

THE PHONOLOGY OF ASPIRATION IN ICELANDIC:
A GESTURE-BASED APPROACH

A Dissertation

Presented to the Faculty of the Graduate School

of Cornell University

in Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

by

Linda Heimisdóttir

August 2015

© 2015 Linda Heimisdóttir
ALL RIGHTS RESERVED

THE PHONOLOGY OF ASPIRATION IN ICELANDIC: A GESTURE-BASED
APPROACH

Linda Heimisdóttir, Ph.D.

Cornell University 2015

This dissertation examines aspirated consonants in Icelandic from several angles, including dialectal variation, language acquisition, and diachronic development. The main question addressed pertains to the articulatory organization of these consonants, more specifically how the relationship between laryngeal speech gestures and the oral gestures they are produced in tandem with can best be understood and represented in phonological terms. We propose an analysis of glottal gestures as subordinate speech gestures tied to oral head gestures and show how the coordination between these two types of gestures is determined by phonological constraints. We pay special attention to preaspirated stops in Icelandic and discuss how children's early acquisition of these stops compared to postaspirated stops sheds a light on patterns of articulatory coordination.

Icelandic is ideal for examining the coordination of glottal gestures because it is rich in laryngeal contrasts. Its two main dialects, the Northern Dialect (ND) and the Southern Dialect (SD), differ primarily in the degree of aspiration on word-internal stop consonants. We present an analysis of these dialectal patterns, where variation in aspiration is explained in terms of the timing of glottal gestures relative to oral ones, we discuss the history of these differences from various angles, and propose sociolinguistic reasons for why they have occurred.

BIOGRAPHICAL SKETCH

Linda Heimisdóttir was born in the town of Akureyri in northern Iceland in 1984 but moved to a suburb of the capital city, Reykjavík, at the age of two. At the age of sixteen she began junior college at Menntaskólinn í Reykjavík where she majored in classic languages. It was there where her interest in linguistics first awoke while attending a year-long introductory course in synchronic and diachronic linguistics. After graduating from junior college summa cum laude in 2004 she moved on to doing an undergraduate degree at the University of Iceland in Icelandic linguistics and literature, with a minor in Latin. Upon finishing her B.A. in 2008 she was offered the opportunity to move to Ithaca NY and teach a course in Old Norse at Cornell University for one year while attending classes at the Department of Linguistics as a non-degree student. She liked the department so much that she decided to stay at Cornell and apply for the Ph.D. program in linguistics, where she began her graduate studies in the fall of 2009. After completing her Ph.D. Linda will be moving to Portland OR to live with her husband and (hopefully) start her linguistics career.

To Bishu, for his unconditional love and support

ACKNOWLEDGEMENTS

It is only fitting that I begin this section by acknowledging Draga Zec who has been my advisor since the end of my first year as a Ph.D. student at Cornell. She has taught me so much about phonology and academic writing, about how to structure presentations and abstracts, and how to solve problems. She has made me a better linguist and for that I will always be grateful. I am also indebted to my minor committee members. Sam Tilsen has provided me with invaluable feedback on all things phonetics and statistics, and he has devoted himself to making the Cornell Phonetics Lab a better and more fun work environment, an effort much appreciated by all of his students. Michael Weiss has been a pleasure to interact with and I have learned a lot about historical linguistics from him. Other faculty members at the Linguistics Department have always been supportive and approachable when I have come to them for advise and for that I thank them.

I would never have ended up at Cornell in the first place had it not been for my undergraduate professor and mentor, Guðrún Þórhallssdóttir. I was completing my undergraduate degree at the University of Iceland when the position of an Old Norse instructor became available at Cornell, a position normally filled by an Icelandic graduate student as per the terms of the late Willard Fiske, the donator of the Fiske Icelandic Collection, the largest collection of Icelandic literature in North America. Guðrún, herself a graduate of Cornell University, reached out to me and encouraged me to apply for the position, and it was because of her support and faith in me that I took the plunge and set out for the adventure that my stay at Cornell has turned out to be. I have no words to express how grateful I am to Guðrún for setting me on this path. I would also like to thank another Cornell alumnus, Haraldur Bernharðsson, who taught me my very first linguistics course in junior college (and awoke my interest in the field!) and later became my

undergraduate thesis advisor. Besides doing a stellar job of advising me on my thesis during my last year of undergrad, Haraldur was an endless source of good advice regarding my upcoming stay in Ithaca and my new job there as an Old Norse instructor. While on the topic of Old Norse, I'd like to give a special thank you to the Old Norse reading group that I have been a part of ever since I first came to Cornell. It has been a pleasure and a privilege to read and learn about Old Norse every week from Tom, Oren, Patrick, Xan, Binna, and many other previous members. I will miss those gatherings.

My years at Cornell have been the best years of my life. Here I have grown as a person, a linguist, a friend, and a partner. I met my husband Bishu during my very first week in Ithaca and a few months later we started our relationship. Bishu has always been my biggest cheerleader and I am looking forward to many more years with such a loving and supportive partner. Our friends from the international TA program at Cornell, Leifur, Milena, Manasi, and Sarabjeet, made my first year in Ithaca unforgettable. I have had the good fortune of getting to know several amazing people during my stay here, each of whom has contributed to my life in a meaningful way. I am grateful to Shion for showing me how to lift weights (often a welcome distraction during more stressful times) and for teaching me so much about life and academia. Julie has been a trusted friend since my first year at Cornell and her constant presence in my life has proved to me that great friendships transcend geographical boundaries. I've had so many good times with my girlfriends, Anca, Natalia, and MJ, both in Ithaca and on our various travels. I couldn't have asked for better colleagues or friends. I've been fortunate enough to be a part of a tight-knit community of graduate students at the linguistics department. Not only have I benefited from my colleagues' insights on my work, but I have shared some great times with them outside of work at house parties,

picnics, the Big Red Barn, the Chapter House, and various other places. Last but certainly not least of my Ithaca friends, Corey and Adam have understood me in a way nobody else can and for that I am grateful.

I have been fortunate enough to not just have support locally in Ithaca but also from my friends and family back home in Iceland. Ever since I was a little girl, my parents have supported me in every decision I have made, whether it was personal or academic. They have never put pressure on me to follow a certain path in life and have always shared in my joy over various achievements on my way to this point, my graduation from Cornell. I am lucky to have such great parents and a great family, many of whom have visited me in the US and opened their homes to me and my various travel partners when I have gone back to Iceland. Two Icelandic friends in particular, Elva and Rannveig, have remained close to me over the years despite our physical distance. Although sometimes far between, our conversations over Skype always leave me rejuvenated and mindful of the most important things in life, love and friendship.

TABLE OF CONTENTS

Biographical Sketch	iii
Dedication	iv
Acknowledgements	v
Table of Contents	viii
List of Tables	xi
List of Figures	xiv
1 Introduction	1
1.1 Goals	1
1.2 Background	1
1.3 Overview	7
2 The Phonological Structure of Icelandic	11
2.1 Introduction	11
2.2 Sound Inventory	12
2.2.1 Vowels	12
2.2.2 Consonants	13
2.3 Syllable Structure	17
2.4 Dialectal Differences	24
2.4.1 Native phonology	25
2.4.2 Loanwords	30
2.5 Foot Structure	32
2.6 Final Remarks	39
3 Phonetic Study	41
3.1 Introduction	41
3.2 Previous Studies	42
3.2.1 Acoustic studies	42
3.2.2 Other phonetic studies	56
3.3 Present Study	58
3.3.1 Methodology	58
3.3.2 Results for word-initial stops	64
3.3.3 Results for intervocalic stops	69
3.3.4 Preaspirated stops	78
3.3.5 Comparison of all intervocalic stops	83
3.3.6 Clusters of sonorant + stop	85
3.3.7 [s]+stop clusters	96
3.3.8 Acoustic data and articulatory gestures	98
3.4 Comparison to Previous Studies	104
3.5 Discussion and Final Remarks	107

4	Gestural Coordination: Evidence from Speech Acquisition	112
4.1	Introduction	112
4.2	Preaspirated Stops	114
4.3	Gestural Coordination of Aspiration	121
4.3.1	Gestural coordination and acquisition	123
4.3.2	The ND pattern	133
4.3.3	Two types of preaspiration	135
4.3.4	Aspirated clusters and questions of gestural affiliation	143
4.4	Is Aspiration Segmentally Bound?	149
4.5	Conclusion	153
5	A Phonological Analysis of Aspiration in Icelandic	154
5.1	Introduction	154
5.2	Aspiration as a Gesture	156
5.3	Gestures and Phonology	159
5.3.1	Previous work	159
5.3.2	The Icelandic data	165
5.4	Relevant Acoustic Findings	169
5.5	Language Acquisition and the Phonology of Aspiration	172
5.6	Formal Analysis	173
5.6.1	Intervocalic stops	179
5.6.2	Word-initial stops	181
5.6.3	Preaspirated stops	182
5.6.4	Heterorganic stop clusters	185
5.6.5	Complex onsets	186
5.7	Conclusion	191
6	Sociolinguistic Factors - Attitudes towards Dialectal Differences in Iceland	194
6.1	Introduction	194
6.2	A Brief History of Language Purism in Iceland	195
6.2.1	19th century: the golden age of language purism	197
6.2.2	Examples of language planning successes and failures	200
6.2.3	Language planning in modern times	206
6.3	Dialectal Differences and Aspiration: An Overview	208
6.3.1	Aspiration in early grammatical literature	210
6.3.2	Postaspiration of intervocalic singleton stops	214
6.3.3	Aspiration in consonant clusters	216
6.3.4	Characterization of aspiration in early grammars	220
6.3.5	Questions of origin	226
6.3.6	Other references to dialectal differences	228
6.3.7	Final remarks	231
6.4	Survey on Dialectal Attitudes in Iceland	234
6.4.1	Main results	236

6.4.2	Final remarks	241
6.5	Conclusion	241
7	Conclusion	244
A	Wordlist from Phonetic Study	248
B	Questionnaire on Dialectal Attitudes	251

LIST OF TABLES

2.1	Icelandic monophthongs.	12
2.2	Icelandic diphthongs.	12
2.3	Consonants in Icelandic. Allophones are shown in parentheses. . .	13
2.4	Sonority hierarchy in Icelandic.	21
3.1	Results from Einarsson's (1927) acoustic study (numbers represent durations in ms.)	43
3.2	Average durations for Icelandic stop consonants according to Garnes's (1976) acoustic study (numbers represent durations in ms.) .	44
3.3	Results from Pétursson's (1974b) acoustic study on SD speakers (numbers represent durations in ms.)	45
3.4	Results from Pétursson's (1974b) acoustic study on ND speakers (numbers represent durations in ms.)	45
3.5	Comparison of averages for SD and ND speakers from Pétursson's (1974b) study (numbers represent durations in ms.)	46
3.6	Results from Rögnvaldsson's (1980) acoustic study on SD speakers (numbers represent durations in ms.)	47
3.7	Results from Rögnvaldsson's (1980) acoustic study on ND speakers (numbers represent durations in ms.)	47
3.8	Comparison of averages for SD and ND speakers from Rögnvaldsson's (1980) study (numbers represent durations in ms.)	48
3.9	Results from Indriðason et al.'s (1991) acoustic study on SD speakers (numbers represent durations in ms.)	49
3.10	Results from Indriðason et al.'s (1991) acoustic study on ND speakers (numbers represent durations in ms.)	50
3.11	Comparison of averages for SD and ND speakers from Indriðason et al.'s (1991) study (numbers represent durations in ms.)	50
3.12	Results from the present study on word-initial stop consonants spoken at a normal speech rate (numbers represent durations in ms. averaged over all speakers)	65
3.13	Results from the present study on word-initial stop consonants spoken at a faster than normal speech rate (numbers represent durations in ms. averaged over all speakers)	65
3.14	Average durations of word-initial stops in normal and fast speech shown as proportions of the duration of the entire syllable (CVV).	68
3.15	Results from the present study on intervocalic geminate stops spoken at a normal and faster speech rate (numbers represent durations in ms. averaged over all speakers)	70
3.16	Average durations of intervocalic geminate stops in normal and fast speech shown as proportions of the duration of V+C.	71

3.17	Results from the present study on intervocalic singleton stops spoken at a normal speech rate (numbers represent durations in ms. averaged over all speakers)	72
3.18	Results from the present study on intervocalic singleton stops spoken at a faster than normal speech rate (numbers represent durations in ms. averaged over all speakers)	73
3.19	Average durations of intervocalic singletons stops in normal and fast speech shown as proportions of the duration of V+C.	75
3.20	Comparison of word-initial and intervocalic aspirated stops in ND (numbers represent durations in ms. averaged over all speakers)	77
3.21	Results from the present study on intervocalic preaspirated stops spoken at a normal and a faster than normal speech rate (numbers represent durations in ms. averaged over all speakers)	79
3.22	Results from the present study on preaspirated stops before sonorants, spoken at a normal speech rate (numbers represent durations in ms. averaged over all speakers)	80
3.23	Results from the present study on preaspirated stops before sonorants, spoken at a faster than normal speech rate (numbers represent durations in ms. averaged over all speakers)	80
3.24	Average durations of intervocalic preaspirated stops in normal and fast speech shown as proportions of the duration of V+C.	83
3.25	Average durations of preaspirated stops before sonorants in normal and fast speech shown as proportions of the duration of V+C.	83
3.26	Comparison of mean stop closure durations (ms.) in three types of intervocalic stops, singleton, geminate, and preaspirated, across both dialects and speech rates.	84
3.27	Comparison of mean short and long vowel durations (ms.) in normal and faster than normal speech).	84
3.28	Proportion of tokens produced with a voiced sonorant in ND.	87
3.29	Results from the present study on clusters of sonorant + aspirated stop, spoken at a normal speech rate (numbers represent durations in ms. averaged over all speakers)	88
3.30	Results from the present study on clusters of sonorant + aspirated stop, spoken at a faster than normal speech rate (numbers represent durations in ms. averaged over all speakers)	89
3.31	Total number of tokens in ND, split up by type of sonorant, aspirated or voiced.	90
3.32	Average durations of sonorant + stop clusters in normal and fast speech shown as proportions of the duration of the entire cluster.	90
3.33	Results from the present study on clusters of sonorant + plain stop, spoken at a normal and a faster than normal speech rate (numbers represent durations in ms. averaged over all speakers)	93

3.34	Comparison of a sonorant + plain stop cluster and a sonorant + aspirated stop cluster in the words <i>lamba</i> and <i>lampa</i> , respectively. Both pronunciations of <i>lampa</i> are shown. Values are given in ms. and averaged over all speakers	94
3.35	Results from the present study on [s]+stop clusters spoken at a normal and a faster than normal speech rate (numbers represent durations in ms. averaged over all speakers)	97
3.36	Results from the present study on [s]+stop clusters spoken at a normal and a faster than normal speech rate (numbers represent durations in ms. averaged over all speakers)	101
3.37	Hypotheses and results	111
5.1	Sonority hierarchy in Icelandic.	187
6.1	Two ways of inflecting the masculine <i>ija</i> -stem <i>hellir</i> ‘cave’ in Icelandic. The Old Norse inflection is shown on the left hand side, the new inflection, i.e. the inflection that was dominant in the 19th century, is shown on the right hand side.	201

LIST OF FIGURES

3.1	Spectrogram of the word <i>gata</i> produced by a male ND speaker. ‘x’ is used to denote VOT.	60
3.2	Spectrogram of the word <i>fatta</i> produced by a male SD speaker. ‘h’ is used to denote preaspiration and ‘x’ denotes VOT.	61
3.3	Values for VOT as well as closure and vowel durations, averaged over all speakers and split up by dialects.	66
3.4	A comparison of mean VOT durations (averaged over all speakers) in intervocalic stops between ND and SD.	75
3.5	Interaction of VOT with stop closure durations in intervocalic ND stops (correlation=0.4, $p<0.001$).	76
3.6	A comparison of mean values (averaged over all speakers and both dialects) for three dependent variables, VOT, preaspiration duration, and closure duration, in two environments: before a sonorant consonant and in intervocalic position.	81
3.7	Interaction of VOT with stop closure durations in ND aspirated clusters with a voiced sonorant and an aspirated stop (correlation=0.05, $p=0.477$).	95
3.8	Mean duration (ms.) of intervocalic geminate stops in SD and ND speech according to 6 different studies.	105
5.1	Gestural representation of the coordination between a laryngeal gesture and its oral ‘head gesture’. The solid line represents the oral gesture and the purple dotted line represents the laryngeal gesture.	165
5.2	Glottal opening data from Hoole and Bombien (2010). Comparison of a voiceless unaspirated stop on the left and what I analyze as a voiceless unaspirated [spread glottis] stop on the right.	168
5.3	Two ways of coordinating a preaspirated stop with a preceding consonant. Only the pattern in 5.3(b) is attested in Icelandic due to the high ranking of CC-COORD.	178

CHAPTER 1

INTRODUCTION

1.1 Goals

The main questions we intend on asking in this dissertation have not been addressed sufficiently in the literature and pertain to the articulatory organization of aspirated segments in Icelandic. Given ample phonetic evidence suggesting that differences in aspiration may be reduced to the size and timing of glottal gestures relative to oral ones, we will explore how this articulatory relationship can best be understood and represented in phonological terms. In doing so, we will consider the realization of aspiration in Icelandic from several different angles, including dialectal distinction, language acquisition, and diachronic developments. Our central goal is to offer a fresh perspective on a much debated phonological problem by attempting to move the discussion away from segments and somewhat vaguely defined features and autosegments towards a more gesture-based theory that still retains the abstractness and insights of traditional phonology.

1.2 Background

Ever since Lisker and Abramson's (1964) influential paper on voice onset time (VOT) and the central role it plays in distinguishing between different categories of stop consonants, several papers have been written about aspiration from a phonetic standpoint as well as a phonological one. Lisker and Abramson (1964) took issue with the fact that phonetic features of stops, such as voicing, aspiration and force of articulation, were assumed to be independent of each other, and proposed instead

that these were all articulatory consequences of a single feature, VOT. Kim (1970) continued with a similar line of thinking in his analysis of Korean voiceless stops. He diverged from Lisker and Abramson, however, in proposing that it is not the timing of the glottal opening that matters, rather the presence or absence as well as the duration of aspiration is determined by the size of the glottal opening gesture. The larger the glottal opening, the longer it takes for the glottis to close again and for voicing to begin in Kim's view.

Since this early literature on the articulation of aspiration, numerous articulatory studies have been conducted that confirm that both arguments presented above have some merit. In other words, distinct categories of stops vary in both the timing and the size of the glottal opening gesture. Studies that have looked at Icelandic stop consonants in particular include Pétursson (1972, 1977), Löfqvist and Pétursson (1978), Löfqvist and Yoshioka (1981b), Hoole (1987) and Hoole and Bombien (2010) (the results of these studies will be discussed in more detail in Chapter 5). Despite the amount of data that have been collected on the articulatory aspects of aspiration production, phonological analyses have lagged behind and failed to take these data into serious consideration.

A great deal of work exists on aspirated segments in Icelandic. In particular, preaspirated stops in the language have been a popular subject of discussion as well as voiceless or aspirated sonorants. Preaspirated stops appear in two environments in Icelandic, intervocalically (1-a) and before [l] or [n] (1-b). Aspirated sonorants are found word-initially (1-c) and before fortis stops¹ (1-d), and contrast with voiced sonorants in both of these positions.

¹The terms 'fortis' and 'lenis' will be used in this dissertation to distinguish between voiceless stops that are aspirated and unaspirated, respectively, in underlying structure. This is not meant to convey any kind of phonetic truth. These are simply useful umbrella terms for distinguishing the two stop series found in Icelandic.

- | | | | | |
|-----|----|---------------|-----------|-------------------------|
| (1) | a. | <i>fatta</i> | [fahta] | ‘to realize/understand’ |
| | b. | <i>epli</i> | [ɛhplɪ] | ‘apple’ |
| | c. | <i>hlutur</i> | [l̥y:tyr] | ‘thing’ |
| | d. | <i>vanta</i> | [vaŋta] | ‘to lack’ |

Less has been written about dialectal variation in Icelandic, which is particularly interesting as it pertains to aspiration. The two dialects we focus on in this dissertation, the Southern Dialect (SD) and the Northern Dialect (ND), differ in two major aspects. First, intervocalic singleton stops are unaspirated in SD (2-a) but postaspirated in ND (2-b). Second, clusters of sonorants followed by fortis stops have aspiration on the sonorant in SD (3-a) but the stop in ND (3-b).

- | | | | | | |
|-----|----|----|--------------|-----------------------|-----------|
| (2) | a. | SD | <i>fata</i> | [fa:ta] | ‘bucket’ |
| | b. | ND | <i>fata</i> | [fa:t ^h a] | ‘bucket’ |
| (3) | a. | SD | <i>vanta</i> | [vaŋta] | ‘to lack’ |
| | b. | ND | <i>vanta</i> | [vaŋt ^h a] | ‘to lack’ |

Haugen’s (1958) book on the phonemics of Icelandic was perhaps the first attempt at applying some phonological structure to aspiration in the language. Before Haugen’s work, all analyses simply aimed at describing the distribution of these sounds, as was to be expected under a structuralist view of phonology (cf. Kress 1937, Malone 1952). Haugen entertained two possibilities regarding the structure of aspirated stops in Icelandic; either the aspiration is a component of the stop or it is a phoneme of its own (in which case there is only one series of stops in the language; aspirated stops are simply the result of the coarticulation of

a stop and /h/). The main advantage of the latter analysis, in Haugen’s opinion, is that stops lack aspiration when directly preceded by [s], a fact that is easily explained if those clusters are simply not produced in tandem with an /h/-phoneme. However, the disadvantage of applying such a structure, Haugen explains, is that it doesn’t allow for analyzing voiceless fricatives as allophones of aspirated stops, an analysis that finds support in the complementary distribution of these sounds in Icelandic. He, therefore, concludes that aspirated stops, whether they are pre- or postaspirated are a single unit in Icelandic and that the “position of this aspiration is a matter to be stated in the allophonic rules (Haugen 1958:72)”. Regarding the distribution of aspirated stops in Icelandic, Haugen states that:

In each case the aspiration occurs on the side of the consonant closest to the syllabic. It occurs not only before vowels in medial or final position, but also before other consonants, as in *vatn*, *opna*, *vakna*. The aspiration is the criterion of the fortis series of stops, as I suggested a number of years ago (Haugen 1958:72).

Haugen goes on to explain that “in the position before aspirated stops voicelessness is closely correlated to the aspiration of the stops and in general appears to be determined by it (Haugen 1958:73)”. He further notes that there is a symmetry in the fact that continuants are voiceless both preceding and following fortis stops in the standard dialect of Icelandic, while conceding that this is not the case for speakers of the northern dialect.

Liberman (1972) described preaspiration in Icelandic as suprasegmental, i.e. an accent on par with Danish *stød*, while Anderson (1974) viewed it as vowel devoicing, noting that whether preceded by a long² or a short vowel, a preaspirated consonant has the effect of devoicing exactly one-half of the preceding syllabic

²i.e. a diphthong; Anderson does not address the fact that diphthongs are either long or short in Icelandic depending on phonetic context

element. He treats preaspirated stops as one phonetic unit but notes that they “are often the surface realizations of long or geminate consonants, and so do not appear distinctively in underlying representations in any language we know of, but they are a real and distinctive phenomenon in phonetic representations, and some descriptive device must be available to account for them (Anderson 1974:265).” He further notes that the distribution of aspiration in Icelandic shows that glottal features may be related to segmental (or oral-articulatory) features in a different way from the way these segmental features are related to one another. In other words, the segmental features of a segment are coextensive with each other, i.e. produced in complete synchrony, while glottal features have more freedom to extend longer or shorter. Despite this, Anderson does not think that there is reason to encode the timing relationship into the phonology of aspirated segments. He writes:

We do not, however, mean to introduce a dimension of timing directly into the laryngeal component of a phonetic representation, as has recently been advocated by Lisker and Abramson [1964] and Ladefoged (1972). These scholars go too far, we feel, in advocating a virtual abandonment of the specification of distinctive laryngeal postures corresponding to different sorts of consonant, in favor of a simple temporal specification of some such parameter as delay in voicing onset time [...]. It seems entirely worthwhile and productive to attempt to explain these time differences in terms of differences of laryngeal configuration, and hence to preserve as far as possible the ‘timeless’ character of phonetic and phonological representation (Anderson 1974:267).

