$	0.2760	0.8008	0.2762	0.8008	0.2764	0.8007	0.2760	0.8004
$l > r / \_u \_a$	0.1156	0.1817	0.1160	0.1816	0.1157	0.1817	0.1155	0.1819
$l > \_l / \_a: \_i$	0.5494	0.0000	0.5490	0.0000	0.5491	0.0000	0.5500	0.0001
$l > l / \_a: \_i$	0.2935	0.8220	0.2936	0.8230	0.2939	0.8220	0.2936	0.8226
$l > r / \_a: \_i$	0.1571	0.1780	0.1574	0.1770	0.1571	0.1780	0.1564	0.1773
$l > \emptyset / \_a \_a$	0.0126	0.0190	0.0127	0.0190	0.0126	0.0190	0.0126	0.0190
$l > v / \_a \_a$	0.0280	0.0000	0.0280	0.0000	0.0280	0.0000	0.0280	0.0000
$l > \_l / \_a \_a$	0.5078	0.0000	0.5076	0.0000	0.5078	0.0000	0.5080	0.0000
$l > \_r / \_a \_a$	0.0093	0.0070	0.0094	0.0070	0.0094	0.0070	0.0093	0.0070
$l > l / \_a \_a$	0.2921	0.8269	0.2920	0.8271	0.2921	0.8270	0.2919	0.8266
$l > l / \_a \_a$	0.0101	0.0128	0.0102	0.0128	0.0102	0.0128	0.0101	0.0128
$l > n / \_a \_a$	0.0000	0.0137	0.0000	0.0137	0.0000	0.0136	0.0000	0.0137
$l > r / \_a \_a$	0.1401	0.1206	0.1402	0.1204	0.1400	0.1206	0.1401	0.1208
$l > \_l / \_a \_i:$	0.5790	0.0000	0.5783	0.0000	0.5789	0.0000	0.5781	0.0000
$l > l / \_a \_i:$	0.3445	0.8489	0.3450	0.8490	0.3446	0.8489	0.3453	0.8491
$l > r / \_a \_i:$	0.0766	0.1510	0.0767	0.1510	0.0765	0.1511	0.0766	0.1509
$s > \emptyset / \_a \_m$	0.4240	0.1362	0.4250	0.1356	0.4251	0.1360	0.4241	0.1361
$s > h / \_a \_m$	0.0000	0.5866	0.0000	0.5871	0.0000	0.5871	0.0001	0.5869
$s > s / \_a \_m$	0.5760	0.2772	0.5750	0.2773	0.5748	0.2770	0.5758	0.2770
$l > \_l / \_a: \_i:$	0.5785	0.0001	0.5768	0.0001	0.5791	0.0000	0.5794	0.0000
$l > l / \_a: \_i:$	0.3226	0.6058	0.3246	0.6053	0.3227	0.6054	0.3238	0.6046
$l > r / \_a: \_i:$	0.0989	0.3941	0.0986	0.3946	0.0982	0.3946	0.0968	0.3954
$l > \_l / \_a: \_a:$	0.5950	0.0000	0.5946	0.0000	0.5942	0.0000	0.5948	0.0000
$l > l / \_a: \_a:$	0.4050	1.0000	0.4054	1.0000	0.4058	1.0000	0.4052	1.0000
$l > \_l / \_u \_i$	0.6071	0.0000	0.6071	0.0000	0.6071	0.0000	0.6085	0.0000
$l > l / \_u \_i$	0.2455	0.8387	0.2453	0.8389	0.2447	0.8389	0.2438	0.8387
$l > r / \_u \_i$	0.1473	0.1613	0.1476	0.1611	0.1482	0.1611	0.1476	0.1613
$\_n > \_n / \_o \_a$	0.9199	0.1849	0.9197	0.1848	0.9203	0.1854	0.9197	0.1852
$\_n > n / \_o \_a$	0.0801	0.8151	0.0803	0.8152	0.0797	0.8146	0.0803	0.8148
$\_n > \_n / \_u \_a$	0.9731	0.2549	0.9739	0.2545	0.9728	0.2549	0.9731	0.2548
$\_n > n / \_u \_a$	0.0269	0.7451	0.0261	0.7455	0.0272	0.7451	0.0269	0.7452
$\_n > \_n / \_i \_a$	0.8392	0.0865	0.8387	0.0862	0.8388	0.0861	0.8382	0.0865
$\_n > n / \_i \_a$	0.1608	0.9135	0.1613	0.9138	0.1612	0.9139	0.1618	0.9135
$l > \_l / \_a: \_u$	0.6639	0.0000	0.6649	0.0001	0.6643	0.0000	0.6642	0.0000
$l > l / \_a: \_u$	0.2319	0.8545	0.2312	0.8547	0.2316	0.8550	0.2319	0.8548
$l > r / \_a: \_u$	0.1041	0.1455	0.1040	0.1452	0.1040	0.1450	0.1039	0.1452
$n > \_n / \_u: \_a$	0.6825	0.0000	0.6818	0.0000	0.6820	0.0000	0.6824	0.0000
$n > n / \_u: \_a$	0.3175	1.0000	0.3182	1.0000	0.3180	1.0000	0.3176	1.0000
$\_n > \_n / \_u \_t^h$	0.7110	0.0000	0.7103	0.0000	0.7106	0.0000	0.7104	0.0011

$\eta_l > n / u \text{ } \underline{t^h}$	0.2890	1.0000	0.2897	1.0000	0.2894	1.0000	0.2896	0.9989
$\eta_l > \eta_l / a: \text{ } \underline{a}$	0.9769	0.2153	0.9767	0.2151	0.9771	0.2155	0.9768	0.2154
$\eta_l > n / a: \text{ } \underline{a}$	0.0231	0.7847	0.0233	0.7849	0.0229	0.7845	0.0232	0.7846
$n > \eta_l / e \text{ } \underline{a}$	0.8868	0.0642	0.8866	0.0647	0.8873	0.0646	0.8868	0.0647
$n > n / e \text{ } \underline{a}$	0.1132	0.9358	0.1134	0.9353	0.1127	0.9354	0.1132	0.9353
$\eta_l > \eta_l / a \text{ } \underline{i}$	0.9642	0.1316	0.9640	0.1314	0.9639	0.1313	0.9641	0.1315
$\eta_l > n / a \text{ } \underline{i}$	0.0358	0.8684	0.0360	0.8686	0.0361	0.8687	0.0359	0.8685
$l > l / u \text{ } \underline{u}$	0.8012	0.0000	0.8000	0.0000	0.8005	0.0002	0.8007	0.0000
$l > l / u \text{ } \underline{u}$	0.1988	1.0000	0.2000	1.0000	0.1995	0.9998	0.1993	1.0000
$\eta_l > \emptyset / a \text{ } \underline{a}$	0.0125	0.0052	0.0125	0.0051	0.0124	0.0052	0.0125	0.0051
$\eta_l > \eta_l / a \text{ } \underline{a}$	0.9211	0.1911	0.9209	0.1910	0.9210	0.1910	0.9210	0.1910
$\eta_l > n / a \text{ } \underline{a}$	0.0665	0.0000	0.0666	0.0000	0.0666	0.0000	0.0665	0.0000
$\eta_l > n / a \text{ } \underline{a}$	0.0000	0.8037	0.0000	0.8038	0.0000	0.8039	0.0000	0.8038
$n > \eta_l / i \text{ } \underline{a}$	0.8190	0.0000	0.8192	0.0000	0.8191	0.0000	0.8198	0.0000
$n > n / i \text{ } \underline{a}$	0.1810	1.0000	0.1808	1.0000	0.1809	1.0000	0.1802	1.0000
$n > \eta_l / i: \text{ } \underline{a}$	0.8514	0.0000	0.8517	0.0000	0.8521	0.0001	0.8519	0.0000
$n > n / i: \text{ } \underline{a}$	0.1486	1.0000	0.1483	1.0000	0.1479	0.9999	0.1481	1.0000
$n > \eta_l / a: \text{ } \underline{i}$	0.8584	0.0003	0.8587	0.0000	0.8593	0.0000	0.8588	0.0000
$n > n / a: \text{ } \underline{i}$	0.1416	0.9997	0.1413	1.0000	0.1407	1.0000	0.1412	1.0000
$n > \eta_l / a \text{ } \underline{u}$	0.8639	0.0000	0.8646	0.0000	0.8625	0.0000	0.8628	0.0000
$n > n / a \text{ } \underline{u}$	0.1361	1.0000	0.1354	1.0000	0.1375	1.0000	0.1372	1.0000
$\eta_l > \eta_l / i \text{ } \underline{i}$	1.0000	0.1270	1.0000	0.1273	1.0000	0.1263	1.0000	0.1274
$\eta_l > n / i \text{ } \underline{i}$	0.0000	0.8730	0.0000	0.8727	0.0000	0.8737	0.0000	0.8726
$n > \eta_l / i \text{ } \underline{i}$	0.8746	0.0000	0.8746	0.0000	0.8746	0.0000	0.8748	0.0001
$n > n / i \text{ } \underline{i}$	0.1254	1.0000	0.1254	1.0000	0.1254	1.0000	0.1252	0.9999
$n > \eta_l / u \text{ } \underline{a}$	0.9742	0.0580	0.9739	0.0580	0.9741	0.0582	0.9740	0.0580
$n > n / u \text{ } \underline{a}$	0.0258	0.9420	0.0261	0.9420	0.0259	0.9418	0.0260	0.9420
$n > \eta_l / a: \text{ } \underline{i}$	0.7434	0.0000	0.7425	0.0000	0.7424	0.0002	0.7431	0.0000
$n > \eta_l / a: \text{ } \underline{i}$	0.2566	0.1878	0.2575	0.1880	0.2576	0.1885	0.2569	0.1879
$n > n / a: \text{ } \underline{i}$	0.0000	0.8122	0.0000	0.8120	0.0000	0.8113	0.0000	0.8121
$\eta_l > \eta_l / a: \text{ } \underline{i}$	1.0000	0.0838	1.0000	0.0844	1.0000	0.0837	1.0000	0.0837
$\eta_l > n / a: \text{ } \underline{i}$	0.0000	0.9162	0.0000	0.9156	0.0000	0.9163	0.0000	0.9163
$n > \eta_l / o \text{ } \underline{a}$	0.9229	0.0001	0.9228	0.0000	0.9225	0.0000	0.9229	0.0001
$n > n / o \text{ } \underline{a}$	0.0771	0.9999	0.0772	1.0000	0.0775	1.0000	0.0771	0.9999
$n > \eta_l / a \text{ } \underline{i}$	0.9368	0.0000	0.9365	0.0000	0.9366	0.0000	0.9364	0.0000
$n > n / a \text{ } \underline{i}$	0.0632	1.0000	0.0635	1.0000	0.0634	1.0000	0.0636	1.0000
$n > \eta_l / a: \text{ } \underline{a}$	0.9360	0.0070	0.9360	0.0070	0.9362	0.0070	0.9360	0.0071
$n > n / a: \text{ } \underline{a}$	0.0284	0.0251	0.0285	0.0250	0.0284	0.0250	0.0285	0.0251
$n > n / a: \text{ } \underline{a}$	0.0356	0.9679	0.0356	0.9680	0.0354	0.9680	0.0356	0.9678
$n > \emptyset / a \text{ } \underline{a}$	0.0063	0.0046	0.0063	0.0046	0.0062	0.0046	0.0063	0.0046
$n > \eta_l / a \text{ } \underline{a}$	0.8836	0.0000	0.8836	0.0000	0.8837	0.0000	0.8836	0.0000
$n > n / a \text{ } \underline{a}$	0.0671	0.0049	0.0671	0.0049	0.0670	0.0049	0.0670	0.0049
$n > n / a \text{ } \underline{a}$	0.0430	0.9905	0.0430	0.9905	0.0430	0.9905	0.0431	0.9906
$\eta_l > \eta_l / r \text{ } \underline{a}$	1.0000	0.0381	1.0000	0.0378	1.0000	0.0383	1.0000	0.0380
$\eta_l > n / r \text{ } \underline{a}$	0.0000	0.9619	0.0000	0.9622	0.0000	0.9617	0.0000	0.9620
$\eta_l > \eta_l / a: \text{ } \underline{a}$	0.9817	0.0000	0.9812	0.0001	0.9830	0.0000	0.9781	0.0000
$\eta_l > n / a: \text{ } \underline{a}$	0.0183	1.0000	0.0188	0.9999	0.0170	1.0000	0.0219	1.0000
$n > \eta_l / i \text{ } \underline{a:}$	0.9984	0.0000	0.9995	0.0000	0.9994	0.0000	0.9996	0.0000
$n > n / i \text{ } \underline{a:}$	0.0016	1.0000	0.0005	1.0000	0.0006	1.0000	0.0004	1.0000
$n > \eta_l / a \text{ } \underline{i:}$	1.0000	0.0002	1.0000	0.0003	1.0000	0.0005	1.0000	0.0002
$n > n / a \text{ } \underline{i:}$	0.0000	0.9998	0.0000	0.9997	0.0000	0.9995	0.0000	0.9998
$n > \eta_l / a: \text{ } \underline{a:}$	1.0000	0.0001	1.0000	0.0000	1.0000	0.0000	1.0000	0.0000
$n > n / a: \text{ } \underline{a:}$	0.0000	0.9999	0.0000	1.0000	0.0000	1.0000	0.0000	1.0000

## 10.1 Logistic normal model sound change probabilities

change	initialization 1		initialization 2		initialization 3		initialization 4	
	$k = 0$	$k = 1$	$k = 0$	$k = 1$	$k = 0$	$k = 1$	$k = 0$	$k = 1$

i > i / n _ d	0.6606	0.6617	0.6625	0.6606	0.6639	0.6607	0.6607	0.6623
i > i: / n _ d	0.3394	0.3383	0.3375	0.3394	0.3361	0.3393	0.3393	0.3377
h > ∅ / a _ a:	0.3399	0.3387	0.3378	0.3384	0.3402	0.3375	0.3412	0.3398
h > h / a _ a:	0.6601	0.6613	0.6622	0.6616	0.6598	0.6625	0.6588	0.6602
s > h / e _ a	0.3365	0.3430	0.3374	0.3411	0.3414	0.3412	0.3446	0.3414
s > s / e _ a	0.6635	0.6570	0.6626	0.6589	0.6586	0.6588	0.6554	0.6586
ɤ > h / a: _ a	0.4757	0.4806	0.4748	0.4798	0.4771	0.4781	0.4764	0.4761
ɤ > s / a: _ a	0.5243	0.5194	0.5252	0.5202	0.5229	0.5219	0.5236	0.5239
u > o / m _ s	0.3860	0.3883	0.3867	0.3888	0.3891	0.3923	0.3868	0.3895
u > u / m _ s	0.6140	0.6117	0.6133	0.6112	0.6109	0.6077	0.6132	0.6105
j > ∅ / v _ a	0.8842	0.8871	0.8844	0.8871	0.8854	0.8864	0.8844	0.8861
j > d / v _ a	0.1158	0.1129	0.1156	0.1129	0.1146	0.1136	0.1156	0.1139
ɤ > h / o _ a	0.2371	0.2343	0.2358	0.2331	0.2368	0.2322	0.2382	0.2339
ɤ > s / o _ a	0.7629	0.7657	0.7642	0.7669	0.7632	0.7678	0.7618	0.7661
ɲ > ∅ / i _ c	0.3907	0.3848	0.3899	0.3828	0.3884	0.3865	0.3900	0.3843
ɲ > ɲ / i _ c	0.6093	0.6152	0.6101	0.6172	0.6116	0.6135	0.6100	0.6157
i > i / l _ k	0.5785	0.5857	0.5772	0.5852	0.5767	0.5853	0.5799	0.5856
i > i: / l _ k	0.4215	0.4143	0.4228	0.4148	0.4233	0.4147	0.4201	0.4144
r > l / # _ a	0.0283	0.0313	0.0283	0.0311	0.0284	0.0313	0.0284	0.0310
r > r / # _ a	0.9717	0.9687	0.9717	0.9689	0.9716	0.9687	0.9716	0.9690
u > u / d _ g	0.7190	0.7305	0.7210	0.7268	0.7187	0.7265	0.7186	0.7280
u > u: / d _ g	0.2810	0.2695	0.2790	0.2732	0.2813	0.2735	0.2814	0.2720
i > ∅ / p _ t	0.1186	0.1269	0.1183	0.1278	0.1201	0.1275	0.1193	0.1272
i > i / p _ t	0.8814	0.8731	0.8817	0.8722	0.8799	0.8725	0.8807	0.8728
r > ∅ / a _ f	0.6142	0.6264	0.6134	0.6285	0.6153	0.6279	0.6145	0.6292
r > r / a _ f	0.3858	0.3736	0.3866	0.3715	0.3847	0.3721	0.3855	0.3708
r̥ > a / b <sup>h</sup> _ ɤ	0.3773	0.3907	0.3801	0.3922	0.3776	0.3924	0.3763	0.3937
r̥ > u / b <sup>h</sup> _ ɤ	0.6227	0.6093	0.6199	0.6078	0.6224	0.6076	0.6237	0.6063
s > ɲ / a _ j	0.1797	0.1913	0.1802	0.1920	0.1799	0.1912	0.1783	0.1912
s > s / a _ j	0.8203	0.8087	0.8198	0.8080	0.8201	0.8088	0.8217	0.8088
ɪ: > ∅ / r _ j	0.3295	0.3190	0.3297	0.3161	0.3289	0.3146	0.3305	0.3125
ɪ: > i / r _ j	0.3378	0.3498	0.3360	0.3501	0.3385	0.3517	0.3364	0.3531
ɪ: > i: / r _ j	0.3326	0.3312	0.3344	0.3338	0.3326	0.3336	0.3331	0.3344
i > i / s _ d	0.7010	0.7151	0.6978	0.7168	0.6942	0.7148	0.6997	0.7146
i > i: / s _ d	0.2990	0.2849	0.3022	0.2832	0.3058	0.2852	0.3003	0.2854
n > ɲ / i _ d <sup>h</sup>	0.5203	0.5362	0.5191	0.5396	0.5208	0.5420	0.5187	0.5398
n > n / i _ d <sup>h</sup>	0.4797	0.4638	0.4809	0.4604	0.4792	0.4580	0.4813	0.4602
r > ∅ / u: _ d <sup>h</sup>	0.8153	0.8290	0.8132	0.8292	0.8135	0.8292	0.8140	0.8293
r > ɲ / u: _ d <sup>h</sup>	0.1847	0.1710	0.1868	0.1708	0.1865	0.1708	0.1860	0.1707
r̥ > ∅ / n _ t	0.2663	0.2807	0.2657	0.2800	0.2659	0.2809	0.2653	0.2818
r̥ > a / n _ t	0.2620	0.2465	0.2612	0.2473	0.2609	0.2480	0.2620	0.2461
r̥ > a: / n _ t	0.4717	0.4728	0.4731	0.4727	0.4732	0.4712	0.4727	0.4721
u > o / # _ t	0.0442	0.0358	0.0440	0.0358	0.0440	0.0357	0.0440	0.0359
u > u / # _ t	0.9558	0.9642	0.9560	0.9642	0.9560	0.9643	0.9560	0.9641
r > ∅ / a: _ j	0.7165	0.7378	0.7179	0.7375	0.7170	0.7384	0.7169	0.7368
r > ɲ / a: _ j	0.2835	0.2622	0.2821	0.2625	0.2830	0.2616	0.2831	0.2632
u > ∅ / d _ h	0.3555	0.3318	0.3544	0.3338	0.3552	0.3340	0.3553	0.3325
u > u / d _ h	0.6445	0.6682	0.6456	0.6662	0.6448	0.6660	0.6447	0.6675
u: > u / p _ r	0.6012	0.6264	0.6020	0.6247	0.6013	0.6246	0.6027	0.6261
u: > u: / p _ r	0.3988	0.3736	0.3980	0.3753	0.3987	0.3754	0.3973	0.3739
i > i / ɲ _ n	0.4127	0.4439	0.4206	0.4455	0.4202	0.4462	0.4212	0.4384
i > i: / ɲ _ n	0.5873	0.5561	0.5794	0.5545	0.5798	0.5538	0.5788	0.5616
i > i / h _ k	0.5758	0.6031	0.5728	0.6032	0.5754	0.6062	0.5754	0.6043
i > i: / h _ k	0.4242	0.3969	0.4272	0.3968	0.4246	0.3938	0.4246	0.3957
f > t <sup>h</sup> / a _ j	0.1828	0.2061	0.1806	0.2063	0.1833	0.2064	0.1832	0.2081
f > s / a _ j	0.8172	0.7939	0.8194	0.7937	0.8167	0.7936	0.8168	0.7919
u > u / # _ ɤ	0.5970	0.5632	0.5973	0.5662	0.5953	0.5645	0.5934	0.5636
u > u: / # _ ɤ	0.4030	0.4368	0.4027	0.4338	0.4047	0.4355	0.4066	0.4364
ɤ > ∅ / e _ a	0.1963	0.1874	0.1967	0.1873	0.1961	0.1866	0.1964	0.1885

