

A Phonetic Illustration of the Sound System of Icelandic

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1 Introduction

Icelandic, a member of the North Germanic branch of the Indo-European language family, is spoken by over 320,000 people worldwide, with 300,000 in Iceland (Eberhard et al. 2019). A distinction between two major dialect areas is often made: a northern area (*harðmæli*, or "hard" varieties) and a southern area (*linmæli*, or "soft" varieties), although as Hansson (2003:50) points out, these labels are somewhat misleading, as *harðmæli* is spoken mainly in the northeast and *linmæli* in the rest of the country.

A substantial portion of the literature on Icelandic focuses on its unusual laryngeal phonology, and description of the dialect groups is no exception: while *harðmæli* exhibits plain vs. aspirated contrasts in word-internal onsets (in addition to word-initial onsets), *linmæli* has such contrasts only in word-initial position (Hansson 2003, Pétursson 1976, Þráinsson & Árnason 1992). Furthermore, speakers of *linmæli* exhibit a phonation contrast in both word-initial and word-internal sonorants, while this contrast is limited to word-initial position in *harðmæli*. A comprehensive account of the major phonetic differences between these dialect areas, including detailed description of vowel realizations, is given in Þráinsson & Árnason (1992)'s seminal paper on dialectal variation in modern Icelandic.

The focus in this description, however, is on the southern variety (*linmæli*), which is widely spoken and often considered to be the "standard" (Árnason 2011:104). The data presented in this study are from Guðbjartur Hákonarson, a speaker from Reykjavík. At the time of recording, he was in his early twenties and had been living in Bloomington, Indiana for approximately three years while pursuing a four-year undergraduate degree at Indiana University.

The characteristics of the Icelandic sound system that are most often noted include the following. Icelandic has a contrast between plain and aspirated series of voiceless stops. The aspirated series is realized as post-aspirated word-initially and pre-aspirated word-internally. This pattern is extended into sonorants, resulting in a typologically uncommon phonation-type contrast between modal and voiceless sonorants. There is also a large vowel inventory, with a vowel length contrast found in both monophthongs and diphthongs. The following sections deal separately with consonants, vowels, and prosody (stress and intonation).

2 Consonants

An inventory of Icelandic consonants is given in Table 1. The inventory may look deceptively large at first because it includes all commonly transcribed positional variants. However, the set of sounds which can surface word-initially and word-internally are quite distinct, so the phonotactic restrictions for each of these contexts will be treated separately in subsequent subsections. Stops and nasals are found at four major places of articulation, and fricatives are found at five major (supralaryngeal) places of articulation. Icelandic's consonant inventory also includes voiceless sonorants, and typologically rare pre-aspirated stops (Silverman 2003), in which voice offset time precedes stop closure (i.e. [ʰp ʰt ʰc ʰk]).

Table 1 Consonants

	Bilabial	Labio-dental	Dental	Alveolar	Palatal	Velar	Glottal
Plosive	p(:) p ^h ^h p		t(:) t ^h ^h t		c(:) c ^h ^h c	k(:) k ^h ^h k	ʔ
Nasal	m(:) m̥		n(:) n̥		ɲ ɲ̥	ŋ ɲ̥	
Trill				r(:) r̥			
Fricative		f(:)	θ	s(:)	ç	x	h
Approximant		v	ð		j	ɣ	
Lateral				l̥			

Word-internal length contrasts are possible for certain consonants, marked in Table 1 with a parenthetical length diacritic. The supralaryngeal non-strident fricatives come in voiced and voiceless pairs, with the voiced counterpart appearing on the chart midway between the fricative and approximant rows. These sounds can be realized with or without frication—that is to say, more approximant-like and more fricative-like articulations are acceptable and freely vary (Árnason 2011:108, Helgason 1993). Although coronal stops and nasals are produced with a dental articulation (i.e. [t̥ n̥]), keeping with traditional Icelandic transcription, the dental diacritic will not be included.

Further description is found in the following subsections, where consonantal contrasts are divided into initial position (that is to say, before the stressed vowel, which is typically the first syllable of the word) and internal position (following the stressed vowel). Major allophonic alternations, additional phonotactic restrictions, and connected speech processes are described in a third subsection.

2.1 Initial Contrasts

There is a laryngeal contrast at most places of articulation and for most manners in word-initial position. This is realized as an aspiration contrast in stops and a voicing contrast in fricatives and sonorants. Unaspirated and voiced sounds are given in the left column of Table 2, and aspirated and voiceless sounds in the right column. The glottal stop only occurs before vowel-initial stressed syllables, and is generally not considered a phoneme of Icelandic (Árnason 2011:100).

Concerning the word-initial aspiration contrast in stops, it has been found in lab speech that the voice onset time (VOT) of the aspirated series co-varies with speaking rate, while VOT of the unaspirated member is relatively stable across differing speech rates (Pind 1995). Results from glottographic experiments have demonstrated that peak glottal opening occurs close to (Löfqvist & Pétursson 1976) or at (Löfqvist & Yoshioka 1981) the release of the stop in the aspirated series, but nearer to stop closure in the unaspirated series. In addition, it was found that peak glottal opening area was larger for the aspirated series than the unaspirated series.

In word-initial position, voiceless sonorants are realized with both longer duration and greater H1-H2 differences than their voiced counterparts (Bombien 2006). Some of their productions could therefore be characterized as having lax phonation (i.e. breathy rather than voiceless). According to Bombien, this is especially true of nasals and somewhat true of laterals, but rhotics are most often truly voiceless.