These sentiments were undoubtedly shared by many phonologists, especially considering that analyses of Icelandic aspiration referencing articulatory timing do not appear in the literature until very recently (cf. Lodge 2007, Hoole and Bombien 2010), and to our knowledge a complete phonological analysis of this phenomenon, grounded in a theory of gestural phasing, has not been attempted. The first comprehensive analysis of Icelandic aspiration was published in Thráinsson (1978) and

takes inspiration from autosegmental phonology. The central goal of this paper was to present evidence that preaspiration in Icelandic is derived by phonological rule application, rather than being a part of the underlying representation. Thráinsson determines that preaspirated stops (see examples (1-a) and (1-b) above) are clusters of [h] + stop, that result from aspirated geminates (either underlying or derived). He furthermore analyzes aspirated sonorants (example (1-d) above) as having an allophonic status, derived from voiced sonorants via spreading and delinking of the feature [spread glottis] belonging to a following aspirated stop.

Other phonological analyses of aspiration in Icelandic from that time period include standard rule-based approaches by Árnason (1977) and Orešnik (1978) (although Árnason's paper is more of a discussion of phonological alternations than it is a complete analysis), and Árnason (1986), where glottal opening is analyzed as a prosody whose domain is the syllable nucleus. Árnason writes that “for a nucleus to have that prosody means that it is voiceless in the second mora (Árnason 1986:18)”. He adds that this prosody feature is rooted in historical changes caused by anticipatory opening of the glottis before an aspirated consonant.

Various Optimality Theory (OT) based analyses that treat aspiration as some type of autosegment have appeared in the last couple of decades. Keer (1999) treats aspiration as a semi-independent autosegment of a stop consonant, and analyzes preaspiration in terms of metathesis of these two segments. Ringen (1999) also views aspiration as an autosegment but bases her analysis on two prominent phonological constraints, one that requires [spread glottis] to be a multiply linked feature, and one that militates against moraic aspirated stops. Morén's (2001) OT analysis follows a similar line of thinking regarding aspiration and moraicity. Finally, Hansson (2003) discusses aspiration in terms of perception and laryngeal

neutralization.

Lodge (2007) attempts to provide a fresh perspective on the issue of preaspiration in Icelandic. In the abstract he writes:

This paper questions the a priori assumption of the segment in phonology by considering the issues surrounding the relative timing of articulatory movements and its relationship with phonological structure. The specific focus of the paper is on pre- and postaspiration in Icelandic, with a question as to why the former is normally treated as segmental while the latter is not (Lodge 2007:66).

Given the above description, the actual analysis presented in Lodge's paper is somewhat of a let down for proponents of Articulatory Phonology. While he devotes quite some space to discouraging segment-based approaches to phenomena that are better explained in terms of articulatory timing, Lodge does not make any clear predictions about the phasing relationship between glottal and oral gestures in his analysis of Icelandic preaspirated stops. Instead, his analysis, which is grounded in Declarative Phonology (cf. Bird 1995), is a feature-based one. He refers to the preaspiration itself as either a voiceless vowel offset (due to a [voiceless] specification of the syllable rhyme) or simply an allophone of an aspirated stop, depending on phonological context.

1.3 Overview

The focus of this study are aspirated consonants in two dialects of Icelandic. The goal is to answer the question of how their distribution is determined, from a synchronic as well as a diachronic point of view. Icelandic is an interesting language to study for these purposes because it is rich in articulatory contrasts that involve

aspiration on stop consonants as well as sonorants and fricatives. Furthermore, the distribution of these consonants in the language varies depending on the dialectal area. These dialectal differences will be studied in detail and a hypothesis will be put forth regarding the mechanisms that coordinate aspiration in speech. Our central assumption is that the two dialects examined here share a common underlying structure, and that the variation in aspiration that exist on the surface can be adequately explained with the application of phonological constraints that are based on gestural phasing relationships. A formal phonological analysis of the coordinative relationship between glottal gestures and oral gestures in Icelandic will be proposed, and possible sociolinguistic influences on the distribution of aspiration will be discussed.

In Chapter 2 we discuss aspirated consonants in Icelandic in a phonological context. We give an overview of the phonological structure of the language in a broader perspective and give a detailed account of the dialectal differences we want to shed light on. We, furthermore, discuss syllable and foot structure in Icelandic in order to address the question of whether the distribution of aspiration is determined by stress patterns.

In Chapter 3 we present the results of a phonetic study conducted in two dialectal areas in Iceland, areas we will henceforth refer to as the Northern Dialectal (ND) area and the Southern Dialectal (SD) area. The study focused on the production of aspirated consonants in each of the dialects and the goal was to obtain an accurate description of the phonetic correlates of aspiration, with a special focus on environments where the two dialects differ. In addition to native words, we also looked at non-native vocabulary since stop consonants in certain borrowed words have introduced a new phonological pattern in ND, while seemingly assimilating

to an existing phonological pattern in SD. We furthermore collected data at two different speech rates to examine the effects of variation in rate on the production of aspirated consonants.

Our phonological analysis, presented in Chapters 4 and 5, takes inspiration from the framework of Articulatory Phonology (Browman and Goldstein 1986). In Chapter 4 we propose a decomposed view of aspirated segments as sets of gestures whose internal organization is determined by diachronic and perceptual factors as well as ease of acquisition. In particular, we focus on preaspirated stops in Icelandic and discuss how their historical origins as well as children's acquisition of them can shed light on their articulatory organization and their phonological status. In Chapter 5 we present a more formal view of the gestural organization of aspirated segments and propose an Optimality Theory analysis that captures our insights on the matter.

The subject of Chapter 6 are sociolinguistic attitudes towards dialectal differences in Icelandic, both from a diachronic and a contemporary perspective. We review references that were made to differences in people's speech in grammar books and newspaper articles from the 19th and early 20th centuries. We also present the results of a questionnaire given to the participants in our phonetic study that contained questions regarding their attitudes towards dialectal differences in Icelandic. Furthermore, we examine old grammars and language descriptions for evidence to determine the relative age of the two Icelandic dialects we focus on in this dissertation. We discovered that any references to aspirated consonants do not start appearing in the literature until the late 19th century, presumably much later than those differences first emerged in the language. We discuss possible reasons for these differences going unnoticed for as long as they did, and propose that

a lack of the kind of phonetic knowledge required to understand and articulate nuances in levels of aspiration was a deciding factor.

A discussion of our findings and final remarks are found in Chapter 7.

CHAPTER 2
THE PHONOLOGICAL STRUCTURE OF ICELANDIC

2.1 Introduction

This chapter gives an overview of the the Icelandic phonological system, including phonotactics and syllable structure. The goal of this chapter is to provide the reader with an intimate knowledge of the Icelandic language, which will facilitate the discussion of our phonetic study in Chapter 3, and our phonological analysis of aspiration in Icelandic in Chapters 4 and 5. A basic OT analysis will be given to explain the principles governing the organization of sounds into syllables followed by a discussion of foot structure and the possible role of it in the distribution of aspiration in the language.

The chapter will proceed as follows. In Section 2.2 we give an overview of the sound inventory of Icelandic, both vowels and consonants, and discuss allophonic alternations of various kinds. The subject of Section 2.3 is the syllable structure of Icelandic. Dialectal differences involving aspiration are discussed in Section 2.4. Section 2.5 contains a discussion of stress patterns and the potential relationship between foot structure and aspiration in Icelandic. Fiinal remarks are found in Section 2.6.

2.2 Sound Inventory

2.2.1 Vowels

The Icelandic vowel system consists of 8 monophthongal vowel phonemes (Table 2.1) and 5 diphthongs (Table 2.2). All vowels, both monophthongs and diphthongs, can be realized as either short or long, depending on phonetic context.

	Front		Back	
	unrounded	rounded	unrounded	rounded
Close	i			u
Close-mid	ɪ	ʏ		
Open-mid	ɛ	œ		ɔ
Open			a	

Table 2.1: Icelandic monophthongs.

	Front offglide	Back offglide
Mid	ei ~ øi	ou
Open	ai	au

Table 2.2: Icelandic diphthongs.

While Icelandic is sometimes described as restricting the vowel inventory of unstressed syllables to [ɪ], [a] and [ʏ] (which was true of older stages of the language), factors such as morphological concatenation and borrowings from other languages have rendered that observation obsolete. As matters stand now, Icelandic vowels are distributed freely, regardless of stress.

2.2.2 Consonants

Table 2.3 shows the consonant inventory of Icelandic.

	Labial	Dental	Alveolar	Palatal	Velar	Glottal
Plosive	p p ^h		t t ^h	(c) (c ^h)	k k ^h	
Nasal	m (m̥)		n (n̥)	(ɲ) (ɲ̥)	(ŋ) (ŋ̥)	
Fricative	f	θ	s		y (x)	h
Approximant	v	ð		j (ç)		
Lateral			l (l̥)			
Trill			r (r̥)			

Table 2.3: Consonants in Icelandic. Allophones are shown in parentheses.

It has been suggested in various sources (see e.g. Kohler 1984, Kingston 1990, Iverson and Salmons 1995) and will be assumed here, that in most Germanic languages, including Icelandic, laryngeal contrasts in obstruents are primarily encoded as a distinction in the feature [spread glottis], rather than [voice]. This analysis can be extended to sonorants in Icelandic, which emerge as ‘voiceless’ when followed by a [spread glottis] obstruent. Phonological analyses of this process (see e.g. Thráinsson 1978, Árnason 2005) often assume that the [spread glottis] feature of the obstruent shifts to the preceding sonorant, leaving the obstruent unaspirated. Therefore, it is perhaps more appropriate to refer to these sonorants as ‘aspirated’ rather than using the more conventional term ‘voiceless’.

The process whereby sonorants become aspirated in Icelandic is reflected in Table 2.3 where they are all shown as allophones of their unaspirated counterparts. It should be noted, however, that /n/, /l/, /r/ and /j/ can all contrast for aspiration in word-initial position.

- (1) Word-initial sonorants in both dialects of Icelandic
- | | | | |
|----|---------------|----------|---------------|
| a. | <i>nǫtja</i> | [ni:ta] | ‘make use of’ |
| b. | <i>hnǫtja</i> | [n̥i:ta] | ‘tie a knot’ |

Historical as well as orthographic evidence suggests that these word-initial aspirated sonorants were at some point clusters of [h] + sonorant. For example, the word *hlutur* ‘thing’ corresponds to the English word *lot*, which in Old English was *hlot*. While the [h] has been dropped in English, it has merged with the sonorant in Icelandic. One can of course argue that this merger merits a phonemic status given to the aspirated sonorants. On the other hand, since this contrast is limited to word-initial position, it is also possible to assume that word-initial aspirated sonorants have an underlying representation of /h/ + sonorant. We will let that explanation suffice for now but return to this discussion in Chapter 4.

Other allophonic variants depicted in Table 2.3 include palatal stops and velar and palatal nasals. The palatals appear before a front high vowel [ɪ] and the velar nasal is produced before a velar stop. Finally, the Icelandic phonetic inventory includes two kinds of velar fricatives, an unaspirated [ɣ] and a corresponding aspirated [x]. The aspirated velar fricative, [x], has an allophonic status since it only appears in environments where it can be assumed to have acquired aspiration from an adjacent segment, namely before /t^h/ and /s/, respectively. As we will discuss in detail later, phonological processes that appear to involve the regressive shifting or sharing of aspiration are common in Icelandic and, thus, there is no reason to posit a separate phoneme for the aspirated velar fricative.

While Table 2.3 indicates that [ɣ] is phonemic, its phonemic status is not altogether clear. Unaspirated fricatives, such as [ɣ], are in complementary distribution

with plain stops in Icelandic. [ɣ] appears in intervocalic position (excluding certain loanwords, see (5) below) and before [r] and [ð], respectively, while [k] appears word-initially, before [l] and [n], and in post-consonantal position.

(2) Distribution of velar fricatives and stops in both dialects of Icelandic

a.	<i>laga</i>	[laː.ɣa]	‘to fix’
b.	<i>sigra</i>	[siɣ.ra]	‘to win’
c.	<i>bragða</i>	[praɣ.ða]	‘to taste’
d.	<i>sigla</i>	[sik.la]	‘to sail’
e.	<i>helga</i>	[hɛl.ka]	‘to hallow’

The complementary distribution of [ɣ] and [k] is often observed within the same lexical item:

(3)	a.	<i>saga</i>	[saː.ɣa]	‘story’
	b.	<i>sagna</i>	[sak.na]	‘story, gen.pl.’

Based on these examples it seems straightforward to analyze [k] and [ɣ] as allophones of the same phoneme. However, there are other fricatives in Icelandic that exhibit similar alternations with corresponding stop consonants but are still considered independent phonemes. For instance, [v] has the same distribution word-internally as [ɣ], appearing intervocalically and before [r], while [p] appears before [l] and [n]. However, both [v] and [p] can appear freely in word-initial position and, thus, seem to belong to different phonemes.

(4) Word-initial labials in both dialects of Icelandic

- a. *vera* [vɛɪ.ra] ‘to be’
b. *bera* [pɛɪ.ra] ‘to carry’

Furthermore, if we are to analyze [ɣ] and [k] as belonging to the same phoneme, it begs the question of whether that phoneme is a stop or a fricative. Since the appearance of the fricative is more restricted, it seems sensible to posit the stop as the phoneme. However, there are a number of loanwords in Icelandic that do have an intervocalic plain stop (in both dialects), like the one shown in (5).

(5) *sígaretta* [siː.ka.rɛh.ta] ‘cigarette’

If these words have an underlying plain stop and there is a rule in Icelandic whereby plain stops are realized as fricatives in intervocalic position, then why does the rule not apply to loanwords? Alternatively, we could assume that the underlying sound is a fricative. But then it seems strange that plain stop consonants, which otherwise form a more uniform class of sounds in Icelandic than unaspirated fricatives do, would have a gap where one would expect there to be a velar stop. A third option is to assume that the complementary distribution of [ɣ] and [k] in Icelandic is an accidental consequence of various historical sound changes. More on this in Section 2.4.1.

2.3 Syllable Structure

Types of syllables that occur in Icelandic are (CCC)V(:) and (CCC)VC. Primary stress is always on the word-initial syllable.

(6) Syllable types in both dialects of Icelandic

a.	CV:	<i>bú</i>	[pu:]	‘farm’
b.	V:	<i>á</i>	[au:]	‘river’
c.	CVC	<i>borða</i>	[pɔr.ða]	‘eat’
d.	VC	<i>anda</i>	[an.ta]	‘breathe’

Vowel length is completely predictable and thus non-contrastive in Icelandic. Vowels are long in open stressed syllables and short in closed syllables. Stressed syllables either have a long vowel (7-a) or a coda consonant (7-b).

(7) Heavy stressed syllables in both dialects of Icelandic

a.	<i>fara</i>	/fara/	[fa:ra]	‘go’
b.	<i>taska</i>	/t ^h ask ^h a/	[t ^h as.ka]	‘bag’

The form in (7-a) suggests that onsets are preferred over codas and that stressed syllables must be heavy, i.e. contain two moras. As an implication, we can assume that the example in (7-b) has a moraic coda. The following constraints are needed to formalize the basic syllable structure of Icelandic in OT:

- (8)
- | | |
|-------------------------|---------------------------------------------------------------------------|
| ONSET | A syllable must have an onset. |
| STRESS-TO-WEIGHT | Stressed syllables must be heavy (bimoraic). |
| NO LONG VOWEL | Assign one violation mark for each instance of a long vowel in output. |
| NO CODA | Syllables are open. |
| *WORD FINAL MORA (*μ #) | The word-final segment should not be associated with a mora (Morén 2001). |

ONSET outranks STRESS-TO-WEIGHT because otherwise the intervocalic consonant would surface in coda position to satisfy the bimoraic requirement. STRESS-TO-WEIGHT outranks NO LONG VOWEL allowing the vowel to be lengthened in an open syllable. ONSET » STRESS-TO-WEIGHT » NO LONG VOWEL.

- (9) Intervocalic consonants surface in onset position.

Input: /ala/	ONS	STOW	NLV
a. a.la		*!	
b.  a:la			*
c. al.a	*!		

The data in (7-b) indicate a preference for coda consonants over complex onset clusters preceded by a long vowel. This outcome is achieved by ranking NO LONG VOWEL higher than a constraint against coda consonants. NO LONG VOWEL » NO CODA.

- (10) Codas are preferred over complex onsets.

Input: /pinta/	NLV	NoCODA
a.  pm.ta		*
b. pu.nta	*!	

Monosyllabic words of the type (C)VC have a long vowel which, given the facts discussed above, indicates that final consonants are “extrasyllabic” in Icelandic, i.e. that they don’t contribute to syllable weight.

- (11) *haf* /haf/ [haaf] ‘ocean’

This is achieved in OT by posing a constraint against assigning moras to word-final consonants, $*\mu] \#$. This constraint must outrank NOLONGVOWEL because it is better to lengthen a vowel than to allow a word-final consonant to be a moraic coda. $*\mu] \# \gg$ NOLONGVOWEL.

- (12) Final consonants do not contribute to syllable weight.

Input: /haf/	$*\mu] \#$	NLV
a. haf	*!	
b.  haa.f		*

While word-internal consonant clusters are typically heterosyllabic in Icelandic, as evidenced by the example in (7-b) above, there is an exception to this, namely that clusters of the type aspirated stop or /s/ + /j, v, r/ syllabify as complex onsets (13). The examples below are transcribed according to their pronunciation in the standard dialect, SD, i.e. with unaspirated stops. Note, however, that our discussion of the syllable structure of these examples applies equally to both dialects since they both follow the same principles of syllabification.

(13)	a.	<i>tepra</i>	/t ^h ɛp ^h ra/	[t ^h ɛɪ.pra]	‘prude’
	b.	<i>skrökva</i>	/sk ^h rœk ^h va/	[skrœɪ.kva]	‘lie’
	c.	<i>flysja</i>	/flɪsja/	[flɪɪ.sja]	‘peel’
	d.	<i>lepja</i>	/lɛp ^h ja/	[lɛɪ.pja]	‘drink’

Vennemann (1972) offers a straightforward way of explaining this syllabification in a language that otherwise prefers codas over complex onsets, namely by referring to sonority distance (he calls stops and [s] the ‘strongest’ consonants in the language and [j, v, r] the ‘weakest’ but the idea is essentially the same). By asserting that /j, v, r/ are the most sonorous consonants in Icelandic, it may be hypothesized that consonant clusters can only rise in sonority by a certain number of points across a syllable boundary. The sonority gap between /p, t, k, s/ and /j, v, r/, then, is too great for them to be heterosyllabic.

This idea is adopted in Gouskova (2004) where it is pointed out that different languages select different thresholds for an acceptable sonority slope between coda and a following onset. Gouskova proposes a theory for deriving hierarchies of relational constraints from prominence scales in the constraint set in OT. The idea is that some segments make better codas than others and some segments make

better onsets than others. The harmony of a sequence is proportional to the cumulative harmony of its members. This harmony is then encoded in a universally fixed hierarchy of markedness constraints, which militates against different kinds of sequences. Basically, if a coda-onset sequence that rises in sonority by a certain degree is acceptable in a language, then all other coda-onset sequences of equal or less sonority difference will be acceptable as well. Table 2.4 shows the sonority hierarchy we propose for Icelandic.

0						+1			+2		+3			+4	+5		
p ^h	t ^h	k ^h	p	t	k	s	f	θ	x	ɣ	ð	m	n	l	r	v	j

Table 2.4: Sonority hierarchy in Icelandic.

Ranking aspirated and plain stops together on the sonority scale is substantiated by the fact that while plain stops appear in heterosyllabic clusters before liquids and nasals (just like their aspirated counterparts) they do not appear at all before /r/, /v/ or /j/ (becoming spirantized instead). However, the main aspect of the hierarchy in Table 2.4 that stands out as unusual is that we have ranked /s/ with the plosives rather than the other aspirated fricatives. This is again due to the phonological patterns of the language, where /s/ groups with aspirated stops and not other fricatives. Specifically, we are referring to the resyllabification process before /j, v, r/ which not only affects a preceding aspirated stop but /s/ as well (14-a). Other fricatives do not syllabify as complex onsets with a following /j, v, r/. Instead, aspirated fricatives become voiced and remain in coda (14-b).

- (14) a. *Esja* /ɛsja/ [ɛ:sja] ‘proper name’
 b. *hefja* /hefja/ [hev.ja] ‘begin’

Of course, there is no agreement in the literature as to what exactly sonority is and whether or not it is based in any kind of a phonetic reality. As Blevins (1995) put it “[a] phonetic basis for sonority has been widely contested, though measurements based on acoustic intensity are often taken as a starting point for estimating the perceptual saliency or loudness of a particular sound (Blevins 1995:211)”. Other approaches include the one of Price (1980) who identified three factors that he believed contributed to the sonority of a sound: degree of vocal tract opening, source of the speech signal, and the degree of transience, i.e. duration of a segment. Lindblom (1983) defined sonority in terms of jaw position, which correlates with a consonant’s ability to coarticulate, and Keating (1988) concluded that sonority needs to be defined over more than one domain.

Others have rejected that sonority is anything but a phonological construct. Vennemann (1972) didn’t even entertain the notion that sonority could have a phonetic basis: “I base my strength hierarchies on synchronic phonological rules, including syllabification rules (Vennemann 1972:7)”. Hankamer and Aissen (1974) discussed a possible definition of a sonority-correlated feature in acoustic or articulatory terms but failing to do so concluded that “the facts force us to recognize the sonority hierarchy as a phonological reality (Hankamer and Aissen 1974:137)”. Hooper (1976) came to a similar conclusion while still assuming that sonority, while mostly a theoretic construct, is not entirely divorced from physical reality. Still others have rejected the notion of sonority altogether, or in Ohala’s (1992) words: ““Sonority” and its causing “strength” do not exist and should be abandoned for the sake of explaining universal sequential constraints (Ohala 1992:334)”.

Our approach to sonority is mostly of a phonological nature, although we recognize that the particular phonological process we are interested in, i.e. syllabification

of certain clusters as complex onsets, might provide support for ideas of the type suggested by Lindblom (1983), i.e. that sonority is determined by the ability of a sound to coarticulate with another sound. In gestural terms, since Articulatory Phonology assumes that gestural selection processes differ between complex onsets and other types of consonant clusters, it could very well be the case that the transition between a stop or sibilant and a highly “sonorous” consonant is a particularly smooth one and that over time a tighter coordination has resulted in these particular clusters becoming tautosyllabic. These are simply speculations though. What we do assume is that the ranking of segments in terms of sonority is somewhat language-specific, if only for the fact that the articulation of phonologically identical speech sounds can differ between languages, as pointed out by e.g. Hankamer and Aissen (1974). For those who might not subscribe to the idea that sonority is simply a useful concept to describe phonological processes, one could point to evidence such as those presented by Jany et al. (2007) who took intensity measures in four different languages and found that (assuming intensity is a proxy for sonority) undisputed contrasts, such as sonorants being more sonorous than obstruents, were cross-linguistically consistent in their acoustic patterns while more disputed sonority contrasts, such as the one of sibilants vs. other fricatives, followed language-specific patterns. More relevant to Icelandic is an argument put forth in Hooper (1976). She points to the fact that /s/ is the only fricative that remains voiceless in voiced environments in Icelandic:

- | | | | | | |
|------|----|-------------|--------|---------|--------|
| (15) | a. | <i>lifa</i> | /lifa/ | [li.va] | ‘live’ |
| | b. | <i>lesa</i> | /lesa/ | [lɛ.sa] | ‘read’ |

In Hooper's view voicing as well as assimilation is essentially loss of consonantal strength. She interprets the data in (15) as evidence that /s/ is stronger (i.e. less sonorous) than other spirants in Icelandic. Whether or not Hooper's characterization of the intervocalic voicing process is accurate, the fact remains that in this respect /s/ again behaves more like a plosive than a fricative, which in our view justifies ranking it alongside the plosives on the sonority scale for Icelandic.

2.4 Dialectal Differences

In terms of phonology, the two dialectal variants of Icelandic discussed here, ND and SD, mainly differ with respect to treatment of aspirated segments. In Chapter 3 we will report the results of our phonetic study that investigated those differences. One of the goals of Chapter 5, where we propose a phonological analysis of aspiration in Icelandic, is to model each of the dialects in a phonological framework. Crucially, we assume that both dialects have the same underlying representation of aspirated segments. Any surface variation found between SD and ND is the result of differently ranked phonological constraints on the gestural phasing of glottal and oral speech gestures. The main differences between the two dialects, SD and ND, were discussed briefly in Chapter 1 but will be laid out in more detail here.

2.4.1 Native phonology

Aspirated stops

As we will report in Chapter 3, the Northern dialect is subject to quite a bit of inter- and intra speaker variation in the production of aspirated stops. This great amount of variation might indicate that certain aspects of ND are disappearing due to the influence of the standard dialect, SD. However, one feature of ND that remains strong is the postaspiration of intervocalic stop consonants. Loanwords aside, only fortis stops are found in intervocalic position in Icelandic. In SD, these stops surface without any acoustic aspiration (16) whereas they are postaspirated in ND (17).