ʃ > h / e _ a	0.1947	0.1742	0.1955	0.1743	0.1956	0.1738	0.1970	0.1736
ʃ > s / e _ a	0.6090	0.6383	0.6078	0.6384	0.6082	0.6395	0.6066	0.6379
i > i / v _ d	0.8574	0.8293	0.8561	0.8305	0.8567	0.8295	0.8565	0.8308
i > i: / v _ d	0.1426	0.1707	0.1439	0.1695	0.1433	0.1705	0.1435	0.1692
ʃ > ∅ / # _ l	0.5985	0.5580	0.5999	0.5600	0.5999	0.5622	0.5992	0.5614
ʃ > s / # _ l	0.4015	0.4420	0.4001	0.4400	0.4001	0.4378	0.4008	0.4386
l > ∅ / l _ a	0.0565	0.0391	0.0564	0.0392	0.0561	0.0392	0.0567	0.0388
l > l / l _ a	0.9435	0.9609	0.9436	0.9608	0.9439	0.9608	0.9433	0.9612
r > l / a _ j	0.5379	0.4973	0.5368	0.4971	0.5410	0.4971	0.5359	0.4964
r > r / a _ j	0.4621	0.5027	0.4632	0.5029	0.4590	0.5029	0.4641	0.5036
u > o / t _ ŋ	0.3661	0.4059	0.3671	0.4055	0.3660	0.4059	0.3635	0.4051
u > u / t _ ŋ	0.6339	0.5941	0.6329	0.5945	0.6340	0.5941	0.6365	0.5949
i > ∅ / t _ ŋ	0.3553	0.3163	0.3536	0.3167	0.3537	0.3161	0.3576	0.3124
i > i: / t _ ŋ	0.6447	0.6837	0.6464	0.6833	0.6463	0.6839	0.6424	0.6876
u: > o / b _ l	0.6299	0.5889	0.6302	0.5876	0.6320	0.5881	0.6277	0.5902
u: > u / b _ l	0.3701	0.4111	0.3698	0.4124	0.3680	0.4119	0.3723	0.4098
j > ∅ / a _ a:	0.7626	0.7247	0.7622	0.7238	0.7628	0.7241	0.7634	0.7258
j > j / a _ a:	0.2374	0.2753	0.2378	0.2762	0.2372	0.2759	0.2366	0.2742
u > a / g _ r	0.3454	0.3911	0.3432	0.3906	0.3442	0.3903	0.3461	0.3904
u > u / g _ r	0.6546	0.6089	0.6568	0.6094	0.6558	0.6097	0.6539	0.6096
i > i / b <sup>h</sup> _ t	0.5878	0.5395	0.5859	0.5385	0.5881	0.5399	0.5874	0.5398
i > i: / b <sup>h</sup> _ t	0.4122	0.4605	0.4141	0.4615	0.4119	0.4601	0.4126	0.4602
s > h / a _ a:	0.1246	0.1614	0.1242	0.1611	0.1248	0.1589	0.1244	0.1620
s > s / a _ a:	0.8754	0.8386	0.8758	0.8389	0.8752	0.8411	0.8756	0.8380
u > o / t _ l	0.1449	0.1076	0.1443	0.1070	0.1441	0.1079	0.1443	0.1078
u > u / t _ l	0.8551	0.8924	0.8557	0.8930	0.8559	0.8921	0.8557	0.8922
n > n / u _ d	0.5442	0.6015	0.5449	0.6016	0.5441	0.6023	0.5435	0.6005
n > n / u _ d	0.4558	0.3985	0.4551	0.3984	0.4559	0.3977	0.4565	0.3995
u: > u / # _ r	0.7910	0.7393	0.7918	0.7418	0.7917	0.7407	0.7908	0.7406
u: > u: / # _ r	0.2090	0.2607	0.2082	0.2582	0.2083	0.2593	0.2092	0.2594
l > l / # _ a:	0.9371	0.9026	0.9373	0.9026	0.9368	0.9024	0.9366	0.9024
l > n / # _ a:	0.0629	0.0974	0.0627	0.0974	0.0632	0.0976	0.0634	0.0976
s > ∅ / # _ n	0.8715	0.8258	0.8718	0.8253	0.8718	0.8244	0.8715	0.8249
s > s / # _ n	0.1285	0.1742	0.1282	0.1747	0.1282	0.1756	0.1285	0.1751
h > ∅ / o _ a	0.2040	0.1536	0.2049	0.1550	0.2047	0.1538	0.2037	0.1544
h > h / o _ a	0.7960	0.8464	0.7951	0.8450	0.7953	0.8462	0.7963	0.8456
u: > ∅ / r _ p	0.1259	0.0942	0.1257	0.0941	0.1259	0.0945	0.1261	0.0941
u: > u / r _ p	0.4064	0.3799	0.4053	0.3799	0.4065	0.3801	0.4056	0.3790
u: > u: / r _ p	0.4677	0.5259	0.4689	0.5261	0.4675	0.5254	0.4683	0.5269
kʃ > k / i _ a:	0.2249	0.2826	0.2239	0.2823	0.2250	0.2835	0.2255	0.2837
kʃ > k <sup>h</sup> / i _ a:	0.7751	0.7174	0.7761	0.7177	0.7750	0.7165	0.7745	0.7163
n > ∅ / # _ a	0.0183	0.0304	0.0182	0.0305	0.0182	0.0305	0.0182	0.0305
n > l / # _ a	0.0191	0.0364	0.0191	0.0365	0.0191	0.0365	0.0191	0.0363
n > n / # _ a	0.9627	0.9332	0.9627	0.9330	0.9627	0.9330	0.9627	0.9332
r > ∅ / a _ j	0.8981	0.9359	0.8984	0.9361	0.8984	0.9362	0.8984	0.9356
r > j / a _ j	0.1019	0.0641	0.1016	0.0639	0.1016	0.0638	0.1016	0.0644
kʃ > c <sup>h</sup> / # _ u	0.2511	0.3152	0.2516	0.3143	0.2518	0.3158	0.2517	0.3143
kʃ > k <sup>h</sup> / # _ u	0.7489	0.6848	0.7484	0.6857	0.7482	0.6842	0.7483	0.6857
i > i / kʃ _ n	0.3471	0.4197	0.3485	0.4204	0.3488	0.4204	0.3489	0.4192
i > i: / kʃ _ n	0.6529	0.5803	0.6515	0.5796	0.6512	0.5796	0.6511	0.5808
h > ∅ / a: _ u	0.2924	0.3629	0.2938	0.3622	0.2906	0.3613	0.2889	0.3626
h > h / a: _ u	0.7076	0.6371	0.7062	0.6378	0.7094	0.6387	0.7111	0.6374
u > ∅ / # _ p	0.4138	0.4807	0.4139	0.4811	0.4134	0.4816	0.4142	0.4810
u > o / # _ p	0.2385	0.1872	0.2389	0.1874	0.2390	0.1870	0.2388	0.1870
u > u / # _ p	0.3477	0.3321	0.3472	0.3315	0.3476	0.3314	0.3470	0.3320
h > ∅ / a: _ a:	0.1734	0.2386	0.1755	0.2392	0.1741	0.2382	0.1739	0.2386
h > h / a: _ a:	0.8266	0.7614	0.8245	0.7608	0.8259	0.7618	0.8261	0.7614
u > ∅ / # _ l	0.1584	0.2202	0.1571	0.2199	0.1577	0.2213	0.1580	0.2206
u > u / # _ l	0.8416	0.7798	0.8429	0.7801	0.8423	0.7787	0.8420	0.7794
l > ∅ / a _ l	0.6603	0.7394	0.6608	0.7383	0.6620	0.7394	0.6600	0.7400

l > l / a _ l	0.3397	0.2606	0.3392	0.2617	0.3380	0.2606	0.3400	0.2600
i > e / v _ s	0.1960	0.1304	0.1942	0.1299	0.1947	0.1308	0.1946	0.1308
i > i / v _ s	0.8040	0.8696	0.8058	0.8701	0.8053	0.8692	0.8054	0.8692
u > o / m _ t	0.6365	0.5521	0.6373	0.5494	0.6390	0.5507	0.6383	0.5530
u > u / m _ t	0.3635	0.4479	0.3627	0.4506	0.3610	0.4493	0.3617	0.4470
i > i / j _ h	0.5810	0.4945	0.5809	0.4924	0.5802	0.4919	0.5820	0.4918
i > i: / j _ h	0.4190	0.5055	0.4191	0.5076	0.4198	0.5081	0.4180	0.5082
h > Ø / # _ a:	0.0684	0.1209	0.0683	0.1208	0.0681	0.1215	0.0683	0.1205
h > h / # _ a:	0.9316	0.8791	0.9317	0.8792	0.9319	0.8785	0.9317	0.8795
i > i / t <sup>h</sup> _ n	0.5323	0.6227	0.5302	0.6201	0.5300	0.6217	0.5350	0.6214
i > i: / t <sup>h</sup> _ n	0.4677	0.3773	0.4698	0.3799	0.4700	0.3783	0.4650	0.3786
j > Ø / r _ a	0.6005	0.6902	0.5996	0.6901	0.5992	0.6903	0.6004	0.6899
j > j / r _ a	0.3995	0.3098	0.4004	0.3099	0.4008	0.3097	0.3996	0.3101
r > Ø / a _ a	0.0104	0.0096	0.0104	0.0097	0.0104	0.0097	0.0103	0.0096
r > r / a _ a	0.0049	0.0055	0.0049	0.0055	0.0049	0.0055	0.0049	0.0055
r > n / a _ a	0.0125	0.0029	0.0125	0.0029	0.0125	0.0029	0.0125	0.0029
r > l / a _ a	0.0263	0.0195	0.0263	0.0195	0.0263	0.0195	0.0262	0.0194
r > n / a _ a	0.0000	0.0086	0.0000	0.0086	0.0000	0.0086	0.0000	0.0086
r > r / a _ a	0.9459	0.9538	0.9459	0.9536	0.9459	0.9537	0.9460	0.9539
h > Ø / e _ a	0.3815	0.2890	0.3806	0.2881	0.3798	0.2878	0.3811	0.2861
h > h / e _ a	0.6185	0.7110	0.6194	0.7119	0.6202	0.7122	0.6189	0.7139
i > Ø / v _ t	0.3660	0.2695	0.3644	0.2718	0.3672	0.2728	0.3648	0.2678
i > i / v _ t	0.6340	0.7305	0.6356	0.7282	0.6328	0.7272	0.6352	0.7322
u > o / s _ v	0.4300	0.5330	0.4298	0.5351	0.4314	0.5365	0.4328	0.5361
u > u / s _ v	0.5700	0.4670	0.5702	0.4649	0.5686	0.4635	0.5672	0.4639
r > Ø / a _ v	0.7572	0.8422	0.7566	0.8407	0.7562	0.8417	0.7577	0.8419
r > b / a _ v	0.2428	0.1578	0.2434	0.1593	0.2438	0.1583	0.2423	0.1581
r > Ø / k _ t	0.5635	0.4620	0.5663	0.4593	0.5680	0.4589	0.5677	0.4583
r > a / k _ t	0.4365	0.5380	0.4337	0.5407	0.4320	0.5411	0.4323	0.5417
h > Ø / u _ i	0.7354	0.8262	0.7361	0.8252	0.7361	0.8247	0.7361	0.8263
h > h / u _ i	0.2646	0.1738	0.2639	0.1748	0.2639	0.1753	0.2639	0.1737
h > Ø / a _ a	0.2990	0.2051	0.2996	0.2051	0.3000	0.2049	0.2984	0.2051
h > h / a _ a	0.7010	0.7949	0.7004	0.7949	0.7000	0.7951	0.7016	0.7949
u > a / p _ r	0.2095	0.1277	0.2086	0.1271	0.2090	0.1270	0.2084	0.1271
u > u / p _ r	0.7905	0.8723	0.7914	0.8729	0.7910	0.8730	0.7916	0.8729
n > Ø / j _ a	0.3123	0.4179	0.3100	0.4218	0.3103	0.4185	0.3114	0.4169
n > n / j _ a	0.6877	0.5821	0.6900	0.5782	0.6897	0.5815	0.6886	0.5831
i: > e / v _ r	0.1973	0.2613	0.1976	0.2625	0.1972	0.2617	0.1974	0.2627
i: > i / v _ r	0.3774	0.4166	0.3784	0.4166	0.3789	0.4168	0.3778	0.4159
i: > i: / v _ r	0.4253	0.3221	0.4240	0.3209	0.4239	0.3215	0.4248	0.3214
j > Ø / i: _ a	0.6882	0.6877	0.6886	0.6889	0.6884	0.6893	0.6871	0.6882
j > j / i: _ a	0.1585	0.2207	0.1585	0.2194	0.1587	0.2194	0.1590	0.2203
j > j / i: _ a	0.1533	0.0916	0.1529	0.0917	0.1528	0.0913	0.1538	0.0914
r > l / i: _ a	0.0170	0.0600	0.0170	0.0598	0.0170	0.0597	0.0171	0.0599
r > r / i: _ a	0.9830	0.9400	0.9830	0.9402	0.9830	0.9403	0.9829	0.9401
j > Ø / j _ a	0.2873	0.3999	0.2872	0.4010	0.2872	0.3972	0.2862	0.3972
j > j / j _ a	0.7127	0.6001	0.7128	0.5990	0.7128	0.6028	0.7138	0.6028
i > Ø / v _ b <sup>fi</sup>	0.4443	0.5632	0.4437	0.5629	0.4485	0.5632	0.4399	0.5621
i > a / v _ b <sup>fi</sup>	0.5557	0.4368	0.5563	0.4371	0.5515	0.4368	0.5601	0.4379
i > i / c _ n	0.6226	0.7365	0.6234	0.7363	0.6222	0.7397	0.6225	0.7376
i > u / c _ n	0.3774	0.2635	0.3766	0.2637	0.3778	0.2603	0.3775	0.2624
u > o / m _ d	0.1385	0.1044	0.1373	0.1046	0.1370	0.1044	0.1371	0.1046
u > u / m _ d	0.7034	0.6410	0.7056	0.6402	0.7063	0.6394	0.7050	0.6402
u > u: / m _ d	0.1582	0.2546	0.1571	0.2552	0.1567	0.2562	0.1579	0.2552
ŋ > Ø / k s _ a	0.7301	0.6147	0.7316	0.6108	0.7313	0.6156	0.7336	0.6105
ŋ > n / k s _ a	0.2699	0.3853	0.2684	0.3892	0.2687	0.3844	0.2664	0.3895
u > o / k _ d	0.3101	0.4331	0.3116	0.4338	0.3104	0.4337	0.3105	0.4348
u > u / k _ d	0.6899	0.5669	0.6884	0.5662	0.6896	0.5663	0.6895	0.5652
s > h / a: _ i	0.3270	0.2123	0.3281	0.2119	0.3277	0.2122	0.3259	0.2119
s > s / a: _ i	0.6730	0.7877	0.6719	0.7881	0.6723	0.7878	0.6741	0.7881