Table 2 Initial Contrasts¹

[p]	<i>bötum</i>	[ˈpœ:tʏm]	recovery.DAT.PL	[p ^h]	<i>pötum</i>	[ˈp ^h œ:tʏm]	motion.1PL
[m]	<i>mötum</i>	[ˈmœ:tʏm]	feed.1PL				
[v]	<i>vöðum</i>	[ˈvœ:ðʏm]	wade.1PL	[f]	<i>fötum</i>	[ˈfœ:tʏm]	vat.DAT.PL
[t]	<i>dökkum</i>	[ˈtœ ^h kʏm]	dark.DAT.PL	[t ^h]	<i>tökkum</i>	[ˈt ^h œ ^h kʏm]	button.DAT.PL
[n]	<i>nökkva</i>	[ˈnœ ^h kʏva]	dinghy.ACC.SG	[ŋ]	<i>hnökkum</i>	[ˈŋœ ^h kʏm]	nape.DAT.PL
[r]	<i>rökkva</i>	[ˈrœ ^h kʏva]	get dark.INF	[r̥]	<i>hrökkva</i>	[ˈr̥œ ^h kʏva]	recoil.INF
				[θ]	<i>þökkum</i>	[ˈθœ ^h kʏm]	thank.1PL
				[s]	<i>sökkva</i>	[ˈsœ ^h kʏva]	sink.INF
[l]	<i>lökkum</i>	[ˈlœ ^h kʏm]	enamel.DAT.PL	[l̥]	<i>hlökkum</i>	[ˈl̥œ ^h kʏm]	anticipate.1PL
[c]	<i>gjöldum</i>	[ˈcœlʏtʏm]	pay.1PL	[c ^h]	<i>kjöltum</i>	[ˈc ^h œlʏtʏm]	lap.DAT.PL
[k]	<i>göltum</i>	[ˈkœlʏtʏm]	stack.DAT.PL	[k ^h]	<i>köldum</i>	[ˈk ^h œlʏtʏm]	cold.DAT.SG
[j]	<i>jörðum</i>	[ˈjœrðʏm]	earth.DAT.PL	[ç]	<i>hjörðum</i>	[ˈçœrðʏm]	herd.DAT.PL
[ʔ]	<i>öldum</i>	[ˈʔœlʏtʏm]	century.DAT.PL	[h]	<i>höldum</i>	[ˈhœlʏtʏm]	hold.1PL

2.2 Internal Contrasts

Stressed syllables in Icelandic exhibit a word-internal quantity contrast: 'V:C vs. 'VC:, examples of which are given in Table 3. Note that not all consonants which can occur after the stressed vowel have a corresponding short or long counterpart (i.e. ['Vf:], but *['V:f], and ['V:l], but *['V:l:]). For the purposes of the quantity contrast, pre-aspirated stops behave like geminate consonants in that they are always preceded by a short vowel.²

Table 3 Internal Quantity & Manner Contrasts

[p]	<i>krapa</i>	[ˈk ^h ra:pa]	slime.GEN.PL	[^h p]	<i>krappa</i>	[ˈk ^h ra ^h pa]	narrow.F.ACC.SG
[v]	<i>krafa</i>	[ˈk ^h ra:va]	claim.NOM.SG	[p:]	<i>krabba</i>	[ˈk ^h rap:a]	crab.ACC.SG
				[f:]	<i>kaffi</i>	[ˈk ^h af:i]	coffee.NOM.SG
[m]	<i>kremur</i>	[ˈk ^h rɛ:mʏr] ³	crush.2SG	[m:]	<i>klemmu</i>	[ˈk ^h lɛm:y]	clip.ACC.SG
[t]	<i>skata</i>	[ˈska:ta]	stingray.NOM.SG	[^h t]	<i>skatta</i>	[ˈska ^h ta]	tax.ACC.PL
[θ]	<i>skaða</i>	[ˈska:ða]	damage.ACC.SG	[t:]	<i>skadda</i>	[ˈskat:a]	harm.INF
[s]	<i>masa</i>	[ˈma:sa]	chat.INF	[s:]	<i>massa</i>	[ˈmas:a]	mass.ACC.SG
[n]	<i>mana</i>	[ˈma:na]	dare.INF	[n:]	<i>manna</i>	[ˈman:a]	man.GEN.PL
[r]	<i>mara</i>	[ˈma:ra]	sea.GEN.PL	[r:]	<i>marra</i>	[ˈmar:a]	creak.INF
[l]	<i>mala</i>	[ˈma:la]	grind.INF				
[c]	<i>þekja</i>	[ˈθɛ:ca]	roof.NOM.SG	[^h c]	<i>þekkja</i>	[ˈθɛ ^h ca]	recognize.INF
[k]	<i>saka</i>	[ˈsa:ka]	accuse.INF	[^h k]	<i>sakka</i>	[ˈsa ^h ka]	plumb.NOM.SG
[j]	<i>segja</i>	[ˈsei:ja]	say.INF	[c:]	<i>seggja</i>	[ˈsɛc:a]	man.GEN.PL
[ɣ]	<i>saga</i>	[ˈsa:ɣa]	story.NOM.SG	[k:]	<i>sagga</i>	[ˈsak:a]	dampness.ACC.SG

¹ Note that some older speakers may also have word-initial [x] in words like [xva:lʏr] *hvalur* “whale,” realized by younger speakers as [k^hva:lʏr] (Práinsson & Árnason 1992).

² Práinsson (1978) analyzes intervocalic preaspirates and geminates as identical to a series of two consonants on the prosodic tier.

³ The sonorants /r/ and /l/ are very often devoiced in phrase-final position, although this is considered optional (Árnason 2011:237). We have chosen not to transcribe this phenomenon in our examples since it is context-specific. Thus, words such as *kremur* are transcribed herein without the optional devoicing, i.e. as [ˈk^hrɛ:mʏr].

Spectrograms exemplifying the V:C vs. VC: quantity contrast are shown in Figure 1. Corresponding durational measures for the segments of interest appear in Table 4. Regarding production of [r], the tokens presented here exemplify the behavior of our consultant: short [r] was typically produced with one or two occlusions and long [r:] with three or four occlusions.