(16) Intervocalic stops in SD.

a.	<i>súpa</i>	/sup ^h a/	[su:.pa]	‘soup’
b.	<i>fata</i>	/fat ^h a/	[fa:.ta]	‘bucket’
c.	<i>baka</i>	/pak ^h a/	[pa:.ka]	‘to bake’

(17) Intervocalic stops in ND.

a.	<i>súpa</i>	/sup ^h a/	[su:.p ^h a]	‘soup’
b.	<i>fata</i>	/fat ^h a/	[fa:.t ^h a]	‘bucket’
c.	<i>baka</i>	/pak ^h a/	[pa:.k ^h a]	‘to bake’

Positing an aspirated stop in the underlying structure of the above forms is mainly motivated by diachronic data. It is widely accepted that Old Norse, the medieval

language Icelandic evolved from, had a distinction between fortis and lenis stops (see e.g. Haugen 1982, Benediktsson 1972). Although it is possible that, at some point, the fortis/lenis distinction in the parent language was primarily one of voicing, the fact that most, if not all, of the modern Nordic languages exhibit a [spread glottis] distinction in their stop consonants suggests that aspiration was at least a secondary feature of Old Norse fortis stops. In Modern Icelandic, intervocalic lenis stops have evolved into fricatives but a fortis/lenis contrast is still found in word-initial position (18). The fact that aspiration is the only attribute distinguishing fortis stop consonants from lenis ones in word-initial position is a strong indicator that intervocalic stops are specified for aspiration as well.

(18) Word-initial stops contrast for aspiration in both dialects

a.	<i>týna</i>	/t ^h ina/	[t ^h iː.na]	‘to lose’
b.	<i>dýna</i>	/tina/	[tiː.na]	‘mattress’

A second feature distinguishing SD from some forms of ND is the production of post-consonantal stops, more specifically fortis stops following sonorants (excluding /r/) or /ð/. In SD speech, these clusters are pronounced with an aspirated sonorant/fricative followed by a plain stop (19). In ND speech, the sonorant/fricative remains voiced and the following stop is postaspirated (20). There is generally a trade-off relationship between aspirated and unaspirated segments in these clusters; either the sonorant/fricative is aspirated or the stop is aspirated, never both. The two dialects follow different paths. As we will report in Chapter 3, only a subset of ND speakers aspirate post-consonantal stops and the rate of postaspiration seems to depend on various factors, such as speech rate and the nature of the consonants forming the cluster.

(19) Clusters of sonorant/fricative + aspirated stop in SD.

a.	<i>maðka</i>	/maðk ^h a/	[maθ.ka]	‘maggot, GEN.PL.’
b.	<i>vanta</i>	/vant ^h a/	[vaŋ.ta]	‘to lack’
c.	<i>úlpa</i>	/ulp ^h a/	[ul.pa]	‘parka’

(20) Clusters of sonorant/fricative + aspirated stop in a subset of ND.

a.	<i>maðka</i>	/maðk ^h a/	[mað.k ^h a]	‘maggot, GEN.PL.’
b.	<i>vanta</i>	/vant ^h a/	[van.t ^h a]	‘to lack’
c.	<i>úlpa</i>	/ulp ^h a/	[ul.p ^h a]	‘parka’

The production of these clusters as an aspirated sonorant followed by a plain stop in SD is further evidence that, despite never being produced with postaspiration, SD word-internal stops do in fact have a [spread glottis] specification in underlying structure. Thráinsson (1978) proposed that these clusters arise when the glottal gesture shifts from the stop to the previous consonant. An alternative analysis would be to posit aspirated sonorants in the underlying structure of these clusters in SD. However, the appearance of word-internal aspirated sonorants is limited to this exact position¹ and there is, therefore, no evidence to support the notion that they are contrastive segments in that position. Furthermore, given the high rate of intra-speaker variation in the production of these clusters in ND speech, it is not feasible to posit different underlying structures for ND and SD, respectively.

The implication of such an analysis would be that ND speakers would have to

¹Sonorants contrast for aspiration in word-initial position. As noted earlier, these word-initial aspirated sonorants might be better analyzed as the surface result of underlying /h/ + sonorant clusters, although we will refute that type of analysis in Chapter 4. Alternatively, it is quite possible that, while aspirated sonorants exist as phonemes in word-initial position, their appearance word-internally is allophonic.

be drawing from different underlying forms in their varying production of these clusters, i.e. alternating between forms with aspirated and unaspirated sonorants. That seems unlikely.

Plain stops

Next, let us shift our attention to native lenis stops in Icelandic. As example (18) showed, stop consonants contrast for aspiration in word-initial position in both dialects of Icelandic. Plain stops show up as the second members of certain consonant clusters word-internally (21-a) but in those cases they are only contrastive with their aspirated counterparts in the subset of ND which exhibits sonorant voicing (21-b). In SD as well as some versions of ND, the contrast falls on the preceding sonorant/fricative and the stop consonant itself is neutralized to a plain stop (21-c).

(21)	a.	<i>lambda</i>	/lampa/	[lam.pa]	‘ <i>lamb</i> , GEN.PL.’
	b.	<i>lampá</i>	/lamp ^h a/	[lam.p ^h a]	‘ <i>lamp</i> , GEN.PL.’
	c.	<i>lampá</i>	/lamp ^h a/	[lam̥.pa]	‘ <i>lamp</i> , GEN.PL.’

Plain stops are also found pre-consonantly in Icelandic, i.e. before [l], [n], and [s], respectively. Aspirated stops in those same environments either become preaspirated, i.e. before [l] or [n], or spirantize or neutralize to plain stops before [s]. The following examples show word pairs with plain and aspirated stops, respectively.

(22)	a.	<i>Egla</i>	[ɛkla]	‘name of a saga’
	b.	<i>ekla</i>	[ɛ ^h kla]	‘shortage’

- (23) a. *sagna* [sakna] ‘story, GEN.PL’
 b. *sakna* [sa^hkna] ‘to miss’
- (24) a. *hugsa* [hyksa] ‘to think’
 b. *stráksi* [strauxsɪ]/ ‘boy’
 [strauksɪ]

Lenis stops are not found in other environments in Icelandic. Where orthography indicates we might expect to find them, we get fricatives instead. This includes intervocalic position and consonant clusters other than those mentioned in the above examples. Now compare the examples in (22), (23) and (24) above to the ones in (25) and (26) below:

- (25) a. *saga* [sa:ɣa] ‘story’
 b. *saka* [sa:ka] ‘to accuse’
- (26) a. *sigra* [sɪɣra] ‘to conquer’
 b. *sykra* [sɪkɾa] ‘saccharide’

This comparison reveals an interesting pattern. Where aspirated stops contrast with lenis stops in Icelandic, the aspiration is realized in the output (as preaspiration). In environments where fricatives, not stops, are found in the surface structure, no acoustic aspiration is produced in the corresponding aspirated form (in SD, that is; ND has postaspiration in these environments). This suggests that, to some extent at least, the distribution of aspiration is determined by systemic pressure. Or it might be the other way round, i.e. that the distribution of lenis

stops and fricatives has evolved the way it has due to the way aspiration is realized in Icelandic. By stating this we are not suggesting that resistance to confusability is somehow encoded into the phonology of Icelandic. What we are pointing to is a reasonable explanation for how aspiration contrasts have evolved in the language. We will argue in Chapter 5 that glottal gestures move around more freely than oral gestures. Furthermore, there is nothing in the underlying structure of aspirated stops that prevents the glottal gesture from attaching to the stop in any number of ways and ultimately the phasing relationship between these two gestures is determined by factors that include perceptual recoverability. In other words, we find it likely that in the examples given above the production of aspirated stops has adapted to the distributional pattern of lenis stops and fricatives, not the other way round.

2.4.2 Loanwords

The production of loanwords containing word-internal stop consonants should be mentioned here even though no difference is found between the two dialects. Intervocalic stops in borrowed forms are produced without postaspiration in both SD and ND. As a result, these stops are indistinguishable from native aspirated stops in SD. But in ND a two-way contrast arises between plain and postaspirated stops in medial position.

(27) Non-native stops arise without postaspiration in both dialects, ND and SD.

a. *túba* [t^hu:.pa] ‘tuba’

- | | | | |
|----|--------------|----------|-------------|
| b. | <i>radar</i> | [ra:tar] | ‘radar’ |
| c. | <i>sígó</i> | [si:kou] | ‘cigarette’ |

The main question raised by the presence of these stops in the language pertains to their underlying representation. One option to consider is that their structure differs between the two dialects. Since their production is similar to the production of native stops in SD, perhaps they have the same underlying structure? This is not possible in ND, however, since ND native stops surface with postaspiration whereas borrowed stops do not.

An argument against this view (aside from the fact that we would preferably like to argue for identical inputs for both dialects) is that our phonetic study, reported in Chapter 3, revealed a difference between forms with native and non-native stops in SD, i.e. a significantly longer vowel before non-native stops. This kind of a difference in vowel duration could be indicative of the following stops differing with respect to presence or absence of a glottal gesture. More specifically, stops that are not specified for [spread glottis] have been reported to be preceded by longer vowels than [spread glottis] stops (Goldstein and Browman 1986). Of course, this would imply that native stops are produced with a glottal opening gesture in SD despite the fact that this glottal gesture does not result in audible postaspiration. This is precisely what we will argue in Chapter 5.

Returning to the issue of the phonological nature of lenis (native) stops and fricatives in Icelandic, there is very little evidence to suggest that intervocalic fricatives (25-a) are anything other than fricatives in underlying structure. The fact that intervocalic stop consonants in loanwords do not surface as fricatives suggests that there is no synchronic process of intervocalic spirantization in the language.

Therefore, we find it likely that the arrival of these loanwords has introduced a new class of stops that are not specified for [spread glottis] where none existed before. The phonological status of stops and fricatives in other word-internal positions is not as clear and we will not take a stance on that issue since it does not have bearing on the topic of this dissertation. What crucially matters for our argument is that the distribution of these consonants has provided an environment where aspiration has evolved in different ways to preserve contrast.

2.5 Foot Structure

In this section we take a closer look at Icelandic stress patterns by examining the foot structure of the language. The reason why this is of interest to us is that there are certain aspects of how aspirated segments are distributed in Icelandic that suggest that aspiration might be attracted to stress/heavy syllables (or at least not required to surface outside of a stressed syllable). This has been observed by previous scholars; for instance, the OT constraint MAXASP σ plays a large role in Morén's (2001) analysis of Icelandic syllable weight and aspiration patterns. Despite previous claims to the contrary, our goal in this section is to show that stress is in fact not a factor in determining how aspirated segments surface in Icelandic, and will therefore not be taken into consideration in our formal analysis in Chapter 5.

Based on the metrical theory argued for in e.g. Hayes (1995), Icelandic falls into the category of a left-to-right syllable trochee language, meaning that stress applies from left to right (falling, in the case of Icelandic, on every other syllable, starting with the word-initial syllable), and that the head of a metrical foot is

at its left edge. Furthermore, the Icelandic metrical foot is a quantity-insensitive syllable trochee, i.e. formed from two syllables of indiscriminate weight.

There are some problems with this analysis. First of all, the Iambic/Trochaic Law, as presented in Hayes (1995), states that elements contrasting in intensity naturally form groupings with initial prominence while elements that contrast in duration naturally form groupings with final prominence. This is based on results of experiments on rhythmic perception. The implication of this law is that prominence in syllabic trochees is not expected to be marked by increased duration because mora count doesn't matter. Icelandic, however, requires primary stressed syllables to have two moras, either by way of a long vowel or a moraic coda, as shown in (7) above, which goes against the principle. To account for this process, which takes place in a number of syllable trochee languages, Hayes argues that this kind of stressed syllable lengthening is typically phonetic in nature, merely a side product of stress placement. To support his claim he cites evidence from Swedish that shows that stressed syllables are only moderately longer than unstressed ones, not reaching the 1.5-2.0 duration ratio needed to mark a true durational contrast. This is not the case with Icelandic, though. As we will show in Chapter 3, long vowels are approximately double the length of short vowels in Icelandic, a durational difference that is clearly audible. Furthermore, while a lot of syllabic trochee languages have a minimal word requirement of two syllables (on content words), Icelandic allows bimoraic monosyllabic words (see example (6-b) above). Hayes claims that syllabic trochee languages that allow monosyllabic words always impose a two-mora requirement on these words. This claim seems to contradict his claim about open syllable lengthening being of pure phonetic nature because if we are to assume that monosyllabic words have a long vowel that constitutes two moras, should we not assume that an equally long vowel in polysyllabic words is

bimoraic as well?

Mellander (2003) has a different take on this problem. He attributes stressed syllable lengthening in syllabic trochee languages to a requirement that the head of a foot, i.e. the stressed syllable, be more prominent than the unstressed syllable. This happens, in OT terms, when the constraint HD-PROM, which requires head prominence, outranks WT-IDENT-IO, which ensures that the weight of a syllable stays constant between input and output. Note that this process of giving prominence to heads of metrical feet is unrelated to general STRESS-TO-WEIGHT principles that don't reference foot structure.

Again, the problem with this account of disproportional weight distribution within metrical feet in Icelandic has to do with monosyllabic words. If the added weight given to stressed syllables is due to a requirement that they be more prominent than the syllable they form a foot with, then such a process would not be needed in monosyllabic words where the stressed syllable is the *only* syllable. One way to get around this problem would be to pose a separate requirement that all words be at least bimoraic, regardless of their foot structure. In that case, vowel lengthening in monosyllabic words would be attributed to a minimal word requirement rather than a stressed syllable prominence principle. The same fix can, of course, be applied to Hayes's (1995) theory of metrical structure, i.e. one could say that vowel lengthening in monosyllables is somehow of different nature than vowel lengthening that occurs in stressed syllables of polysyllabic words in Icelandic. It doesn't seem ideal, though, to attribute seemingly identical processes to two, entirely different phonological principles.

The observed minimality requirements on the moraic count of initial syllables in Icelandic beg the question of how syllables with secondary stress are treated in

the language. Both Hayes (1995) and Árnason (1980) claim that, unlike syllables with primary stress, secondary stressed syllables are light in Icelandic. Hayes takes this to support his claim that the process whereby stressed syllables become heavy in the language is not of phonological nature. If it were, he claims, it would extend to all stressed syllables.

Determining the weight of syllables with secondary stress in Icelandic is tricky due to the lack of polysyllabic word roots in the language; few, if any, Icelandic morphemes contain more than two syllables. Aside from loanwords, polysyllabic words are limited to compounds, words with inflectional suffixes, and words with derivational affixes. Therefore, one necessarily has to take into account the influence of compounding and the attachment of derivational affixes on the stress patterns of the language. Árnason (1980) points out that not all affixes are created equal when it comes to stress assignment in Icelandic. First, consider the following examples containing the word *drottning* ‘queen’ which is formed by attaching the derivational suffix *-(n)ing* to the root *drott-*:

- | | | | |
|------|----|---------------------------|-------------------|
| (28) | a. | <i>'drottning,ar</i> | ‘queen, GEN.SG.’ |
| | b. | <i>'drottningar,maður</i> | ‘queen’s husband’ |
| | c. | <i>'sunddrott,ning</i> | ‘swim queen’ |
| | d. | <i>*'drottningar,sund</i> | ‘queen’s swim’ |

In (28-a), the genitive singular suffix *-ar*, which has been attached to the stem of the word, receives secondary stress. This is therefore an example of the predominant stress pattern in Icelandic, where stress falls on odd numbered syllables. Example (28-b) shows a compound formed with the nouns *drottning* (in the genitive case to indicate possession) and *maður* ‘man, husband’. Here the secondary stress fails

to land on the genitival suffix and falls instead on the first syllable of the second word of the compound, indicating that compounds are exempt from the general stress rules of the language and prefer to have each of their members carry initial stress. This pattern, however, is not repeated in the compound in (28-c), which consists of the words *sund* ‘swim’ and *drottning*. Given (28-b), we might expect the secondary stress to fall on the root of the second word *drottning*, but instead it falls on the derivational suffix *-ning*. This is likely due to a resistance of stress falling on two adjacent syllables (*CLASH). Note that if we were to reverse this compound, creating the non-existent word *drottningarsund* in (28-d), stress would again fall on each of the two components of the compound.

Disruptions to the traditional stress pattern of Icelandic are not limited to compounds. Certain suffixes seem to attract stress, regardless of the number of syllables preceding them.

- (29) a. *'Akur,eyring,ur* ‘a person from Akureyri’
 b. *'höfðingja,legur* ‘chieftain like’
 c. *'höfðingj,anna* ‘the chieftain, GEN.PL’

Compare the word in (29-a), where the suffix *-ing-* followed by the inflectional ending *-ur* is attached to the place name *Akureyri*, to the word in (29-b), where the suffix *-leg-* followed by the inflectional ending *-ur* is attached to the genitival form *höfðingja* ‘chieftain’. In both examples there are three syllables preceding the suffix, yet the suffix *-leg-* receives secondary stress while *-ing-* does not. The example in (29-c), which is the genitive plural of the definite form of the word *höfðingi*, shows that the stress pattern in (29-b) is not due to the inability of the genitival ending to receive stress. Instead it seems that certain suffixes in Icelandic

behave like elements of compounds with respect to stress assignment. Árnason (2005) refers to suffixes of the *-ing-* type as Suffixes I and suffixes of the *-leg-* type as Suffixes II, noting that suffixes of the second category have a looser connection to the root they attach to (creating an environment similar to that of compounds).

The reason why Icelandic stress patterns are of interest to us is that they correlate in many ways to the distribution of aspiration. In other words, there are certain aspects of how aspirated segments are distributed in Icelandic that suggest that aspiration might be attracted to stress/heavy syllables (or at least not required to surface outside of a stressed syllable). As an example of possibly stress-related aspiration, consider the following examples from SD where the consonant cluster /p^hr/ appears in a stressed and an unstressed syllable onset, respectively:

- | | | | | | |
|------|----|--------------|-------------------------------------|-------------------------|------------|
| (30) | a. | <i>príla</i> | /p ^h rila/ | [p ^h ri:l.a] | ‘to climb’ |
| | b. | <i>tepra</i> | /t ^h εp ^h ra/ | [t ^h ε:pra] | ‘prude’ |

In (30-a) the stop surfaces as postaspirated in a stressed syllable whereas it appears to be unaspirated in the unstressed syllable in (30-b).

However, there are certain Icelandic suffixes containing a preaspirated stop that sometimes surface in unstressed syllables (31-a), (31-b). The same can happen in compounds (31-c).

- | | | | | |
|------|----|---------------------|----------------------------|---------------------------------|
| (31) | a. | <i>'göt-óttur</i> | [kœ:tou ^h tyr] | ‘full of holes’ |
| | b. | <i>'hug-rekki</i> | [hyrɛ ^h ci] | ‘courage’ |
| | c. | <i>'svart-nætti</i> | [svartnai ^h tɪ] | ‘darkness’ (lit. ‘black night’) |

Compounds, like the one in (31-c), can be worked around by assuming that the components are stored separately in the lexicon and undergo phonological processes independently (causing the unstressed syllable to retain its aspiration). Suffixes like *-ótt-* in (31-a) and *-rekk-* in (31-b) are trickier unless we can find evidence that they fall into the category of type II suffixes in Icelandic, i.e. suffixes that behave like independent words and follow the same stress patterns as compounds (in other words, we'd like to know if these particular suffixes are attracted to the stress position of metrical feet). Such evidence would be in the form of a concatenated word, where the suffix in question was preceded by three syllables (to avoid stress being shifted due to a clash). If the suffix is a normal suffix of type I, stress would fall on the third syllable of the word. If the suffix is of type II it should attract stress, resulting in an atypical stress pattern. The problem is that, to the best of our knowledge, such a word does not exist in Icelandic. Other evidence that we might want to consider² is *umlaut*, i.e. a sound change whereby the quality of a root vowel changes due to the influence of a vowel in a following syllable. According to Indriðason (1994) *u*-umlaut, which is otherwise a fairly robust sound change in Icelandic, does not apply across morpheme boundaries in compounds so we expect the same to be true of type II suffixes. However, *u*-umlaut ([a] > [œ]) is frequently observed before the suffix *-ótt* (the vowel was **u* at an earlier stage of the language) as shown in (32).

- (32) *fjall* 'mountain' ~ *fjöllóttur* 'mountainous'
bragð 'trick' ~ *brögðóttur* 'cunning'
skalli 'baldness' ~ *sköllóttur* 'bald'

²Note that, as we mentioned in Section 2.1, all vowels appear freely inside and outside of stressed syllables in Icelandic, Vowel quality can, therefore, not be used as a diagnostic tool for determining foot structure in the language

Given these evidence it seems likely that *-ótt* is just a normal type I suffix in Icelandic. To add to this, we also find preaspirated stops in unstressed syllables in loanwords such as *'múlatt,i* ‘mulatto’ and *'rakkett,a* ‘fire work’. These examples pose a problem for theories that assume that aspiration is something that only surfaces in stressed syllables in Icelandic. We must therefore consider an alternate explanation for why clusters like /p^hr/ surface without postaspiration in unstressed syllables, as shown in (30-b) above. We will return to this discussion in Chapter 5.

A question that still remains to be answered is why there is a minimal weight requirement on stressed syllables in Icelandic and whether secondary stressed syllables are heavy or light. As we discussed above, it is unusual for syllabic trochee languages to require syllables within a foot to be uneven in terms of weight and this constraint is therefore unlikely to be attributable to the foot structure of the language. We set out to explore this issue with the idea in mind that the distribution of aspiration in Icelandic might be dependent on stress or syllable weight. However, having determined that this is unlikely to be the case, we will leave the question of syllable weight in Icelandic unanswered and explore a different analysis in Chapter 5.

2.6 Final Remarks

In this chapter we have given an overview of the aspects of Icelandic phonology that have a bearing on the goal of this dissertation, i.e. determining the phonological distribution of aspiration in the language and the principles that govern its interaction with supraglottally articulated segments. We have shown that this dis-

tribution is unlikely to be caused by stress patterns in the language, and we have furthermore given plausible evidence for viewing stop consonants in non-native vocabulary as a distinct class of segments with a phonological structure different from that of stops in native words in both dialects of Icelandic. We will return to our discussion of Icelandic phonology in Chapter 5 where we will discuss aspiration in detail and present a formal analysis of its distribution in Icelandic.

CHAPTER 3
PHONETIC STUDY

3.1 Introduction

This chapter discusses a phonetic study that was conducted in Iceland in the summer of 2014. The purpose of the study was to obtain an accurate description of the phonetic correlates of various aspirated segments in Icelandic, as well as to examine dialectal differences in the production of these segments. Two dialects were examined, the Southern Dialect (henceforth referred to as SD), which is spoken by a vast majority of Icelanders, and the Northern Dialect (ND), which is an umbrella term for dialects spoken in the Northern part of Iceland that differ from SD mainly in terms of the aspiration of stop consonants. The specific differences between the two dialects were described in Section 2.4 above.

The chapter will proceed as follows: Section 3.2 gives an overview of previous work on the phonetics of Icelandic consonants, both acoustic and articulatory studies. Section 3.3 contains the results of the present study; the research design, methodology, and hypotheses are described in Section 3.3.1, results for word initial stops are found in Section 3.3.2, results for intervocalic singleton and geminate stops are given in Section 3.3.3, Section 3.3.4 describes results for preaspirated stops, and Sections 3.3.6 and 3.3.7 contain results for clusters of sonorant + stop, and clusters of [s] followed by a stop, respectively. A comparison of the present study's results to previous studies is found in Section 3.4, and Section 3.5 contains a discussion of our results and final remarks.

3.2 Previous Studies

This section gives an overview of phonetic studies that have looked at aspirated stops in Icelandic. While several studies have looked at the speech of both SD and ND speakers, reports on VOT are scant and word-initial stop consonants seem to have been mostly overlooked along with stop consonants in non-native vocabulary. The main concern of the present study is to describe how aspiration is distributed in Icelandic and how its presence or absence affects other segments. Previous studies have mainly reported on things like stop closure durations in different kinds of intervocalic stops. Furthermore, data on consonant clusters in Icelandic has been limited to the scope of electroglottographic studies focusing on the distribution of glottal opening and closing gestures. Despite these differences in research interests, we will describe these previous studies on Icelandic phonetics in some detail in the following sections to provide the reader with a comprehensive account of the phonetic information that exists regarding the language.