i > a / n _ r	0.1157	0.0448	0.1151	0.0448	0.1149	0.0450	0.1156	0.0444
i > i / n _ r	0.8843	0.9552	0.8849	0.9552	0.8851	0.9550	0.8844	0.9556
i > i / d <sup>h</sup> _ n	0.5653	0.4303	0.5612	0.4318	0.5629	0.4321	0.5642	0.4300
i > i: / d <sup>h</sup> _ n	0.4347	0.5697	0.4388	0.5682	0.4371	0.5679	0.4358	0.5700
ɤ > ∅ / o _ t <sup>h</sup>	0.9593	0.8898	0.9595	0.8902	0.9593	0.8898	0.9582	0.8903
ɤ > ɤ / o _ t <sup>h</sup>	0.0407	0.1102	0.0405	0.1098	0.0407	0.1102	0.0418	0.1097
i: > i / n _ t	0.5866	0.7181	0.5864	0.7213	0.5849	0.7137	0.5865	0.7148
i: > i: / n _ t	0.4134	0.2819	0.4136	0.2787	0.4151	0.2863	0.4135	0.2852
i: > i / j _ r	0.3354	0.4703	0.3324	0.4706	0.3346	0.4731	0.3362	0.4680
i: > i: / j _ r	0.6646	0.5297	0.6676	0.5294	0.6654	0.5269	0.6638	0.5320
i > e / t _ n	0.1926	0.3052	0.1925	0.3079	0.1921	0.3066	0.1938	0.3056
i > i / t _ n	0.4849	0.3792	0.4845	0.3761	0.4842	0.3776	0.4833	0.3800
i > i: / t _ n	0.3224	0.3155	0.3230	0.3160	0.3237	0.3158	0.3229	0.3144
s > ∅ / t _ a	0.0738	0.1203	0.0737	0.1197	0.0742	0.1198	0.0739	0.1206
s > c <sup>h</sup> / t _ a	0.7066	0.5719	0.7069	0.5720	0.7063	0.5728	0.7062	0.5712
s > s / t _ a	0.2196	0.3078	0.2194	0.3083	0.2196	0.3074	0.2198	0.3082
ɲ > ɲ / r _ a	0.0674	0.1567	0.0676	0.1568	0.0675	0.1570	0.0678	0.1563
ɲ > n / r _ a	0.9326	0.8433	0.9324	0.8432	0.9325	0.8430	0.9322	0.8437
h > ∅ / a _ i	0.6308	0.4875	0.6311	0.4873	0.6300	0.4888	0.6321	0.4871
h > h / a _ i	0.3692	0.5125	0.3689	0.5127	0.3700	0.5112	0.3679	0.5129
j > ∅ / l _ a	0.7817	0.8877	0.7805	0.8870	0.7813	0.8873	0.7812	0.8871
j > h / l _ a	0.0880	0.0508	0.0884	0.0510	0.0882	0.0510	0.0882	0.0510
j > l / l _ a	0.1303	0.0616	0.1311	0.0620	0.1305	0.0618	0.1306	0.0619
r > ∅ / a _ ɤ	0.4358	0.5458	0.4366	0.5470	0.4364	0.5463	0.4363	0.5457
r > n / a _ ɤ	0.0692	0.0581	0.0688	0.0580	0.0688	0.0581	0.0690	0.0581
r > r / a _ ɤ	0.4214	0.3715	0.4211	0.3708	0.4212	0.3712	0.4213	0.3715
r > s / a _ ɤ	0.0736	0.0245	0.0735	0.0242	0.0737	0.0245	0.0733	0.0247
i > e / n _ m	0.2074	0.3375	0.2077	0.3367	0.2071	0.3343	0.2073	0.3373
i > i / n _ m	0.7926	0.6625	0.7923	0.6633	0.7929	0.6657	0.7927	0.6627
i: > i / s _ s	0.4420	0.5916	0.4424	0.5932	0.4402	0.5895	0.4411	0.5915
i: > i: / s _ s	0.5580	0.4084	0.5576	0.4068	0.5598	0.4105	0.5589	0.4085
r > ∅ / a _ ɲ	0.8555	0.9452	0.8560	0.9453	0.8557	0.9450	0.8561	0.9453
r > n / a _ ɲ	0.1445	0.0548	0.1440	0.0547	0.1443	0.0550	0.1439	0.0547
u: > u / b <sup>h</sup> _ t	0.7075	0.5640	0.7075	0.5604	0.7058	0.5596	0.7077	0.5600
u: > u: / b <sup>h</sup> _ t	0.2925	0.4360	0.2925	0.4396	0.2942	0.4404	0.2923	0.4400
i: > i / d _ p	0.6910	0.8214	0.6897	0.8207	0.6911	0.8204	0.6916	0.8213
i: > i: / d _ p	0.3090	0.1786	0.3103	0.1793	0.3089	0.1796	0.3084	0.1787
i > a / t _ r	0.3432	0.2044	0.3416	0.2060	0.3430	0.2085	0.3423	0.2057
i > i / t _ r	0.6568	0.7956	0.6584	0.7940	0.6570	0.7915	0.6577	0.7943
u > u / # _ c	0.8857	0.7701	0.8853	0.7705	0.8864	0.7701	0.8856	0.7702
u > u: / # _ c	0.1143	0.2299	0.1147	0.2295	0.1136	0.2299	0.1144	0.2298
u: > u / c _ r	0.4308	0.2840	0.4334	0.2844	0.4306	0.2836	0.4308	0.2831
u: > u: / c _ r	0.5692	0.7160	0.5666	0.7156	0.5694	0.7164	0.5692	0.7169
u > o / k _ ɤ	0.4640	0.6163	0.4626	0.6185	0.4648	0.6166	0.4636	0.6183
u > u / k _ ɤ	0.5360	0.3837	0.5374	0.3815	0.5352	0.3834	0.5364	0.3817
u: > u / j _ t	0.5889	0.7331	0.5894	0.7355	0.5881	0.7348	0.5876	0.7377
u: > u: / j _ t	0.4111	0.2669	0.4106	0.2645	0.4119	0.2652	0.4124	0.2623
i > ∅ / h _ t	0.3409	0.3121	0.3411	0.3122	0.3415	0.3101	0.3411	0.3121
i > e / h _ t	0.0957	0.1922	0.0949	0.1939	0.0948	0.1943	0.0949	0.1934
i > i / h _ t	0.2623	0.2763	0.2626	0.2746	0.2622	0.2759	0.2634	0.2753
i > i: / h _ t	0.3011	0.2194	0.3013	0.2193	0.3014	0.2197	0.3006	0.2192
h > ∅ / # _ a	0.0152	0.0811	0.0155	0.0813	0.0153	0.0813	0.0153	0.0813
h > h / # _ a	0.9848	0.9189	0.9845	0.9187	0.9847	0.9187	0.9847	0.9187
h > ∅ / a: _ a	0.3332	0.1895	0.3328	0.1891	0.3327	0.1896	0.3327	0.1904
h > h / a: _ a	0.6668	0.8105	0.6672	0.8109	0.6673	0.8104	0.6673	0.8096
i > i / d <sup>h</sup> _ k	0.5295	0.6907	0.5298	0.6944	0.5310	0.6908	0.5288	0.6913
i > i: / d <sup>h</sup> _ k	0.4705	0.3093	0.4702	0.3056	0.4690	0.3092	0.4712	0.3087
n > ∅ / a _ d <sup>h</sup>	0.0475	0.0815	0.0474	0.0816	0.0475	0.0817	0.0475	0.0816
n > n / a _ d <sup>h</sup>	0.4274	0.4154	0.4263	0.4146	0.4262	0.4143	0.4272	0.4148



n > n / a <sub>-</sub> d <sup>fi</sup>	0.4878	0.3920	0.4890	0.3925	0.4890	0.3929	0.4880	0.3923
n > n <sup>fi</sup> / a <sub>-</sub> d <sup>fi</sup>	0.0373	0.1111	0.0372	0.1113	0.0373	0.1112	0.0373	0.1113
r > Ø / a <sub>-</sub> p	0.8561	0.8641	0.8559	0.8642	0.8561	0.8636	0.8557	0.8636
r > n / a <sub>-</sub> p	0.0565	0.1126	0.0564	0.1126	0.0563	0.1130	0.0564	0.1130
r > p / a <sub>-</sub> p	0.0875	0.0233	0.0877	0.0232	0.0876	0.0234	0.0879	0.0234
i > e / c <sup>h</sup> <sub>-</sub> d	0.2173	0.3660	0.2182	0.3687	0.2170	0.3681	0.2174	0.3649
i > i / c <sup>h</sup> <sub>-</sub> d	0.5590	0.4853	0.5585	0.4829	0.5593	0.4828	0.5583	0.4871
i > i: / c <sup>h</sup> <sub>-</sub> d	0.2238	0.1486	0.2233	0.1484	0.2236	0.1491	0.2243	0.1480
s > Ø / a <sub>-</sub> a	0.0316	0.0939	0.0317	0.0941	0.0318	0.0940	0.0316	0.0938
s > h / a <sub>-</sub> a	0.1930	0.1090	0.1936	0.1093	0.1939	0.1091	0.1934	0.1089
s > s / a <sub>-</sub> a	0.7311	0.7344	0.7304	0.7337	0.7300	0.7342	0.7306	0.7346
s > t / a <sub>-</sub> a	0.0443	0.0627	0.0443	0.0629	0.0444	0.0627	0.0444	0.0626
i > i / c <sub>-</sub> t	0.9514	0.8496	0.9518	0.8496	0.9517	0.8490	0.9519	0.8493
i > i: / c <sub>-</sub> t	0.0486	0.1504	0.0482	0.1504	0.0483	0.1510	0.0481	0.1507
i > i / d <sub>-</sub> k	0.3113	0.4814	0.3075	0.4809	0.3118	0.4817	0.3106	0.4807
i > i: / d <sub>-</sub> k	0.6887	0.5186	0.6925	0.5191	0.6882	0.5183	0.6894	0.5193
j > Ø / i <sub>-</sub> a:	0.5085	0.3359	0.5086	0.3348	0.5078	0.3354	0.5081	0.3362
j > j / i <sub>-</sub> a:	0.4915	0.6641	0.4914	0.6652	0.4922	0.6646	0.4919	0.6638
n > Ø / a <sub>-</sub> n	0.7712	0.9012	0.7707	0.9016	0.7717	0.9016	0.7717	0.9016
n > n / a <sub>-</sub> n	0.2288	0.0988	0.2293	0.0984	0.2283	0.0984	0.2283	0.0984
l > Ø / # <sub>-</sub> a	0.0112	0.0245	0.0113	0.0246	0.0113	0.0246	0.0113	0.0245
l > h / # <sub>-</sub> a	0.0152	0.0291	0.0154	0.0291	0.0153	0.0292	0.0153	0.0291
l > l / # <sub>-</sub> a	0.9528	0.8545	0.9526	0.8540	0.9527	0.8539	0.9526	0.8547
l > n / # <sub>-</sub> a	0.0208	0.0919	0.0207	0.0923	0.0208	0.0922	0.0208	0.0918
s > Ø / a: a	0.1059	0.0512	0.1057	0.0513	0.1059	0.0513	0.1061	0.0512
s > h / a: a	0.2874	0.1796	0.2881	0.1801	0.2888	0.1799	0.2879	0.1799
s > s / a: a	0.6067	0.7691	0.6063	0.7686	0.6053	0.7688	0.6059	0.7689
ʒ > Ø / a <sub>-</sub> t	0.8256	0.8080	0.8256	0.8079	0.8257	0.8080	0.8255	0.8078
ʒ > t / a <sub>-</sub> t	0.1609	0.1103	0.1609	0.1102	0.1608	0.1104	0.1610	0.1104
ʒ > n / a <sub>-</sub> t	0.0135	0.0818	0.0134	0.0819	0.0136	0.0816	0.0135	0.0818
u: > u / m <sub>-</sub> l	0.4001	0.5809	0.3982	0.5809	0.3987	0.5816	0.3996	0.5810
u: > u: / m <sub>-</sub> l	0.5999	0.4191	0.6018	0.4191	0.6013	0.4184	0.6004	0.4190
u > Ø / # <sub>-</sub> d	0.0639	0.0961	0.0627	0.0962	0.0630	0.0959	0.0630	0.0961
u > o / # <sub>-</sub> d	0.0231	0.0875	0.0228	0.0876	0.0227	0.0877	0.0229	0.0876
u > u / # <sub>-</sub> d	0.8856	0.7603	0.8872	0.7601	0.8869	0.7603	0.8869	0.7602
u > u: / # <sub>-</sub> d	0.0275	0.0561	0.0273	0.0561	0.0273	0.0561	0.0272	0.0561
i > i / p <sub>-</sub> p	0.9021	0.7684	0.9015	0.7661	0.9016	0.7652	0.9020	0.7667
i > i: / p <sub>-</sub> p	0.0979	0.2316	0.0985	0.2339	0.0984	0.2348	0.0980	0.2333
i > i / s <sub>-</sub> k	0.4092	0.5927	0.4095	0.5927	0.4099	0.5937	0.4088	0.5941
i > i: / s <sub>-</sub> k	0.5908	0.4073	0.5905	0.4073	0.5901	0.4063	0.5912	0.4059
n > n / s <sub>-</sub> a:	0.6889	0.8441	0.6895	0.8433	0.6902	0.8449	0.6893	0.8449
n > n <sup>fi</sup> / s <sub>-</sub> a:	0.3111	0.1559	0.3105	0.1567	0.3098	0.1551	0.3107	0.1551
r > Ø / a: a	0.0203	0.0098	0.0204	0.0098	0.0204	0.0098	0.0203	0.0099
r > l / a: a	0.0177	0.0000	0.0177	0.0000	0.0178	0.0000	0.0177	0.0000
r > ɾ / a: a	0.0091	0.0026	0.0091	0.0026	0.0092	0.0026	0.0092	0.0026
r > l / a: a	0.0027	0.0383	0.0028	0.0384	0.0027	0.0384	0.0027	0.0385
r > r / a: a	0.9501	0.9493	0.9500	0.9492	0.9499	0.9492	0.9501	0.9491
u: > u / j <sub>-</sub> r	0.4465	0.6328	0.4457	0.6333	0.4480	0.6316	0.4475	0.6321
u: > u: / j <sub>-</sub> r	0.5535	0.3672	0.5543	0.3667	0.5520	0.3684	0.5525	0.3679
r > Ø / e <sub>-</sub> a	0.0789	0.1911	0.0790	0.1901	0.0791	0.1903	0.0780	0.1901
r > l / e <sub>-</sub> a	0.2048	0.2465	0.2035	0.2481	0.2063	0.2482	0.2022	0.2484
r > r / e <sub>-</sub> a	0.7163	0.5624	0.7176	0.5618	0.7146	0.5615	0.7198	0.5614
ŋ > n / s <sub>-</sub> a	0.3479	0.5365	0.3482	0.5348	0.3488	0.5379	0.3479	0.5374
ŋ > n <sup>fi</sup> / s <sub>-</sub> a	0.6521	0.4635	0.6518	0.4652	0.6512	0.4621	0.6521	0.4626
i > a / g <sub>-</sub> r	0.4884	0.6749	0.4877	0.6784	0.4880	0.6753	0.4931	0.6782
i > a: / g <sub>-</sub> r	0.5116	0.3251	0.5123	0.3216	0.5120	0.3247	0.5069	0.3218
ɾ > a / m <sub>-</sub> s	0.3609	0.1903	0.3577	0.1905	0.3584	0.1888	0.3590	0.1893
ɾ > i / m <sub>-</sub> s	0.6391	0.8097	0.6423	0.8095	0.6416	0.8112	0.6410	0.8107
ʒ > h / a: a:	0.5999	0.4121	0.6050	0.4106	0.6050	0.4118	0.6063	0.4106
ʒ > s / a: a:	0.4001	0.5879	0.3950	0.5894	0.3950	0.5882	0.3937	0.5894

i > i / f _ k	0.7710	0.5895	0.7688	0.5919	0.7677	0.5876	0.7699	0.5886
i > i: / f _ k	0.2290	0.4105	0.2312	0.4081	0.2323	0.4124	0.2301	0.4114
l > ∅ / u _ l	0.6136	0.7920	0.6153	0.7908	0.6157	0.7908	0.6146	0.7912
l > l / u _ l	0.3864	0.2080	0.3847	0.2092	0.3843	0.2092	0.3854	0.2088
u > u / j _ g	0.7650	0.5777	0.7626	0.5775	0.7644	0.5820	0.7641	0.5795
u > u: / j _ g	0.2350	0.4223	0.2374	0.4225	0.2356	0.4180	0.2359	0.4205
i > i / m _ n	0.3659	0.5633	0.3661	0.5641	0.3650	0.5635	0.3692	0.5625
i > i: / m _ n	0.6341	0.4367	0.6339	0.4359	0.6350	0.4365	0.6308	0.4375
i > e / # _ j	0.6090	0.7887	0.6093	0.7920	0.6059	0.7908	0.6116	0.7883
i > i / # _ j	0.3910	0.2113	0.3907	0.2080	0.3941	0.2092	0.3884	0.2117
u > o / t _ s	0.1711	0.0484	0.1703	0.0485	0.1710	0.0486	0.1702	0.0486
u > u / t _ s	0.8289	0.9516	0.8297	0.9515	0.8290	0.9514	0.8298	0.9514
i > e / n _ k	0.2021	0.0970	0.2021	0.0972	0.2013	0.0970	0.2024	0.0975
i > i / n _ k	0.4438	0.6296	0.4425	0.6307	0.4431	0.6305	0.4439	0.6286
i > i: / n _ k	0.3540	0.2733	0.3554	0.2721	0.3555	0.2725	0.3537	0.2739
i > ∅ / r _ d	0.4530	0.6216	0.4524	0.6192	0.4528	0.6212	0.4523	0.6236
i > a / r _ d	0.1743	0.0675	0.1751	0.0675	0.1749	0.0676	0.1751	0.0676
i > i / r _ d	0.3727	0.3110	0.3725	0.3134	0.3722	0.3112	0.3727	0.3088
h > ∅ / a: _ i	0.3750	0.5762	0.3731	0.5751	0.3724	0.5748	0.3730	0.5760
h > h / a: _ i	0.6250	0.4238	0.6269	0.4249	0.6276	0.4252	0.6270	0.4240
u: > u / t _ r	0.5708	0.7644	0.5715	0.7631	0.5702	0.7655	0.5685	0.7623
u: > u: / t _ r	0.4292	0.2356	0.4285	0.2369	0.4298	0.2345	0.4315	0.2377
u: > u / f _ r	0.3909	0.5987	0.3896	0.5980	0.3929	0.5999	0.3964	0.5971
u: > u: / f _ r	0.6091	0.4013	0.6104	0.4020	0.6071	0.4001	0.6036	0.4029
n > ∅ / i _ n	0.5999	0.7906	0.6050	0.7939	0.5978	0.7908	0.5981	0.7902
n > n / i _ n	0.4001	0.2094	0.3950	0.2061	0.4022	0.2092	0.4019	0.2098
ɲ > ∅ / o _ ch	0.6939	0.4843	0.6933	0.4850	0.6922	0.4850	0.6941	0.4845
ɲ > ɲ / o _ ch	0.3061	0.5157	0.3067	0.5150	0.3078	0.5150	0.3059	0.5155
i > e / v _ d <sup>h</sup>	0.4756	0.2679	0.4733	0.2667	0.4759	0.2681	0.4721	0.2684
i > i / v _ d <sup>h</sup>	0.5244	0.7321	0.5267	0.7333	0.5241	0.7319	0.5279	0.7316
u: > u / s _ k	0.3210	0.5369	0.3226	0.5380	0.3263	0.5361	0.3243	0.5367
u: > u: / s _ k	0.6790	0.4631	0.6774	0.4620	0.6737	0.4639	0.6757	0.4633
i: > ∅ / f _ t	0.6896	0.8478	0.6901	0.8480	0.6899	0.8485	0.6889	0.8481
i: > i / f _ t	0.1280	0.0299	0.1279	0.0296	0.1277	0.0297	0.1283	0.0296
i: > i: / f _ t	0.1824	0.1223	0.1820	0.1224	0.1824	0.1218	0.1828	0.1222
s > ∅ / a _ t	0.7120	0.8719	0.7117	0.8721	0.7121	0.8717	0.7111	0.8714
s > h / a _ t	0.0989	0.0723	0.0988	0.0719	0.0986	0.0722	0.0993	0.0723
s > t / a _ t	0.1891	0.0559	0.1895	0.0560	0.1893	0.0561	0.1896	0.0563
u: > u / b <sup>h</sup> _ m	0.5124	0.7280	0.5140	0.7289	0.5140	0.7273	0.5156	0.7267
u: > u: / b <sup>h</sup> _ m	0.4876	0.2720	0.4860	0.2711	0.4860	0.2727	0.4844	0.2733
u > o / l _ d	0.6111	0.3906	0.6122	0.3913	0.6105	0.3899	0.6108	0.3904
u > u / l _ d	0.3889	0.6094	0.3878	0.6087	0.3895	0.6101	0.3892	0.6096
i > ∅ / p _ t	0.1832	0.1979	0.1830	0.1967	0.1832	0.1974	0.1824	0.1976
i > e / p _ t	0.2695	0.4593	0.2697	0.4623	0.2706	0.4614	0.2699	0.4605
i > i / p _ t	0.5473	0.3427	0.5473	0.3409	0.5462	0.3413	0.5477	0.3419
n > ∅ / a _ d	0.0267	0.1478	0.0267	0.1475	0.0269	0.1472	0.0270	0.1475
n > ɲ / a _ d	0.4803	0.4208	0.4800	0.4215	0.4793	0.4213	0.4810	0.4209
n > n / a _ d	0.4930	0.4313	0.4934	0.4310	0.4938	0.4315	0.4920	0.4315
u: > u / d _ r	0.4011	0.6227	0.4000	0.6242	0.4002	0.6227	0.4008	0.6237
u: > u: / d _ r	0.5989	0.3773	0.6000	0.3758	0.5998	0.3773	0.5992	0.3763
r > ∅ / m _ a	0.5773	0.7840	0.5744	0.7851	0.5765	0.7864	0.5763	0.7853
r > b / m _ a	0.4227	0.2160	0.4256	0.2149	0.4235	0.2136	0.4237	0.2147
u > a / g _ l	0.1570	0.1339	0.1571	0.1361	0.1568	0.1349	0.1569	0.1345
u > u / g _ l	0.6591	0.8178	0.6594	0.8155	0.6590	0.8164	0.6598	0.8166
u > u: / g _ l	0.1839	0.0483	0.1836	0.0483	0.1842	0.0487	0.1832	0.0489
f > ∅ / a _ u	0.2307	0.0979	0.2304	0.0958	0.2301	0.0961	0.2289	0.0962
f > h / a _ u	0.3136	0.2397	0.3121	0.2387	0.3129	0.2387	0.3148	0.2406
f > s / a _ u	0.4557	0.6623	0.4575	0.6655	0.4569	0.6652	0.4564	0.6632
r > ∅ / a _ t	0.8224	0.9238	0.8218	0.9239	0.8219	0.9238	0.8221	0.9239