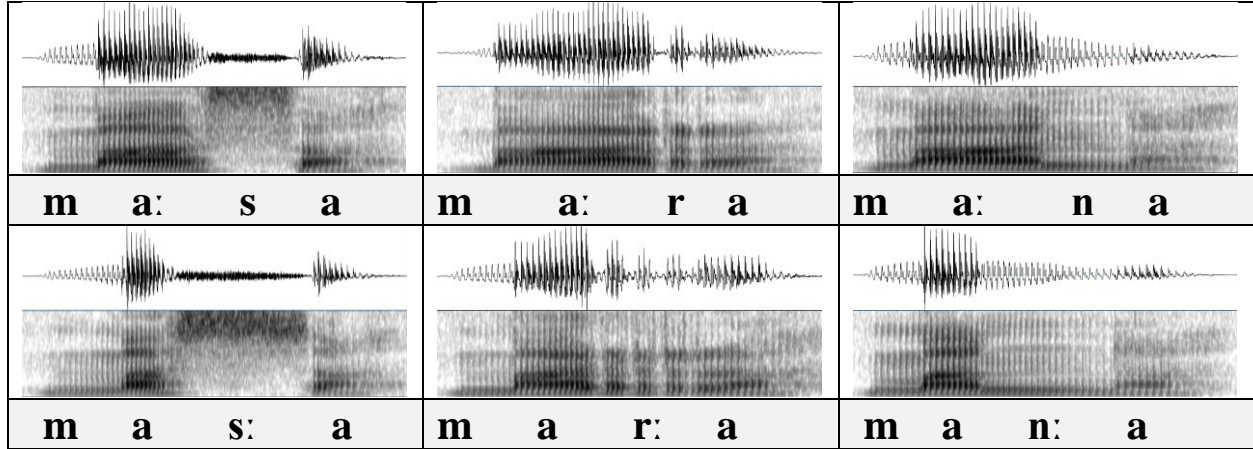


Figure 1 Words minimally contrastive in quantity: the V:C member is shown in the top row, VC: in the bottom row. Spectrograms produced using Praat speech analysis software (Boersma & Weenink 2019).

Table 4 Duration for vowels and consonants illustrated in Figures 1 and 2.

	Length of V (in ms)	Length of C (in ms)
[^h ma:sa]	180	156
[^h mas:a]	87	250
[^h ma:ra]	243	71
[^h mar:a]	122	158
[^h ma:na]	179	119
[^h man:a]	83	188
[^h k ^h ra:pa]	187	149
[^h k ^h rap:a]	89	213

Both Garnes (1976) and Pétursson (1976) reported that in sets of words minimally contrastive in quantity (such as those in Table 3), consistent differences in duration were maintained between short and long vowels, but that durational differences in certain classes of consonant were not as robust. Vowels would accordingly seem to be the primary cue to the quantity contrast. However, the speakers in Pind (1995)’s study systematically manipulated the duration of the long member of the pair (i.e. V:C and VC:) at different speech rates, while the duration of the short member remained relatively stable across rates.

Figure 2 shows the three-way contrast between [^hra:pa] ~ [^hra^hpa] ~ [^hrap:a]. The top and bottom panels show the tokens from which the last two rows of duration measures in Table 4 ([a:p] vs. [ap:]) were taken.

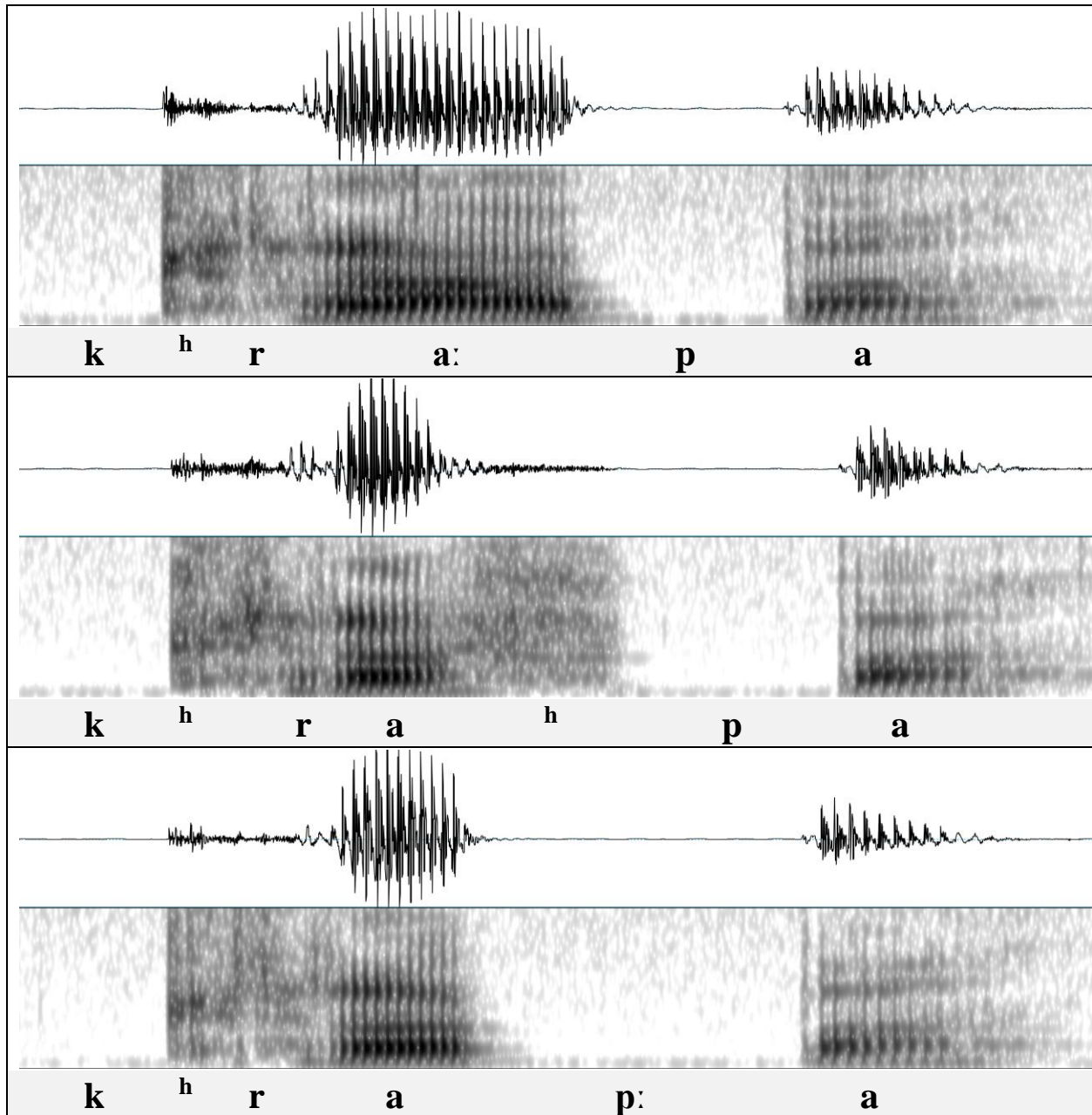


Figure 2 Illustration of a plain voiceless singleton stop (top), a pre-aspirated voiceless stop (middle), and a geminate voiceless stop (bottom).