3.2.1 Acoustic studies

The first acoustic study on Icelandic, that we have records of, was carried out by Stefán Einarsson in 1927. Einarsson, who was a speaker of ND, measured the duration of intervocalic stop consonants in his own speech using a kymograph, a device that produces a graphical representation of changes in phenomena such as motion or pressure. Words were spoken in isolation and Einarsson reports that he often spoke clearer than he would have under normal circumstances. Einarsson looked at singletons, geminates and preaspirated stops. He found geminates to be approximately double the length of singletons, except for labial stops where the

ratio was closer to 5:3, and preaspirated stops to be slightly longer in duration than singleton stops (an average of 18 ms difference). VOT for the intervocalic singletons was on average 40% of the duration of the preceding stop closure whereas the duration of preaspiration averaged to 66% of the duration for the following stop closure (Einarsson 1927). Einarsson’s results are shown in Table 3.1.

	Singleton		Preaspirated		Geminate
	Closure	VOT	Preaspiration	Closure	Closure
p	153	69	110	180	249
t	149	70	94	181	294
k	147	50	n/a	n/a	285
c	157	59	136	150	291
Average	152	62	113	170	280

Table 3.1: Results from Einarsson’s (1927) acoustic study (numbers represent durations in ms.)

A couple of acoustic studies on Icelandic were carried out in the 1970s. Garnes (1976) looked at consonant duration in the speech of 6 speakers of SD. Garnes had her participants produce words both in isolation and in a frame sentence. She had this to say about where she drew the line between vowels and consonants:

Medial and final plosives were segmented at the beginning and end of a zero line which represents the lack of energy during voiceless plosives. [...] The final portion of a vowel is also occasionally accompanied by less regular oscillations. Before plosives and fricatives this less regular portion was included in the vowel duration (Garnes 1976).

Garnes’s results for the duration of different stop closures in intervocalic position were comparable to those of Einarsson (1927). However, she found the aspiration period in preaspirated stops to be much closer in duration to the following stop than Einarsson did, approximately 86% of the stop closure duration

to be precise. Garnes also studied vowel duration in Icelandic and found the duration of long vowels (before singletons) to be more than twice the duration of short vowels (before preaspirated stops or geminates). In addition, her results indicated that vowels are on average 12 ms. longer before a preaspirated stop than before a geminate stop. The total duration of V+C was longest in preaspirated stops (324 ms.) and shortest in geminate stops (295 ms.). A summary of results is shown in Table 3.2.

	Vowel	Preaspiration	Closure	VOT	Total
Singleton	192		94	20	306
Preaspirated	99	95	110	20	324
Geminate	87		185	23	295

Table 3.2: Average durations for Icelandic stop consonants according to Garnes's (1976) acoustic study (numbers represent durations in ms.)

Magnús Pétursson was, to the best of our knowledge, the first linguist to look at the acoustic differences between SD and ND speech in a systematic way. He studied intervocalic stop consonants in the speech of 7 Icelanders, 2 speakers of ND and 5 speakers of SD, and published his results in a series of works (see Pétursson 1974a,b, 1976). His results regarding consonant durations in SD were surprising and have not been replicated since.¹ Pétursson found that the durational difference between singletons and geminates in SD (33 ms. on average) was insignificant compared to ND (singletons have similar durations in both dialects but geminates are considerably longer in ND than SD according to his results). He therefore concluded that consonant duration is contrastive in ND while durational contrast are solely based on vowel length in SD, a claim that had not previously been made in the literature on Icelandic. Furthermore, he found preaspirated stops to

¹Pétursson himself attempted to replicate the results in a later study, using different participants, but failed to do so. Instead he found SD geminate stops to be comparable in duration to the ND ones in his previous study (see Pétursson 1978).

be quite a lot shorter in duration than singletons in SD while the opposite held true for ND.² Finally, regarding the duration of vowels before stop consonants, Pétursson reported that long vowels were longer and short vowels shorter in ND than in SD. In fact, he found no significant difference at all between long and short vowels in SD, despite claiming that vowels are the only segments contrasting for length in the dialect. Results from Pétursson (1974b) are summarized in Tables 3.3³, 3.4 and 3.5.

	Singleton		Preaspirated		Geminate
	Closure	VOT	Preaspiration	Closure	Closure
p	141	18	102	103	171
t	125	21	110	97	180
k	119	33	110	93	161
c	149	28	105	97	155
Average	134	25	107	98	167

Table 3.3: Results from Pétursson’s (1974b) acoustic study on SD speakers (numbers represent durations in ms.)

	Singleton		Preaspirated		Geminate
	Closure	VOT	Preaspiration	Closure	Closure
p	162	48	138	153	227
t	139	46	142	150	224
k	118	62	139	131	211
c	141	54	137	140	227
Average	140	53	139	144	222

Table 3.4: Results from Pétursson’s (1974b) acoustic study on ND speakers (numbers represent durations in ms.)

²Despite being derived from the same dataset, Pétursson’s results vary somewhat between publications. This is because he used different parts of his data for each paper. The results discussed here hold for most of his data but note that Pétursson (1974b) reported the same duration for singleton and preaspirated stops in ND while his other papers show preaspirated stops to be significantly longer than singletons.

³Durations given for [p] and [pp] follow Indriðason et al. (1991) who note that there is a calculation mistake in Pétursson (1974b), where lower averages are reported.

	Singleton		Preaspirated		Geminate
	Closure	VOT	Preaspiration	Closure	Closure
SD	134	25	107	98	167
ND	140	53	139	144	222

Table 3.5: Comparison of averages for SD and ND speakers from Pétursson’s (1974b) study (numbers represent durations in ms.)

Rögnavaldsson (1980) reports the results of another acoustic study focusing on dialectal contrast in Icelandic. The focus of his study was the production of intervocalic stops in the speech of 11 Icelanders, 4 speakers of SD and 7 speakers of ND.⁴ Words were spoken in a frame sentence. Rögnavaldsson reports that he drew a boundary between a vowel and a following consonant where the vowel formants start to become aperiodic (unlike Garnes (1976) who included the aperiodic signal in the vowel portion). He defines the end of a stop closure as the point where noise is detected in the spectrogram, and VOT ends where the formants of a following vowel have become periodic.

Rögnavaldsson’s results showed that singleton stops are on average 14 ms. shorter in ND than SD. Duration of preaspirated stops in ND, according to Rögnavaldsson’s results, is nearly the same as that of singleton stops whereas these stops are considerably shorter than singletons in SD (a difference of 19 ms. on average). This is contrary to the results reported in Pétursson (1974b), where preaspirated stops were found to be considerably *longer* than singleton stops in SD. Both studies looked at words that were spoken in frame sentences so it is not clear why the results are so different. It is possible that Rögnavaldsson’s data were not conducive to accurate comparisons since they were collected for a different study. It is equally

⁴Note that the data used in Rögnavaldsson (1980) were limited by the fact that they had originally been collected for a different study that did not involve comparison of stop durations. The reason for this was that, at the time, the technology to produce spectrograms was not available in Iceland. Rögnavaldsson was, thus, not able to collect and analyze his own data.

possible that Pétursson’s data are dubious since other parts of his study produced results that do not conform to any other data collected on Icelandic since.

Finally, the results reported in Rögnvaldsson (1980) show geminates to be comparable in duration in both dialects. Again, this is contrary to the results of Pétursson (1974b), where geminates in SD were reported to be almost equal in duration to singletons and thereby considerably shorter than ND geminates.

Rögnvaldsson does not give any results for VOT in the two dialects. His results are summarized in Tables 3.6, 3.7 and 3.8.

	Singleton	Preaspirated		Geminate
	Closure	Preaspiration	Closure	Closure
p	n/a	85	120	n/a
t	170	95	120	250
k	120	95	118	195
c	120	123	113	n/a
Average	137	100	118	223

Table 3.6: Results from Rögnvaldsson’s (1980) acoustic study on SD speakers (numbers represent durations in ms.)

	Singleton	Preaspirated		Geminate
	Closure	Preaspiration	Closure	Closure
p	110	73	141	210
t	130	108	118	250
k	123	107	117	200
c	130	87	107	n/a
Average	123	94	121	220

Table 3.7: Results from Rögnvaldsson’s (1980) acoustic study on ND speakers (numbers represent durations in ms.)

Indriðason et al. (1991) describe a comparative phonetic study of intervocalic stop consonants in ND and SD. The segments researched were singletons, gemi-

	Singleton	Preaspirated		Geminate
	Closure	Preaspiration	Closure	Closure
SD	137	100	118	223
ND	123	94	121	220

Table 3.8: Comparison of averages for SD and ND speakers from Rögnvaldsson's (1980) study (numbers represent durations in ms.)

nates and preaspirated stops. 12 speakers participated in the study, 6 speakers of each dialect. Words were spoken in a frame sentence and each speaker produced one token of each test word. Segmenting methods were comparable to those used by Rögnvaldsson and Pétursson.

Results show a clear difference (93 ms. on average) between long and short stops in SD. This difference is reduced to 52 ms. in ND since geminate stops are on average 44 ms. longer in SD than in ND while singleton stops have nearly the same duration in both dialects (VOT excluded). Interestingly, the combined stop closure and VOT in ND singleton stops is only 15 ms. shorter on average than the same components of geminate stops. It would thus appear that in ND, singleton and geminate stops are mainly distinguished based on the duration of a preceding vowel or the presence or absence of audible postaspiration rather than the overall duration of the stop.

Results for preaspirated stops show that they are slightly longer in duration than singleton stops (a difference of 4 ms.) in SD but slightly shorter (6 ms.) in ND. Average VOT for singleton stops in SD is 40 ms. and 60 ms. in ND. Mean difference in VOT between the two dialects is therefore only 20 ms. Indriðason et al. (1991) do mention in their report that several of their SD speakers seemed to aspirate their stops in an unnatural way and that the results reflect that. They don't seem concerned, however, that their participants' abnormal way of speaking

may have skewed other parts of their data.

Indriðason et al. (1991) also report on vowel durations in different contexts. Results showed that in SD a long vowel is on average equal in duration to a following singleton stop (including postaspiration). In ND, however, the combined closure and VOT is on average 37% longer than the vowel. This is partly due to a longer VOT compared to SD, and partly due to a shorter vowel. The duration of a short vowel is about a third of the duration of a following geminate stop in both dialects.

Finally, Indriðason et al. (1991) report that the place of articulation in stop consonants seems to affect the duration of a previous vowel. Vowels are shorter before palatals and velars than labials and alveolars (stop closure is also shorter in palatals and velars than in other stop consonants whereas VOT is somewhat longer). Results are summarized in Tables 3.9, 3.10, and 3.11.

	Singleton			Preaspirated			Geminate	
	V	Clos.	VOT	V	Preasp.	Clos.	V	Clos.
p	162	115	33	94	87	120	79	213
t	169	122	34	79	98	136	79	223
k	151	115	41	77	115	123	64	201
c	156	133	51	86	144	119	76	220
Average	160	121	40	84	111	125	75	214

Table 3.9: Results from Indriðason et al.'s (1991) acoustic study on SD speakers (numbers represent durations in ms.)

Pind (1995) conducted an acoustic experiment to examine the effects of speech rate on VOT (in word-initial stops) and vowel and consonant duration in Icelandic two-syllable words. He recorded 4 participants (including himself) but does not disclose which dialectal area they belong to. 4 words were chosen as the stimuli for the experiment ([kaala], [kalla], [k^haala], [k^halla]), consisting of either a plain or

	Singleton			Preaspirated			Geminate	
	V	Clos.	VOT	V	Preasp.	Clos.	V	Clos.
p	138	122	44	73	82	129	76	180
t	132	123	50	76	86	111	75	179
k	128	112	63	70	99	104	62	157
c	122	116	81	73	101	104	68	163
Average	130	118	60	73	92	112	70	170

Table 3.10: Results from Indriðason et al.’s (1991) acoustic study on ND speakers (numbers represent durations in ms.)

	Singleton			Preaspirated			Geminate	
	V	Clos.	VOT	V	Preasp.	Clos.	V	Clos.
SD	160	121	40	84	111	125	75	214
ND	130	118	60	73	92	112	70	170

Table 3.11: Comparison of averages for SD and ND speakers from Indriðason et al.’s (1991) study (numbers represent durations in ms.)

postaspirated stop followed by either a short vowel and a geminate, or a long vowel and a singleton consonant. Participants were instructed to utter each token at 5 self-selected speech rates: normal, faster than normal, as fast as possible, slower than normal, and as slow as possible.

Results of a two-way ANOVA, with the factors being type of stop (plain or aspirated) and speech rate (1-5), showed both factors to have a significant effect on VOT. The interaction of stop type and rate was also significant for aspirated stops but no correlation was found in the plain series. Furthermore, Pind found that the phonemic quality of the following vowel (i.e. whether it was long or short) had no effect on the duration of the VOT. Pind had this to say about his VOT findings:

Indeed, this would seem to indicate that the VOT region occupied by the aspirated member puts severe limits on the stretchability of

the VOT of the unaspirated member, since otherwise there would be considerable overlap between the two categories—overlap, that is, which would exceed the rate normalization typically seen in studies of VOT perception. For the aspirated member, however, no such upper limiting factor exists, thus allowing its VOT to increase with slower rates of speech.

Regarding the durations of vowels and consonants, Pind found that the average rhyme duration (V+C) for the VVC-type words was slightly longer than for VCC-type words, or 342 ms. compared to 324 ms. He notes that, although this difference is statistically significant, these data must be considered to fit well with the description of the quantity contrast in Icelandic as being one of complementary opposition.

According to Pind's result, a slower speech rate has the effect of a long vowel being stretched considerably while the effect on the consonant is limited. This leads to a dramatic change in the V/C ratio from 1.31 at the shortest vowel durations to 2.92 at the longer durations. For the VCC-type syllables the effect is reversed; the long consonants stretch quite a bit while the short vowels do not stretch to the same extent. The V/C ratio ranges from 0.44 for the shortest consonant durations to 0.27 for the longest durations.

Finally, Pind notes that the type of stop (aspirated or plain) affects the duration of a following vowel, with vowels being shorter following an aspirated stop. On the other hand, syllables with aspirated stops were somewhat longer in duration than ones with plain stops so this difference cannot be explained entirely as being the result of a trade-off between VOT and the vowel.

Kingston (1990) performed an experiment on a single female speaker of (the Northern dialect of) Icelandic to determine whether the abduction of the glottis

in preaspirated stops is coordinated with the stop closure or the preceding vowel. Kingston's experiment was intended to provide validation for his binding principle, which states that glottal articulations in stops are much more frequently realized as modifications of the release of the oral closure than of its onset.⁵ Preaspirated stops posed a problem for Kingston's theory since the early abduction of the glottis appears to be tied to the onset of the oral closure. Since postaspirated stops are also found in Icelandic, a contrast seems to exist in the language, in Kingston's opinion, between stops whose glottal abduction binds to either the onset or the release of the oral closure. If the glottal abduction in Icelandic preaspirates were found to be tied to the oral closure, then Kingston's binding principle would be violated.

Kingston's experiment assumes that if two articulations are coordinated with one another, their individual durations will covary across different speech rates and prosodic contexts. Specifically, to find support for the binding principle, the duration of an abduction overlapping the release of a stop closure, as in postaspirated stops, must correlate positively with the duration of the closure. No such correlation should be observed in preaspirated stops. The single speaker tested produced several words containing pre- and postaspirated stops in intervocalic position. The words were spoken in a frame sentence, with focus on either the test word itself or the word immediately preceding it. Additionally, each word was spoken at self-selected moderate and fast speech rates.

Kingston's data showed positive correlations between preaspiration and *both* flanking oral articulations, i.e. the preceding vowel and the oral closure. For postaspirated stops, Kingston found a positive correlation of the glottal abduc-

⁵The binding principle is intended to account for another asymmetry in the distribution of glottal articulations, namely that stops are much more likely to contrast for glottal articulations than either fricatives or sonorants (Kingston 1990).

tion with the following vowel but not between the abduction and the preceding closure. In other words, the Icelandic data failed to conform to the binding principle on two fronts, with the preaspiration showing ties to the oral closure and with the postaspiration failing to do so.

Taking a closer look at the data, Kingston identifies two different components of the preaspiration period, a breathy interval where the glottis is partially abducted but not enough to extinguish voicing altogether, and a noisy interval where the vocal folds have come too far apart to vibrate any longer and only noise is produced. Chasaide (1986) has argued that the breathy interval rather than the noisy interval is the most salient cue to identifying a stop as preaspirated in Icelandic. Kingston found that the breathy component varied much less in duration across the experimental conditions than the noisy component, leading him to identify the noisy component as the single variable component of the measured duration of preaspiration. Having adjusted his findings according to this, Kingston found the timing of the preaspiration to be solely coordinated with the preceding vowel.

Note that Kingston's dilemma regarding the Icelandic preaspirated stops presupposes that preaspiration is a mirror reflection of postaspiration rather than an independent segment as has been proposed by Thráinsson (1978) among others. If it is indeed an independent segment, the preaspiration period takes the position of a coda consonant in a stressed syllable. The fact that its duration correlates more with the stop closure than the preceding vowel (if we don't accept Kingston's argument about the two components of preaspiration) could simply be due to the fact that, as Pind (1995) has shown, changes in speech rate affect components of the stressed syllable disproportionately. However, Kingston's results could also support an analysis of preaspirated stops in Icelandic as a single unit. We will return

to the discussion of the phonological nature of preaspirated stops in Chapter 4.

Summary

As indicated by the overview given here, acoustic studies on Icelandic obstruents have to a large extent been concerned with durational ratios between vowels and stop closures. VOTs have been less studied.

Three studies have made comparisons between the Northern and Southern dialects of Icelandic: Pétursson (1974b), Rögnvaldsson (1980) and Indriðason et al. (1991). Rögnvaldsson (1980) reports that singletons are somewhat longer in SD than ND but otherwise his results do not indicate any differences between the two dialects (recall that he does not give measurements for VOTs). The remaining two studies disagree on most fronts. Pétursson (1974b) reports that both the preaspiration period and the following closure are considerably longer in ND than SD but Indriðason et al. (1991) find the opposite to be true. Pétursson (1974b) concludes that geminates are much longer in duration in ND than SD (which he doesn't consider to have geminates at all based on the results) while Indriðason et al. (1991), again, come to the opposite conclusion.

Regarding vowel durations, Pétursson's (1974b) findings are, again, at odds with other studies on the subject. He concludes that there is little difference between long and short vowels in SD while both Indriðason et al. (1991) and Garnes (1976) find long vowels to be roughly double the length of short vowels in SD.

Results for preaspirated stops have mostly been concerned with comparing the duration of the closure period in these stops to either the preceding aspiration

or the duration of a singleton stop closure. Einarsson (1927) concluded that the preaspiration period was considerably shorter than the following closure (66% of the closure duration) while Garnes (1976) found the preaspiration to be quite a bit longer in duration, or 86% of the following closure. Pétursson (1974b) reported that preaspirated stops are longer than singleton stops in SD while Rögnvaldsson (1980) came to the opposite conclusion.

Two studies have looked at rate-dependent durations in Icelandic vowels and stop consonants. Kingston (1990) set out to examine what kind of correlations existed between aspiration periods (preaspiration and VOT) and flanking segments across changes in speech rate and focus. He expected his results to show a positive correlation between duration of stop closure and VOT, an indication, in his opinion, that the two are coordinated with each other, but found no such correlation. Furthermore, he interpreted his results as showing (with some adjustments) that the duration of preaspiration is only coordinated with a previous vowel and has no relationship with the stop following it.

Pind (1995) looked at word-initial stop consonants followed by both long and short vowels across 5 different speech rates. His main finding was that certain speech segments become more stretched out than others with a decrease in speech rate. Long vowels will stretch out more than a following singleton consonant, while a geminate stop will stretch out more than a preceding short vowel. Pind also found that the phonemic quantity of a following vowel (i.e. whether it is long or short) has no effect on VOT.

3.2.2 Other phonetic studies

Löfqvist and Yoshioka (1981a,b) examined laryngeal-oral coordination in voiceless obstruent production using electromyography to film the larynx as well as aerodynamic and palatographic records to obtain information about laryngeal articulations. They looked at several languages, including Icelandic, where they examined singleton stops as well as obstruent clusters. The sole Icelandic participant was a female speaker of SD. Words were produced in a carrier phrase.

For the singleton stops, Löfqvist and Yoshioka contrasted three types: word-initial plain and aspirated stops, and intervocalic preaspirated stops. The results revealed that voiceless obstruent production involves simultaneous, temporally coordinated activity of oral and laryngeal articulations. More specifically, Löfqvist and Yoshioka found that variations in the relative timing of laryngeal and oral articulations are used to produce contrasts of aspiration in stop consonants. According to their findings, glottal abduction starts at implosion and peak glottal opening occurs close to the implosion in Icelandic voiceless unaspirated stops. In voiceless aspirated stops glottal abduction begins at implosion but glottis continues to open until stop release. Peak glottal opening achieved is much larger than for unaspirated stops. In preaspirated stops both glottal abduction and peak glottal opening precede oral closure and the glottal opening is smaller in size than the one found in postaspirated stops.

Löfqvist and Yoshioka furthermore found an interaction between the size and timing of a laryngeal gesture, leading them to regard these as interacting strategies of achieving a specific acoustic output. In other words, we must not necessarily assume that the size of a laryngeal gesture is phonologically encoded. Rather, the size is determined by the temporal relationship of the gesture to the oral

articulation.

Regarding laryngeal activity in Icelandic obstruent clusters, Löfqvist and Yoshioka (1981b) found that clusters of fricative and plain stop and clusters of two fricatives have only one glottal opening gesture. In clusters, where the stop is acoustically unaspirated (such as [s]+stop clusters), the glottal gesture occurs during the articulation of the fricative. When the stop is postaspirated (this only occurs if a word boundary intervenes between a fricative and a following stop), however, the glottal opening gesture is coordinated with the stop closure. Peak glottal opening occurs close to the onset of fricatives, i.e. earlier than in postaspirated stops where it is coordinated with the release.

In their concluding remarks, Löfqvist and Yoshioka (1981a) raise the question of the validity of using timeless phonological representation to describe speech phenomena that show such clear signs of temporal coordination.

As interarticulator timing appears to be an essential feature of voiceless obstruent production, one may question the descriptive adequacy and usefulness of feature systems with timeless representations for modeling speech production, whatever their merits may be for abstract phonological analysis. [...] The difference between postaspirated and unaspirated voiceless stops is rather one of interarticulator timing than of spread versus constricted glottis. Similarly, the difference between voiceless and voiced postaspirated stops is also one of timing rather than of stiff versus slack vocal cords. Preaspirated stops are naturally accounted for within a timing framework, but cannot be readily differentiated from postaspirated ones in a timeless feature representation. It is, of course, possible to translate a timeless representation into differences in interarticulator timing, but if timing is of importance, it seems counterintuitive to derive it rather than represent it directly, especially if feature representations are to have a phonetic basis and describe parameters that the speaker can control independently (Löfqvist and Yoshioka 1981a).

We will return to this discussion in Chapter 5 where a phonological analysis

of aspirated segments in Icelandic is presented that takes into consideration the temporally coordinated properties of these segments.

3.3 Present Study

The study described here was conducted in two locations in Iceland in 2014 and gathered acoustic data on stop consonants in various environments. The goal was to reach a comprehensive understanding of dialectal differences in the production of aspirated consonants in Icelandic.

3.3.1 Methodology

Stimuli

The wordlist designed for the study consisted of 43 words that all contained a stop consonant in one of the following environments (the entire wordlist is given in Appendix A):

- a. Word-initial position (plain/aspirated)
- b. Intervocalic position, following a long vowel (aspirated/borrowed)
- c. Intervocalic position, following a short vowel (preaspirated/plain geminate)
- d. Word-medial consonant cluster, following a sonorant (plain/aspirated)
- e. Word-medial position, preceding a sonorant (preaspirated/plain)
- f. Word-initial position, following [s] (aspirated)
- g. Word-medial position, following [s] (aspirated)

Participants

29 participants were recorded, 14 speakers of SD (6 male and 8 female) and 15 speakers of ND (8 male and 7 female). Data from 2 male speakers of SD were excluded from the analysis. One of them was unusually soft-spoken, making his spectrograms extremely hard to read. The other one was excluded because his intervocalic stops were unnaturally aspirated, and indicator that he was attempting to emulate an ND accent. This leaves data from 27 speakers, 12 SD speakers and 15 ND speakers.

All participants, except for 1 female speaker of ND, were recorded in or around their dialectal area. SD speakers were recorded in the capital Reykjavík (located in the southwestern part of Iceland) and ND speakers were recorded in Akureyri, the largest town in the northern part of Iceland. All of the participants had spent the majority of their lives in their own dialectal area but due to the fact that the availability of higher education is limited outside of the capital, several of the ND speakers had lived in a different dialectal area at some point in their lives.