r > t / a _ t	0.0969	0.0110	0.0972	0.0111	0.0972	0.0111	0.0970	0.0111
r > n / a _ t	0.0140	0.0332	0.0139	0.0331	0.0139	0.0331	0.0140	0.0331
r > r / a _ t	0.0667	0.0320	0.0671	0.0319	0.0670	0.0320	0.0669	0.0319
u > u / b _ s	0.5922	0.8015	0.5922	0.8006	0.5926	0.8019	0.5919	0.8017
u > u: / b _ s	0.4078	0.1985	0.4078	0.1994	0.4074	0.1981	0.4081	0.1983
u: > u / # _ n	0.8648	0.9809	0.8654	0.9809	0.8654	0.9810	0.8650	0.9809
u: > u: / # _ n	0.1352	0.0191	0.1346	0.0191	0.1346	0.0190	0.1350	0.0191
r > Ø / u: _ c	0.6383	0.4076	0.6340	0.4075	0.6411	0.4076	0.6363	0.4126
r > n / u: _ c	0.3617	0.5924	0.3660	0.5925	0.3589	0.5924	0.3637	0.5874
i > i / m _ t	0.8890	0.7096	0.8917	0.7086	0.8915	0.7094	0.8909	0.7097
i > i: / m _ t	0.1110	0.2904	0.1083	0.2914	0.1085	0.2906	0.1091	0.2903
i > e / v _ h	0.1690	0.3738	0.1709	0.3731	0.1697	0.3733	0.1716	0.3744
i > i / v _ h	0.8310	0.6262	0.8291	0.6269	0.8303	0.6267	0.8284	0.6256
ʂ > Ø / r _ t <sup>h</sup>	0.6971	0.8841	0.6983	0.8830	0.6981	0.8838	0.6984	0.8833
ʂ > t / r _ t <sup>h</sup>	0.3029	0.1159	0.3017	0.1170	0.3019	0.1162	0.3016	0.1167
u > o / k _ ŋ	0.0280	0.1559	0.0280	0.1557	0.0277	0.1564	0.0280	0.1555
u > u / k _ ŋ	0.7807	0.6778	0.7816	0.6771	0.7817	0.6765	0.7807	0.6777
u > u: / k _ ŋ	0.1912	0.1663	0.1905	0.1672	0.1906	0.1672	0.1913	0.1668
i > Ø / v _ k	0.1393	0.0940	0.1388	0.0939	0.1393	0.0945	0.1395	0.0942
i > e / v _ k	0.2159	0.0801	0.2170	0.0802	0.2163	0.0797	0.2169	0.0800
i > i / v _ k	0.5432	0.7435	0.5430	0.7434	0.5432	0.7436	0.5422	0.7437
i > i: / v _ k	0.1016	0.0824	0.1012	0.0824	0.1012	0.0822	0.1014	0.0820
u > a / p _ n	0.4575	0.2397	0.4602	0.2383	0.4585	0.2396	0.4605	0.2398
u > u / p _ n	0.5425	0.7603	0.5398	0.7617	0.5415	0.7604	0.5395	0.7602
u: > u / m _ t	0.4575	0.6877	0.4587	0.6856	0.4590	0.6862	0.4569	0.6867
u: > u: / m _ t	0.5425	0.3123	0.5413	0.3144	0.5410	0.3138	0.5431	0.3133
r > Ø / t _ i:	0.5894	0.8016	0.5878	0.8000	0.5879	0.8011	0.5896	0.8017
r > r / t _ i:	0.4106	0.1984	0.4122	0.2000	0.4121	0.1989	0.4104	0.1983
n > Ø / u _ d <sup>h</sup>	0.2225	0.4156	0.2206	0.4165	0.2231	0.4169	0.2230	0.4161
n > ŋ / u _ d <sup>h</sup>	0.2644	0.1480	0.2634	0.1466	0.2645	0.1476	0.2641	0.1476
n > n / u _ d <sup>h</sup>	0.3119	0.3097	0.3160	0.3106	0.3125	0.3091	0.3117	0.3095
n > n / u _ d <sup>h</sup>	0.2011	0.1267	0.2000	0.1263	0.1999	0.1264	0.2011	0.1269
n > n / e _ d	0.3916	0.6244	0.3906	0.6244	0.3875	0.6242	0.3935	0.6266
n > n / e _ d	0.6084	0.3756	0.6094	0.3756	0.6125	0.3758	0.6065	0.3734
r > Ø / i _ a	0.0369	0.0351	0.0367	0.0350	0.0366	0.0352	0.0369	0.0352
r > l / i _ a	0.0000	0.0780	0.0000	0.0776	0.0000	0.0777	0.0000	0.0777
r > r / i _ a	0.9631	0.8868	0.9633	0.8874	0.9634	0.8871	0.9631	0.8871
i: > i / p _ t	0.6058	0.3723	0.6091	0.3706	0.6057	0.3727	0.6072	0.3701
i: > i: / p _ t	0.3942	0.6277	0.3909	0.6294	0.3943	0.6273	0.3928	0.6299
u > Ø / d _ k	0.4263	0.6672	0.4239	0.6658	0.4262	0.6674	0.4268	0.6679
u > u: / d _ k	0.5737	0.3328	0.5761	0.3342	0.5738	0.3326	0.5732	0.3321
i > a / n _ ʂ	0.1243	0.0118	0.1249	0.0119	0.1250	0.0118	0.1241	0.0119
i > e / n _ ʂ	0.0829	0.0605	0.0839	0.0604	0.0843	0.0600	0.0828	0.0607
i > i / n _ ʂ	0.7928	0.9277	0.7911	0.9278	0.7907	0.9281	0.7930	0.9275
r > Ø / a _ i	0.0995	0.0345	0.0992	0.0346	0.0993	0.0345	0.0996	0.0344
r > l / a _ i	0.0438	0.0046	0.0435	0.0046	0.0436	0.0046	0.0437	0.0046
r > h / a _ i	0.0269	0.0371	0.0269	0.0373	0.0269	0.0372	0.0270	0.0370
r > l / a _ i	0.0232	0.1000	0.0230	0.1001	0.0230	0.1002	0.0231	0.1000
r > r / a _ i	0.8067	0.8238	0.8074	0.8235	0.8071	0.8236	0.8066	0.8240
ʂ > j / # _ a	0.0823	0.0000	0.0826	0.0000	0.0828	0.0000	0.0825	0.0000
ʂ > c <sup>h</sup> / # _ a	0.7062	0.7146	0.7056	0.7164	0.7058	0.7144	0.7056	0.7143
ʂ > s / # _ a	0.2115	0.2853	0.2119	0.2836	0.2114	0.2856	0.2119	0.2856
ʂ > Ø / r _ a	0.2085	0.0686	0.2083	0.0681	0.2081	0.0677	0.2073	0.0680
ʂ > h / r _ a	0.2499	0.1723	0.2494	0.1712	0.2497	0.1722	0.2492	0.1728
ʂ > s / r _ a	0.5416	0.7591	0.5422	0.7607	0.5422	0.7601	0.5435	0.7591
i > i / j _ t	0.4706	0.7185	0.4724	0.7158	0.4718	0.7205	0.4713	0.7184
i > i: / j _ t	0.5294	0.2815	0.5276	0.2842	0.5282	0.2795	0.5287	0.2816
kʂ > Ø / a: _ i	0.2984	0.4247	0.2973	0.4181	0.2988	0.4192	0.2987	0.4189
kʂ > h / a: _ i	0.0902	0.2076	0.0902	0.2096	0.0898	0.2090	0.0901	0.2090
kʂ > k <sup>h</sup> / a: _ i	0.6114	0.3677	0.6126	0.3723	0.6113	0.3717	0.6112	0.3722

s > s / # _ u	1.0000	0.9073	1.0000	0.9069	1.0000	0.9072	1.0000	0.9072
s > x / # _ u	0.0000	0.0927	0.0000	0.0931	0.0000	0.0928	0.0000	0.0928
u > u / p _ t	0.8800	0.6641	0.8798	0.6662	0.8801	0.6659	0.8804	0.6661
u > u: / p _ t	0.1200	0.3359	0.1202	0.3338	0.1199	0.3341	0.1196	0.3339
i: > i / t _ r	0.3330	0.5903	0.3341	0.5936	0.3343	0.5926	0.3327	0.5891
i: > i: / t _ r	0.6670	0.4097	0.6659	0.4064	0.6657	0.4074	0.6673	0.4109
r > Ø / a _ c	0.4989	0.7517	0.4985	0.7515	0.4989	0.7518	0.4980	0.7513
r > n / a _ c	0.5011	0.2483	0.5015	0.2485	0.5011	0.2482	0.5020	0.2487
r > Ø / u: _ v	0.6234	0.8535	0.6243	0.8528	0.6247	0.8521	0.6237	0.8523
r > r / u: _ v	0.3766	0.1465	0.3757	0.1472	0.3753	0.1479	0.3763	0.1477
j > j / # _ u	0.8568	0.6274	0.8557	0.6290	0.8560	0.6285	0.8561	0.6290
j > t / # _ u	0.1432	0.3726	0.1443	0.3710	0.1440	0.3715	0.1439	0.3710
u > a / c _ l	0.2894	0.0882	0.2890	0.0885	0.2894	0.0885	0.2915	0.0885
u > u / c _ l	0.5493	0.6708	0.5501	0.6685	0.5495	0.6693	0.5477	0.6704
u > u: / c _ l	0.1613	0.2410	0.1610	0.2431	0.1612	0.2422	0.1608	0.2411
i > Ø / t <sup>h</sup> _ t	0.2192	0.0686	0.2192	0.0683	0.2198	0.0687	0.2197	0.0684
i > i / t <sup>h</sup> _ t	0.3827	0.6060	0.3832	0.6071	0.3843	0.6075	0.3827	0.6081
i > i: / t <sup>h</sup> _ t	0.3981	0.3254	0.3977	0.3246	0.3960	0.3238	0.3976	0.3235
r̥ > Ø / v _ t	0.3819	0.1619	0.3831	0.1612	0.3818	0.1613	0.3797	0.1616
r̥ > a / v _ t	0.3755	0.4087	0.3730	0.4075	0.3739	0.4092	0.3754	0.4068
r̥ > u / v _ t	0.2426	0.4293	0.2439	0.4312	0.2443	0.4296	0.2449	0.4316
i > i / h _ n	0.5053	0.7645	0.5069	0.7638	0.5063	0.7646	0.5047	0.7645
i > i: / h _ n	0.4947	0.2355	0.4931	0.2362	0.4937	0.2354	0.4953	0.2355
r > Ø / p _ a	0.9172	0.9415	0.9170	0.9413	0.9169	0.9415	0.9171	0.9414
r > a / p _ a	0.0828	0.0069	0.0830	0.0069	0.0831	0.0069	0.0829	0.0069
r > i / p _ a	0.0000	0.0516	0.0000	0.0518	0.0000	0.0516	0.0000	0.0516
r > Ø / t _ a	0.9612	0.7879	0.9611	0.7885	0.9608	0.7896	0.9615	0.7862
r > r / t _ a	0.0388	0.2121	0.0389	0.2115	0.0392	0.2104	0.0385	0.2138
r > l / a: _ i	0.1895	0.0273	0.1901	0.0271	0.1880	0.0280	0.1901	0.0272
r > l / a: _ i	0.2995	0.3623	0.2994	0.3627	0.3005	0.3629	0.2997	0.3621
r > r / a: _ i	0.5110	0.6104	0.5106	0.6103	0.5115	0.6091	0.5101	0.6107
ɲ > Ø / j _ a:	0.2840	0.1431	0.2824	0.1421	0.2825	0.1426	0.2829	0.1429
ɲ > ɲ / j _ a:	0.2018	0.0818	0.2005	0.0819	0.2016	0.0814	0.2022	0.0821
ɲ > n / j _ a:	0.5142	0.7751	0.5171	0.7761	0.5158	0.7760	0.5149	0.7750
h > Ø / o _ i	0.2171	0.4812	0.2172	0.4820	0.2170	0.4815	0.2179	0.4799
h > h / o _ i	0.7829	0.5188	0.7828	0.5180	0.7830	0.5185	0.7821	0.5201
r > Ø / g _ a	0.8613	0.9940	0.8612	0.9940	0.8615	0.9941	0.8618	0.9941
r > a / g _ a	0.1387	0.0060	0.1388	0.0060	0.1385	0.0059	0.1382	0.0059
s > c <sup>h</sup> / t _ j	0.8987	0.6663	0.8998	0.6704	0.8986	0.6671	0.8974	0.6655
s > s / t _ j	0.1013	0.3337	0.1002	0.3296	0.1014	0.3329	0.1026	0.3345
r > Ø / a _ k	0.6999	0.7945	0.7000	0.7950	0.6998	0.7955	0.6990	0.7947
r > n / a _ k	0.0625	0.1131	0.0625	0.1129	0.0626	0.1125	0.0628	0.1130
r > k / a _ k	0.1412	0.0924	0.1413	0.0920	0.1414	0.0920	0.1416	0.0923
r > r / a _ k	0.0963	0.0000	0.0962	0.0000	0.0962	0.0000	0.0966	0.0000
i > Ø / ɲ _ j	0.3834	0.1342	0.3836	0.1347	0.3817	0.1343	0.3822	0.1347
i > i / ɲ _ j	0.6166	0.8658	0.6164	0.8653	0.6183	0.8657	0.6178	0.8653
r > Ø / a _ d <sup>h</sup>	0.8377	0.9334	0.8373	0.9331	0.8386	0.9329	0.8368	0.9332
r > d / a _ d <sup>h</sup>	0.1143	0.0000	0.1147	0.0000	0.1136	0.0000	0.1150	0.0000
r > r / a _ d <sup>h</sup>	0.0480	0.0666	0.0480	0.0669	0.0478	0.0671	0.0482	0.0668
ʂ > h / a _ a	0.3380	0.1035	0.3389	0.1038	0.3391	0.1036	0.3389	0.1040
ʂ > s / a _ a	0.6620	0.8965	0.6611	0.8962	0.6609	0.8964	0.6611	0.8960
u > Ø / t _ h	0.5355	0.2551	0.5368	0.2541	0.5346	0.2535	0.5386	0.2552
u > u / t _ h	0.4645	0.7449	0.4632	0.7459	0.4654	0.7465	0.4614	0.7448
j > Ø / e _ a	0.3235	0.6127	0.3237	0.6100	0.3231	0.6116	0.3232	0.6122
j > j / e _ a	0.6765	0.3873	0.6763	0.3900	0.6769	0.3884	0.6768	0.3878
i > i / h _ ʂ	0.6654	0.9024	0.6668	0.9028	0.6661	0.9024	0.6655	0.9029
i > i: / h _ ʂ	0.3346	0.0976	0.3332	0.0972	0.3339	0.0976	0.3345	0.0971
ʃ > Ø / r̥ _ c	0.4743	0.7630	0.4739	0.7681	0.4754	0.7641	0.4750	0.7629
ʃ > c / r̥ _ c	0.5257	0.2370	0.5261	0.2319	0.5246	0.2359	0.5250	0.2371

u > o / c _ t	0.2650	0.5124	0.2664	0.5127	0.2643	0.5136	0.2648	0.5149
u > u / c _ t	0.2951	0.2986	0.2967	0.2973	0.2950	0.2982	0.2953	0.2995
u > u: / c _ t	0.4399	0.1890	0.4369	0.1900	0.4407	0.1882	0.4400	0.1856
ɤ > Ø / r _ t	0.7324	0.9481	0.7331	0.9476	0.7325	0.9478	0.7329	0.9476
ɤ > t / r _ t	0.2676	0.0519	0.2669	0.0524	0.2675	0.0522	0.2671	0.0524
u: > u / d <sup>h</sup> _ m	0.5210	0.8066	0.5229	0.8055	0.5194	0.8067	0.5218	0.8062
u: > u: / d <sup>h</sup> _ m	0.4790	0.1934	0.4771	0.1945	0.4806	0.1933	0.4782	0.1938
u > u / ʃ _ k	0.6688	0.9122	0.6711	0.9133	0.6711	0.9127	0.6702	0.9126
u > u: / ʃ _ k	0.3312	0.0878	0.3289	0.0867	0.3289	0.0873	0.3298	0.0874
r > Ø / a _ d	0.7928	0.7520	0.7930	0.7515	0.7929	0.7520	0.7934	0.7516
r > ɖ / a _ d	0.0771	0.0162	0.0771	0.0162	0.0773	0.0162	0.0773	0.0161
r > ɳ / a _ d	0.0736	0.1061	0.0736	0.1063	0.0735	0.1061	0.0733	0.1063
r > l / a _ d	0.0564	0.0286	0.0562	0.0287	0.0562	0.0284	0.0560	0.0287
r > r / a _ d	0.0001	0.0971	0.0001	0.0973	0.0001	0.0973	0.0001	0.0974
u > Ø / k _ t	0.2254	0.0395	0.2257	0.0395	0.2258	0.0396	0.2255	0.0395
u > a / k _ t	0.0767	0.0362	0.0762	0.0360	0.0765	0.0360	0.0768	0.0360
u > o / k _ t	0.0612	0.1037	0.0616	0.1036	0.0616	0.1037	0.0614	0.1033
u > u / k _ t	0.6367	0.8206	0.6365	0.8209	0.6362	0.8207	0.6364	0.8212
u: > o / c _ d	0.2560	0.0944	0.2556	0.0944	0.2554	0.0948	0.2561	0.0939
u: > u / c _ d	0.1965	0.4652	0.1969	0.4644	0.1974	0.4638	0.1972	0.4622
u: > u: / c _ d	0.5475	0.4404	0.5475	0.4413	0.5472	0.4413	0.5467	0.4439
s > c <sup>h</sup> / # _ u:	0.0003	0.1398	0.0000	0.1418	0.0000	0.1405	0.0001	0.1403
s > s / # _ u:	0.9997	0.8602	1.0000	0.8582	1.0000	0.8595	0.9999	0.8597
j > Ø / i _ a	0.9234	0.6714	0.9231	0.6677	0.9231	0.6682	0.9228	0.6713
j > j / i _ a	0.0766	0.3286	0.0769	0.3323	0.0769	0.3318	0.0772	0.3287
j > Ø / a: _ a:	0.7328	0.4269	0.7346	0.4270	0.7312	0.4271	0.7311	0.4263
j > ɳ / a: _ a:	0.1249	0.1866	0.1237	0.1871	0.1252	0.1873	0.1254	0.1866
j > j / a: _ a:	0.1423	0.3865	0.1417	0.3860	0.1436	0.3856	0.1436	0.3871
ɤ > ɳ / i _ a	0.2277	0.2862	0.2273	0.2865	0.2281	0.2860	0.2305	0.2861
ɤ > h / i _ a	0.4469	0.1555	0.4454	0.1558	0.4448	0.1557	0.4402	0.1563
ɤ > s / i _ a	0.3254	0.5583	0.3273	0.5577	0.3270	0.5582	0.3293	0.5576
i > i / n _ n	0.2438	0.5606	0.2429	0.5585	0.2431	0.5632	0.2448	0.5596
i > i: / n _ n	0.7562	0.4394	0.7571	0.4415	0.7569	0.4368	0.7552	0.4404
i > Ø / r _ t	0.5261	0.2140	0.5268	0.2137	0.5257	0.2140	0.5273	0.2136
i > i / r _ t	0.4739	0.7860	0.4732	0.7863	0.4743	0.7860	0.4727	0.7864
ʃ > Ø / a _ a	0.3940	0.3081	0.3940	0.3078	0.3940	0.3075	0.3943	0.3077
ʃ > ʃ / a _ a	0.0652	0.0152	0.0651	0.0153	0.0652	0.0153	0.0651	0.0154
ʃ > ɳ / a _ a	0.0662	0.0000	0.0664	0.0000	0.0665	0.0000	0.0663	0.0000
ʃ > h / a _ a	0.2226	0.2150	0.2224	0.2146	0.2224	0.2150	0.2225	0.2149
ʃ > r / a _ a	0.0402	0.0269	0.0401	0.0270	0.0401	0.0271	0.0401	0.0269
ʃ > s / a _ a	0.2118	0.4347	0.2119	0.4352	0.2117	0.4351	0.2117	0.4352
j > Ø / n _ a	0.8514	1.0000	0.8513	1.0000	0.8500	1.0000	0.8508	1.0000
j > j / n _ a	0.1486	0.0000	0.1487	0.0000	0.1500	0.0000	0.1492	0.0000
ɤ > Ø / i _ t	0.7245	0.9563	0.7253	0.9560	0.7255	0.9558	0.7248	0.9563
ɤ > t / i _ t	0.2755	0.0437	0.2747	0.0440	0.2745	0.0442	0.2752	0.0437
s > Ø / # _ a:	0.0141	0.0751	0.0138	0.0754	0.0140	0.0753	0.0141	0.0753
s > s / # _ a:	0.9859	0.8124	0.9862	0.8123	0.9860	0.8125	0.9859	0.8122
s > x / # _ a:	0.0000	0.1125	0.0000	0.1122	0.0000	0.1122	0.0000	0.1125
j > Ø / a: _ a	0.8830	0.5990	0.8841	0.5999	0.8836	0.6003	0.8833	0.5992
j > j <sup>h</sup> / a: _ a	0.0326	0.1239	0.0326	0.1241	0.0323	0.1239	0.0327	0.1237
j > j / a: _ a	0.0844	0.2771	0.0832	0.2760	0.0841	0.2758	0.0840	0.2771
n > Ø / a: _ t	0.0982	0.3543	0.0981	0.3522	0.0985	0.3540	0.0983	0.3543
n > ɳ / a: _ t	0.6416	0.5293	0.6421	0.5318	0.6410	0.5293	0.6420	0.5295
n > n / a: _ t	0.2602	0.1164	0.2598	0.1160	0.2606	0.1168	0.2597	0.1162
u > o / ʃ _ ŋ	0.1351	0.2641	0.1349	0.2653	0.1384	0.2651	0.1346	0.2651
u > u / ʃ _ ŋ	0.7205	0.3920	0.7201	0.3906	0.7159	0.3907	0.7201	0.3892
u > u: / ʃ _ ŋ	0.1445	0.3439	0.1450	0.3441	0.1457	0.3442	0.1453	0.3457
r > Ø / a: _ g	0.5471	0.6427	0.5446	0.6433	0.5483	0.6430	0.5465	0.6426
r > ɳ / a: _ g	0.4014	0.1504	0.4032	0.1502	0.3998	0.1506	0.4009	0.1511