Despite extensive discussion in the literature on Icelandic phonetics and phonology, there is no consensus on whether pre-aspirated stops should be thought of and transcribed as a single segment, e.g. [ʰp], or as a sequence of [h] followed by a stop, e.g. [hp] (Árnason 2011:219-227, Hoole & Bombien 2010, Pétursson 1972, Ringen 1999, and Þráinsson 1978, among others). On the one hand, post-vocalic aspiration is found only before stop closures, so word-internal [h] would be subject to strict positional requirements if it were to be considered an autonomous segment. This close association between voice-offset time and stop closure suggests that the two phases be considered part of a single segment (i.e. [ʰp]). However, as can be seen in the middle panel of

Figure 3, word-internal aspiration is quite long in duration, and that pre-aspirated stops are always preceded by a short vowel suggests that they be considered phonologically long, or consisting of two prosodic units for the purposes of the quantity contrast. This behavior would perhaps be better captured by an analysis in which pre-aspirated stops are treated as two equal units (i.e. [hp]). As the orthographic representation of these sounds suggests, the three-way contrast between modern Icelandic *-p* [p] ~ *-pp* [ʰp] ~ *-bb* [b:], to use the labial place of articulation as an example, is thought to go back to *-p* [ʰp] ~ *-pp* [ʰp:] ~ *-bb* [b:] in Proto-Norse (Helgason 2002). It then seems that the obstruent system has evolved in such a way that voicing during stop closure was eliminated, yet a durational contrast between *-p* and *-pp* and a laryngeal contrast between *-pp* and *-bb* were both retained.

Word-internal contrastive voicing in fricatives and sonorants is found only in the context of consonant clusters, as seen in Table 5. In addition, it can be seen that the dorsal nasals [ɲ ɲ̥ ɲ̥̊] only surface before a word-internal homorganic stop.

Table 5 Internal Laryngeal Contrasts

[m]	<i>lambi</i>	[ˈlampɪ]	lamb.DAT.SG	[m̥]	<i>lampi</i>	[ˈlampɪ]	lamp.NOM.SG
[n]	<i>vanda</i>	[ˈvanta]	do carefully.INF	[n̥]	<i>vanta</i>	[ˈvanta]	need.INF
[ɲ]	<i>hangi</i>	[ˈhaŋcɪ]	hang.3SG.PRS.SJV	[ɲ̥]	<i>hanki</i>	[ˈhaŋcɪ]	loop.NOM.SG
[ŋ]	<i>hanga</i>	[ˈhaŋka]	hang.INF	[ŋ̥]	<i>hanka</i>	[ˈhaŋka]	loop.ACC.SG
[r]	<i>hjarða</i>	[ˈçarða]	herd.GEN.PL	[r̥]	<i>hjarta</i>	[ˈçarta]	heart.NOM.SG
[l]	<i>hálfa</i>	[ˈhaulva]	half.F.ACC.SG	[l̥]	<i>hjálpa</i>	[ˈçauɫpa]	help.INF
[v]	<i>höfðum</i>	[ˈhœvðym]	head.DAT.PL	[f]	<i>höftum</i>	[ˈhœftym]	constriction.DAT.PL
[ɣ]	<i>sigðum</i>	[ˈsɪɣðym]	sickle.DAT.PL	[x]	<i>sigtum</i>	[ˈsɪxtym]	strainer.DAT.PL

According to Bombien (2006), there are a host of cues which contribute to the voicing contrast in sonorants, including duration, frication, and phonation type, and the relative strength of these cues varies by position and by sonorant. For example, similarly to word-initial position, word-medial voiceless sonorants are often longer than their voiced counterparts (visible in Figure 3 below). They also usually involve some degree of frication. Frication is greater in medial position than in initial position, and is greatest in rhotics, followed by laterals, and least in nasals (Bombien 2006).⁴

As shown with the sample pair [ˈlampɪ] and [ˈlampɪ] in Figure 3, voiceless sonorants tend to be produced with noticeable frication and poor or absent formant structure. Hoole & Bombien (2010) reported that pre-aspirated stops and word-medial voiceless nasals have a very similar

⁴ The tendency for voiceless laterals and rhotics to be produced with some degree of frication is not unique to Icelandic. Production of /l/ as [ɬ] and /r/ as [ɬ] or [ɬ̥] is also attested in, for example, Tibeto-Burman languages (Lotven et al. 2020). In work focused specifically on laterals, Maddieson and Emmorey (1984) point out that the tendency for voiceless approximants to be produced with frication is so strong that some scholars have argued that voiceless laterals *must* be produced as fricatives. The authors present acoustic data from five languages (Burmese, Navajo, Taishan Chinese, Tibetan, Zulu) which clearly establishes that while there are measurable differences between voiceless lateral approximants and fricatives, the differences are subtle. A typological survey of phonotactic patterns in approximately 60 additional languages, however, reveals that voiceless approximants and fricatives pattern differently in terms of positional restrictions, attested allophonic variants, and so forth. The distinction is therefore both acoustically subtle and phonologically important. For our purposes, while a more thorough investigation of these sounds is beyond the scope of the present work, but is certainly a topic to be addressed in the future.

gesture of glottal abduction, both in terms of duration and the timing of its onset with respect to the preceding vowel.