Participants' ages ranged from 22 years to 42 years, with a mean and median age of 31 years. It was considered especially important to record a younger generation of ND speakers to obtain an accurate account of how their dialect is evolving. As will be discussed later on, the results for ND speakers indicate that certain characteristics might be disappearing from that dialect.

Procedure

Participants were recorded in a quiet room in their own homes using a Sennheiser headset connected to a MacBook Pro laptop. The software used for the recordings

and subsequent data segmentation was Praat (version 5.1.19) and the sampling rate was 22050 Hz. All data were hand-segmented and later analyzed using the statistical software *R*.

Segment boundaries were drawn in the following way: vowels were considered to start at the beginning of periodic voicing in the spectrogram and to end at the end of periodic voicing. Post-vocalic stop closure begins at the end of periodic voicing (Figure 3.1). This means that sometimes a brief period of turbulence is included at the beginning of a stop closure. Stop closure ends at burst and the following noisy period, ending at the onset of regular voicing, is considered the VOT. Preaspiration is considered to start where regular vowel formants are not visible in the spectrogram anymore and preaspiration ends where most signs of turbulence have disappeared from the spectrogram and waveform (Figure 3.2). Boundaries between vowels and voiced sonorants were drawn in the middle of the transition between the two if a clearer boundary was not detectable.

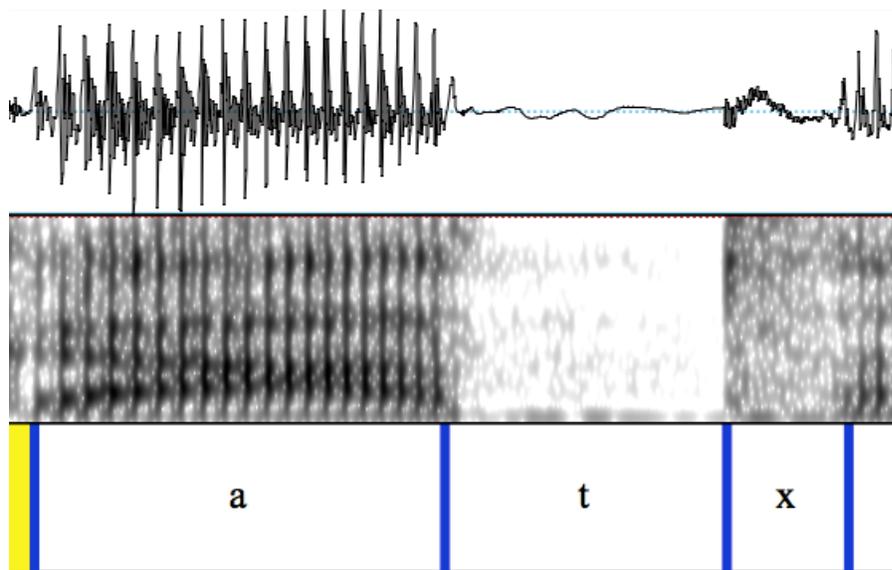


Figure 3.1: Spectrogram of the word *gata* produced by a male ND speaker. 'x' is used to denote VOT.

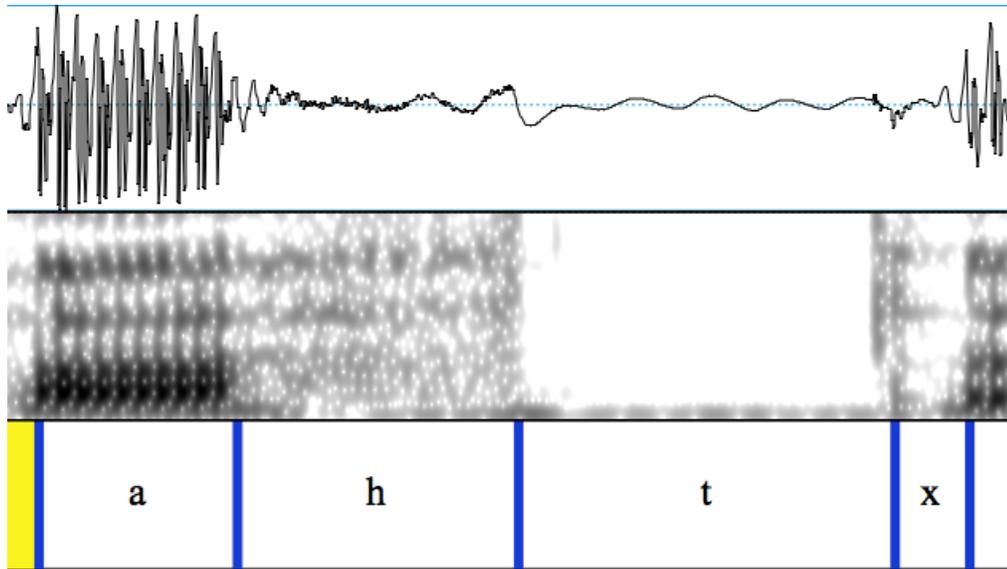


Figure 3.2: Spectrogram of the word *fatta* produced by a male SD speaker. ‘h’ is used to denote preaspiration and ‘x’ denotes VOT.

Stimuli were presented to the participants in 6 blocks, each of them containing the same words but in a different randomized order each time. Words appeared one at a time on a screen in front of the participant (an Ipad was used for this) and the participant was instructed to utter each word in the frame sentence *Segðu _____ fyrir mig* ‘Say _____ for me’. Participants went through the 6 blocks twice, first at a normal (self-selected) speech rate, later at a faster (self-selected) speech rate. Each participant thus produced 12 tokens of each word, 6 at a normal speech rate, 6 at a faster rate. This brings the total of tokens uttered by each speaker to 516 or a total of 13,932 tokens across all 27 speakers.

After recordings were done, each participant was asked a series of questions from a questionnaire designed to inform the researcher about the participant’s attitude towards dialectal variation in Icelandic (see Appendix B for questionnaire). The purpose of this was twofold. First, it was of some concern that speakers of SD, in particular, would exaggerate certain characteristics of their own speech to make it

sound more like ND speech, which is considered by some to be the clearer and more aesthetically pleasing of the two.⁶ It was expected that any major outliers in the speech of an SD speaker might be reflected in their answers to specific questions in the questionnaire, i.e. that SD speakers, who felt strongly that ND was in some way superior to SD, might e.g. have unusually long VOTs in their intervocalic aspirated stops. A detailed account of participants' responses to the questionnaire will be discussed in Chapter 6 but it is worth mentioning at this point that the one SD speaker, whose data were excluded due to his unnatural speech, did in fact exhibit a strong preference for ND in his responses.

Second, sociolinguistic factors, such as attitudes towards different dialects in Iceland, have not been widely studied. This was, therefore, an opportunity to collect data on an understudied subject in the realm of Icelandic linguistics. The results of this part of the study, as well as a comprehensive historical overview of language attitudes in Iceland, will be discussed in Chapter 6.

Hypotheses

The study looked at various aspects of the production of aspirated consonants in Icelandic, with a special focus on environments where the two dialects, SD and ND, diverge. Our main hypotheses relate to dialectal differences as well as certain gestural timing relationships which can be inferred from acoustic measurements. Our hypotheses and predictions are listed below.

- **Hypothesis I:** Intervocalic stop consonants are structurally different in SD

⁶This is mostly based on the author's own impressions of linguistic attitudes in Iceland although various older documentations, discussed at length in Chapter 6, suggest that historically speaking, ND has been more celebrated for its characteristics than SD.

native and borrowed vocabulary, respectively.

- **Prediction:** There is a difference in the acoustic signal of these two types of stops. That difference can be reflected in the duration of the preceding vowel, the duration of the stop closure, or VOT.
- **Hypothesis II:** VOT differences between SD and ND stem from differences in the timing of glottal gestures with respect to oral ones.
 - **Prediction:** VOT, which indirectly reflects the timing of glottal gestures, might differ more subtly between ND and SD than in the categorical terms it is often discussed (i.e. postaspiration vs. no aspiration). We might, for instance, observe differences in preaspiration periods or word-initial VOT between the two dialects.
- **Hypothesis III:** There is a structural difference between oral and glottal gestures, in that glottal gestures are subordinate to their oral head gestures. They are therefore more free to move around to accommodate an accompanying oral gesture.
 - **Prediction:** Changes in speech rate (from normal to fast speech) will disproportionately affect voice onset/offset time compared to the duration of stop closures, i.e. the ratio between the two will not remain stable across differences in speech rate.
- **Hypothesis IV:** Certain or all features of the minority dialect (ND) are unstable and slowly disappearing from the language.
 - **Prediction:** An unstable dialectal feature will emerge less reliably, i.e. will be produced in fewer tokens, especially at a faster speech rate (cf.

Labov’s (1966) finding that post-vocalic [r] was produced less reliably in spontaneous than careful speech by participants in his study, leading him to suggest that it was not internalized in that environment).

3.3.2 Results for word-initial stops

This portion of the study looked at word-initial stop consonants in Icelandic and compared their phonetic output between the two dialects, ND and SD. Word-initial position is the only syllabic position where stops contrast for aspiration in *both* dialects of Icelandic (1).

(1)	a.	<i>para</i>	/p ^h ara/	[p ^h a:ra]	‘to pair’
	b.	<i>bara</i>	/para/	[pa:ra]	‘only’

The consonants studied were /p^h, t^h, k^h, p, t, k/ and appeared in the following words: *pata* ‘to flail’, *tala* ‘to talk’, *Kana* ‘American, acc.sg.’, *bana* ‘to slay’, *dama* ‘lady’, *gala* ‘to crow’. Each of the stops appeared in an open syllable, followed by a long stressed vowel. The measurements taken were for duration of stop closure, VOT/opening, and vowel duration.

Linear mixed regression models were fit to the data to investigate which variables had a significant effect on each of the response variables measured, i.e. stop closure, VOT, and vowel duration. *Speaker* was included as a random variable. For each of these outputs, speech rate and stop type (i.e. plain vs. aspirated) were found to be significant but dialect was only significant for VOT ($p < 0.05$). Furthermore, the interaction of stop type and speech rate was also found to have a

significant effect on each of the dependent variables. Mean durations, split up by stop and dialect, are found in Tables 3.12 (normal speech rate) and 3.13 (faster speech rate).

	SD				ND			
	Closure	VOT	Vowel	C+V	Closure	VOT	Vowel	C+V
p ^h	103	66	127	296	106	55	130	291
t ^h	94	71	144	309	96	61	153	310
k ^h	88	83	147	318	92	71	155	318
Average	95	73	139	308	98	62	146	306
p	117	12	176	305	110	13	181	304
t	107	17	170	294	105	15	173	293
k	98	28	174	300	102	26	186	314
Average	107	19	173	300	106	18	180	304

Table 3.12: Results from the present study on word-initial stop consonants spoken at a normal speech rate (numbers represent durations in ms. averaged over all speakers)

	SD				ND			
	Closure	VOT	Vowel	C+V	Closure	VOT	Vowel	C+V
p ^h	86	45	89	220	85	39	94	218
t ^h	75	53	97	225	76	46	108	230
k ^h	78	62	102	242	74	56	110	240
Average	80	53	96	229	78	47	104	229
p	90	12	115	217	93	11	124	228
t	81	17	116	214	79	15	114	208
k	79	27	117	223	75	24	120	219
Average	83	19	116	218	82	17	119	218

Table 3.13: Results from the present study on word-initial stop consonants spoken at a faster than normal speech rate (numbers represent durations in ms. averaged over all speakers)

As indicated by the values in Table 3.12, VOT is on average 11 ms. longer in duration in SD than ND (at a normal speech rate). In terms of percentages, VOT is on average 77% of the duration of the preceding stop closure in SD but a mere

63% in ND. At a faster speech rate, this value drops to 66% in SD and 60% in ND. In turn, the vowel duration is somewhat longer in ND although the difference is not great enough to be significant in the regression model. Notice that vowels are also longer in ND following a plain stop consonant, even though VOTs are comparable in duration across both dialects. This might suggest that vowels are in general a little bit longer in ND than SD, regardless of what precedes them. Table 3.12 also shows that both stop closures and following vowels are significantly longer in duration when the stop is unaspirated, the latter being mostly due to a great reduction in VOT.

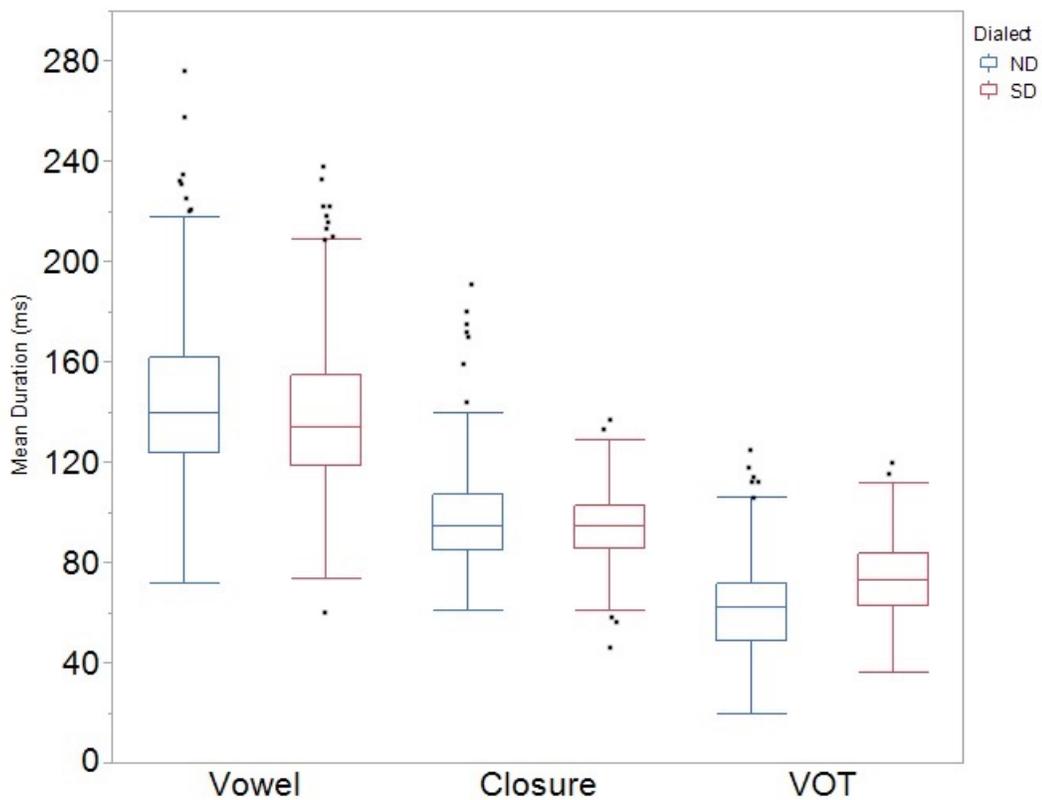


Figure 3.3: Values for VOT as well as closure and vowel durations, averaged over all speakers and split up by dialects.

The values for the faster speech rate, listed in Table 3.13, show the same trends as the slower rate values, albeit on a smaller scale. This suggests that an increase

in speaking rate has similar effects on the speech of all speakers, regardless of their dialect.

The interaction between stop type and speech rate, which was found to be significant for all the dependent variables, was examined further by means of *t*-tests.⁷ Results for VOT showed that speech rate had a significant effect in aspirated stops but plain stops were not found to differ significantly in VOT between the normal and fast speech rates. Results for both vowel and stop duration showed all interactions of stop type and speech rate to be significant, although the difference between plain and aspirated stop closures in the faster speech rate condition was barely enough to be statistically significant.

Regarding the effect of dialects, aspirated stops were found to differ significantly in VOT between ND and SD at both speech rates. VOT for plain stops was found to differ significantly between ND and SD at the faster speech rate ($p=0.002$) but not at the normal speech rate.

At this point it is important to issue certain caveats regarding statistical testing. While statistical tests are useful to determine which variables have a significant effect on the duration of a speech segment, it is open to interpretation whether a statistically significant difference necessarily reflects an actual difference. To clarify this point, one might ask if it is enough for VOT to be *significantly* longer in one dialect than the other under certain conditions for us to conclude that the dialects are actually different. The answer is: maybe not. A difference of e.g. 6 ms. in VOT is not great enough to be perceptible by any listener. On the other hand, it is interesting that VOTs are consistently longer in SD than ND, even though that difference is reduced to an average of 6 ms. at a fast speech rate. The fact that the

⁷A Bonferroni correction was used to control for multiple comparisons.

difference is still there might lead us to ask some questions about the phonological difference between the two dialects. At the very least, this is an indication that the timing of the glottal gesture with respect to the oral gesture in word-initial stops is consistently different between ND and SD, although that difference is admittedly small.

To give a better idea of the effects of changes in speech rate on individual speech segments, it is beneficial to view individual segment durations as a function of the entire syllable duration. The average values found in Tables 3.12 and 3.13 are given as proportions in Table 3.14.

		SD			ND		
		Closure	VOT	Vowel	Closure	VOT	Vowel
Aspirated	Normal	0.31	0.24	0.45	0.32	0.20	0.48
	Fast	0.35	0.23	0.42	0.34	0.21	0.45
Plain	Normal	0.36	0.06	0.58	0.35	0.06	0.59
	Fast	0.38	0.09	0.53	0.38	0.08	0.55

Table 3.14: Average durations of word-initial stops in normal and fast speech shown as proportions of the duration of the entire syllable (CVV).

The proportional values shown in Table 3.14 confirm that VOT is indeed longer in SD aspirated stops than their ND counterparts, and that the reverse is true of vowel duration. Table 3.14 also reveals that, as speech rate decreases, the vowel takes up a larger space in the syllable whereas the stop closure becomes proportionally shorter. This is in keeping with the results of Pind (1995), who observed that, across 5 different speech rates, the vowel stretched quite dramatically with a slower speech rate in Icelandic CVV syllables (while the same effect was observed on the coda consonant in CVC syllables).

Summary

Word-initial stop consonants are more heavily aspirated in SD than ND. Vowels are slightly longer in ND than SD but the difference is not enough to be considered statistically significant. Differences in speech rate have a significant effect on all speech segments except for VOTs in plain stops. Vowels are considerably longer following plain stops than aspirated ones and stop closures are also slightly longer for plain stops.

Looking at the proportional duration on each speech segment reveals that a reduction in speech rate has the effect of expanding the space taken up by the vowel. VOTs in aspirated stops stay the same, proportionally speaking, but stop consonants are allotted less space in slower speech than fast speech.

3.3.3 Results for intervocalic stops

Geminates

Only plain stops can be geminated in Icelandic. The consonants examined in this part of the study were [pp, tt, kk] and appeared in the following words: *labba* ‘to walk’, *gadda* ‘spike, gen.pl.’, *bagga* ‘baggage, gen.pl.’. Each of the stops appeared in intervocalic position, preceded by a short stressed vowel. The measurements taken were for vowel duration, duration of stop closure and VOT/opening. Average durations, split up by dialect and speech rate, are given in Table 3.15.

As the numbers in Table 3.15 show, there seems to be little or no dialectal difference in the production of geminate stops in Icelandic. The only real difference

		SD				ND			
		Vowel	Closure	VOT	V+C	Vowel	Closure	VOT	V+C
Normal	pp	61	184	15	260	60	178	15	253
	tt	66	193	18	277	71	177	25	273
	kk	70	174	29	273	71	177	25	266
Average		66	184	21	270	67	177	22	264
Fast	pp	49	120	16	185	47	110	14	171
	tt	54	120	17	191	56	118	15	189
	kk	57	103	25	185	57	113	23	184
Average		53	114	19	187	53	114	17	181

Table 3.15: Results from the present study on intervocalic geminate stops spoken at a normal and faster speech rate (numbers represent durations in ms. averaged over all speakers)

is that the stop closure is on average 7 ms. longer in SD than ND at the normal speech rate but this difference disappears in faster speech. A linear mixed regression model, with *Speaker* included as a random variable, confirmed that there is no significant difference between dialects. Speech rate was found to be the only significant factor ($p < 0.001$) in determining the duration of the stop closure and the vowel, whereas VOT was not significantly affected by any variables.

Proportional values for each of the speech components looked at are shown in Table 3.16. These numbers reveal that, as speech rate decreases, the stop closure takes up a proportionally large space while the vowel shortens. This is the opposite of what was found in open syllables, where the vowel stretched out in the slower speech rate condition. Both of these results are in agreement with Pind’s (1995) findings for the effects of differences in speech rate on the duration of segments in Icelandic.

	SD			ND		
	Vowel	Closure	VOT	Vowel	Closure	VOT
Normal	0.24	0.68	0.08	0.25	0.67	0.08
Fast	0.28	0.61	0.10	0.29	0.63	0.09

Table 3.16: Average durations of intervocalic geminate stops in normal and fast speech shown as proportions of the duration of V+C.

Singletons

Two kinds of singleton stops appear in intervocalic position in Icelandic: aspirated stops in native vocabulary (2-a) (2-b) and unaspirated stops in loanwords (2-c). The native vocabulary aspirated stops only surface with postaspiration in ND (2-a).

- (2)
- | | | | | |
|----|--------------|------------------------|---------|---------|
| a. | <i>gata</i> | [kaː.t ^h a] | ‘road’ | ND |
| b. | <i>gata</i> | [kaː.ta] | ‘road’ | SD |
| c. | <i>radar</i> | [raː.tar] | ‘radar’ | SD & ND |

One of the questions of interest regarding intervocalic stops in Icelandic is whether there is any difference in the phonetic output of SD stops between native and non-native vocabulary, respectively. It is unclear how non-native stops should be represented in underlying structure and whether it is perhaps necessary to posit a different underlying structure for each of the dialects. The fact that native and non-native stops behave differently from one another in ND suggests a difference in underlying structure but the seemingly identical output of these two categories of stops in SD points to the opposite conclusion.

The consonants examined in this part of the study appeared in the following words: *súpa* ‘soup’, *túba* ‘tuba’, *gata* ‘road.’, *radar* ‘radar’, *seka* ‘guilty, acc.sg.’, *Megas* ‘stage name of a musician’. Due to the limited number of loanwords in Icelandic it was not possible to keep the vowel constant across all tokens. Where the loanword had a vowel other than [a], it was decided to use the same vowel in the corresponding native word, i.e. since the loanword containing [p], *túba*, has the vowel [u] preceding the stop, the native word *súpa*, also containing [u], was used to represent [p^(h)]. Results for all stops are given in Tables 3.17 and 3.18.

		SD				ND			
		Vowel	Closure	VOT	V+C	Vowel	Closure	VOT	V+C
Aspirated	p ^(h)	106	113	19	238	110	107	50	267
	t ^(h)	145	112	21	278	148	104	48	300
	k ^(h)	128	106	31	265	131	102	56	289
Average		126	110	24	260	130	104	51	285
Loan	p	96	109	17	222	107	114	17	238
	t	162	116	22	300	156	121	18	295
	k	131	99	28	258	131	104	25	260
Average		130	108	22	260	131	113	20	264

Table 3.17: Results from the present study on intervocalic singleton stops spoken at a normal speech rate (numbers represent durations in ms. averaged over all speakers)

The results show, as expected, that aspirated stops have a considerably longer VOT in ND than SD, both in the normal and the faster speech rate conditions. Comparison between native vocabulary and loanword stop consonants in SD reveals that the average closure duration and VOT is similar in both types of stops. It is more difficult, however, to say anything definitive about vowel duration. Due to the fact that each of the stop consonants was preceded by a different vowel, there is quite a lot of variation in the average vowel duration. If we compare the vowel duration for each pair of native word and corresponding loanword (at the

		SD				ND			
		Vowel	Closure	VOT	V+C	Vowel	Closure	VOT	V+C
Aspirated	p ^(h)	65	77	17	159	71	76	34	181
	t ^(h)	95	74	21	190	106	75	36	217
	k ^(h)	82	69	24	175	89	74	40	203
Average		81	73	21	175	89	75	37	200
Loan	p	63	78	17	158	72	80	15	167
	t	108	79	21	208	112	85	17	214
	k	85	64	26	175	94	71	22	187
Average		85	74	21	180	93	79	18	189

Table 3.18: Results from the present study on intervocalic singleton stops spoken at a faster than normal speech rate (numbers represent durations in ms. averaged over all speakers)

normal speech rate), we find that there is little difference in words that have [k], the vowel is 10 ms. longer before [p] in native vocabulary than in loanwords, but 17 ms. shorter before [t] in native tokens than borrowed tokens. These results seem conflicting at first but a clearer image emerges if we consider the environment *preceding* each of these vowels. The word pairs used to represent stop consonants in native words and corresponding stop consonants in borrowed vocabulary are repeated in (3) for the reader’s convenience.