r > n / a: _g	0.0515	0.2069	0.0523	0.2065	0.0518	0.2064	0.0526	0.2063
f > s / # _o	1.0000	0.8461	1.0000	0.8466	1.0000	0.8460	1.0000	0.8459
f > x / # _o	0.0000	0.1539	0.0000	0.1534	0.0000	0.1540	0.0000	0.1541
i > ∅ / t _k	0.1466	0.1897	0.1466	0.1887	0.1464	0.1898	0.1461	0.1898
i > i / t _k	0.2380	0.5163	0.2381	0.5152	0.2384	0.5163	0.2381	0.5160
i > i: / t _k	0.6154	0.2940	0.6153	0.2961	0.6152	0.2939	0.6158	0.2941
u: > u / # _s	0.3063	0.6415	0.3081	0.6358	0.3076	0.6410	0.3073	0.6408
u: > u: / # _s	0.6937	0.3585	0.6919	0.3642	0.6924	0.3590	0.6927	0.3592
r̥ > a / f _η	0.1774	0.0851	0.1773	0.0844	0.1768	0.0850	0.1771	0.0847
r̥ > a: / f _η	0.2269	0.0554	0.2256	0.0554	0.2260	0.0555	0.2280	0.0551
r̥ > i / f _η	0.5127	0.6315	0.5140	0.6329	0.5142	0.6324	0.5121	0.6331
r̥ > i: / f _η	0.0830	0.2280	0.0831	0.2272	0.0830	0.2271	0.0829	0.2272
i > i / b <sup>h</sup> _k <sub>s</sub>	0.2753	0.6069	0.2754	0.6059	0.2735	0.6082	0.2768	0.6068
i > i: / b <sup>h</sup> _k <sub>s</sub>	0.7247	0.3931	0.7246	0.3941	0.7265	0.3918	0.7232	0.3932
r > l / a _u	0.0001	0.1570	0.0000	0.1581	0.0001	0.1566	0.0000	0.1566
r > r / a _u	0.9999	0.8430	1.0000	0.8419	0.9999	0.8434	1.0000	0.8434
i: > ∅ / j _v	0.1363	0.0510	0.1364	0.0505	0.1364	0.0508	0.1364	0.0510
i: > i / j _v	0.3945	0.7260	0.3941	0.7271	0.3946	0.7274	0.3934	0.7263
i: > i: / j _v	0.4692	0.2231	0.4695	0.2224	0.4690	0.2218	0.4702	0.2227
s > f / # _i:	0.1575	0.0001	0.1576	0.0000	0.1575	0.0000	0.1572	0.0000
s > s / # _i:	0.8425	0.9999	0.8424	1.0000	0.8425	1.0000	0.8428	1.0000
f > f / # _u	0.1064	0.0365	0.1072	0.0365	0.1069	0.0366	0.1062	0.0366
f > s / # _u	0.8936	0.8239	0.8928	0.8247	0.8931	0.8238	0.8938	0.8237
f > x / # _u	0.0000	0.1395	0.0000	0.1388	0.0000	0.1396	0.0000	0.1397
h > ∅ / # _i	0.0471	0.2938	0.0470	0.2938	0.0467	0.2949	0.0466	0.2939
h > h / # _i	0.9529	0.7062	0.9530	0.7062	0.9533	0.7051	0.9534	0.7061
u: > o / l _k	0.2145	0.3946	0.2166	0.3916	0.2163	0.3924	0.2165	0.3929
u: > u / l _k	0.3448	0.4671	0.3415	0.4701	0.3444	0.4693	0.3435	0.4690
u: > u: / l _k	0.4407	0.1383	0.4419	0.1382	0.4393	0.1383	0.4400	0.1381
j > ∅ / a _a	0.7326	0.5465	0.7319	0.5473	0.7324	0.5472	0.7322	0.5470
j > v / a _a	0.0202	0.0572	0.0201	0.0572	0.0201	0.0572	0.0200	0.0570
j > t̥ / a _a	0.0366	0.0123	0.0367	0.0123	0.0367	0.0123	0.0367	0.0123
j > n / a _a	0.0802	0.0184	0.0803	0.0183	0.0804	0.0183	0.0803	0.0183
j > j / a _a	0.0524	0.1987	0.0526	0.1982	0.0524	0.1984	0.0525	0.1986
j > l / a _a	0.0169	0.0223	0.0170	0.0222	0.0169	0.0222	0.0169	0.0223
j > n / a _a	0.0303	0.1080	0.0306	0.1081	0.0304	0.1080	0.0305	0.1079
j > r / a _a	0.0307	0.0365	0.0309	0.0364	0.0307	0.0364	0.0308	0.0366
n > n / h _a	0.7867	0.4551	0.7867	0.4549	0.7871	0.4558	0.7876	0.4559
n > n <sup>h</sup> / h _a	0.2133	0.5449	0.2133	0.5451	0.2129	0.5442	0.2124	0.5441
i > i / p _s	0.3237	0.6688	0.3227	0.6667	0.3287	0.6692	0.3265	0.6688
i > i: / p _s	0.6763	0.3312	0.6773	0.3333	0.6713	0.3308	0.6735	0.3312
k <sub>s</sub> > c <sup>h</sup> / # _o	0.7337	0.3957	0.7396	0.3978	0.7394	0.3958	0.7380	0.3958
k <sub>s</sub> > k <sup>h</sup> / # _o	0.2663	0.6043	0.2604	0.6022	0.2606	0.6042	0.2620	0.6042
l > ∅ / a _u:	0.3828	0.7295	0.3835	0.7324	0.3854	0.7301	0.3863	0.7310
l > l / a _u:	0.6172	0.2705	0.6165	0.2676	0.6146	0.2699	0.6137	0.2690
n > n / a _j	0.1697	0.0000	0.1692	0.0000	0.1696	0.0000	0.1694	0.0000
n > n / a _j	0.8303	1.0000	0.8308	1.0000	0.8304	1.0000	0.8306	1.0000
s > h / h _a	0.3247	0.6715	0.3263	0.6811	0.3283	0.6813	0.3243	0.6792
s > s / h _a	0.6753	0.3285	0.6737	0.3189	0.6717	0.3187	0.6757	0.3208
u: > u / m _r	0.4896	0.8241	0.4924	0.8250	0.4902	0.8246	0.4915	0.8227
u: > u: / m _r	0.5104	0.1759	0.5076	0.1750	0.5098	0.1754	0.5085	0.1773
ŋ > ∅ / a: _d	0.0172	0.1573	0.0171	0.1580	0.0172	0.1578	0.0173	0.1570
ŋ > ŋ / a: _d	0.3078	0.0987	0.3083	0.0988	0.3083	0.0988	0.3085	0.0986
ŋ > n / a: _d	0.4927	0.5937	0.4920	0.5929	0.4920	0.5930	0.4917	0.5940
ŋ > n / a: _d	0.1823	0.1503	0.1825	0.1503	0.1825	0.1503	0.1825	0.1504
i: > e / v _t	0.0596	0.3013	0.0593	0.3008	0.0596	0.3009	0.0593	0.3008
i: > i / v _t	0.3854	0.4010	0.3853	0.4018	0.3854	0.4017	0.3842	0.4017
i: > i: / v _t	0.5550	0.2976	0.5554	0.2974	0.5550	0.2974	0.5564	0.2975
i > i / t _k	0.1860	0.5245	0.1854	0.5229	0.1866	0.5238	0.1859	0.5240
i > i: / t _k	0.8140	0.4755	0.8146	0.4771	0.8134	0.4762	0.8141	0.4760

j > j / # _ a	0.9919	0.7886	0.9918	0.7888	0.9919	0.7888	0.9918	0.7886
j > j / # _ a	0.0081	0.1513	0.0082	0.1513	0.0081	0.1512	0.0082	0.1512
j > z / # _ a	0.0000	0.0601	0.0000	0.0600	0.0000	0.0600	0.0000	0.0602
u > u / g _ s	0.4775	0.8185	0.4765	0.8190	0.4778	0.8189	0.4760	0.8191
u > u: / g _ s	0.5225	0.1815	0.5235	0.1810	0.5222	0.1811	0.5240	0.1809
r > i / p _ s	0.4208	0.4797	0.4197	0.4791	0.4209	0.4798	0.4212	0.4800
r > i: / p _ s	0.1795	0.4078	0.1791	0.4086	0.1790	0.4077	0.1793	0.4075
r > u / p _ s	0.3996	0.1125	0.4012	0.1123	0.4001	0.1125	0.3995	0.1125
n > n / i _ d	0.5422	0.1948	0.5410	0.1950	0.5423	0.1952	0.5426	0.1937
n > n / i _ d	0.4578	0.8052	0.4590	0.8050	0.4577	0.8048	0.4574	0.8063
i > i / b _ n	0.4370	0.7881	0.4369	0.7887	0.4363	0.7904	0.4386	0.7881
i > u / b _ n	0.5630	0.2119	0.5631	0.2113	0.5637	0.2096	0.5614	0.2119
i > i / r _ n	0.2447	0.6011	0.2445	0.6037	0.2432	0.6040	0.2450	0.6016
i > i: / r _ n	0.7553	0.3989	0.7555	0.3963	0.7568	0.3960	0.7550	0.3984
ŋ > Ø / a _ d	0.0882	0.2547	0.0881	0.2556	0.0884	0.2552	0.0882	0.2544
ŋ > ŋ / a _ d	0.3612	0.1336	0.3605	0.1336	0.3606	0.1335	0.3612	0.1336
ŋ > n / a _ d	0.3206	0.4961	0.3204	0.4952	0.3202	0.4956	0.3208	0.4966
ŋ > n / a _ d	0.2301	0.1156	0.2311	0.1156	0.2308	0.1156	0.2298	0.1154
r > Ø / g <sup>h</sup> _ t	0.2372	0.5954	0.2381	0.5985	0.2353	0.5980	0.2291	0.5922
r > i / g <sup>h</sup> _ t	0.7628	0.4046	0.7619	0.4015	0.7647	0.4020	0.7709	0.4078
u: > u / s _ t	0.4185	0.7782	0.4192	0.7787	0.4193	0.7798	0.4200	0.7785
u: > u: / s _ t	0.5815	0.2218	0.5808	0.2213	0.5807	0.2202	0.5800	0.2215
i > i / # _ s	0.6196	0.2550	0.6225	0.2523	0.6216	0.2513	0.6218	0.2536
i > i: / # _ s	0.3804	0.7450	0.3775	0.7477	0.3784	0.7487	0.3782	0.7464
r > a / k _ s	0.1177	0.4298	0.1178	0.4290	0.1173	0.4279	0.1182	0.4294
r > a: / k _ s	0.3234	0.2899	0.3236	0.2895	0.3232	0.2907	0.3255	0.2888
r > i / k _ s	0.5589	0.2803	0.5586	0.2815	0.5595	0.2813	0.5563	0.2818
r > Ø / d _ f	0.6633	0.2890	0.6616	0.2916	0.6616	0.2923	0.6622	0.2887
r > i / d _ f	0.3367	0.7110	0.3384	0.7084	0.3384	0.7077	0.3378	0.7113
f > f / # _ v	0.1918	0.0000	0.1921	0.0000	0.1925	0.0002	0.1910	0.0000
f > s / # _ v	0.8082	1.0000	0.8079	1.0000	0.8075	0.9998	0.8090	1.0000
f > h / a _ a:	0.0484	0.3303	0.0483	0.3307	0.0480	0.3312	0.0480	0.3329
f > s / a _ a:	0.9516	0.6697	0.9517	0.6693	0.9520	0.6688	0.9520	0.6671
f > Ø / a: _ a	0.2166	0.2984	0.2163	0.2981	0.2164	0.2983	0.2159	0.2979
f > j / a: _ a	0.1198	0.0000	0.1193	0.0000	0.1195	0.0000	0.1196	0.0000
f > n / a: _ a	0.0795	0.0921	0.0799	0.0923	0.0797	0.0921	0.0799	0.0922
f > h / a: _ a	0.2068	0.0742	0.2072	0.0742	0.2067	0.0740	0.2071	0.0742
f > n / a: _ a	0.0530	0.0329	0.0529	0.0330	0.0529	0.0331	0.0527	0.0331
f > s / a: _ a	0.3243	0.5024	0.3243	0.5024	0.3247	0.5025	0.3248	0.5026
f > f / # _ a:	0.1408	0.0130	0.1397	0.0131	0.1406	0.0131	0.1412	0.0131
f > s / # _ a:	0.8592	0.8682	0.8603	0.8682	0.8593	0.8681	0.8588	0.8680
f > x / # _ a:	0.0000	0.1188	0.0000	0.1188	0.0000	0.1188	0.0000	0.1189
i: > i / k _ l	0.2910	0.6741	0.2931	0.6721	0.2932	0.6720	0.2929	0.6737
i: > i: / k _ l	0.7090	0.3259	0.7069	0.3279	0.7068	0.3280	0.7071	0.3263
i > Ø / r _ k	0.2594	0.2567	0.2592	0.2556	0.2591	0.2558	0.2595	0.2568
i > i / r _ k	0.1928	0.5213	0.1929	0.5208	0.1927	0.5207	0.1920	0.5183
i > i: / r _ k	0.5479	0.2220	0.5479	0.2237	0.5482	0.2235	0.5485	0.2249
i > Ø / c _ k	0.3690	0.2321	0.3690	0.2308	0.3698	0.2315	0.3693	0.2311
i > i / c _ k	0.2608	0.6280	0.2601	0.6297	0.2601	0.6293	0.2610	0.6294
i > i: / c _ k	0.3702	0.1399	0.3709	0.1395	0.3701	0.1391	0.3697	0.1394
r > Ø / a _ b <sup>h</sup>	0.6771	0.9609	0.6775	0.9609	0.6788	0.9610	0.6763	0.9607
r > b / a _ b <sup>fi</sup>	0.3229	0.0391	0.3225	0.0391	0.3212	0.0390	0.3237	0.0393
r > Ø / t _ a:	0.6976	0.9699	0.6956	0.9698	0.6979	0.9699	0.6976	0.9698
r > r / t _ a:	0.3024	0.0301	0.3044	0.0302	0.3021	0.0301	0.3024	0.0302
kʂ > k / a: _ a	0.1187	0.4664	0.1180	0.4688	0.1203	0.4674	0.1207	0.4645
kʂ > k <sup>h</sup> / a: _ a	0.8813	0.5336	0.8820	0.5312	0.8797	0.5326	0.8793	0.5355
s > Ø / # _ a	0.0038	0.0710	0.0038	0.0708	0.0038	0.0709	0.0038	0.0711
s > f / # _ a	0.0273	0.0018	0.0274	0.0018	0.0274	0.0018	0.0273	0.0018
s > c <sup>h</sup> / # _ a	0.0096	0.0029	0.0096	0.0028	0.0096	0.0029	0.0096	0.0029
s > h / # _ a	0.0029	0.0642	0.0028	0.0641	0.0029	0.0642	0.0029	0.0643