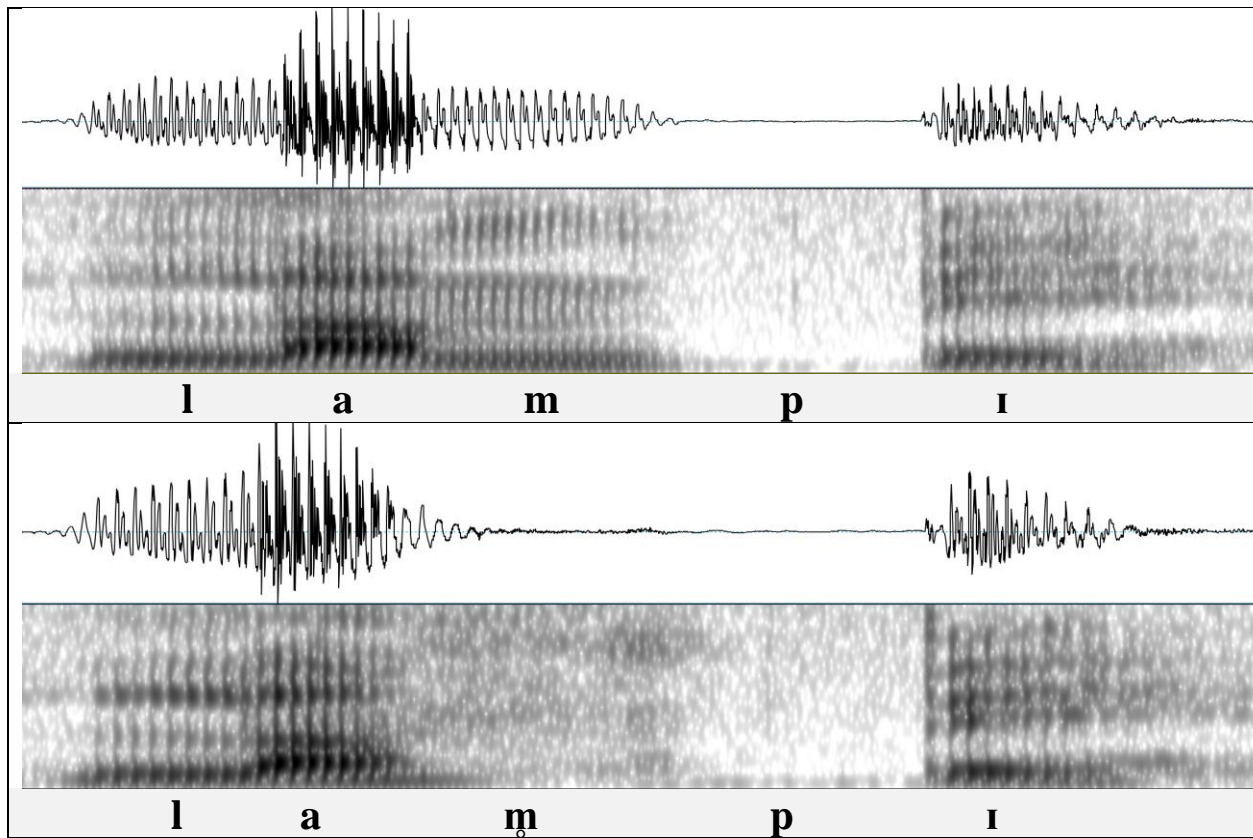


Figure 3 Illustration of a voiced bilabial nasal (top) and a voiceless bilabial nasal (bottom).

2.3 Processes Affecting Consonants

There are a number of additional observations that can be made about the patterning of consonants in Icelandic. Obstruents exhibit regular alternations directly preceding [l] and [n]. For example, intervocalic plain stops [p t c/k] alternate with pre-aspirated stops [p^h t^h k^h] before [l] and [n], and voiced approximants [v ʝ] with plain stops [p k].⁵ These alternations often arise from concatenation of the GEN.PL *-na* suffix (e.g. [ˈkaːta] street.NOM.SG ~ [ˈka^htna] GEN.PL, [ˈsaːʝa] story.NOM.SG ~ [ˈsakna] GEN.PL), or when word-medial syncope obtains in disyllabic roots ending in [l] or [n] (e.g. [ˈʔoːpin] open.F.NOM.SG ~ [ˈʔo^hpnar] F.NOM.PL, [ˈp^haiːcɪl] brine.ACC.SG ~ [ˈp^hai^hkɪl] DAT.SG, [ˈtjœːvʏl] devil.ACC.SG ~ [ˈtjœplɪ] DAT.SG). In addition, the voiced approximants [v ð ʝ] and [l r] are often devoiced to [f θ x] and [l̥ r̥] when they appear in pre-pausal and utterance final position (Árnason 1980, Dehé 2014).

Voiced fricatives and [r] are frequently reduced or deleted in connected speech (Árnason 1980), and regularly, or even obligatorily, in many consonant clusters (Côté 2004, Helgason 1993, Rögnvaldsson 1989). In triconsonantal clusters (C₁C₂C₃), which are often encountered at

⁵ The contrast between palatals and velars is only maintained prevocally. Before consonants or word-finally they are neutralized to velars.

morpheme boundaries, C_3 is always preserved, so if the cluster is to be simplified, C_1 or C_2 are omitted (Côté 2004, Rögnvaldsson 1989). Côté (2004) argues that consonantal deletion is driven by perceptual factors and sonority requirements. For example, deletion mainly targets stops and non-strident fricatives, the segments with the weakest internal cues. Côté also identifies the following post-sonorant hierarchy of deletion: C_2 obstruents are least likely to be deleted (and never obligatorily so) when C_1 is [r], are likely to be deleted (and even obligatorily so for some speakers) when C_1 is [l], and are obligatorily deleted when C_1 is a nasal.

There exists a similar sonorant-specific hierarchy with respect to the patterning of word-internal voiced fricatives. In native monomorphemic words, all three of the voiced fricatives [v ð ɣ] surface post-vocally, only [v ð] surface after [r], only [v] surfaces after [l], and none surface after nasals (Flego 2017). This $r > l > n$ hierarchy was also identified in Bombien (2006) for degree of frication and degree of voicelessness in non-modal sonorants, and subsets of this hierarchy also seem to pattern together in other areas of the sound system (e.g. devoicing of utterance final [l] and [r] but not [n], manner/laryngeal alternations among obstruents before [l] and [n], but not before [r]). These sonorant-specific implicational relationships intersect with many phonetic and phonological phenomena in Icelandic, from static phonotactics inherited in the native vocabulary, down to low-level phonetic tendencies in the modern language.