- (3) súpa ~ túba
gata ~ radar
seka ~ Megas

Notice that the loanword in the first pair, *túba*, has an aspirated stop preceding the vowel. As discussed in Section 3.3.2 above, postaspiration has the effect of considerably shortening a following vowel (average difference between vowels following plain and aspirated stops, respectively, was 34 ms. for SD speakers at a

normal speech rate). Thus, considering the effect that the VOT has on the vowel duration in the loanword *túba*, we can assume that the absolute vowel duration is actually markedly longer before a borrowed [p] than it is before a native [p]. Our results now suggest that the origin of a stop consonant, i.e. whether it appears in native vocabulary or in loanwords, has an effect on the duration of a preceding vowel (although the effect is not strong for the velar stop).

Mixed regression models were fit to the data to determine which variables contribute significantly to the values of two dependent variables, vowel duration and VOT. *Speaker* and *Vowel* were included as random variables. For VOT, speech rate and stop type (native vs. non-native) were found to be highly significant ($p < 0.001$) as well as the interaction of dialect and stop type. Interaction effects were examined closer by means of *t*-tests. VOTs for stops in native words were, unsurprisingly, found to differ significantly between SD and ND ($p < 0.001$). A comparison of VOTs of stops in non-native words also returned a significant difference in means between dialects ($p < 0.001$) but since the difference is less than 3 ms. it is doubtful that it has any actual significance. Finally, no significant difference was found in VOT between stops in native and non-native vocabulary, respectively, in SD.

Speech rate ($p < 0.001$) and type of stop (native vs. non-native) ($p < 0.01$) were found to have a significant effect on vowel duration. Dialect was not found to be significant. Despite the fact that stop type had a significant effect on vowel duration in the regression model, a *t*-test comparing vowel duration in loanwords and native words concluded that the difference in means is not significant. This is not surprising given our discussion above regarding the effect of the postaspiration of a previous stop on vowel duration in the word *túba*.

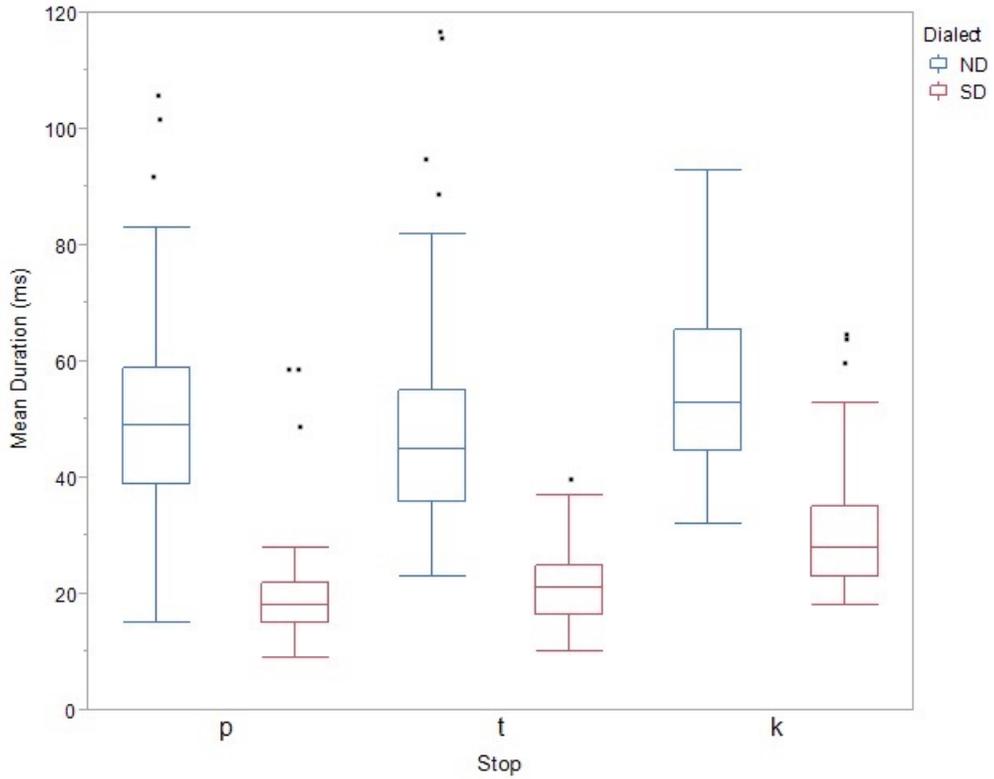


Figure 3.4: A comparison of mean VOT durations (averaged over all speakers) in intervocalic stops between ND and SD.

Proportional values for each of the dialects and speech rates are given in Table 3.19. The values indicate that the proportions of speech taken up by each of the segments stays fairly constant across differences in speech rate. Note, in particular, that VOT in ND aspirated stops is not reduced in faster speech.

		SD			ND		
		Vowel	Closure	VOT	Vowel	Closure	VOT
Aspirated	Normal	0.48	0.42	0.09	0.46	0.36	0.18
	Fast	0.46	0.42	0.12	0.45	0.38	0.19
Loan	Normal	0.50	0.42	0.08	0.50	0.43	0.08
	Fast	0.47	0.41	0.12	0.49	0.42	0.10

Table 3.19: Average durations of intervocalic singletons stops in normal and fast speech shown as proportions of the duration of V+C.

In keeping with Kingston's (1990) discussion regarding the coordination of glottal articulations with oral ones, we tested the correlation between VOTs and stop closure durations in ND aspirated stops. Data for both speech rates were pooled together. As Figure 3.5 shows, we found there to be somewhat of a positive correlation between VOT and stop closure duration in ND aspirated stops, i.e. fluctuations in the duration of the stop closure are also reflected in the VOT. This suggests that the aspiration and the stop closure are coordinated with each other (i.e. are one unit in some sense) although the correlation admittedly is not very strong.

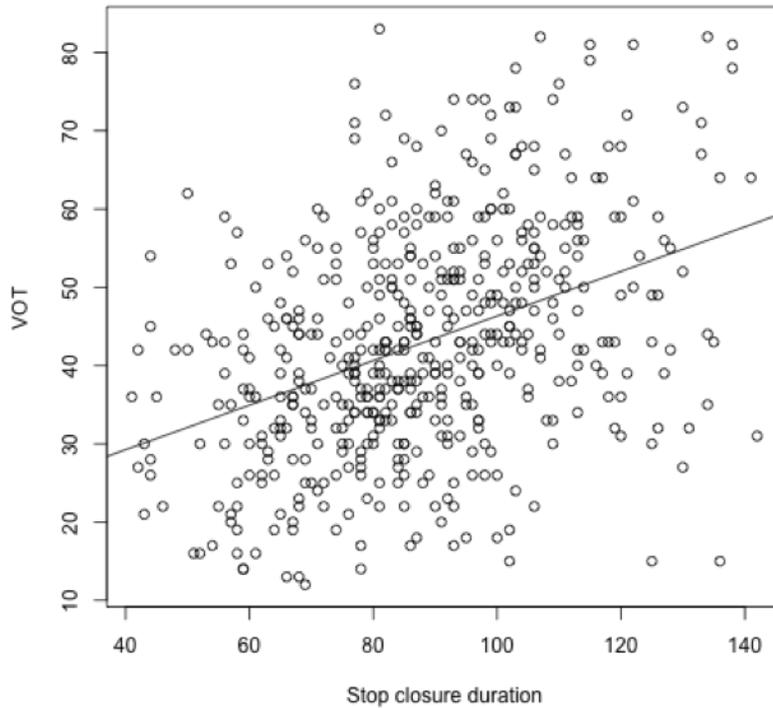


Figure 3.5: Interaction of VOT with stop closure durations in intervocalic ND stops (correlation=0.4, $p < 0.001$).

Comparison of word-initial and intervocalic stops

Table 3.20 compares the average duration of stop closures and VOTs in ND word-initial and intervocalic aspirated stops at both speech rates. With regards to syllabic position, the two kinds of stops are identical in that they both stand in syllable onsets. However, only the word-initial stops are in a stressed position.

		Normal Rate		Faster Rate	
		Closure	VOT	Closure	VOT
Intervocalic	p ^h	107	50	76	34
	t ^h	104	48	75	36
	k ^h	102	56	74	40
Average		104	51	75	37
Word-Initial	p ^h	106	55	85	39
	t ^h	96	61	76	46
	k ^h	92	71	74	56
Average		98	62	78	47

Table 3.20: Comparison of word-initial and intervocalic aspirated stops in ND (numbers represent durations in ms. averaged over all speakers)

The table shows, rather surprisingly, that there is very little difference between word-positions in the combined duration of the stop closure and the VOT at the normal speech rate. VOT is, on average, 10 ms. longer in word-initial stops than intervocalic ones, but in turn the stop closure is shorter in word-initial stops. The difference in VOT is maintained at a faster speech rate but the stop closure is reduced more intervocalically than word-initially, resulting in a slightly longer closure in word-initial position.

Summary

Our results, although inconclusive, suggest that differences between stop consonants in native and borrowed vocabulary, respectively, might be reflected in the duration of the preceding vowel in SD. This effect is not present in ND which is not surprising given that longer VOT serves to distinguish the different types of stops in that dialect.

A positive correlation was found between VOTs and the duration of stop closures in ND aspirated stops. This suggests some coordination between aspiration and stop closure. In other words, these results support the idea that the stop and the VOT are a single phonological entity.

A comparison between ND aspirated stops in word-initial and intervocalic position, respectively, revealed a surprisingly small effect of stress on the overall duration of the stop. VOT is considerably longer in word-initial stops but the effect on stop closure duration is smaller, especially at a faster speech rate. This might suggest that stress mainly targets aspiration but that the oral constriction is fairly immune to differences in stress.

3.3.4 Preaspirated stops

Preaspirated stops appear in two environments in (both dialects of) Icelandic: in intervocalic position (where there was historically a geminate aspirated stop, see (4-a)) and in postvocalic position before [l] or [n] (4-b).⁸

⁸The reader will notice that we have chosen a different transcription method for the preaspirated stop in each of the two environments. This choice will be justified in Chapter 4 where the phonological status of these stops will be discussed in detail.

- (4) a. *mappa* [mahpa] ‘folder’
 b. *sakna* [sa^hkna] ‘to miss’

The following words were recorded for this portion of the study: *mappa* ‘folder’, *fatta* ‘to realize’, *bakka* ‘to back up’, *vopna* ‘weapon gen.pl.’, *kapla* ‘cable acc.pl.’, *gatna* ‘road gen.pl.’, *fatla* ‘sling acc.sg.’, *sakna* ‘to miss’, *hekla* ‘to crochet’. The quality of the vowel was kept constant where possible. For two of the clusters, [hpn] and [hkl], no words could be found where [a] precedes the cluster so other vowel were used in those cases.

Results for intervocalic preaspirated stops are shown in Table 3.21 and results for pre-sonorant stops are found in Tables 3.22 (normal speech rate) and 3.23 (faster speech rate).

		SD				ND			
		Vowel	Preasp.	Clos.	VOT	Vowel	Preasp.	Clos.	VOT
Normal	hp	75	96	113	15	75	98	106	15
	ht	75	88	112	20	77	91	108	14
	hk	79	108	93	27	79	104	94	25
Average		76	97	106	21	77	98	103	18
Fast	hp	63	51	86	15	64	53	77	13
	ht	63	45	75	23	68	46	75	16
	hk	60	62	67	24	65	62	66	22
Average		62	53	76	21	66	54	73	17

Table 3.21: Results from the present study on intervocalic preaspirated stops spoken at a normal and a faster than normal speech rate (numbers represent durations in ms. averaged over all speakers)

Results for intervocalic and pre-sonorant stops were pooled together for a statistical analysis since their values proved to be similar. Linear mixed regression models were fit to the data to determine which variables contribute significantly

	SD			ND		
	Vowel	Preasp.	Closure	Vowel	Preasp.	Closure
^h pn	88	96	89	90	91	79
^h pl	76	73	104	83	70	95
^h tn	80	95	91	87	96	87
^h tl	78	87	75	80	89	78
^h kn	76	91	84	80	86	75
^h kl	91	97	79	103	83	87
Average	82	90	87	87	86	84

Table 3.22: Results from the present study on preaspirated stops before sonorants, spoken at a normal speech rate (numbers represent durations in ms. averaged over all speakers)

	SD			ND		
	Vowel	Preasp.	Closure	Vowel	Preasp.	Closure
^h pn	75	57	67	76	53	56
^h pl	69	34	77	76	30	72
^h tn	68	55	65	76	54	62
^h tl	68	46	44	71	50	54
^h kn	66	49	61	70	53	57
^h kl	88	54	56	90	42	63
Average	72	49	62	77	47	61

Table 3.23: Results from the present study on preaspirated stops before sonorants, spoken at a faster than normal speech rate (numbers represent durations in ms. averaged over all speakers)

to the values of three dependent variables, vowel duration, preaspiration, and stop closure. *Speaker* and *Vowel* were included as random variables. The models confirmed that the position of the preaspirated stop, i.e. whether it is intervocalic or pre-sonorant, has no effect on either vowel duration or duration of preaspiration. However, stop closure was found to be significantly longer in intervocalic position than before a sonorant ($p < 0.001$). Speech rate was significant for all three response variables ($p < 0.001$) and was, in fact, the only variable found to affect

either vowel duration or duration of preaspiration. Dialect of speaker did not have a significant effect on any of the response variables.

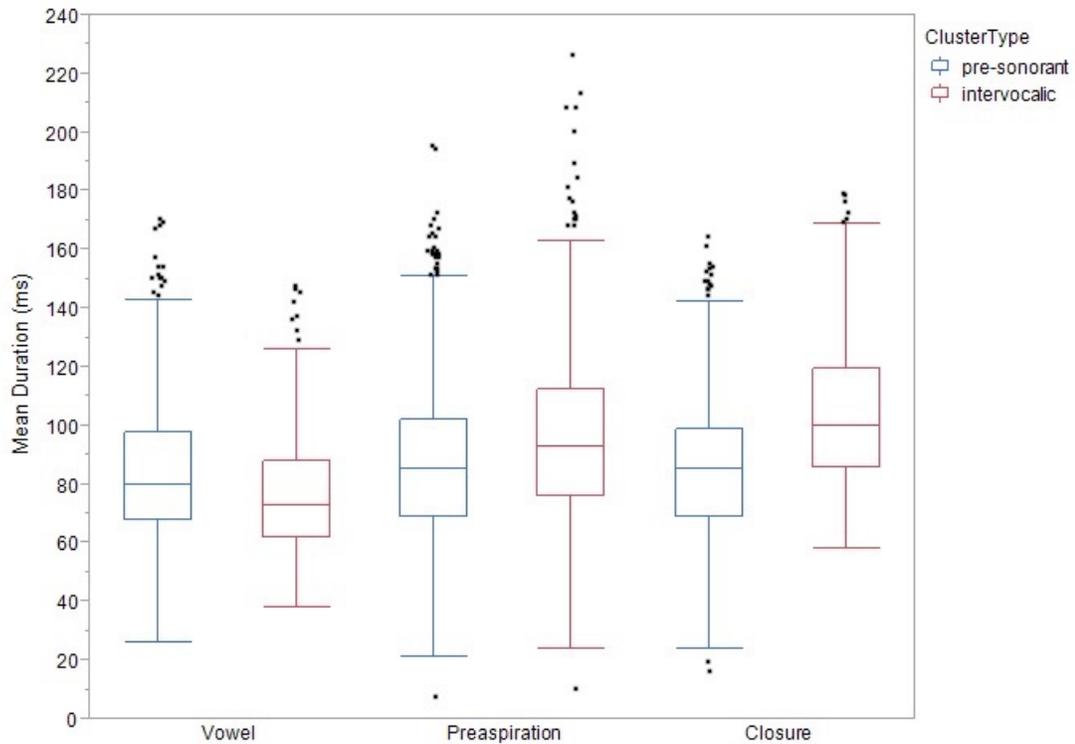


Figure 3.6: A comparison of mean values (averaged over all speakers and both dialects) for three dependent variables, VOT, preaspiration duration, and closure duration, in two environments: before a sonorant consonant and in intervocalic position.

To give a better idea about the effect of speech rate on the response variables, Tables 3.24 and 3.25 show their durations as proportions of the duration of all segments measured. As the tables indicate, an increased speech rate has the effect of proportionately reducing the space taken up by the preaspirated period whereas the vowel gets stretched out. This effect was so strong that several tokens were produced without any preaspiration at all at the faster speech rate. The proportional duration of the stop consonant remains constant regardless of whether the

stop is flanked by a vowel or a sonorant consonant.

Earlier in this chapter we discussed the results of Pind (1995) who found that in Icelandic CVC syllables the relative duration of the coda is negatively correlated with an increase in speech rate. The syllabic affiliation of preaspiration in Icelandic, or rather its status as a segment or, alternatively, a secondary articulation of the following stop, has often been debated in the literature (see Chapter 4 for an in-depth discussion). The question is whether the preaspiration alone stands in the syllable coda, making it a separate entity or a segment, or if it is accompanied by the following stop closure, which would mean that these two articulations are a phonological unit since Icelandic does not have complex codas. Since our results show that only the preaspiration, and not the stop closure, is proportionally affected by changes in speech rate they could be taken to mean that the coda consists of the preaspiration alone. On the other hand, Pind's (1995) results (which are also based on acoustic measurements) do not say anything about individual articulations of a single segment either. In other words, the fact that the glottal articulation of a stop is disproportionately affected by speech rate compared to the supralaryngeal articulation doesn't necessarily exclude a phonological analysis of these two articulations as one unit. Put differently, the assertion that coda consonants reduce at an increased speech rate does not entail that every articulatory component of that coda reduces. It simply entails that the coda undergoes an overall reduction effect.

Summary

Results for preaspirated stops in both dialects of Icelandic show that the position of the preaspirated stop has no statistically significant effect on the duration of either

	SD				ND			
	Vowel	Preasp.	Clos.	VOT	Vowel	Preasp.	Clos.	VOT
Normal	0.25	0.32	0.35	0.07	0.26	0.33	0.35	0.06
Fast	0.29	0.25	0.36	0.10	0.32	0.26	0.35	0.08

Table 3.24: Average durations of intervocalic preaspirated stops in normal and fast speech shown as proportions of the duration of V+C.

	SD			ND		
	Vowel	Preasp.	Clos.	Vowel	Preasp.	Clos.
Normal	0.32	0.35	0.34	0.34	0.33	0.33
Fast	0.39	0.27	0.34	0.42	0.25	0.33

Table 3.25: Average durations of preaspirated stops before sonorants in normal and fast speech shown as proportions of the duration of V+C.

the preaspiration or the preceding vowel, although we did find the duration of the two to be inversely correlated across environments. However, stop closures were found to be shorter when followed by a sonorant. Speech rate is highly significant in determining the values of the individual responses and our results conform to those reported in Pind (1995) for coda consonants in Icelandic, i.e. that, as speech rate slows down, they take up proportionally more space.

3.3.5 Comparison of all intervocalic stops

It is not one of the goals of the present study to compare stop closure durations across various types of environments in Icelandic since such a comparison has no bearing on the issue of aspiration and its distribution. However, for the sake of providing a point of reference to previous acoustic studies on Icelandic, Table 3.26 summarizes our findings for average durations of stop closures in three types of

intervocalic stops, singleton (native), geminate, and preaspirated.

	SD			ND		
	Singleton	Geminate	Preasp.	Singleton	Geminate	Preasp.
Normal	110	184	106	104	177	103
Fast	73	114	76	75	114	73

Table 3.26: Comparison of mean stop closure durations (ms.) in three types of intervocalic stops, singleton, geminate, and preaspirated, across both dialects and speech rates.

According to our results, the duration of intervocalic singleton stops is approximately 3/5 of the duration of geminates. The durational gap between geminates and singletons is slightly reduced at the faster speech rate, where the duration of the singleton is 64% of the geminate’s duration in SD and 66% in ND. Geminates are slightly longer in SD than ND at a normal speech rate but the difference disappears at a faster speech rate. The preaspirated stop closure is nearly equal to the singleton closure in both dialects and at both speech rates.

Table 3.27 shows a comparison of vowel durations in our data. The numbers for long vowels are taken from words with word-initial plain stops in an open syllable. The values for short vowels are from words with intervocalic geminate and preaspirated stops.

	SD		ND	
	Short	Long	Short	Long
Normal	71	173	72	180
Fast	58	116	60	119

Table 3.27: Comparison of mean short and long vowel durations (ms.) in normal and faster than normal speech).

As the table shows, short vowels are fairly equal in duration in SD and ND. Long vowels are slightly longer in ND but the difference between the dialects is

reduced in faster speech. In terms of proportions, the duration of short vowels at a normal speech rate is approximately 41% of the duration of long vowels in SD and 40% in ND. At a faster speech rate, this ratio increases to 50% in both dialects.

3.3.6 Clusters of sonorant + stop

Aspirated stops

Clusters of a sonorant or /ð/ and a following aspirated stop⁹ are pronounced differently in Icelandic depending on the dialect of the speaker. In SD speech, aspiration invariably shifts from the aspirated stop to the preceding sonorant.

(5) *vanta* /vant^ha/ [vaŋ.ta] ‘to lack’

Some speakers of ND, however, produce these clusters with a voiced sonorant followed by a postaspirated stop.

(6) *vanta* /vant^ha/ [van.t^ha] ‘to lack’

The latter type of pronunciation will henceforth be referred to as ‘sonorant voicing’ in keeping with Icelandic tradition. The Icelandic term for this dialectal feature is *raddaður framburður* or ‘voiced pronunciation’, referring to the voicing of the sonorant.

⁹For the sake of convenience these clusters will henceforth be referred to as sonorant + stop clusters even though /ð/ is a fricative.

Whereas all speakers of ND postaspirate their intervocalic fortis stops, there is considerable inter- and, as our results will show, intra speaker variation within the dialect regarding the treatment of sonorant + aspirated stop clusters. Some ND speakers lack sonorant voicing altogether, others voice some or most of their sonorants but speakers vary quite a bit in terms of which sonorants they voice and how consistently they do so. The inter speaker variation depends, in part, on the birthplace of the speaker. Nearly all the ND speakers in the study were recorded in the same town in the north of Iceland (Akureyri) and, while most of them have resided in that town for the majority of their lives, several speakers are originally from smaller towns in the area. However, even among the speakers who were born and raised in Akureyri and would perhaps be expected to share dialectal features, there was still considerable variation. This may to some extent be attributed to differences in the speech of the participants' parents and grandparents who may have moved to Akureyri from other locations but there are undoubtedly other sociolinguistic factors at play as well.¹⁰ This discussion will proceed in Chapter 6 but what is important to note here is that any statistical inferences made from the data at hand should be interpreted with caution due to the great amount of variability observed in them.

The words recorded for this part of the study were the following: *maðka* 'maggot, gen.pl.', *Alpa* 'Alps, gen.pl.', *salta* 'to salt', *Salka* 'proper name', *lampa* 'lamp,

¹⁰With around 18,000 inhabitants, Akureyri is the largest town in the north of Iceland, the dialectal area we were interested in studying. This location was chosen for various reasons. First and foremost, conducting the study in Akureyri provided easier access to younger speakers, who were the target age group. Due to lack of higher education as well as employment for skilled laborers and educated people in smaller towns, it is common for young people to migrate from those locations to Akureyri. The downside of recording in an educational and cultural center like Akureyri is that there is more variation in people's speech than in smaller locations. However, previous research (see e.g. Þráinsson and Árnason 1992) has shown, and our results seem to confirm, that sonorant voicing is disappearing in younger generations. It is therefore likely that the variation in the data stems as much from the age of the target group as the location chosen for the recordings.

gen.pl.’, *fanta* ‘brute, gen.pl’, *bunka* ‘pile, gen.pl.’. As always, vowels in both syllables were kept constant where possible. Due to a sound process in Icelandic that diphthongizes /a/ before /nk^h/ clusters, (/pank^ha/ > [paun̥ka]) a different vowel was chosen for the stressed syllable preceding that cluster.

Cluster	Slow		Fast	
	Devoiced	Voiced	Devoiced	Voiced
/ðk ^h /	0.57	0.43	0.59	0.41
/lp ^h /	0.86	0.14	0.92	0.08
/lt ^h /	1.00	0.00	0.99	0.01
/lk ^h /	0.98	0.02	0.99	0.01
/mp ^h /	0.70	0.30	0.73	0.27
/nt ^h /	0.73	0.27	0.76	0.24
/nk ^h /	0.67	0.33	0.74	0.26

Table 3.28: Proportion of tokens produced with a voiced sonorant in ND.