s > s / # _ a	0.9563	0.7761	0.9563	0.7765	0.9563	0.7762	0.9563	0.7756
s > x / # _ a	0.0000	0.0841	0.0000	0.0840	0.0000	0.0841	0.0000	0.0844
i: > i / t _ j	0.3284	0.7178	0.3274	0.7169	0.3275	0.7165	0.3286	0.7174
i: > i: / t _ j	0.6716	0.2822	0.6726	0.2831	0.6725	0.2835	0.6714	0.2826
u > o / g _ p <sup>h</sup>	0.1194	0.4775	0.1198	0.4751	0.1193	0.4779	0.1212	0.4771
u > u / g _ p <sup>h</sup>	0.8806	0.5225	0.8802	0.5249	0.8807	0.5221	0.8788	0.5229
i > i / ŋ _ k	0.4454	0.8258	0.4459	0.8249	0.4468	0.8256	0.4473	0.8263
i > i: / ŋ _ k	0.5546	0.1742	0.5541	0.1751	0.5532	0.1744	0.5527	0.1737
ɤ > Ø / e _ t	0.9794	0.7100	0.9823	0.7090	0.9802	0.7091	0.9793	0.7099
ɤ > ɤ / e _ t	0.0206	0.2900	0.0177	0.2910	0.0198	0.2909	0.0207	0.2901
u > Ø / k _ l	0.1637	0.0691	0.1633	0.0694	0.1636	0.0687	0.1637	0.0694
u > a / k _ l	0.0913	0.0485	0.0912	0.0487	0.0915	0.0486	0.0912	0.0489
u > o / k _ l	0.1453	0.0580	0.1453	0.0582	0.1455	0.0581	0.1450	0.0584
u > u / k _ l	0.4318	0.8013	0.4317	0.8006	0.4312	0.8016	0.4322	0.8002
u > u: / k _ l	0.1679	0.0230	0.1685	0.0231	0.1682	0.0230	0.1679	0.0231
l > l / i _ a:	0.4417	0.8259	0.4398	0.8264	0.4439	0.8268	0.4429	0.8272
l > r / i _ a:	0.5583	0.1741	0.5602	0.1736	0.5561	0.1732	0.5571	0.1728
u: > u / k _ t	0.2449	0.6453	0.2473	0.6446	0.2456	0.6432	0.2457	0.6462
u: > u: / k _ t	0.7551	0.3547	0.7527	0.3554	0.7544	0.3568	0.7543	0.3538
u: > u / k _ r	0.8700	0.4963	0.8707	0.4959	0.8703	0.4975	0.8698	0.4961
u: > u: / k _ r	0.1300	0.5037	0.1293	0.5041	0.1297	0.5025	0.1302	0.5039
i: > i / f _ r	0.1705	0.5645	0.1712	0.5674	0.1714	0.5673	0.1718	0.5638
i: > i: / f _ r	0.8295	0.4355	0.8288	0.4326	0.8286	0.4327	0.8282	0.4362
f > Ø / # _ a	0.0031	0.0477	0.0031	0.0478	0.0031	0.0478	0.0032	0.0477
f > f / # _ a	0.1329	0.0166	0.1321	0.0166	0.1326	0.0167	0.1330	0.0166
f > c <sup>h</sup> / # _ a	0.0264	0.0339	0.0263	0.0340	0.0263	0.0341	0.0263	0.0339
f > h / # _ a	0.0000	0.0444	0.0000	0.0446	0.0000	0.0446	0.0000	0.0446
f > s / # _ a	0.8376	0.7607	0.8385	0.7603	0.8380	0.7601	0.8375	0.7603
f > x / # _ a	0.0000	0.0967	0.0000	0.0966	0.0000	0.0967	0.0000	0.0969
i: > i / b <sup>h</sup> _ r	0.2345	0.6453	0.2354	0.6427	0.2361	0.6454	0.2342	0.6455
i: > i: / b <sup>h</sup> _ r	0.7655	0.3547	0.7646	0.3573	0.7639	0.3546	0.7658	0.3545
i > Ø / l _ t	0.6585	0.2402	0.6504	0.2415	0.6582	0.2386	0.6498	0.2408
i > i / l _ t	0.3415	0.7598	0.3496	0.7585	0.3418	0.7614	0.3502	0.7592
i: > i / s _ m	0.4778	0.8669	0.4793	0.8663	0.4796	0.8690	0.4782	0.8688
i: > i: / s _ m	0.5222	0.1331	0.5207	0.1337	0.5204	0.1310	0.5218	0.1312
i: > i / kɤ _ r	0.2228	0.6495	0.2245	0.6487	0.2244	0.6479	0.2227	0.6484
i: > i: / kɤ _ r	0.7772	0.3505	0.7755	0.3513	0.7756	0.3521	0.7773	0.3516
i > e / v _ f	0.2549	0.0000	0.2537	0.0001	0.2539	0.0000	0.2549	0.0000
i > i / v _ f	0.7451	1.0000	0.7463	0.9999	0.7461	1.0000	0.7451	1.0000
j > Ø / d _ a	0.2337	0.2104	0.2332	0.2103	0.2326	0.2101	0.2338	0.2099
j > j / d _ a	0.7663	0.5365	0.7668	0.5368	0.7674	0.5374	0.7662	0.5371
j > d / d _ a	0.0000	0.2531	0.0000	0.2529	0.0000	0.2525	0.0000	0.2530
f > f / # _ r	0.2595	0.0000	0.2605	0.0000	0.2596	0.0000	0.2609	0.0000
f > s / # _ r	0.7405	1.0000	0.7395	1.0000	0.7404	1.0000	0.7391	1.0000
f > Ø / r _ a	0.1916	0.0928	0.1904	0.0934	0.1907	0.0932	0.1907	0.0933
f > h / r _ a	0.4122	0.0900	0.4129	0.0896	0.4119	0.0910	0.4135	0.0901
f > s / r _ a	0.3962	0.8171	0.3967	0.8169	0.3974	0.8159	0.3958	0.8166
ɤ > Ø / u _ a	0.3627	0.0589	0.3606	0.0589	0.3624	0.0586	0.3632	0.0587
ɤ > h / u _ a	0.2479	0.1468	0.2478	0.1453	0.2458	0.1482	0.2472	0.1463
ɤ > s / u _ a	0.3894	0.7943	0.3916	0.7957	0.3918	0.7931	0.3896	0.7950
j > Ø / d <sup>h</sup> _ a:	0.1211	0.5357	0.1232	0.5364	0.1225	0.5350	0.1223	0.5374
j > j <sup>h</sup> / d <sup>h</sup> _ a:	0.8789	0.4643	0.8768	0.4636	0.8775	0.4650	0.8777	0.4626
u > Ø / t _ r	0.1938	0.0461	0.1933	0.0460	0.1934	0.0459	0.1940	0.0463
u > o / t _ r	0.2070	0.0227	0.2072	0.0227	0.2069	0.0226	0.2073	0.0227
u > u / t _ r	0.5389	0.9226	0.5394	0.9226	0.5396	0.9228	0.5385	0.9223
u > u: / t _ r	0.0602	0.0086	0.0602	0.0086	0.0601	0.0086	0.0603	0.0087
i > e / n _ j	0.7031	0.2567	0.7026	0.2553	0.6985	0.2553	0.7041	0.2558
i > i / n _ j	0.2969	0.7433	0.2974	0.7447	0.3015	0.7447	0.2959	0.7442
i > i / l _ n	0.3199	0.7650	0.3206	0.7665	0.3204	0.7663	0.3194	0.7663
i > i: / l _ n	0.6801	0.2350	0.6794	0.2335	0.6796	0.2337	0.6806	0.2337



u > ∅ / f _ r	0.5447	0.1161	0.5470	0.1172	0.5456	0.1170	0.5444	0.1157
u > u / f _ r	0.4553	0.8839	0.4530	0.8828	0.4544	0.8830	0.4556	0.8843
r > ∅ / d _ a	0.5472	0.9293	0.5477	0.9293	0.5480	0.9293	0.5464	0.9295
r > a / d _ a	0.0680	0.0000	0.0679	0.0000	0.0681	0.0000	0.0681	0.0000
r > l / d _ a	0.0831	0.0332	0.0832	0.0331	0.0832	0.0332	0.0832	0.0331
r > r / d _ a	0.3017	0.0375	0.3012	0.0376	0.3007	0.0376	0.3023	0.0374
i > a / k _ r	0.2905	0.0001	0.2913	0.0001	0.2903	0.0001	0.2905	0.0000
i > i / k _ r	0.7095	0.9999	0.7087	0.9999	0.7097	0.9999	0.7095	1.0000
ɲ > ∅ / a _ c	0.1115	0.1880	0.1113	0.1885	0.1115	0.1885	0.1116	0.1883
ɲ > ɲ / a _ c	0.4057	0.0350	0.4055	0.0350	0.4056	0.0350	0.4061	0.0350
ɲ > n / a _ c	0.2652	0.4717	0.2651	0.4708	0.2649	0.4708	0.2650	0.4715
ɲ > i / a _ c	0.0101	0.0348	0.0101	0.0348	0.0101	0.0347	0.0101	0.0347
ɲ > n / a _ c	0.2075	0.2705	0.2079	0.2709	0.2078	0.2709	0.2071	0.2704
ŋ > ∅ / u _ d	0.1463	0.2673	0.1464	0.2678	0.1465	0.2675	0.1467	0.2682
ŋ > ŋ / u _ d	0.2924	0.0308	0.2917	0.0309	0.2920	0.0309	0.2921	0.0309
ŋ > n / u _ d	0.2487	0.5593	0.2482	0.5589	0.2484	0.5593	0.2487	0.5584
ŋ > n / u _ d	0.3126	0.1426	0.3137	0.1424	0.3132	0.1424	0.3124	0.1426
s > f / # _ i	0.2150	0.0000	0.2153	0.0000	0.2156	0.0000	0.2151	0.0000
s > s / # _ i	0.7850	0.8805	0.7847	0.8805	0.7844	0.8803	0.7849	0.8806
s > x / # _ i	0.0000	0.1195	0.0000	0.1195	0.0000	0.1196	0.0000	0.1194
i > ∅ / kʂ _ k	0.4069	0.8636	0.4092	0.8647	0.4058	0.8623	0.4067	0.8631
i > i: / kʂ _ k	0.5931	0.1364	0.5908	0.1353	0.5942	0.1377	0.5933	0.1369
u > ∅ / r _ ʂ	0.2676	0.0935	0.2675	0.0940	0.2687	0.0937	0.2666	0.0931
u > u / r _ ʂ	0.7149	0.5496	0.7109	0.5517	0.7139	0.5486	0.7139	0.5531
u > u: / r _ ʂ	0.0175	0.3569	0.0216	0.3543	0.0173	0.3577	0.0196	0.3539
i > i / h _ ŋ	0.8433	0.3754	0.8429	0.3771	0.8400	0.3729	0.8425	0.3752
i > i: / h _ ŋ	0.1567	0.6246	0.1571	0.6229	0.1600	0.6271	0.1575	0.6248
r > ∅ / d _ a:	0.5513	0.9393	0.5493	0.9396	0.5498	0.9394	0.5490	0.9395
r > a / d _ a:	0.1552	0.0000	0.1556	0.0000	0.1557	0.0001	0.1559	0.0000
r > r / d _ a:	0.2935	0.0606	0.2951	0.0603	0.2946	0.0606	0.2951	0.0605
h > ∅ / a _ u	0.4030	0.0259	0.4053	0.0278	0.4031	0.0281	0.4051	0.0265
h > h / a _ u	0.5970	0.9741	0.5947	0.9722	0.5969	0.9719	0.5949	0.9735
ɲ > ɲ / u _ j	0.4967	0.0602	0.4959	0.0601	0.4957	0.0598	0.4993	0.0596
ɲ > n / u _ j	0.5033	0.9398	0.5041	0.9399	0.5043	0.9402	0.5007	0.9404
ɲ > ∅ / a _ j	0.0629	0.2576	0.0634	0.2576	0.0632	0.2574	0.0630	0.2571
ɲ > ɲ / a _ j	0.4029	0.1142	0.4016	0.1144	0.4003	0.1144	0.4024	0.1144
ɲ > n / a _ j	0.5342	0.4636	0.5350	0.4635	0.5365	0.4638	0.5346	0.4638
ɲ > n / a _ j	0.0000	0.1646	0.0000	0.1645	0.0000	0.1643	0.0000	0.1647
j > ∅ / t _ a	0.3219	0.3368	0.3210	0.3357	0.3215	0.3357	0.3211	0.3372
j > c / t _ a	0.5618	0.2339	0.5620	0.2330	0.5618	0.2331	0.5625	0.2331
j > j / t _ a	0.1163	0.1527	0.1170	0.1536	0.1167	0.1534	0.1164	0.1528
j > s / t _ a	0.0000	0.2766	0.0000	0.2777	0.0000	0.2778	0.0000	0.2770
r > ∅ / g _ a:	0.6658	0.9999	0.6664	1.0000	0.6666	0.9999	0.6659	1.0000
r > r / g _ a:	0.3342	0.0001	0.3336	0.0000	0.3334	0.0001	0.3341	0.0000
i > ∅ / r _ v	0.8488	0.3586	0.8462	0.3597	0.8464	0.3590	0.8482	0.3573
i > e / r _ v	0.0839	0.3016	0.0851	0.3007	0.0850	0.3007	0.0839	0.3025
i > i / r _ v	0.0674	0.3398	0.0687	0.3396	0.0686	0.3404	0.0679	0.3402
ɾ > ∅ / m _ t	0.3076	0.2000	0.3076	0.1999	0.3077	0.2004	0.3072	0.2004
ɾ > a / m _ t	0.0556	0.3494	0.0556	0.3486	0.0559	0.3465	0.0558	0.3477
ɾ > a: / m _ t	0.1677	0.2853	0.1673	0.2855	0.1673	0.2870	0.1674	0.2868
ɾ > i / m _ t	0.3054	0.0359	0.3060	0.0361	0.3055	0.0359	0.3060	0.0358
ɾ > u / m _ t	0.1636	0.1294	0.1635	0.1298	0.1637	0.1302	0.1637	0.1293
u > a / d _ r	0.3074	0.0127	0.3072	0.0122	0.3078	0.0126	0.3081	0.0125
u > u / d _ r	0.4140	0.8516	0.4138	0.8536	0.4136	0.8525	0.4129	0.8521
u > u: / d _ r	0.2786	0.1357	0.2790	0.1342	0.2786	0.1349	0.2790	0.1354
n > ∅ / a _ t	0.1167	0.4409	0.1172	0.4415	0.1168	0.4412	0.1169	0.4412
n > ŋ / a _ t	0.0556	0.0000	0.0554	0.0000	0.0553	0.0000	0.0555	0.0000
n > n / a _ t	0.3153	0.4360	0.3165	0.4355	0.3164	0.4359	0.3152	0.4359
n > n / a _ t	0.5124	0.1231	0.5109	0.1230	0.5114	0.1229	0.5125	0.1229
f > f / # _ ɾ	0.2334	0.0000	0.2335	0.0000	0.2339	0.0000	0.2333	0.0000

$\int > s / \# \_r$	0.7666	0.8364	0.7664	0.8373	0.7661	0.8369	0.7666	0.8354
$\int > x / \# \_r$	0.0000	0.1635	0.0000	0.1627	0.0000	0.1631	0.0000	0.1646
$i > \emptyset / g \_n$	0.5119	0.1802	0.5128	0.1800	0.5130	0.1793	0.5117	0.1766
$i > e / g \_n$	0.2695	0.0900	0.2689	0.0898	0.2679	0.0895	0.2697	0.0903
$i > i / g \_n$	0.2186	0.7298	0.2182	0.7302	0.2191	0.7312	0.2185	0.7331
$u > u / m \_k^h$	0.6534	0.9999	0.6511	0.9999	0.6512	0.9999	0.6518	0.9999
$u > u: / m \_k^h$	0.3466	0.0001	0.3489	0.0001	0.3488	0.0001	0.3482	0.0001
$\S > \emptyset / u \_t$	0.6526	0.8440	0.6533	0.8446	0.6532	0.8449	0.6528	0.8443
$\S > t / u \_t$	0.3211	0.0000	0.3203	0.0000	0.3204	0.0000	0.3208	0.0000
$\S > n / u \_t$	0.0263	0.1560	0.0264	0.1554	0.0264	0.1551	0.0264	0.1556
$i > \emptyset / r \_j$	0.2387	0.1267	0.2379	0.1271	0.2385	0.1266	0.2379	0.1276
$i > i / r \_j$	0.1450	0.6527	0.1456	0.6524	0.1450	0.6529	0.1451	0.6510
$i > i: / r \_j$	0.6163	0.2206	0.6165	0.2205	0.6166	0.2205	0.6170	0.2214
$i > \emptyset / t \_s$	0.6293	0.1236	0.6280	0.1227	0.6272	0.1230	0.6286	0.1233
$i > a: / t \_s$	0.1441	0.3675	0.1440	0.3689	0.1448	0.3702	0.1445	0.3690
$i > i / t \_s$	0.2265	0.5089	0.2279	0.5084	0.2280	0.5068	0.2269	0.5077
$i > i / v \_N$	0.1670	0.6922	0.1665	0.6919	0.1667	0.6917	0.1667	0.6930
$i > i: / v \_N$	0.8330	0.3078	0.8335	0.3081	0.8333	0.3083	0.8333	0.3070
$i: > i / c \_r$	0.1161	0.6280	0.1156	0.6314	0.1201	0.6253	0.1178	0.6268
$i: > i: / c \_r$	0.8839	0.3720	0.8844	0.3686	0.8799	0.3747	0.8822	0.3732
$\int > \int / \# \_i$	0.5220	0.0517	0.5240	0.0521	0.5233	0.0518	0.5230	0.0514
$\int > s / \# \_i$	0.4780	0.9483	0.4760	0.9479	0.4767	0.9482	0.4770	0.9486
$j > j / \# \_a:$	1.0000	0.6200	1.0000	0.6219	1.0000	0.6223	1.0000	0.6194
$j > j / \# \_a:$	0.0000	0.3800	0.0000	0.3781	0.0000	0.3777	0.0000	0.3806
$u: > u / d^{hi} \_n$	0.4433	0.9351	0.4433	0.9348	0.4430	0.9343	0.4423	0.9347
$u: > u: / d^{hi} \_n$	0.5567	0.0649	0.5567	0.0652	0.5570	0.0657	0.5577	0.0653
$r > \emptyset / t \_i$	0.3263	0.8151	0.3262	0.8155	0.3267	0.8152	0.3261	0.8154
$r > a / t \_i$	0.0743	0.0000	0.0740	0.0000	0.0744	0.0000	0.0742	0.0000
$r > r / t \_i$	0.5791	0.1360	0.5795	0.1355	0.5787	0.1357	0.5794	0.1357
$r > t / t \_i$	0.0203	0.0490	0.0203	0.0490	0.0203	0.0490	0.0203	0.0489
$\eta > \emptyset / a \_t$	0.0543	0.2047	0.0544	0.2056	0.0547	0.2048	0.0544	0.2043
$\eta > \eta / a \_t$	0.5922	0.0865	0.5926	0.0869	0.5924	0.0871	0.5922	0.0864
$\eta > n / a \_t$	0.3535	0.7088	0.3530	0.7075	0.3529	0.7081	0.3534	0.7093
$i > \emptyset / r \_n$	0.4420	0.7310	0.4412	0.7309	0.4415	0.7317	0.4428	0.7328
$i > a / r \_n$	0.3910	0.0001	0.3929	0.0001	0.3925	0.0001	0.3902	0.0001
$i > i / r \_n$	0.1670	0.2690	0.1659	0.2691	0.1659	0.2683	0.1670	0.2671
$k\$_ > n / a \_a$	0.0347	0.0889	0.0344	0.0890	0.0345	0.0889	0.0347	0.0890
$k\$_ > c^h / a \_a$	0.0672	0.0000	0.0671	0.0000	0.0671	0.0000	0.0673	0.0000
$k\$_ > k / a \_a$	0.0068	0.3372	0.0068	0.3362	0.0068	0.3370	0.0070	0.3374
$k\$_ > k / a \_a$	0.1194	0.0210	0.1194	0.0209	0.1193	0.0209	0.1193	0.0209
$k\$_ > k^h / a \_a$	0.7250	0.5132	0.7254	0.5142	0.7253	0.5136	0.7248	0.5130
$k\$_ > s / a \_a$	0.0469	0.0396	0.0469	0.0397	0.0469	0.0396	0.0468	0.0397
$\jmath > \emptyset / u \_c$	0.1387	0.3822	0.1387	0.3845	0.1404	0.3850	0.1373	0.3849
$\jmath > \jmath / u \_c$	0.5527	0.0570	0.5520	0.0571	0.5477	0.0571	0.5517	0.0573
$\jmath > n / u \_c$	0.3086	0.5608	0.3093	0.5585	0.3120	0.5579	0.3110	0.5579
$\int > \int / \# \_i$	0.3486	0.0058	0.3473	0.0058	0.3476	0.0058	0.3478	0.0058
$\int > c^h / \# \_i$	0.0850	0.0598	0.0846	0.0601	0.0852	0.0598	0.0846	0.0600
$\int > s / \# \_i$	0.5664	0.7880	0.5681	0.7880	0.5673	0.7876	0.5676	0.7876
$\int > x / \# \_i$	0.0000	0.1464	0.0000	0.1461	0.0000	0.1468	0.0000	0.1467
$k\$_ > n / a \_i$	0.0458	0.4973	0.0461	0.4996	0.0460	0.4982	0.0461	0.4975
$k\$_ > k / a \_i$	0.2352	0.2530	0.2360	0.2508	0.2348	0.2514	0.2348	0.2516
$k\$_ > k^h / a \_i$	0.7190	0.2497	0.7179	0.2496	0.7192	0.2504	0.7191	0.2509
$r > \emptyset / d \_o$	0.5873	1.0000	0.5867	1.0000	0.5885	1.0000	0.5886	1.0000
$r > r / d \_o$	0.4127	0.0000	0.4133	0.0000	0.4115	0.0000	0.4114	0.0000
$j > j / d^{hi} \_a$	0.4223	0.0586	0.4210	0.0584	0.4213	0.0585	0.4220	0.0590
$j > j^{hi} / d^{hi} \_a$	0.5777	0.6772	0.5789	0.6784	0.5786	0.6778	0.5780	0.6774
$j > d / d^{hi} \_a$	0.0000	0.2642	0.0000	0.2632	0.0000	0.2636	0.0000	0.2636
$l > l / i: \_a$	0.2920	0.0000	0.2910	0.0000	0.2930	0.0000	0.2924	0.0000
$l > l / i: \_a$	0.5169	0.9737	0.5180	0.9739	0.5154	0.9738	0.5168	0.9739
$l > r / i: \_a$	0.1911	0.0263	0.1910	0.0261	0.1916	0.0262	0.1908	0.0261