3 Vowels

The inventory of contrastive vowel types in Icelandic is traditionally thought to consist of eight monophthongs and five diphthongs (Garnes, 1974, Pétursson 1976, Þráinsson & Árnason 1992, among others). In the vowel quadrilaterals in Figure 4, approximate positions of monophthongs and diphthongs are given in the left and right panels, respectively.

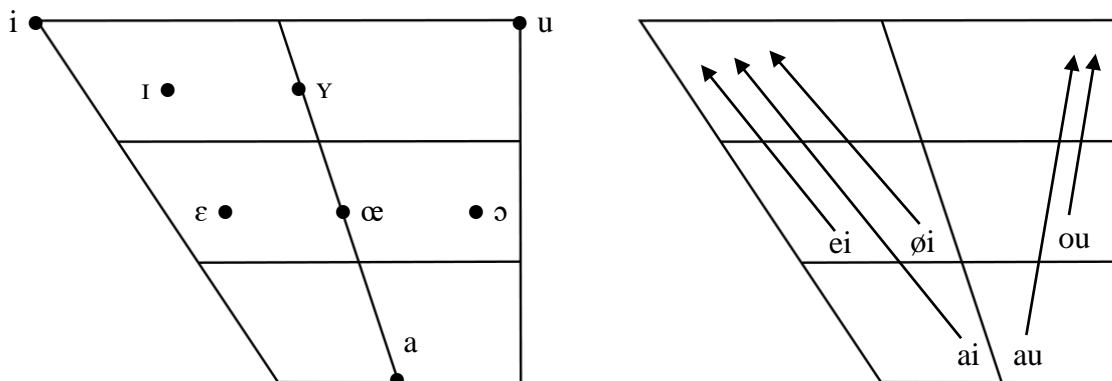


Figure 4 Icelandic Vowel Charts.

Vowel length participates in the quantity contrast discussed above. Briefly, all vowels (monophthongs and diphthongs) are short if followed by a geminate, pre-aspirated stop, or consonant cluster, and surface as long otherwise.⁶ The addition of inflectional suffixes can alter word-internal syllabification, which often induces vowel length alternations (e.g. [ˈfjœ:ðʏr] feather.NOM.SG ~ [ˈfjœðʏrɪm] DAT.PL, [ˈhei:l] whole.F.NOM.SG ~ [ˈhei]t N.NOM.SG, [ˈplau:]

⁶ There is one particular group of clusters which are not preceded by a short vowel: if C_1 is a stop or [s] and C_2 is one of three segments ([v r j]), the preceding vowel is long. Gouskova (2004) analyzes this phenomenon by appealing to syllable contact, in which low sonority C_1 and high sonority C_2 are heterosyllabified as a post-tonic onset cluster.

blue.F.NOM.SG ~ ['plau^ht] N.NOM.SG). Interestingly, Pétursson (1976) reported a slight difference in intrinsic length between monophthongs and diphthongs, with both long and short diphthongs being 12-20 ms longer than long and short monophthongs. Garnes (1974) notes that short diphthongs are still diphthongal, but the overall distance across the vowel space is quite reduced.

A near minimal set of the eight monophthongs and five diphthongs is presented in Table 6. Due to the post-vocalic context shared among the example words, all stressed vowels are long.

Table 6 Near-minimal set for vowel contrasts

[i]	<i>bíður</i>	['pi:ðyr]	wait.2SG.PRS.IND
[ɪ]	<i>biður</i>	['pɪ:ðyr]	ask.2SG.PRS.IND
[ei]	<i>beiðu</i>	['pei:ðy]	mantis.ACC.SG
[ɛ]	<i>beðin</i>	['pɛ:ðɪn]	wait.PST.PTCP.N.NOM.PL
[ai]	<i>bæði</i>	['pai:ði]	both.N.NOM.PL
[ʏ]	<i>buðum</i>	['pʏ:ðym]	invite.1PL.PST.IND
[øi]	<i>baud</i>	['pøi:ð]	invite.1SG.PST.IND
[œ]	<i>böðum</i>	['pœ:ðym]	bathroom.DAT.PL
[u]	<i>búðir</i>	['pu:ðɪr]	shop.NOM.PL
[ou]	<i>bjóðir</i>	['pjou:ðɪr]	invite.2SG.PRS.SBJV
[ɔ]	<i>boði</i>	['pɔ:ði]	invitation.DAT.SG
[au]	<i>báðir</i>	['pau:ðɪr]	both.M.NOM.PL
[a]	<i>baði</i>	['pa:ði]	bathroom.DAT.SG

Formant measurements were taken for each of the long monophthongs in the example words in Table 6. These are plotted in the left panel of Figure 5, where arrow start-point represents the formant value taken at 20% of the vowel duration and arrow endpoint indicates the measurement taken at 80%. It can be seen that the mid vowels exhibit considerable spectral movement. Garnes (1974) and Pétursson (1976) have previously noted that the short and long variants of /ɛ œ ɔ/ have very different spectral characteristics. Garnes (1974) reported that the long allophones of the three mid vowels /ɛ ɔ œ/ are diphthongal, opening and centralizing over the course of the vowel, and that the short allophones are considerably lower and centralized. This description is consistent with our informant's behavior, which is represented in the right panel of Figure 5.