Table 3.28 shows, for each cluster, the proportion of tokens produced with a voiced sonorant by ND speakers in the present study. Three things are evident from the table: first, sonorant voicing varies depending on the cluster; second, sonorant voicing is not all that common in ND speech; third, sonorant voicing is to some extent rate-dependent.

Out of 15 ND speakers recorded, 6 (1 male, 5 female) did not voice any of their sonorants. Only one speaker (originally from the town of Ólafsfjörður, 37 miles north of Akureyri, but had lived in Akureyri for the past 15 years) voiced all types of sonorants but not all of them consistently, i.e. all tokens of /ð/ and /m/ were voiced in his speech but other sonorants alternated between being voiced and voiceless. Two of the speakers only voiced nasals (not consistently) and two speakers only voiced /ð/ (consistently). Two speakers voiced /ð/ and nasals (not consistently). Two speakers voiced everything except for /l/ before /t^h/ and /k^h/.

Out of these two speakers, one was consistent in his sonorant voicing but the other one was only consistent in his voicing of /ð/ and /n/.

Tables 3.29 and 3.30 show results for clusters of sonorant + aspirated stop for all participants. Speakers are divided into two groups based on whether or not they exhibited any sonorant voicing in their speech (statistical analysis did not indicate any differences between SD speakers and non-voicing ND speakers and they are therefore pooled together under the label ‘sonorant aspirating dialect’, a group which contains results from a total of 19 speakers, whereas 9 speakers fall into the ‘sonorant voicing dialect’ category). For further analysis, the data from all speakers were fitted to a linear mixed regression model.

	Sonorant aspirating dialect				Sonorant voicing dialect			
	Vowel	Sonorant	Closure	VOT	Vowel	Sonorant	Closure	VOT
/ðk ^h /	76	121	83	28	106	68	97	58
/lp ^h /	108	122	103	15	130	95	120	40
/lt ^h /	72	118	78	16	n/a	n/a	n/a	n/a
/lk ^h /	73	123	81	26	73	84	98	66
/mp ^h /	74	122	85	16	70	90	104	44
/nt ^h /	76	124	80	18	79	89	106	44
/nk ^h /	95	118	67	34	87	74	93	62
Average	82	121	82	22	91	83	103	52

Table 3.29: Results from the present study on clusters of sonorant + aspirated stop, spoken at a normal speech rate (numbers represent durations in ms. averaged over all speakers)

Results of the statistical analysis show that speech rate has a significant effect on the duration of all response variables ($p < 0.001$), i.e. the duration will decrease with a faster speech rate. Whether or not a sonorant is voiced has a significant effect on its duration ($p < 0.001$). Aspirated sonorants are considerably longer in duration than voiced ones. Dialect (i.e. SD vs. ND) does not have a significant

	Sonorant aspirating dialect				Sonorant voicing dialect			
	Vowel	Sonorant	Closure	VOT	Vowel	Sonorant	Closure	VOT
/ðk ^h /	61	78	58	27	80	49	72	42
/lp ^h /	94	77	80	13	116	68	105	28
/lt ^h /	60	77	52	16	61	73	80	29
/lk ^h /	60	80	56	24	61	76	87	57
/mp ^h /	62	82	56	15	57	66	82	30
/nt ^h /	64	84	57	17	67	62	71	32
/nk ^h /	70	76	44	27	68	54	65	45
Average	67	79	58	20	73	64	80	38

Table 3.30: Results from the present study on clusters of sonorant + aspirated stop, spoken at a faster than normal speech rate (numbers represent durations in ms. averaged over all speakers)

effect on sonorant duration which is probably due to the ratio of voiced to aspirated tokens being too small to show a significant effect of dialects even though all the voiced tokens come from ND. Finally, type of cluster is significant in that /nt^h/ and /mp^h/ have slightly longer sonorants than other clusters.

Sonorant voicing is also a significant factor in the duration of stop consonants. Stops are longer after voiced sonorants than aspirated ones. Stop type also has a significant effect on duration; /p^h/ is significantly longer in duration than either /t^h/ or /k^h/.

Sonorant voicing has a significant effect on VOT duration following the stop ($p < 0.001$). This is expected since stops are postaspirated following a voiced sonorant but plain following an aspirated one. VOTs are longest after /k^h/ and type of sonorant is significant as well, with the longest VOT times appearing when the sonorant is /ð/. However, this result should not be given much weight since the cluster /ðk^h/ had by far the most instances of sonorant voicing (see Table 3.31). As a result, mean VOTs are higher in that cluster than other clusters where

sonorant voicing (and thus postaspiration) is less common.

Cluster	Aspirated tokens	Voiced tokens
/ðk ^h /	239 (76%)	75 (24%)
/lp ^h /	295 (94%)	19 (6%)
/lt ^h /	316 (100%)	1 (0%)
/lk ^h /	316 (99%)	3 (1%)
/mp ^h /	233 (84%)	45 (16%)
/nt ^h /	250 (86%)	42 (14%)
/nk ^h /	235 (83%)	47 (17%)

Table 3.31: Total number of tokens in ND, split up by type of sonorant, aspirated or voiced.

Table 3.32 gives a clearer picture of the effect of speech rate on the duration of individual segments. As the proportions given in the table indicate, a faster speech rate has the effect of reducing the duration of the sonorant and increasing VOT when the sonorant is not voiced. When the sonorant is voiced, however, changing the rate of speech has little or no effect on the proportional duration of individual segments.

	Aspirating dialect			Voicing dialect		
	Sonorant	Closure	VOT	Sonorant	Closure	VOT
Normal	0.54	0.36	0.10	0.35	0.43	0.22
Fast	0.50	0.37	0.13	0.35	0.44	0.21

Table 3.32: Average durations of sonorant + stop clusters in normal and fast speech shown as proportions of the duration of the entire cluster.

In order to further examine the factors contributing to sonorant voicing in ND, the data were fitted to a mixed logistic regression model. Logistic regression is a type of a probabilistic statistical classification model, used to predict a binary response from predictor variables. In this case, we were interested in finding out which of the variables predict whether or not a sonorant is voiced in any given

token containing a sonorant + aspirated stop cluster. Only results for ND were considered since it was known beforehand that sonorant voicing is not found in SD speech. VOT was not considered as a predictor variable because doing so resulted in an error in the model due to the problem of perfect separation, i.e. in this case all the lower VOT values are grouped on one side of the binary response variable (0=no sonorant voicing, 1=sonorant voicing) and the higher values are grouped on the other side. This is because stop consonants are only aspirated (i.e. have considerably longer VOTs) after voiced sonorants. In effect, what this means is that VOT is a perfect predictor of sonorant voicing but that result is not interesting to us. What we set out to discover is which other variables can be used to predict whether or not a speaker produces a token containing a voiced sonorant.

Speaker was included in the model as a random effect.¹¹ Results showed that the age of a participant is slightly positively correlated with the presence of sonorant voicing but not enough for the effect to be significant. Shorter sonorants are significantly more likely to be voiced. The likelihood of voicing is positively correlated with the duration of the following stop, i.e. the longer the stop consonant, the more likely the sonorant is to be voiced. Gender is a significant factor; based on our sample, men are 412 times more likely to voice their sonorants than women.¹² Speech rate is a significant factor in determining the likelihood of a sonorant being voiced. Speakers are about 21 times more likely to voice a sonorant when speaking at a normal speech rate compared to a faster than normal speech rate.

¹¹We considered including word frequency in the model as a fixed effect. This proved impossible, however, because information about relative frequency is not available for all the words recorded for this portion of the study. For the record, word frequency data from Pind et al. (1991) indicate that *lampa* is by far the most frequent of all the words in the study but that was not the word with the highest rate of sonorant voicing.

¹²It should be kept in mind that the sample size is small. However, it would be of great interest to look more closely at the role that gender plays in maintaining or converging dialects in Icelandic. This will be discussed in greater detail in Chapter 6.

Finally, the rate of sonorant voicing will differ depending on the nature of the consonant cluster. Voicing is most likely to occur in /ðk^h/, /mp^h/, or /nt^h/ (no significant difference was found between these clusters), but far less likely in /lp^h/, followed by /lk^h/, and finally /lt^h/. It is interesting to look at how these results correlate to the pattern of sonorant voicing observed in each individual ND speaker. As discussed above, the speakers who did have some voicing varied in whether they only voiced /ð/, only voiced nasals, or voiced both /ð/ and nasals. According to the logistic regression model, voicing is statistically speaking equally likely to take place in each of these. Furthermore, no speaker voiced only laterals and those speakers who did voice their laterals, also had at least one voiced token of each of the other sonorants in their speech. In other words, it can be assumed from the results that lateral voicing is only present in an individual's speech if that individual also voices nasals and /ð/ (not necessarily in a consistent manner though). A speaker, who voices his nasals but not the dental fricative, will not have any voiced laterals in his speech.

Comparison to clusters with plain stops

This section looks at the production of clusters of sonorant and plain stop in Icelandic, i.e. clusters that are homorganic to the ones discussed in the previous section but lack aspiration (7).

(7) *landa* /lanta/ [lan.ta] ‘country, gen.pl.’

Of special interest is the difference between these clusters and the ones containing aspirated stops in the faster speech rate condition. As noted in Section 3.3.6,

VOT is considerably reduced in faster speech in clusters of sonorant + aspirated stop, where the sonorant is produced with voicing. In fact, the lowest VOT value measured in fast speech was 11 ms. This raises the question of whether, as a result, those clusters become harder to distinguish from clusters containing a plain stop or whether there are additional cues to the nature of the stop consonant.

The following words were recorded: *feðga* ‘father and son, gen.pl.’, *falda* ‘to hem’, *felga* ‘wheel rim’, *lambda* ‘lamb, gen.pl.’, *landa* ‘country, gen.pl.’, *lunga* ‘lung’. The variation in the quality of the stressed vowel is partly due to a gap in the lexicon (no words were found where [a] precedes [ðk] or [lk]) and partly the result of a sound change that diphthongizes [a] before [nk]. Table 3.33 shows the results for these clusters.

	Normal rate				Faster rate			
	Vowel	Sonorant	Closure	VOT	Vowel	Sonorant	Closure	VOT
/ðk/	89	77	102	29	64	52	73	26
/lt/	71	111	100	17	56	74	62	17
/lk/	67	99	95	28	54	69	62	25
/mp/	67	102	101	16	52	68	64	15
/nt/	71	99	101	18	58	67	63	17
/nk/	62	102	88	29	49	71	58	26
Average	71	98	98	23	56	67	64	21

Table 3.33: Results from the present study on clusters of sonorant + plain stop, spoken at a normal and a faster than normal speech rate (numbers represent durations in ms. averaged over all speakers)

The average values given in Table 3.33 indicate that a sonorant and a following plain stop are fairly equal in duration and that these proportions hold across different speaking rates. To eliminate the effect of different vowels for the comparison to aspirated clusters, Table 3.34 only looks at the minimal pair /lampa/ ~ /lamp^ha/.

	[lampa]		[lam̩pa]		[lamp ^h a]	
	Slow	Fast	Slow	Fast	Slow	Fast
Vowel	67	52	74	62	70	57
Sonorant	102	68	122	82	90	66
Stop closure	101	64	85	56	104	82
VOT	16	15	16	15	44	30

Table 3.34: Comparison of a sonorant + plain stop cluster and a sonorant + aspirated stop cluster in the words *lamba* and *lampa*, respectively. Both pronunciations of *lampa* are shown. Values are given in ms. and averaged over all speakers

From Table 3.34 we see that regarding durations of individual segments there are, generally speaking, more similarities between the plain cluster in [lampa] and the aspirated cluster in [lamp^ha] than between the two pronunciations of the aspirated cluster, [lamp^ha] and [lam̩pa]. However, besides differences in VOT, [lampa] and [lamp^ha] differ as well in that a faster speech rate has a considerably smaller effect on the duration of the stop closure in the aspirated cluster than in the plain cluster. A *t*-test confirmed that the stop is significantly longer when aspirated ($p=0.003$). Results for intervocalic stops (see Section 3.3.3) showed the opposite effect, i.e. stop closures tend to be shorter in aspirated stops than plain ones, both in normal and faster than normal speech. It may perhaps be hypothesized that a longer stop closure in fast utterances of [lamp^ha], compared to [lampa], serves as an additional cue to the aspirated nature of the cluster.

To investigate this further, we looked at the correlation between stop closure duration and VOT in all aspirated clusters that were produced with a voiced sonorant followed by a postaspirated stop. What we found is that the durations of these two articulations are not correlated at all, as illustrated by Figure 3.7. This is unexpected given the fact that we found there to be a positive correlation between VOT and stop closure duration in ND intervocalic aspirated stops. This is

further indication that stop consonants behave in a peculiar way in these particular clusters. It is hard to speculate about the cause of this. As we mentioned above, the stop duration in these clusters is the only attribute, aside from a longer VOT, that separates them from homorganic unaspirated clusters. It is perhaps conceivable that the production of these clusters has developed in such a way that the stop duration has been manipulated to cue the listener in on the nature of the cluster. It is unclear, however, if this difference in stop duration between plain and aspirated clusters is robust enough to be perceptible to a listener.

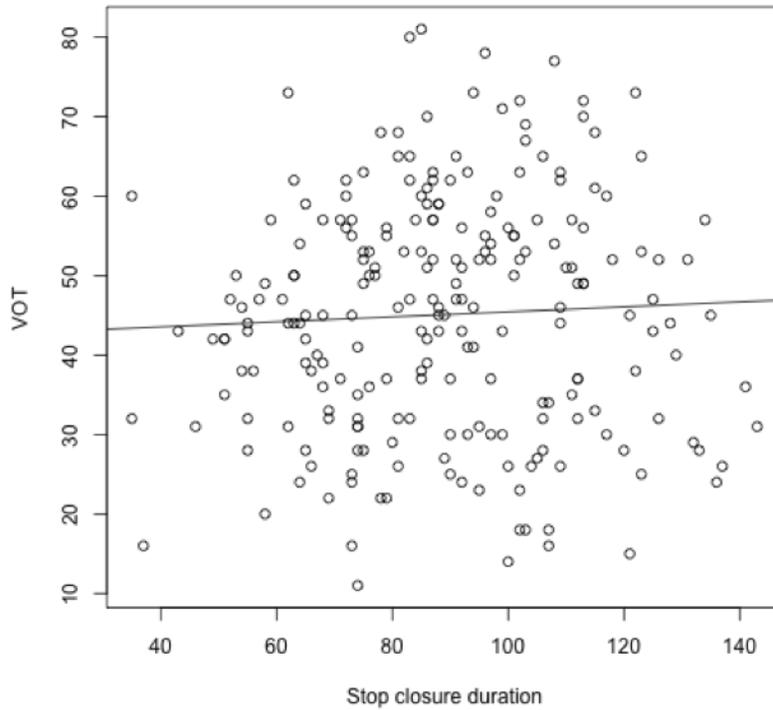


Figure 3.7: Interaction of VOT with stop closure durations in ND aspirated clusters with a voiced sonorant and an aspirated stop (correlation=0.05, $p=0.477$).

Summary

Considerable inter speaker variation was found in the data for ND sonorant + aspirated stop clusters. A logistic regression model revealed that factors such as speech rate, gender of participant, and the nature of the sonorant all play a part in determining whether the sonorant will be voiced or aspirated. Voicing is more likely to occur at a normal speech rate, men in our sample voiced their sonorants much more than the women did, and voicing will only take place in laterals if the same speaker voices both of their nasals and the fricative as well.

Results of a linear mixed regression model showed that VOT is reduced significantly at a faster speech rate in clusters where the sonorant is voiced (and the following stop is, thus, postaspirated). Durations of individual segments in these clusters were compared to those found in clusters of voiced sonorant + plain stop. The goal was to find out if VOT was the only cue to the nature of the cluster or if there are additional speech cues to indicate whether the cluster has aspiration or not, especially at a faster speech rate where VOT is considerably reduced. Results indicated that the duration of the stop closure differs significantly between the two kinds of clusters. Furthermore, no correlation was found between the duration of stop closures and VOTs in the aspirated clusters, a surprising finding that indicates that these two articulations are to some extent treated separately.

3.3.7 [s]+stop clusters

This portion of the study looked at clusters of [s] + a following aspirated stop, both in word-initial position and in word-medial position, where the sibilant is the coda of the stressed syllable and the stop the onset of the following syllable (8).

- (8) a. *stama* /st^hama/ [sta:ma] ‘to studder’
 b. *fasta* /fast^ha/ [fas.ta] ‘to fast’

Aspirated stops lose their aspiration in both dialects of Icelandic when preceded by [s] and the results show no differences in how these clusters are treated in each of the dialects. The words recorded were: *spaka* ‘wise, acc.pl.m.’, *stama* ‘to studder’, *skata* ‘skate’, *raspa* ‘to scrape’, *fasta* ‘to fast’, *maska* ‘face mask, acc.sg.’. Table 3.35 shows the main results.

		SD			ND		
		[s]	Closure	VOT	[s]	Closure	VOT
Initial	Normal	92	77	20	80	77	18
	Fast	65	65	18	58	62	17
Medial	Normal	128	89	21	121	88	19
	Fast	79	66	21	76	66	18

Table 3.35: Results from the present study on [s]+stop clusters spoken at a normal and a faster than normal speech rate (numbers represent durations in ms. averaged over all speakers)

Linear mixed regression models were fitted to the data for each of the dependent variables. Results for stop duration show that speech rate and type of stop have a significant effect. Dialect is not a significant contributor as already mentioned. Position within a word is significant, with stops being longer in medial position (i.e. syllable-initial position following a coda consonant) than in word-initial position, following [s] ($p < 0.001$). Same variables were found to be significant for the duration of [s]. As was already discussed, speech rate has a stronger effect on [s] than the stop consonant although the effect is statistically significant for both response variables. As expected, [s] is considerably longer in duration when in coda position than when it shares an onset with a following stop. For VOT, position

within a word was significant, with VOTs being longer in medial position than initial position. Speaking rate was also significant although the effect was small. Finally, type of stop was significant; VOTs were found to be longest after /k/ and shortest after /p/.

Summary

We looked at [s] + stop clusters in two syllable positions in Icelandic, word-initial and intervocalic. Results show that the production of these clusters does not differ between the two dialects, ND and SD. Both the sibilant and the stop are longer in duration word-medially, where they stand in coda and a following onset, respectively. [s] is more reduced in faster speech than stop consonants are and we hypothesized that this might be caused by the aspirated status of the sibilant. The same effect was found in other aspirated clusters looked at in the present study.

3.3.8 Acoustic data and articulatory gestures

While we chose to conduct an acoustic study to collect our data, the actual articulation of speech segments is of particular interest to us. In Chapters 4 and 5 we will discuss the phonological representation of aspirated consonants in Icelandic from a gestural point of view and present a theory on how glottal gestures are coordinated with oral gestures. Acoustic data can be useful in shedding light on certain aspects of gestural articulation. In our case, differences in voice onset/offset time across speakers, dialects, and speech rates can give us some information regarding the size of the glottal gesture as well as the nature of its coordination with an adjacent stop closure. In this section we will discuss some of our results from a gestural

point of view.

Intervocalic stops

One of the hypotheses we laid out in Section 3.3.1 regarded the nature of intervocalic stop consonants in borrowed vocabulary in Icelandic. We hypothesized that, despite similarities between these stops and SD native fortis stops (which are produced without aspiration), they were nevertheless structurally different. In Section 3.3.3 we found some evidence that vowels are significantly longer in duration before loanword stops than before stops in native words. It has been argued that a difference in a stop's glottal activity is reflected in the duration of a preceding vowel, i.e. that vowels are longer if the following stop lacks a glottal gesture altogether (see e.g. Goldstein and Browman 1986). These results might, thus, suggest that the stop consonants in native and borrowed words, respectively, differ with respect to the presence vs. absence of a glottal opening gesture. The same effect can be observed in ND but to a much smaller extent. That is not surprising given the fact that these two types of stops are distinguished in ND by means of postaspiration. A vowel lengthening effect would be secondary to that and could have been leveled out with time.

Preaspirated stops

In Section 3.3.4 we presented results for preaspirated stops in two environments in Icelandic: intervocalic position and post-vocalic position preceding [l] or [n]. What we found, among other things, was that the preaspiration period is on average shorter in the pre-consonant environment than intervocalically (the difference in overall means for normal speech was 7 ms. in SD and 12 ms. in ND, see Tables

3.21 and 3.22 for reference). We found the opposite result for stop closures in these environments, their duration being considerably longer in intervocalic stops (the difference in overall means for normal speech was 19 ms. in SD and 14 ms. in ND).

These durational differences found between preaspirated stops in the two different environments are of some interest. The shorter stop closure in the pre-sonorant condition could possibly be due to shortening effects that have previously been observed in consonant clusters, i.e. when flanked by other consonants, stops tend to be shorter than when flanked by vowels (see e.g. Klatt 1973). However, while not statistically significant, our results did show slight differences in the duration of both the vowel and the preaspiration between the two conditions; more specifically, the vowel is on average longer and the preaspiration shorter before a stop followed by a sonorant. This could indicate a difference in gestural coordination. In other words, it is possible that in the pre-sonorant condition, the preaspiration has a tighter connection, i.e. exhibits more overlap, with the following stop closure while in the intervocalic condition, the preaspiration is not as tightly coordinated with the stop but instead overlaps more with the preceding vowel. This is only speculative, however.

Consonant clusters

The main results for [s] + stop clusters, given in Table 3.35 above, are repeated here for the reader's convenience.

A comparison of mean durations for both speech rates indicates that the sibilant is considerably more reduced in faster speech than the stop consonant is, both in initial and medial position. This might be considered a similar effect to the one reported in Waals (1999), who looked at shortening effects in consonant clusters

		SD			ND		
		[s]	Closure	VOT	[s]	Closure	VOT
Initial	Normal	92	77	20	80	77	18
	Fast	65	65	18	58	62	17
Medial	Normal	128	89	21	121	88	19
	Fast	79	66	21	76	66	18

Table 3.36: Results from the present study on [s]+stop clusters spoken at a normal and a faster than normal speech rate (numbers represent durations in ms. averaged over all speakers)

relative to singleton consonants in Dutch onsets. According to her findings, compression disproportionately affects higher-sonority segments relative to ones lower in sonority. In other words, the fact that in our data the sibilant is more reduced than the stop in faster speech might reflect differences in sonority. However, a comparison to other consonant clusters in our study reveals that this is probably not the case.

In addition to [s] + stop clusters, we have examined clusters of aspirated sonorant + stop and voiced sonorant + aspirated stop (see Tables 3.29 and 3.30 above) as well as clusters of voiced sonorant + plain stop (see Table 3.33 above). If sonority was the culprit, we would expect to see a greater reduction in the sonorant compared to the stop in all of these clusters. This does, indeed, turn out to be the case with clusters of aspirated sonorant + stop, where the sonorant is on average reduced by 35% across speech rates compared to a 29% reduction in the stop consonant. However, there is barely any difference observed between the sonorant and the stop in the two kinds of clusters that contain a voiced sonorant (the aspirated stop is slightly less reduced than the preceding sonorant while the plain stop is slightly more reduced than the sonorant). In addition to sonorant + stop clusters, we have examined preaspirated stops (Table 3.21 above) which are, phonetically

speaking, simply clusters of [h] + stop. In those clusters, the aspiration in coda is considerably more reduced in faster speech than the following stop is.

On the basis of these evidence, a different pattern begins to emerge. Instead of sonority, we now hypothesize that it is aspiration, or rather presence or absence thereof, that determines how much segments are reduced in faster speech. A possible reason for this might be that glottal gestures undergo more reduction in faster speech than oral ones. Since oral gestures are temporally coordinated with the glottal gestures they overlap, this would force a greater reduction of the oral gesture as well. The reason why this effect is not present in clusters of voiced sonorant + aspirated stop is that in postaspirated stops the glottal gesture is only partially overlapped by the stop closure. Therefore, while we see a great reduction in VOT in faster speech, the stop closure is much less affected.

As a side note, a comparison of vowel duration between the minimal pairs /sk^hat^ha/ and /kat^ha/¹³ shows that, at a normal speech rate, the vowel is approximately 9 ms. longer following a simplex onset than when following a complex onset. This difference is increased to 11 ms. in faster than normal speech. *t*-tests confirm that this difference in vowel duration is statistically significant for both speech rates ($p < 0.01$).