i: > i / n _ l	0.0985	0.6438	0.0985	0.6460	0.0998	0.6453	0.0998	0.6439
i: > i: / n _ l	0.9015	0.3562	0.9015	0.3540	0.9002	0.3547	0.9002	0.3561
ŋ > ŋ / i _ d	0.2707	0.2452	0.2706	0.2489	0.2703	0.2478	0.2714	0.2453
ŋ > n / i _ d	0.3375	0.7541	0.3385	0.7509	0.3387	0.7520	0.3375	0.7545
ŋ > n / i _ d	0.3918	0.0007	0.3909	0.0002	0.3910	0.0002	0.3911	0.0002
i > i / r _ n	0.1468	0.7201	0.1465	0.7188	0.1463	0.7187	0.1466	0.7193
i > i: / r _ n	0.8532	0.2799	0.8535	0.2812	0.8537	0.2813	0.8534	0.2807
l > ∅ / u: _ a	0.0505	0.0736	0.0509	0.0733	0.0506	0.0733	0.0503	0.0733
l > l / u: _ a	0.4293	0.0000	0.4287	0.0000	0.4289	0.0000	0.4295	0.0000
l > l / u: _ a	0.3522	0.7481	0.3519	0.7470	0.3521	0.7466	0.3520	0.7486
l > r / u: _ a	0.1680	0.1783	0.1685	0.1797	0.1684	0.1801	0.1682	0.1781
i: > e / p _ d	0.0459	0.3788	0.0459	0.3798	0.0459	0.3793	0.0460	0.3793
i: > i / p _ d	0.3368	0.5192	0.3368	0.5175	0.3363	0.5184	0.3386	0.5203
i: > i: / p _ d	0.6173	0.1020	0.6173	0.1027	0.6177	0.1024	0.6154	0.1004
l > l / i _ a	0.2452	0.0000	0.2448	0.0000	0.2450	0.0000	0.2455	0.0000
l > l / i _ a	0.4928	0.9621	0.4937	0.9619	0.4933	0.9618	0.4926	0.9623
l > l / i _ a	0.0918	0.0378	0.0916	0.0381	0.0918	0.0382	0.0917	0.0377
l > r / i _ a	0.1701	0.0000	0.1700	0.0000	0.1699	0.0000	0.1701	0.0000
r > ∅ / t _ a	0.4208	0.9216	0.4206	0.9216	0.4205	0.9215	0.4209	0.9217
r > l / t _ a	0.0469	0.0000	0.0469	0.0000	0.0469	0.0000	0.0469	0.0000
r > a / t _ a	0.0992	0.0033	0.0994	0.0033	0.0994	0.0033	0.0993	0.0033
r > e / t _ a	0.0271	0.0235	0.0271	0.0233	0.0271	0.0235	0.0271	0.0234
r > i / t _ a	0.0130	0.0227	0.0131	0.0227	0.0131	0.0228	0.0131	0.0227
r > l / t _ a	0.0088	0.0097	0.0086	0.0098	0.0088	0.0097	0.0088	0.0096
r > r / t _ a	0.3117	0.0094	0.3117	0.0095	0.3116	0.0095	0.3115	0.0095
r > t / t _ a	0.0600	0.0069	0.0600	0.0069	0.0600	0.0069	0.0600	0.0069
r > u / t _ a	0.0125	0.0029	0.0125	0.0029	0.0125	0.0029	0.0125	0.0029
l > l / o _ a	0.4563	0.0000	0.4578	0.0000	0.4575	0.0000	0.4568	0.0000
l > l / o _ a	0.4184	0.8550	0.4168	0.8549	0.4170	0.8551	0.4175	0.8552
l > r / o _ a	0.1253	0.1449	0.1254	0.1450	0.1255	0.1449	0.1257	0.1448
n > ŋ / a _ a:	0.4682	0.0000	0.4681	0.0000	0.4678	0.0000	0.4695	0.0000
n > n / a _ a:	0.5318	1.0000	0.5319	1.0000	0.5322	1.0000	0.5305	1.0000
l > ∅ / a _ a:	0.0273	0.0648	0.0272	0.0652	0.0272	0.0652	0.0271	0.0650
l > l / a _ a:	0.4732	0.0000	0.4735	0.0000	0.4723	0.0000	0.4737	0.0000
l > l / a _ a:	0.3933	0.7492	0.3930	0.7485	0.3941	0.7478	0.3936	0.7492
l > r / a _ a:	0.1063	0.1860	0.1063	0.1863	0.1064	0.1870	0.1055	0.1858
l > l / e _ a	0.6131	0.0504	0.6152	0.0491	0.6137	0.0479	0.6150	0.0497
l > l / e _ a	0.3869	0.9496	0.3848	0.9509	0.3863	0.9521	0.3850	0.9503
u > ∅ / n _ s	0.2096	0.2081	0.2115	0.2079	0.2113	0.2079	0.2106	0.2077
u > i / n _ s	0.0570	0.5228	0.0573	0.5225	0.0573	0.5227	0.0566	0.5226
u > u / n _ s	0.2556	0.2175	0.2553	0.2188	0.2547	0.2174	0.2553	0.2180
u > u: / n _ s	0.4778	0.0515	0.4759	0.0507	0.4767	0.0520	0.4774	0.0516
u > ∅ / m _ k	0.7236	0.1206	0.7230	0.1202	0.7223	0.1212	0.7239	0.1207
u > a / m _ k	0.1166	0.5515	0.1163	0.5473	0.1167	0.5492	0.1168	0.5519
u > u / m _ k	0.1599	0.3279	0.1606	0.3325	0.1610	0.3296	0.1594	0.3274
ɲ > ∅ / a: _ j	0.0002	0.5037	0.0001	0.5053	0.0001	0.5031	0.0001	0.5056
ɲ > n / a: _ j	0.6741	0.3571	0.6769	0.3560	0.6808	0.3580	0.6774	0.3559
ɲ > n / a: _ j	0.3257	0.1392	0.3229	0.1387	0.3191	0.1389	0.3225	0.1385
u > o / t _ n	0.0846	0.7006	0.0861	0.7016	0.0855	0.6998	0.0852	0.6960
u > u / t _ n	0.9154	0.2994	0.9139	0.2984	0.9145	0.3002	0.9148	0.3040
ʃ > ∅ / n _ a	0.3816	0.0061	0.3801	0.0063	0.3811	0.0061	0.3810	0.0061
ʃ > ʃ / n _ a	0.0584	0.0168	0.0582	0.0168	0.0580	0.0167	0.0584	0.0167
ʃ > h / n _ a	0.1970	0.0582	0.1972	0.0580	0.1973	0.0582	0.1973	0.0579
ʃ > s / n _ a	0.3631	0.8277	0.3644	0.8272	0.3637	0.8272	0.3634	0.8280
ʃ > x / n _ a	0.0000	0.0912	0.0000	0.0917	0.0000	0.0917	0.0000	0.0912
n > ∅ / a _ t <sup>h</sup>	0.1353	0.3777	0.1352	0.3782	0.1350	0.3765	0.1351	0.3786
n > ŋ / a _ t <sup>h</sup>	0.2537	0.0000	0.2537	0.0000	0.2536	0.0000	0.2540	0.0000
n > n / a _ t <sup>h</sup>	0.2721	0.5924	0.2719	0.5919	0.2728	0.5936	0.2721	0.5914
n > n / a _ t <sup>h</sup>	0.3389	0.0299	0.3392	0.0298	0.3386	0.0299	0.3388	0.0300
l > ∅ / a _ i	0.1584	0.0320	0.1579	0.0319	0.1581	0.0319	0.1585	0.0320

l > l / a _ i	0.4188	0.0000	0.4186	0.0000	0.4184	0.0000	0.4181	0.0000
l > l / a _ i	0.2983	0.8508	0.2988	0.8509	0.2989	0.8510	0.2991	0.8508
l > r / a _ i	0.1245	0.1171	0.1247	0.1172	0.1247	0.1171	0.1243	0.1171
l > ∅ / a: _ a	0.0503	0.0107	0.0504	0.0107	0.0502	0.0107	0.0503	0.0107
l > v / a: _ a	0.0307	0.0000	0.0307	0.0000	0.0306	0.0000	0.0307	0.0000
l > l / a: _ a	0.4755	0.0000	0.4752	0.0000	0.4755	0.0000	0.4758	0.0000
l > l / a: _ a	0.3094	0.8050	0.3097	0.8055	0.3097	0.8053	0.3093	0.8050
l > r / a: _ a	0.1341	0.1843	0.1339	0.1838	0.1339	0.1840	0.1339	0.1842
l > l / e _ a:	0.5471	0.0000	0.5447	0.0000	0.5457	0.0000	0.5476	0.0000
l > l / e _ a:	0.2062	0.3949	0.2068	0.3932	0.2068	0.3958	0.2068	0.3947
l > r / e _ a:	0.2467	0.6051	0.2486	0.6067	0.2475	0.6041	0.2457	0.6053
ŋ > ŋ / a _ i:	0.9196	0.2698	0.9199	0.2695	0.9202	0.2682	0.9208	0.2692
ŋ > n / a _ i:	0.0804	0.7302	0.0801	0.7305	0.0798	0.7318	0.0792	0.7308
l > l / u _ a	0.6088	0.0171	0.6071	0.0175	0.6078	0.0171	0.6081	0.0177
l > l / u _ a	0.2738	0.8000	0.2752	0.7998	0.2745	0.8001	0.2743	0.7994
l > r / u _ a	0.1174	0.1828	0.1177	0.1827	0.1177	0.1827	0.1176	0.1829
l > ∅ / a _ a	0.0125	0.0185	0.0126	0.0184	0.0126	0.0185	0.0126	0.0184
l > v / a _ a	0.0281	0.0000	0.0281	0.0000	0.0281	0.0000	0.0281	0.0000
l > l / a _ a	0.5026	0.0000	0.5022	0.0000	0.5024	0.0000	0.5023	0.0000
l > r / a _ a	0.0091	0.0068	0.0091	0.0068	0.0091	0.0068	0.0091	0.0068
l > l / a _ a	0.2985	0.8336	0.2987	0.8338	0.2985	0.8338	0.2988	0.8337
l > l / a _ a	0.0096	0.0130	0.0097	0.0131	0.0097	0.0130	0.0096	0.0130
l > n / a _ a	0.0000	0.0138	0.0000	0.0138	0.0000	0.0138	0.0000	0.0138
l > r / a _ a	0.1396	0.1142	0.1397	0.1141	0.1397	0.1141	0.1395	0.1142
l > l / a: _ i	0.5615	0.0000	0.5588	0.0000	0.5590	0.0000	0.5603	0.0000
l > l / a: _ i	0.2854	0.8113	0.2874	0.8120	0.2865	0.8115	0.2857	0.8121
l > r / a: _ i	0.1531	0.1887	0.1538	0.1880	0.1546	0.1885	0.1539	0.1878
l > l / a _ i:	0.5853	0.0000	0.5839	0.0000	0.5843	0.0000	0.5852	0.0000
l > l / a _ i:	0.3396	0.8470	0.3410	0.8469	0.3401	0.8466	0.3396	0.8478
l > r / a _ i:	0.0750	0.1530	0.0752	0.1531	0.0756	0.1534	0.0751	0.1522
s > ∅ / a _ m	0.4596	0.1421	0.4592	0.1423	0.4608	0.1418	0.4601	0.1413
s > h / a _ m	0.0003	0.5791	0.0007	0.5788	0.0002	0.5805	0.0002	0.5819
s > s / a _ m	0.5402	0.2788	0.5401	0.2788	0.5390	0.2777	0.5397	0.2767
l > l / a: _ i:	0.5803	0.0000	0.5853	0.0000	0.5793	0.0000	0.5768	0.0000
l > l / a: _ i:	0.3170	0.5766	0.3130	0.5780	0.3179	0.5775	0.3188	0.5773
l > r / a: _ i:	0.1027	0.4234	0.1017	0.4220	0.1028	0.4225	0.1044	0.4226
l > l / a: _ a:	0.6138	0.0000	0.6131	0.0000	0.6119	0.0000	0.6137	0.0001
l > l / a: _ a:	0.3862	1.0000	0.3869	1.0000	0.3881	1.0000	0.3863	0.9999
l > l / u _ i	0.5961	0.0000	0.5960	0.0000	0.5976	0.0000	0.5972	0.0000
l > l / u _ i	0.2473	0.8447	0.2481	0.8461	0.2462	0.8475	0.2465	0.8471
l > r / u _ i	0.1566	0.1552	0.1559	0.1539	0.1562	0.1525	0.1563	0.1528
ŋ > ŋ / u _ a	0.9776	0.2879	0.9773	0.2863	0.9774	0.2882	0.9772	0.2886
ŋ > n / u _ a	0.0224	0.7121	0.0227	0.7137	0.0226	0.7118	0.0228	0.7114
ŋ > ŋ / i _ a	0.8239	0.0887	0.8227	0.0903	0.8268	0.0896	0.8257	0.0891
ŋ > n / i _ a	0.1761	0.9113	0.1773	0.9097	0.1732	0.9104	0.1743	0.9109
n > ŋ / u: _ a	0.6747	0.0000	0.6722	0.0000	0.6725	0.0000	0.6733	0.0000
n > n / u: _ a	0.3253	1.0000	0.3278	1.0000	0.3275	1.0000	0.3267	1.0000
ŋ > ŋ / o _ a	0.9280	0.1768	0.9279	0.1762	0.9279	0.1765	0.9278	0.1766
ŋ > n / o _ a	0.0720	0.8232	0.0721	0.8238	0.0721	0.8235	0.0722	0.8234
l > l / a: _ u	0.6596	0.0000	0.6582	0.0000	0.6594	0.0000	0.6593	0.0000
l > l / a: _ u	0.2347	0.8689	0.2364	0.8685	0.2354	0.8686	0.2354	0.8685
l > r / a: _ u	0.1057	0.1311	0.1054	0.1315	0.1052	0.1314	0.1053	0.1315
ŋ > ŋ / a: _ a	0.9767	0.1981	0.9770	0.1977	0.9762	0.1967	0.9770	0.1984
ŋ > n / a: _ a	0.0233	0.8019	0.0230	0.8023	0.0238	0.8033	0.0230	0.8016
ŋ > ŋ / u _ t <sup>h</sup>	0.7466	0.0001	0.7454	0.0001	0.7510	0.0001	0.7485	0.0001
ŋ > n / u _ t <sup>h</sup>	0.2534	0.9999	0.2546	0.9999	0.2490	0.9999	0.2515	0.9999
n > ŋ / e _ a	0.8959	0.0589	0.8935	0.0593	0.8947	0.0592	0.8957	0.0590
n > n / e _ a	0.1041	0.9411	0.1065	0.9407	0.1053	0.9408	0.1043	0.9410
ŋ > ∅ / a _ a	0.0127	0.0052	0.0127	0.0052	0.0127	0.0052	0.0127	0.0052
ŋ > ŋ / a _ a	0.9188	0.1932	0.9181	0.1933	0.9183	0.1939	0.9186	0.1937

$\eta_l > n / a \_ a$	0.0685	0.0000	0.0691	0.0000	0.0690	0.0000	0.0686	0.0000
$\eta_l > n / a \_ a$	0.0000	0.8016	0.0000	0.8014	0.0000	0.8008	0.0000	0.8011
$l > l / u \_ u$	0.8105	0.0000	0.8133	0.0000	0.8105	0.0000	0.8121	0.0000
$l > l / u \_ u$	0.1895	1.0000	0.1867	1.0000	0.1895	1.0000	0.1879	1.0000
$\eta_l > \eta_l / a \_ i$	0.9670	0.1160	0.9676	0.1150	0.9675	0.1138	0.9673	0.1148
$\eta_l > n / a \_ i$	0.0330	0.8840	0.0324	0.8850	0.0325	0.8862	0.0327	0.8852
$n > \eta_l / i \_ a$	0.8356	0.0000	0.8366	0.0000	0.8359	0.0000	0.8358	0.0000
$n > n / i \_ a$	0.1644	1.0000	0.1634	1.0000	0.1641	1.0000	0.1642	1.0000
$n > \eta_l / a: \_ i:$	0.8489	0.0000	0.8527	0.0001	0.8495	0.0000	0.8497	0.0000
$n > n / a: \_ i:$	0.1511	1.0000	0.1473	0.9999	0.1505	1.0000	0.1503	1.0000
$n > \eta_l / i: \_ a$	0.8609	0.0000	0.8598	0.0000	0.8600	0.0000	0.8588	0.0000
$n > n / i: \_ a$	0.1391	1.0000	0.1402	1.0000	0.1400	1.0000	0.1412	1.0000
$n > \eta_l / a \_ u$	0.8623	0.0000	0.8620	0.0000	0.8613	0.0000	0.8627	0.0000
$n > n / a \_ u$	0.1377	1.0000	0.1380	1.0000	0.1387	1.0000	0.1373	1.0000
$n > \eta_l / i \_ i:$	0.8642	0.0000	0.8641	0.0000	0.8644	0.0000	0.8639	0.0001
$n > n / i \_ i:$	0.1358	1.0000	0.1359	1.0000	0.1356	1.0000	0.1361	0.9999
$\eta_l > \eta_l / i \_ i:$	0.9999	0.1351	0.9999	0.1346	0.9993	0.1346	0.9999	0.1350
$\eta_l > n / i \_ i:$	0.0001	0.8649	0.0001	0.8654	0.0007	0.8654	0.0001	0.8650
$n > \eta_l / u \_ a$	0.9766	0.0573	0.9769	0.0574	0.9770	0.0572	0.9769	0.0572
$n > n / u \_ a$	0.0234	0.9427	0.0231	0.9426	0.0230	0.9428	0.0231	0.9428
$\eta_l > \eta_l / a: \_ i$	0.9999	0.0840	0.9999	0.0836	0.9999	0.0837	0.9999	0.0830
$\eta_l > n / a: \_ i$	0.0001	0.9160	0.0001	0.9164	0.0001	0.9163	0.0001	0.9170
$n > \eta_l / a: \_ i$	0.7461	0.0001	0.7419	0.0000	0.7470	0.0000	0.7463	0.0001
$n > \tau / a: \_ i$	0.2537	0.1758	0.2580	0.1754	0.2529	0.1771	0.2536	0.1729
$n > n / a: \_ i$	0.0002	0.8242	0.0001	0.8246	0.0001	0.8229	0.0001	0.8271
$n > \eta_l / o \_ a$	0.9284	0.0000	0.9278	0.0000	0.9282	0.0002	0.9280	0.0001
$n > n / o \_ a$	0.0716	1.0000	0.0722	1.0000	0.0718	0.9998	0.0720	0.9999
$n > \eta_l / a: \_ a$	0.9377	0.0070	0.9373	0.0070	0.9379	0.0070	0.9377	0.0070
$n > n / a: \_ a$	0.0285	0.0249	0.0287	0.0249	0.0284	0.0249	0.0284	0.0250
$n > n / a: \_ a$	0.0338	0.9681	0.0340	0.9682	0.0337	0.9681	0.0339	0.9680
$n > \eta_l / a \_ i$	0.9424	0.0000	0.9418	0.0000	0.9419	0.0000	0.9424	0.0000
$n > n / a \_ i$	0.0576	1.0000	0.0582	1.0000	0.0581	1.0000	0.0576	1.0000
$n > \emptyset / a \_ a$	0.0061	0.0041	0.0061	0.0041	0.0061	0.0040	0.0061	0.0041
$n > \eta_l / a \_ a$	0.8851	0.0000	0.8849	0.0000	0.8848	0.0000	0.8849	0.0000
$n > n / a \_ a$	0.0671	0.0043	0.0672	0.0043	0.0674	0.0043	0.0672	0.0043
$n > n / a \_ a$	0.0416	0.9916	0.0417	0.9915	0.0417	0.9916	0.0418	0.9916
$\eta_l > \eta_l / r \_ a$	0.9999	0.0385	1.0000	0.0364	1.0000	0.0352	0.9999	0.0356
$\eta_l > n / r \_ a$	0.0001	0.9615	0.0000	0.9636	0.0000	0.9648	0.0001	0.9644
$\eta_l > \eta_l / a \_ a:$	0.9927	0.0003	0.9949	0.0002	0.9944	0.0001	0.9937	0.0002
$\eta_l > n / a \_ a:$	0.0073	0.9997	0.0051	0.9998	0.0056	0.9999	0.0063	0.9998
$n > \eta_l / i \_ a:$	0.9999	0.0000	0.9996	0.0001	0.9997	0.0000	0.9993	0.0000
$n > n / i \_ a:$	0.0001	1.0000	0.0004	0.9999	0.0003	1.0000	0.0007	1.0000
$n > \eta_l / a \_ i:$	1.0000	0.0003	0.9999	0.0000	1.0000	0.0000	0.9999	0.0000
$n > n / a \_ i:$	0.0000	0.9997	0.0001	1.0000	0.0000	1.0000	0.0001	1.0000
$n > \eta_l / a: \_ a:$	0.9999	0.0000	0.9999	0.0000	0.9999	0.0000	0.9999	0.0001
$n > n / a: \_ a:$	0.0001	1.0000	0.0001	1.0000	0.0001	1.0000	0.0001	0.9999

## Accuracy scores for sound change distributions for simulated data

The following table contains accuracy scores for each sound change distribution for Dirichlet (left) and Logistic Normal (right), averaged over 100 simulations.