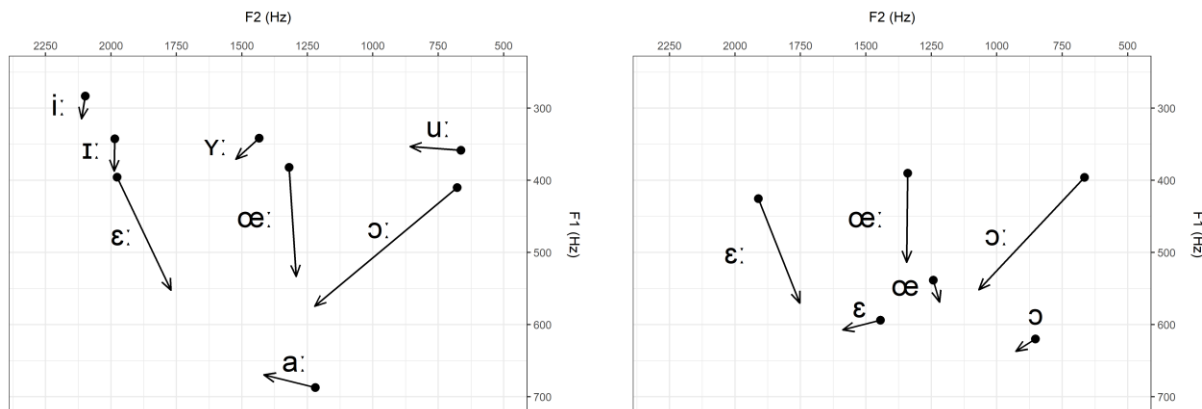


Figure 5 Vowel plots for our informant. Left: measurements taken at 20% and 80% of each of the eight monophthongs in the example words given in Table 6. Right: measurements taken at 20% and 80% of short and long allophones of /ɛ œ ɔ/, averaged across all example words in this paper not beginning with a palatal consonant.

For one of the informants in Pétursson (1976)’s study, durational differences between the canonically long and short allophones of mid vowels were nearly merged, yet distinct differences in vowel quality were preserved. Pind (1999) hypothesized that speakers may allow for more durational overlap between [ɛ] and [ɛ:] than between [a] and [a:], since the former contrast includes the additional disambiguating cue of vowel quality. However, the output of a simple neural network classifier showed that there was no significant difference in misclassification between words with [a]/[a:] and those with [ɛ]/[ɛ:] when only given durational information.

We note two phonotactic restrictions concerning vowel quality. First, word-initial post-consonantal [j] precedes only six of the 13 vowel types ([a ɛ œ u au ou]). Given this restriction, and that post-consonantal [j] participates in the numerous grammatically conditioned vowel quality alternations found in the language (e.g. *boði ~ bjóðir ~ buðum ~ bauð* in Table 6, all semantically related to “invite”), it is unclear whether it should be considered the final consonant in an onset cluster, or as part of the following vowel (for a discussion of sub-syllabic constituency of onglides in American English, see Davis & Hammond 1995). This raises the question of whether Icelandic should be analyzed as having 19 contrastive vowel types instead of the traditionally posited 13. The second positional restriction involves the dorsal nasals [ɲ ɲ̥ ɲ̥̊]. Only a subset of vowel qualities ([i u ai ou ei øi au]) may precede them, although older speakers may be more likely to retain monophthongal realizations of the last three ([ɛ œ a]) in this context (Práinsson & Árnason 1992).

Length does not alternate for vowels in less prominent syllables.⁷ These weakly stressed vowels are often subject to deletion in medial syllables or when word-final and followed by a vowel-initial word (Árnason 1980, Dehé 2008). According to Dehé (2008), likelihood of word-final vowel deletion is affected by a number of factors, including prosodic boundaries (in turn affected by syntactic structure and focus structure) and eurhythmy (stress clashes and lapses). For example, in the illustrative passage below, *fará úr kápunni* is realized by our informant as [fa:ru'k^hau:...], avoiding a stress lapse between the two prominent syllables [fa:] and [k^hau:]. When not deleted, however, unstressed vowels may still show significant spectral reduction. Helgason (1993) found that unstressed vowels were extremely centralized and much higher in the vowel space than their short stressed counterparts.

4 Stress and Intonation

In disyllabic words, the first syllable of a word generally receives main stress. In trisyllabic words (and longer), the first syllable is assigned main stress, but odd-numbered syllables have a secondary stress and even-numbered syllables are weak (Árnason 1985). Alternations in stress patterns can be induced by certain prefixes (e.g. *ó-* “un-”), and some derivational suffixes attract stress, even if they occupy an even-numbered syllable (Árnason 1987, Bergsveinsson 1963).

Icelandic does not have contrastive lexical intonation like mainland Scandinavian languages (i.e. Norwegian and Swedish). In general, the strongest syllable of the rightmost constituent in the utterance bears a pitch accent. However, this seems to interact with the hierarchy **nouns > verbs > prepositions > personal pronouns**, where constituents to the right on the hierarchy are less likely to bear the pitch accent than constituents to their left, even when they occupy the rightmost position in the sentence (Árnason 1998). In addition, contrastive focus can

⁷ While the most common vowel qualities in syllables of lesser stress are [ɪ], [a], and [ʏ] (corresponding historically to the vowel system of inflectional and derivational endings), many proper nouns and loanwords exhibit greater variation in vowel quality in unstressed syllables (see Árnason 2011:67 for discussion and examples).

assign phrasal stress to nearly any part of the utterance when needed (Árnason 1985). In neutral declarative sentences, the syllable bearing phrasal stress typically has a H*L pitch accent if long, or H, followed by L on the next syllable, if short (Árnason 1998). This is contrasted with a L*H contour on the prominent syllable in yes/no questions. In both of these clause types, though, a low boundary tone (L%) is usually associated with the end of the utterance, and thus with finality. A high boundary tone (H%) at the end of a domain signals non-finality (i.e. continuation). The H*L pitch accent and low boundary tone are clearly present on *sterkara* and *veginum*, the final words of the first two sentences in the illustrative passage below. In addition, a high boundary tone signaling continuation is evident on *blés*, the final word of the first phrase in a “the more..., the more...” construction.

In addition to the two bitonal pitch accents (H*L and L*H) advanced by Árnason (1998), Dehé (2009)’s findings suggest the presence of two monotonal pitch accents (H* and L*), although the two sets may be in complementary distribution. Dehé makes no claim as to whether there is a phonological contrast between bitonal and monotonal pitch accents, and leaves this question to future research. Finally, Icelandic prenuclear accents are characterized by a late rise from a low accented syllable (L*H), while final nuclear accents are characterized by an early rise and immediate fall (Dehé 2010).