$\int / \# \_ v$	0.7830	0.7882
$\int / \# \_ r$	0.6851	0.6850
$\int / \# \_ a$	0.6483	0.6502
$\int / \# \_ a:$	0.7612	0.7623
$\int / \# \_ i$	0.5666	0.5626
$\int / \# \_ i:$	0.6571	0.6501
$\int / \# \_ l$	0.5083	0.5117
$\int / \# \_ o$	0.8746	0.8731
$\int / \# \_ r$	0.7847	0.7847

ʃ / # _ u	0.7340	0.7400
ʃ / n _ a	0.4724	0.4734
ʃ / r _ a	0.4742	0.4656
ʃ / r _ c	0.5704	0.5699
ʃ / a _ a	0.2913	0.2902
ʃ / a _ a:	0.7110	0.7107
ʃ / a _ j	0.6728	0.6795
ʃ / a _ u	0.4422	0.4326
ʃ / a: _ a	0.2826	0.2824
ɲ / j _ a	0.5356	0.5385
ɲ / j _ a:	0.5086	0.5058
ɲ / a _ j	0.3814	0.3747
ɲ / a _ c	0.3007	0.3025
ɲ / a: _ j	0.4404	0.4366
ɲ / i _ c	0.5303	0.5260
ɲ / o _ c <sup>h</sup>	0.5358	0.5330
ɲ / u _ j	0.6518	0.6572
ɲ / u _ c	0.4374	0.4299
ɳ / s _ a	0.5137	0.5163
ɳ / r _ a	0.8252	0.8233
ɳ / a _ d	0.3220	0.3180
ɳ / a _ t	0.4848	0.4856
ɳ / a _ a	0.7187	0.7167
ɳ / a _ a:	0.8976	0.9026
ɳ / a _ i	0.7866	0.7915
ɳ / a _ i:	0.6319	0.6414
ɳ / a: _ d	0.3786	0.3784
ɳ / a: _ a	0.7687	0.7734
ɳ / a: _ i	0.8475	0.8446
ɳ / i _ d	0.4319	0.4355
ɳ / i _ a	0.7292	0.7244
ɳ / i _ i:	0.7999	0.7961
ɳ / k <sup>s</sup> _ a	0.5834	0.5803
ɳ / o _ a	0.7100	0.7131
ɳ / r _ a	0.8086	0.8064
ɳ / u _ d	0.3373	0.3355
ɳ / u _ t <sup>h</sup>	0.6813	0.6849
ɳ / u _ a	0.7461	0.7395
ʂ / # _ a	0.5458	0.5518
ʂ / r _ t	0.7646	0.7614
ʂ / r _ t <sup>h</sup>	0.5990	0.6068
ʂ / a _ t	0.6905	0.6880
ʂ / a _ a	0.6566	0.6586
ʂ / a: _ a	0.5161	0.5063
ʂ / a: _ a:	0.5229	0.5209
ʂ / e _ t	0.7356	0.7351
ʂ / e _ a	0.4408	0.4457
ʂ / i _ t	0.7720	0.7732
ʂ / i _ a	0.3857	0.3849
ʂ / o _ t <sup>h</sup>	0.8582	0.8576
ʂ / o _ a	0.6578	0.6518
ʂ / r _ a	0.5208	0.5115
ʂ / u _ t	0.6153	0.6130
ʂ / u _ a	0.4783	0.4803
ɹ / ʃ _ ŋ	0.4083	0.4056
ɹ / v _ t	0.3675	0.3615
ɹ / b <sup>f</sup> _ s	0.5250	0.5257
ɹ / d _ ʃ	0.5376	0.5361
ɹ / g <sup>h</sup> _ t	0.5732	0.5708
ɹ / k _ s	0.3744	0.3734
ɹ / k _ t	0.5031	0.4936

r / m _ s	0.5827	0.5911
r / m _ t	0.2375	0.2360
r / n _ t	0.3713	0.3728
r / p _ s	0.3744	0.3744
h / # _ a	0.9012	0.9045
h / # _ a:	0.8386	0.8341
h / # _ i	0.7441	0.7425
h / a _ a	0.6344	0.6315
h / a _ a:	0.5503	0.5457
h / a _ i	0.5128	0.5127
h / a _ u	0.6546	0.6606
h / a: _ a	0.6220	0.6201
h / a: _ a:	0.6712	0.6771
h / a: _ i	0.5147	0.5210
h / a: _ u	0.5634	0.5633
h / e _ a	0.5501	0.5592
h / o _ a	0.6838	0.6860
h / o _ i	0.5623	0.5638
h / u _ i	0.6193	0.6202
i / # _ s	0.5400	0.5479
i / # _ j	0.5560	0.5536
i / j _ h	0.5036	0.5052
i / j _ t	0.5286	0.5285
i / f _ k	0.5644	0.5785
i / v _ f	0.7604	0.7638
i / v _ s	0.7086	0.7108
i / v _ n	0.6210	0.6218
i / v _ b <sup>fi</sup>	0.5087	0.5055
i / v _ d	0.7313	0.7275
i / v _ d <sup>fi</sup>	0.5663	0.5656
i / v _ h	0.6033	0.6061
i / v _ k	0.4147	0.4287
i / v _ t	0.5533	0.5614
i / ŋ _ j	0.6139	0.6202
i / ŋ _ k	0.6135	0.6120
i / ŋ _ n	0.4932	0.4986
i / t _ k	0.5948	0.5907
i / t <sup>h</sup> _ n	0.5278	0.5251
i / b _ n	0.5301	0.5398
i / b <sup>fi</sup> _ k <sub>s</sub>	0.5410	0.5395
i / b <sup>fi</sup> _ t	0.5050	0.5080
i / c _ k	0.3794	0.3795
i / c _ n	0.5607	0.5597
i / c _ t	0.8102	0.8183
i / c <sup>h</sup> _ d	0.3922	0.3937
i / d _ k	0.5393	0.5368
i / d <sup>fi</sup> _ k	0.5372	0.5376
i / d <sup>fi</sup> _ n	0.4991	0.5027
i / g _ n	0.4004	0.4047
i / g _ r	0.5133	0.5161
i / h _ ŋ	0.6211	0.6228
i / h _ s	0.6626	0.6669
i / h _ k	0.4995	0.5064
i / h _ n	0.5727	0.5717
i / h _ t	0.2761	0.2738
i / k _ r	0.7595	0.7638
i / k <sub>s</sub> _ k	0.5917	0.5940
i / k <sub>s</sub> _ n	0.5321	0.5346
i / l _ k	0.5008	0.4975
i / l _ n	0.5825	0.5898
i / l _ t	0.5679	0.5676

i / m _ n	0.5301	0.5309
i / m _ t	0.6608	0.6622
i / n _ s	0.7489	0.7531
i / n _ d	0.5656	0.5598
i / n _ j	0.5006	0.5093
i / n _ k	0.4291	0.4290
i / n _ m	0.6328	0.6268
i / n _ n	0.5370	0.5461
i / n _ r	0.8372	0.8384
i / p _ s	0.5419	0.5366
i / p _ t	0.3802	0.3796
i / p _ p	0.7225	0.7251
i / p _ t	0.7729	0.7745
i / r _ v	0.4944	0.4959
i / r _ ŋ	0.4351	0.4319
i / r _ n	0.6538	0.6563
i / r _ d	0.4091	0.4088
i / r _ j	0.4590	0.4560
i / r _ k	0.3872	0.3890
i / r _ n	0.5552	0.5572
i / r _ t	0.5963	0.5955
i / s _ d	0.5979	0.5930
i / s _ k	0.5170	0.5097
i / t _ ŋ	0.5264	0.5299
i / t _ s	0.3934	0.3931
i / t _ k	0.3911	0.3958
i / t _ n	0.3553	0.3586
i / t _ r	0.6033	0.6046
i / t <sup>h</sup> _ t	0.4101	0.4048
i: / j _ v	0.4551	0.4614
i: / j _ r	0.5201	0.5251
i: / f _ r	0.5835	0.5876
i: / f _ t	0.6306	0.6338
i: / v _ t	0.3938	0.3938
i: / v _ r	0.3532	0.3546
i: / b <sup>fi</sup> _ r	0.5503	0.5537
i: / c _ r	0.5996	0.6001
i: / d _ p	0.6000	0.6068
i: / k _ l	0.5608	0.5649
i: / k <sup>s</sup> _ r	0.5919	0.5910
i: / n _ l	0.6613	0.6618
i: / n _ t	0.5388	0.5323
i: / p _ d	0.4517	0.4484
i: / p _ t	0.5120	0.5154
i: / r _ j	0.3371	0.3319
i: / s _ m	0.5898	0.5942
i: / s _ s	0.5181	0.5105
i: / t _ j	0.5663	0.5697
i: / t _ r	0.5241	0.5232
j / # _ a	0.8392	0.8355
j / # _ a:	0.8021	0.7909
j / # _ u	0.6519	0.6517
j / j _ a	0.5704	0.5673
j / v _ a	0.7808	0.7835
j / a _ a	0.4243	0.4243
j / a _ a:	0.6224	0.6233
j / a: _ a	0.5992	0.5965
j / a: _ a:	0.4538	0.4514
j / d _ a	0.5502	0.5475
j / d <sup>fi</sup> _ a	0.5068	0.5049
j / d <sup>fi</sup> _ a:	0.5873	0.5985



j / e _ a	0.5433	0.5412
j / i _ a	0.7029	0.7095
j / i _ a:	0.5411	0.5360
j / i: _ a	0.5220	0.5275
j / l _ a	0.6905	0.6926
j / n _ a	0.8622	0.8563
j / r _ a	0.5550	0.5451
j / t _ a	0.3458	0.3510
kʃ / # _ o	0.5509	0.5554
kʃ / # _ u	0.6099	0.6026
kʃ / a _ a	0.4644	0.4645
kʃ / a _ i	0.4619	0.4596
kʃ / a: _ a	0.5885	0.5889
kʃ / a: _ i	0.3960	0.3998
kʃ / i _ a:	0.6265	0.6239
l / # _ a	0.8350	0.8348
l / # _ a:	0.8204	0.8259
l / a _ a	0.5100	0.5107
l / a _ a:	0.5034	0.4996
l / a _ i	0.5143	0.5129
l / a _ i:	0.6068	0.6052
l / a _ l	0.5871	0.5854
l / a _ u:	0.5366	0.5403
l / a: _ a	0.4835	0.4864
l / a: _ a:	0.7768	0.7814
l / a: _ i	0.5525	0.5450
l / a: _ i:	0.4880	0.4855
l / a: _ u	0.5750	0.5788
l / e _ a	0.6676	0.6617
l / e _ a:	0.4318	0.4385
l / i _ a	0.6158	0.6142
l / i _ a:	0.6822	0.6716
l / i: _ a	0.6341	0.6336
l / l _ a	0.9136	0.9113
l / o _ a	0.5464	0.5478
l / u _ a	0.5327	0.5304
l / u _ i	0.5599	0.5624
l / u _ l	0.5786	0.5796
l / u _ u	0.7649	0.7637
l / u: _ a	0.4569	0.4595
n / # _ a	0.8996	0.9003
n / a _ a	0.8223	0.8223
n / a _ a:	0.7776	0.7779
n / a _ d	0.4270	0.4253
n / a _ d <sup>fi</sup>	0.3791	0.3793
n / a _ i	0.8844	0.8877
n / a _ i:	0.9088	0.9077
n / a _ j	0.8182	0.8226
n / a _ n	0.7354	0.7303
n / a _ t	0.3753	0.3747
n / a _ t <sup>h</sup>	0.3641	0.3624
n / a _ u	0.8514	0.8485
n / a: _ a	0.8291	0.8283
n / a: _ a:	0.8743	0.8731
n / a: _ i	0.6014	0.6023
n / a: _ i:	0.8113	0.8092
n / a: _ t	0.4498	0.4511
n / e _ a	0.7919	0.7956
n / e _ d	0.5301	0.5254
n / h _ a	0.5642	0.5517
n / i _ a	0.8395	0.8404

n / i _ a:	0.9205	0.9211
n / i _ d	0.5696	0.5691
n / i _ d <sup>fi</sup>	0.5097	0.5065
n / i _ i:	0.7855	0.7796
n / i _ n	0.5828	0.5836
n / i: _ a	0.8252	0.8269
n / o _ a	0.8760	0.8780
n / s _ a:	0.6607	0.6625
n / u _ a	0.8533	0.8564
n / u _ d	0.5144	0.5112
n / u _ d <sup>fi</sup>	0.2741	0.2733
n / u: _ a	0.7374	0.7370
r / # _ a	0.9454	0.9448
r / t _ a	0.8047	0.8012
r / a _ j	0.8377	0.8395
r / a _ f	0.5357	0.5316
r / a _ v	0.7170	0.7106
r / a _ ŋ	0.8261	0.8267
r / a _ s	0.4039	0.4041
r / a _ a	0.9007	0.9019
r / a _ b <sup>fi</sup>	0.7652	0.7612
r / a _ c	0.5273	0.5332
r / a _ d	0.6041	0.6070
r / a _ d <sup>fi</sup>	0.8020	0.8004
r / a _ i	0.6914	0.6858
r / a _ j	0.5061	0.4992
r / a _ k	0.5884	0.5902
r / a _ p	0.7217	0.7300
r / a _ t	0.7858	0.7816
r / a _ u	0.8673	0.8660
r / a: _ j	0.6046	0.6032
r / a: _ a	0.9037	0.9038
r / a: _ g	0.4547	0.4545
r / a: _ i	0.4322	0.4330
r / d _ a	0.6293	0.6306
r / d _ a:	0.5672	0.5704
r / d _ o	0.7749	0.7758
r / e _ a	0.4736	0.4714
r / g _ a	0.8654	0.8680
r / g _ a:	0.7500	0.7527
r / i _ a	0.8672	0.8642
r / i: _ a	0.9311	0.9305
r / m _ a	0.5794	0.5772
r / p _ a	0.8753	0.8742
r / t _ a	0.5314	0.5306
r / t _ a:	0.7718	0.7689
r / t _ i	0.5246	0.5258
r / t _ i:	0.5922	0.5868
r / u: _ v	0.6584	0.6565
r / u: _ c	0.5346	0.5219
r / u: _ d <sup>fi</sup>	0.6632	0.6737
s / # _ a	0.7749	0.7718
s / # _ a:	0.8395	0.8366
s / # _ i	0.7023	0.7043
s / # _ i:	0.8212	0.8273
s / # _ n	0.7342	0.7414
s / # _ u	0.9097	0.9104
s / # _ u:	0.8773	0.8784
s / a _ a	0.5595	0.5616
s / a _ a:	0.7575	0.7589
s / a _ j	0.7073	0.7052

s / a _ m	0.4501	0.4442
s / a _ t	0.6630	0.6612
s / a: _ a	0.5471	0.5454
s / a: _ i	0.6062	0.6111
s / e _ a	0.5500	0.5510
s / h _ a	0.5370	0.5412
s / t _ a	0.4840	0.4871
s / t _ j	0.6873	0.6851
u / # _ s	0.5142	0.5068
u / # _ c	0.7315	0.7292
u / # _ d	0.6923	0.6911
u / # _ l	0.6891	0.6910
u / # _ p	0.3530	0.3555
u / # _ t	0.9165	0.9173
u / f _ ŋ	0.4139	0.4143
u / f _ k	0.6805	0.6810
u / f _ r	0.6465	0.6391
u / b _ s	0.5787	0.5833
u / c _ t	0.3647	0.3636
u / c _ l	0.4415	0.4496
u / d _ g	0.6040	0.6044
u / d _ h	0.5618	0.5579
u / d _ k	0.5442	0.5419
u / d _ r	0.5707	0.5705
u / g _ s	0.5714	0.5772
u / g _ l	0.6114	0.6012
u / g _ p <sup>h</sup>	0.6787	0.6811
u / g _ r	0.5502	0.5476
u / j _ g	0.5438	0.5458
u / k _ ŋ	0.5849	0.5774
u / k _ s	0.5069	0.5082
u / k _ t	0.5422	0.5462
u / k _ d	0.5374	0.5365
u / k _ l	0.4473	0.4466
u / l _ d	0.5228	0.5147
u / m _ t	0.5255	0.5181
u / m _ d	0.5056	0.5094
u / m _ k	0.4396	0.4425
u / m _ k <sup>h</sup>	0.7772	0.7750
u / m _ s	0.5282	0.5220
u / n _ s	0.3160	0.3168
u / p _ n	0.5475	0.5518
u / p _ r	0.7337	0.7330
u / p _ t	0.6766	0.6743
u / r _ s	0.4924	0.4835
u / s _ v	0.4998	0.4992
u / t _ ŋ	0.5222	0.5270
u / t _ s	0.8240	0.8203
u / t _ h	0.5518	0.5525
u / t _ l	0.7607	0.7662
u / t _ n	0.6850	0.6892
u / t _ r	0.5701	0.5722
u: / # _ s	0.5343	0.5327
u: / # _ n	0.8474	0.8476
u: / # _ r	0.6431	0.6386
u: / j _ r	0.5159	0.5194
u: / f _ r	0.5297	0.5219
u: / b _ l	0.5253	0.5207
u: / b <sup>fi</sup> _ m	0.5239	0.5326
u: / b <sup>fi</sup> _ t	0.5553	0.5510
u: / c _ d	0.4002	0.3946

u: / c _ r	0.5249	0.5276
u: / d _ r	0.5179	0.5208
u: / d <sup>hi</sup> _ m	0.5793	0.5771
u: / d <sup>hi</sup> _ n	0.6521	0.6452
u: / j _ t	0.5421	0.5479
u: / k _ t	0.5483	0.5487
u: / k _ r	0.6546	0.6559
u: / l _ k	0.3644	0.3660
u: / m _ l	0.5155	0.5174
u: / m _ r	0.5942	0.5923
u: / m _ t	0.5390	0.5343
u: / p _ r	0.5197	0.5225
u: / r _ p	0.4173	0.4178
u: / s _ k	0.5214	0.5125
u: / s _ t	0.5337	0.5334
u: / t _ r	0.5744	0.5706