5 Illustrative passage

Icelandic is a highly inflected fusional language. To save space, its inflectional suffixes are glossed using one abbreviation each for person, plurality, tense, mood, gender, case, and definiteness, without periods, in the order they appear here:

Verbal Inflection:

1 ST PERSON (1)	SINGULAR (S)	PRESENT (PS)	INDICATIVE (I)
2 ND PERSON (2)	PLURAL (P)	PRETERITE (PT)	SUBJUNCTIVE (S)
3 RD PERSON (3)			

Nominal Inflection (nouns):⁸

NOMINATIVE (N)	SINGULAR (S)	DEFINITE (D)
ACCUSATIVE (A)	PLURAL (P)	INDEFINITE (I)
DATIVE (D)		
GENITIVE (G)		

Adjectival Inflection (adjectives, pronouns, numerals, participles):

MASCULINE (M)	NOMINATIVE (N)	SINGULAR (S)
FEMININE (F)	ACCUSATIVE (A)	PLURAL (P)
NEUTER (N)	DATIVE (D)	
	GENITIVE (G)	

Einu	sinni	deildu	norðanvindurinn	og	sólin	um,
'ʔei:n-Y	'sin:-I	teil-ty	'norðanvint-YRIN	o	'sou:l-in	'ʔym:
one-NDS	time-DSI	dispute-3PPTI	north.wind-NSD	and	sun-NSD	about

"One time the north wind and sun were quarreling over"

⁸ Icelandic nouns do not inflect for gender in the way adjectives do—rather, grammatical gender is an intrinsic, immutable property of a noun in Icelandic. As such, in an effort to streamline interlinear glosses, we opted not to include gender for nouns.

hvort	þeirra	væri	sterkara.	Þau	sáu	þá
k ^h vɔɾt	θeira	vair-ɪ	'stɛɾk-ar-a	θøi	'sau:-y	θau
which.of.two-NNS	NGP	be\PTS-3SPTS	strong-CM-NNS	NNP	see\PTI-3PPTI	then

"which of the two of them was stronger. Then they saw"

mann	í	hlýrri	kápu	á	ferð	á	veginum.
'man:-Ø	i	'li-r:ɪ	'k ^h au:p-y	au	'fɛrθ-Ø	au	'vei:j-INYM
man-ASI	in	warm-FDS	coat-DSI	on	route-DSI	on	way-DSD

"a man in a warm coat coming along."

þeim	kom	þá	saman	um	að	það	þeirra	skyldi
θeim	'k ^h ɔ:m-Ø	θau	'sa:man	'ɔym:	a	'θa:θ	'θeir:a	scilt-ɪ
NDP	agree\PTI-3SPTI	then	together	agree	CONJ	NNS	NGP	FUT.PTS-3SPTS

"They agreed that the one who could force the man"

teljast	sterkara	sem	gæti	neytt	ferðamanninn
t ^h ɛl-ja-st	'stɛɾk-ar-a	sɛm	cait-ɪ	'nei- ^h t	'fɛrðaman-IN
count-INF-RFL	strong-CM-NNS	REL	can\PTS-3SPTS	force-PTCP.NNS	traveler-ASD

"to take his coat off would be considered"

til þess að	fara	úr	kápunni.	Norðanvindurinn	tók	þá	til að
t ^h ɪl θɛs a	far-a	ur	'k ^h au:p-yɪ	'nɔrðanvɪnt-yɪn	't ^h ouk-Ø	θau	't ^h ɪ:l a
to	go-INF	out.of	coat-DSD	north.wind-NSD	start\PTI-3SPTI	then	to

"the stronger one. The north wind then began"

blása	af	öllum	mætti,	en	því	meira	sem	hann
'plau:s-a	av	'ɔɛtl-yɪm	'mai ^h t-ɪ	ɛn	θi	'mei:r-a	sɛm	han
blow-INF	with	all-MDS	might-DSI	but	CM	much.CM-NS	REL	MNS

"to blow with all his might, but the harder he"

blés,	því	þéttara	vafði	ferðamaðurinn	kápunni	að
'pljɛ:s-Ø	θi	'θjɛ ^h t-ar-a	'vav-ði	fɛrðamað-yɪn	'k ^h au:p-yɪ	'ɔa:ð
blow\PT-3SPTI	CM	tight-CM-NS	wrap\PT-3SPTI	traveler-NSD	coat-DSD	around

"blew, the more tightly the traveler wrapped his coat around"

sér;	og	að	lokum	gafst	norðanvindurinn	upp.
sjer	ɔ	a	'lɔ:k-yɪm	'kaf-st	nɔrðanvɪnt-yɪn	'ɔy ^h p
RFL.3SG.DAT	and	at	end-DPI	give.up\SPTI-RFL	north.wind-NSD	give.up

himself; and finally the north wind gave up."

Svo	fór	sólin	að	skína	og	það	varð
'svɔ:	four-Ø	'sou:l-IN	a	'sci:n-a	ɔ	θað	varð-Ø
so	start\PTI-3SPTI	sun-NSD	to	shine-INF	and	NNS	become\SPTI-3SPTI

"So the sun began to shine and it became"

hlýtt.	Þá	fór	ferðamaðurinn	undir	eins	úr	kápunni.
'li ^h t	'θau:	four-Ø	'ferðamað-yrin	'ʔyntir	eins	ur	'k ^h au:p-yni
warm-NNS	then	go\PTI-3SPTI	traveler-NSD	immediately		out.of	coat-DSD

"warm. Then the traveler took off his coat at once."

Norðanvindurinn	áttaði	sig	þá	á	því að	sólin
'norðanvint-yrin	'ʔau ^h t-aði	six	θau	'ʔau:	θvi a	'sou:l-in
north.wind-NSD	realize-3SPTI	RFL.3SG.ACC	then	CONJ		sun-NSD

"The North wind realized then that the sun"

væri	sterkari	en	hann.
vair-i	'steʀk-ar-i	en	han
be\PTS-3SPTS	strong-CM-MNS	than	MNS

"was stronger than him."

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