This brings to mind discussions of so-called C-center effects in various languages. The idea, first proposed by Browman and Goldstein (1988), is that consonants in complex onsets will act as a whole in their timing relationship with a following vowel. In other words, the onset of the articulatory gesture corresponding to the vowel will begin at the midpoint of the onset, regardless of the number of consonants contained in that onset. In practice, this should mean that with

¹³Since aspiration is lost in stops following /s/, the only difference between these two words is the initial /s/ in *skata*.

every consonant added to the syllable onset, the amount of overlap between the onset and the vowel will increase, i.e. the vowel should become shorter. If that does not happen, one might consider an alternative hypothesis. For instance, the onset might only consist of the consonant flanking the vowel. In that case, other consonants would have to be considered as belonging to a different syllable.

Various research (mostly of articulatory nature) has shown that languages differ in whether they display C-center effects or not. Languages that have not been found to have the effect include among others Moroccan Arabic (Shaw et al. 2009), Georgian (Goldstein et al. 2007) and Hebrew (Tilsen et al. 2012), and languages in which timing patterns have been interpreted as showing the C-center effect include Italian (Hermes et al. 2008) and English (Browman and Goldstein 1988). C-center effects have not been examined in Icelandic and it is not the intention here to make any claims based on the data at hand. It should simply be noted that the difference in vowel duration between the words *skata* and *gata* may be indicative of a C-center effect in Icelandic onset clusters.

Summary

While the present phonetic study is of an acoustic nature and did not examine articulatory data, some of our findings did reveal interesting patterns that may be applicable to a theory of gestural coordination in Icelandic. We found that vowels are longer in duration before stops in borrowed vocabulary than in native words and attributed that to a lack of an active glottal opening gesture in the former category of stops. Based on our data for preaspirated stops in Icelandic, we speculated that in the position before a lateral or nasal, the preaspiration is more tightly coordinated with the stop closure than in intervocalic preaspirated stops.

This might suggest a phonological difference as we will discuss in detail in Chapter 4. Our examination of the effects of speech rate variation on the production of consonants in clusters revealed that aspirated consonants are reduced more in fast speech than unaspirated ones. We suggested that this was due to the glottal gestures being more flexible than the oral ones (as also witnessed by the fact that they move around more freely than oral gestures). Finally, we considered that a shorter stressed vowel after the complex onset [sk] relative to the simplex onset [k] might suggest the presence of a C-center effect in Icelandic. This discussion is only suggestive though and does not have much empirical value since the C-center effect was not a concern of this study.

3.4 Comparison to Previous Studies

As we have already touched upon, the present study does not have much in common with previous acoustic studies on Icelandic in terms of its main focal points. Much of the previous literature has centered around questions regarding differences in absolute segment durations between various syllabic positions and, in some cases, across the two main dialects of Icelandic. The results of these studies have been surprisingly inconsistent with each other, or so it may seem at first glance.

To give some examples, Indriðason et al. (1991) reported that geminates are considerably longer in SD than ND (a difference of 44 ms.) while Rögnvaldsson (1980) came to the conclusion that there is no difference between geminates in the two dialects. Einarsson (1927) found the duration of the preaspiration period to be a mere 66% of the duration of the following stop closure while Garnes's (1976) results indicated that the same ratio was 86%. Garnes (1976) came to

the conclusion that the duration of long vowels in SD is more than double the duration of short vowels. Indriðason et al. (1991) reported that the same ratio was 2:1 and they also found that all vowels, long and short, are shorter in ND than SD. Pétursson (1974b), on the other hand, concluded that long vowels are longer and short vowels shorter in ND than SD.

Figure 3.8 compares the mean results for the duration of intervocalic geminates in both dialects of Icelandic across 6 different studies, including the present study.

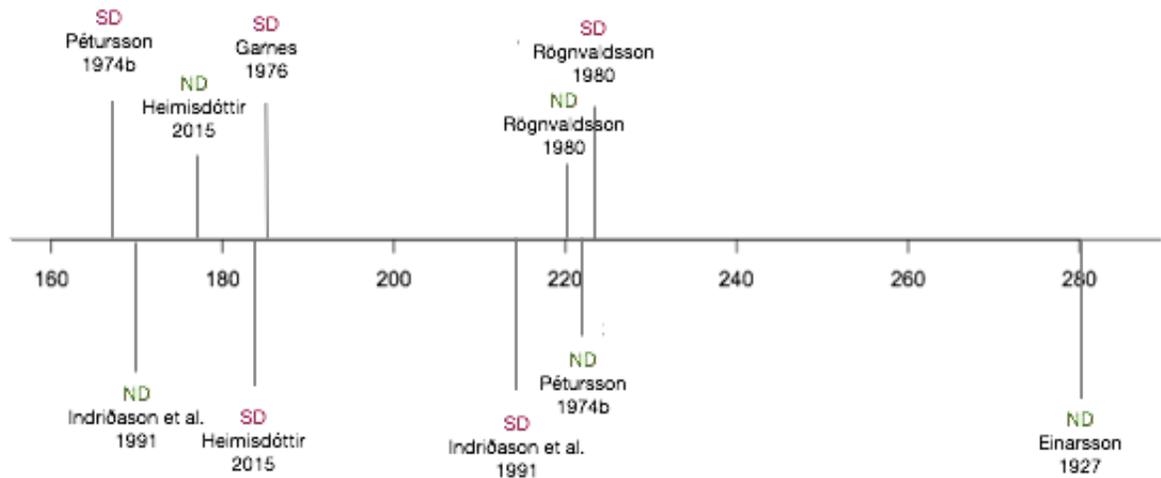


Figure 3.8: Mean duration (ms.) of intervocalic geminate stops in SD and ND speech according to 6 different studies.

One of the findings of the present study (which had to some extent been pointed out by Pind (1995) before) is that variations in speech rate have a different effect on segments depending on i.e. their position within a syllable and, as suggested in Section 3.3.7 above, whether or not they are aspirated. Regarding geminates, we found that they were indeed slightly longer in SD than ND *at a normal speech rate* but this difference disappeared in more rapid speech. According to our findings, preaspiration is very sensitive to changes in speech rate. At a normal speech rate,

the duration of preaspiration was 92% of the duration of the following stop in SD and 95% in ND. At a faster speech rate this ratio decreased dramatically to 70% in SD and 74% in ND. Vowels are sensitive to variations in speech rate as well. As Pind (1995) pointed out, long vowels (i.e. vowels in open syllables) stretch out more than a following consonant as speech rate slows down. Short vowels, on the other hand, stretch out less than a following consonant under the same speech rate conditions. Long vowels in our study turned out to be slightly longer in ND than SD but the difference was reduced in faster speech. At a normal speech rate, the duration of short vowels was approximately 2/5 of the duration of long vowels, i.e. long vowels were more than twice the length of short vowels as Garnes (1976) concluded in her study. At a faster speech rate, the difference between long and short vowels was reduced and short vowels were approximately half the length of long vowels, as Indriðason et al. (1991) reported in their study.

It is evident from these examples that any comparisons of absolute durational values between and even within studies can be problematic. The present study is not excluded from this problem. Speech rates can differ vastly between different studies and even between different participants of the same study. For this reason it is necessary to exercise caution when making claims about dialectal differences in the data at hand. If a particular durational difference between ND and SD does not remain constant across different speech rates, we might consider that the observed difference is caused by individual differences in speech rate rather than being a dialectal feature. Testing speech at different speech rates can therefore be an important diagnostic tool.

Not all differences between studies can be explained away by assuming that different speech rates are the culprit. Another way to control for variation in the

data and to minimize the effect of outliers is to increase the sample size. Most of the previous studies on Icelandic phonetics have used a very small sample. In fact, the present study collected data from more than twice the amount of participants than any other study cited here, as well as recording multiple repetitions of each word from each individual speaker, resulting in a far larger number of tokens than any other study on Icelandic.

This is not to say that previous studies on the phonetics of Icelandic consonants have not revealed interesting things about the language. There is considerable value in descriptive data regarding the composition of syllables and words and such data can be used to inform a phonological analysis of the language. However, what has sometimes been lacking in previous work is to ask *why* certain differences arise in the data of a single study or between multiple studies. In some cases different results are simply indicative of a small sample size or other such problems with the design of a study. In other cases, as we have pointed out, different results are important indicators that there is nothing absolute about speech. Speech segments are dynamic and variable, and they respond differently to various changes in articulation.

3.5 Discussion and Final Remarks

This study was designed to examine the interaction between aspiration and oral articulations in two dialects of Icelandic, SD and ND. Aspiration is interesting because it is the main feature that sets these two dialects apart. One of the main questions asked in the beginning was regarding the status of loanwords in the language and what they tell us about differences in the phonology of the two

dialects. Unlike stop consonants in native vocabulary, which are aspirated in ND in intervocalic position but not in SD, stop consonants in loanwords are produced in the same manner in both dialects, i.e. without aspiration. What we set out to find was whether there is anything in the production of these consonants in SD that sets them apart from native stops and, thereby, supports the idea that these consonants have a different underlying form than stop consonants in native words. Alternatively, one might find it necessary to posit different underlying structures for each of the dialects. Our findings suggest that, even though there is no acoustic difference between native and non-native stop consonants in SD, their different phonological status is reflected in different vowel durations preceding the stop. We will argue in Chapter 5 that this is due to a difference between native and non-native stop consonants in Icelandic with respect to presence and absence of glottal activity. Despite not being audibly postaspirated, we argue that SD native stops are nevertheless produced with an accompanying glottal opening gesture that is completely masked by the oral constriction.

Another finding of this study is that aspirated segments, in particular, seem to be sensitive to changes in speech rate. In clusters of aspirated sonorant + stop, [s] + stop, and in preaspirated stops, the aspirated segment was disproportionately reduced in faster speech compared to other speech segments, and compared to coda consonants in unaspirated clusters. A different way to look at these results is to say that aspirated segments expand more in slower speech than other segments do. We hypothesized that this expansion was mostly driven by glottal movements and that the oral restriction is expanded as well to accommodate the larger glottal gesture. A possible reason for this expansion could be motor control issues. Perhaps it is more difficult to obtain a finer control of the glottis than the oral articulators, resulting in greater differences in the size of the gesture at varying speech rates.

One of the main differences between SD and ND is the treatment of clusters that, in their underlying form, consist of a sonorant followed by an aspirated stop. In ND these clusters have a tendency to be produced with a postaspirated stop while in SD the aspiration is realized on the sonorant. What we found is that so-called sonorant voicing is extremely variable in the ND speakers who have it in their speech in the first place. The frequency of sonorant voicing was sensitive to changes in speech rate and, at least in our sample, the gender of the speaker. A small effect of participant's age was also detected (younger speakers were less likely to voice their sonorants). These results will be discussed in more detail in Chapter 6 but they do suggest that sonorant voicing is slowly disappearing from the ND dialect and perhaps this change is happening faster in female speakers than male ones.

In terms of segment durations, we found more similarities between aspirated clusters with sonorant voicing and corresponding plain clusters, than between the two different outputs of aspirated clusters. We raised the question of whether it is VOT alone that distinguishes aspirated clusters from plain ones but found an additional effect of stop closure duration at a faster than normal speech rate, i.e. aspirated stops were found to be significantly longer at a faster speech rate than plain ones. This is contrary to what was found in intervocalic stops in ND, where aspirated stops had shorter closure durations at both speech rates than unaspirated (non-native) stops as well as being slightly shorter than corresponding (native, unaspirated) SD stops at the faster speech rate. We hypothesized that a longer stop closure in aspirated clusters might serve as an additional cue to distinguish aspirated clusters from plain ones. This was supported by the fact that no correlation was found between stop closure duration and VOT in these clusters.

Our data revealed no differences between SD and ND in the production of either preaspirated stops or geminate plain stops. However, certain differences were detected in the duration of preaspirated stops in the two environments they appear in, i.e. we found that the intervocalic preaspirates are preceded by a shorter vowel than the pre-sonorant ones and have a longer preaspiration period. This could possibly be an indication that the pre-sonorant preaspirates are produced with a tighter coordination of the glottal and oral gestures than the intervocalic ones are.

Finally, an investigation of word-initial aspirated stops found that they are more heavily aspirated in SD than ND, an effect that holds across both speech rates. Since the duration of the actual stop closure was comparable in both dialects, this suggests that there is a slight difference between dialects in how the glottal articulation is aligned with the oral closure.

In Section 3.3 we put forth several hypotheses that our investigation was intended to test. Note that some of our predictions were only partially borne out. For example, while we did find a significant difference in word-initial VOTs between SD and ND, indicating a general trend of dialectal differences in the alignment of glottal gestures to oral ones as per Hypothesis II, no such difference was found in the production of preaspirated stops. Furthermore, Hypothesis IV suggested that certain or all dialectal features of the minority dialect ND were more unstable than the features of SD but we only found that to be true in the case of sonorant voicing. Intervocalic postaspiration proved to be a consistent feature in the speech of all ND speakers, regardless of speech rate or other variables. A summary of our hypotheses and results is shown in Table 3.37.

	Hypothesis/Prediction	Results
✓	Intervocalic stop consonants are structurally different in SD native and borrowed vocabulary, respectively	Vowels are longer before SD stops in loanwords than native ones, possibly due to different glottal activity
✓	VOT differences between ND and SD are found in word-initial stops, due to different interarticulator timing	Word-initial VOT does differ significantly between ND and SD, although the difference is subtle
✗	Preaspiration differs in duration between ND and SD due to different interarticulator timing	Duration of preaspiration does not differ significantly between ND and SD
✓	Oral and glottal gestures are different from each other structurally	Aspiration reacts differently to changes in speech rate than oral segments
✓	Certain or all features of the minority dialect (ND) are unstable and slowly disappearing from the language.	Voiced sonorants were not produced reliably before aspirated stops by most ND speakers

Table 3.37: Hypotheses and results

CHAPTER 4
GESTURAL COORDINATION: EVIDENCE FROM SPEECH
ACQUISITION

4.1 Introduction

In this chapter we explore the phonological structure of aspirated segments in Icelandic from a diachronic standpoint as well discussing how acquisition data can inform our understanding of how these segments are internally coordinated. We will focus on preaspirated stops in particular since their phonological status is the subject of much controversy. We will argue that, phonologically speaking, there are two types of preaspirated stops in Icelandic: clusters of aspiration + stop, and true preaspirates, i.e. articulations where the preaspiration and the stop form a single phonological unit.

We will take inspiration from the framework of Articulatory Phonology (AP) (for discussion, see Browman and Goldstein 1986) in our construction of a theory of how aspiration is coordinated with oral articulations in Icelandic. This is not without reason. As we have already touched upon in previous chapters and as we will discuss in detail in the current chapter, aspiration in Icelandic is subject to a great deal of mobility. Stop consonants can be either pre- or postaspirated, and in the case of fricative/sonorant + stop clusters the aspiration seems to shift to a preceding segment altogether. These patterns can more or less be reduced to variation in voice onset/offset time, i.e. the timing of glottal opening with respect to the timing of oral constriction. While more standard frameworks of phonology have devised various ways of accounting for these kinds of patterns, e.g. by creating the concept of an autosegment that can spread or undergo fission, these kinds of

analyses are highly abstract and lack any reference to the phonetic reality of voice onset/offset time. By positing articulatory gestures as basic phonological units, i.e. by assuming the same type of input to both articulation and the abstract phonology, AP has the potential of unifying phonetic and phonological data in a way that standard theories of phonology do not. More specifically, AP provides us with the option of encoding gestural timing relationships into the phonology of a language. This is especially important when we consider the Icelandic data. We will argue in this chapter that aspiration always depends phonologically on the presence of a stop consonant, even though it is often produced in partial or complete asynchrony with that consonant. We will propose an analysis whereby the phonological affiliation of a glottal gesture is not determined by timing relationships alone, but is affected by distributional patterns. This allows us to consider the effects of diachronic sound changes on the synchronic phonology of the language.

A central theme of this chapter will be children's acquisition of aspirated consonants in Icelandic, preaspirated stops in particular, and what acquisitional data can tell us about the gestural coordination of these consonants. In particular we address the puzzle of why preaspirated stops are much more frequent in Icelandic than postaspirated stops, a fact that is not easily explained under standard approaches. We reject the often assumed notion that preaspirated stops, or any stops that are not postaspirated, incur violations of faithfulness constraints such as LINEARITY and are therefore a marked structure whose appearance needs a special explanation. On the contrary we agree with the idea put forth in Helgason (2002), which he bases on the distribution of aspirated stops in modern Nordic dialects, that preaspirated stops are actually preferred over postaspirated stops in these dialects and we provide articulatory evidence, based on acquisitional data, for why that is the case. Based on our findings regarding the gestural coordination

of aspiration we furthermore assert that out of the two Icelandic dialects ND is the innovative one, and we offer some suggestions from an articulatory standpoint for how it may have developed (the sociolinguistic aspect of these dialectal differences will be discussed in great detail in Chapter 6).

The chapter is organized as follows. In Section 4.2 we focus on preaspirated stops, their phonological status and their articulation, particularly as it relates to language acquisition. In Section 4.3 we discuss theories of gestural coordination and apply them to aspirated consonants in both dialects of Icelandic. Section 4.4 addresses the question of what a segment is and whether or not the concept of a segment is needed in phonological analyses of aspiration. Final remarks are found in Section 4.5.

4.2 Preaspirated Stops

The nature of Icelandic preaspirated stops is a much debated subject. The point of contention is whether it is more accurate to describe these stops as the mirror image of postaspirated stops, i.e. a single phonemic unit where glottal airflow precedes the oral occlusion—hence the term ‘preaspiration’—or as a sequence of [h] + oral stop. Preaspirated stops are found in two kinds of environments in Icelandic. First of all, they appear intervocally where the orthography indicates that, at least at some point, they used to be an aspirated geminate:

- | | | | |
|-----|--------------|------------------------|--------------|
| (1) | <i>mappa</i> | [mah.pa] | ‘folder’ |
| | <i>pakka</i> | [p ^h ah.ka] | ‘to pack’ |
| | <i>fatta</i> | [fah.ta] | ‘to realize’ |

The second environment where preaspirated stops are found in Icelandic is where a fortis stop is followed by a liquid or a nasal, [l], [n] or [m].¹

(2)	<i>epli</i>	[ɛ ^h pli]	‘apple’
	<i>batna</i>	[pa ^h tna]	‘get better’
	<i>sakna</i>	[sa ^h kna]	‘to miss’

While Haugen (1958) concluded that both pre- and postaspiration were components of fortis stops, later works such as that of Pétursson (1972) and Thráinsson (1978) argued that preaspiration should be viewed as a segment of its own, due to its long duration as well as its status within the syllable (as a coda consonant preceding an onset occupied by the oral stop itself). However, the accounts of Pétursson (1972) and Thráinsson (1978) differ in that the former views preaspirated stops as a sequence belonging to the underlying phonological structure (i.e. /h/ + stop) whereas the latter argues that they are phonologically derived, either from an underlying aspirated stop before a homorganic stop (an aspirated geminate) or a single aspirated stop which gets geminated by a phonological rule and consequently loses its place features to form a sequence of [h] + stop in the output (pat^hna > pat^{ht}na > pahtna).

This seems to have been the accepted view for a while, probably because of the supporting phonetic data on the segment-like duration of preaspiration, but more recently diverging views have emerged again. In her Optimality Theory account of syllable contact, Gouskova (2004) results to a single-segment view of Icelandic

¹Sequences of aspirated stop + [m] are only found in loanwords, such as *rytmi* [r^htmi] ‘rhythm’.

preaspirated stops to facilitate her analysis,² and assumes that preaspirated stops are allophones of underlying postaspirated stops (this can be deduced from her IPA transcriptions; she doesn't actually address the status of these consonants). The experiment of Kingston (1990) has already been discussed in some detail in Chapter 3. We mention it again here because Kingston's motivation for determining whether the abduction of the glottis in preaspirated stops is coordinated with the stop closure or the preceding vowel was his need to disprove his assumption that Icelandic preaspirated stops are the mirror image of postaspirated stops, i.e. that the aspiration and the oral closure are one entity. He concluded, admittedly by using some methodological acrobatics, that according to his results preaspiration of Icelandic stop consonants has no ties to the oral occlusion and should therefore, presumably, be viewed as a separate segment.

Recently, Hoole and Bombien (2010) have argued that preaspirated stops are in fact single phonetic entities that stand in complementary distribution with postaspirated stops: "we now have two series of stops [i.e. fortis and lenis] with a fairly free distribution if we accept an allophonic rule for place of aspiration. Previously, the aspirated stops were restricted to word-initial position, being here post-aspirated (Hoole and Bombien 2010:198)." They dismiss previous arguments that the duration of preaspiration is closer to that of an independent segment than it is to the duration of postaspiration, which some previous scholars have taken as proof that preaspiration can't simply be the reverse of postaspiration. In Hoole and Bombien's (2010) words "there may be psycho-acoustic reasons why aspiration

²Gouskova uses a relational hierarchy of markedness constraints on syllable contact to show that each language chooses a different threshold for an acceptable sonority rise across a syllable boundary. It is necessary for her analysis of Icelandic to assume that preaspirated stops are a single entity because she argues that a syllable boundary between an aspirated stop and a liquid or a nasal is fine in Icelandic while anything more sonorous than a liquid or a nasal cannot be heterosyllabic with a preceding aspirated stop. By viewing preaspirated stops as a single segment she can contrast forms such as [ɛ^hp.li] with forms like [a:k^hrar] where the two consonants cluster together as an onset, causing a compensatory lengthening of the preceding vowel.

linked to vowel offset needs to be longer for perceptual saliency than aspiration linked to vowel onset (Hoole and Bombien 2010:173).”

Helgason (2002) examined the reflexes of Old Norse stops in various modern Nordic dialects that developed from the medieval language. He found that in all the Nordic dialects that have normative, i.e. obligatory, preaspiration, the Old Norse word-medial geminates (examples given in (1) above) are reflected as preaspirated. These include, aside from Icelandic, Faroese, the Jæren and Gudbrandsdalen dialects in Norway, the Härjedalen and Gräsö dialects in Sweden, and the Kökar dialect in the Åland archipelago. Furthermore, Helgason reports on several Nordic dialects that have non-normative preaspiration of word-medial fortis geminates. Among these dialects is Central Standard Swedish where “word-medial fortis stops, particularly in VC: syllables, tend to be preaspirated in the speech of two of the subjects, and mostly unaspirated in the speech of the two remaining subjects (Helgason 2002:145).” Judging from Helgason’s data, preaspirating dialects seem to vary in whether the stop following the preaspiration period remains a geminate or is more similar in duration to a singleton, as is the case in Icelandic. Finally, Helgason gathered data on one Nordic dialect, the Western Åland dialect, where Old Norse aspirated geminates are realized as postaspirated geminates.

The general view in the literature is that Old Norse fortis stops were probably postaspirated. Helgason (2002) raises the question of why postaspirated stops are so rare and preaspirated stops so common in the modern Nordic languages if aspiration only manifested itself as postaspiration in Old Norse. He concludes from his research of the Nordic dialects and the geographical spread of certain articulations, that word-medial fortis stops, both singleton and geminate, were most likely non-normatively *preaspirated* in Old Norse contrary to common belief.

Determining the exact phonetic nature of Old Norse fortis stops is beyond the scope of this dissertation but what is important for our purposes is to point out that, given their reflexes in the modern languages as discussed thoroughly in Helgason (2002), Old Norse *pp*, *tt*, *kk* were almost certainly geminates and almost certainly aspirated, however that aspiration was realized. The phonological representation of these stops (which are now preaspirated) in Modern Icelandic is a separate question which we will propose an answer for later in this chapter.

Shifting our attention to the preaspirated stops shown in (2) above, i.e. stops that immediately precede a nasal or a lateral consonant, one of the things that differentiate these types of preaspirated stops from the intervocalic ones in (1) is that these are commonly found in alternation with unaspirated fortis stops or postaspirated stops (depending on the dialect; the transcriptions given in (3) are based on SD pronunciation) within a single paradigm (3-a), (3-b), or between etymologically related word forms (3-c). There is therefore some motivation for considering preaspirated stops and unaspirated/postaspirated stops in Icelandic as allophones of a single phoneme.

(3)	a.	<i>ketill</i>	[cɛ:titl̥]	‘kettle NOM.SG.’
		<i>katli</i>	[k ^h a ^h tli]	‘kettle, DAT.SG’
	b.	<i>rjúpa</i>	[rju:pa]	‘ptarmigan, NOM.SG.’
		<i>rjúpna</i>	[rju ^h pna]	‘ptarmigan, GEN.PL.’
	c.	<i>veikur</i>	[vei:kʏr]	‘weak ‘ADJ’
		<i>veikla</i>	[vei ^h kla]	‘to weaken, VERB’

Phonetically speaking, there is no doubt that preaspirated stop consonants are produced with glottal abduction starting and concluding before the onset of oral

closure. Löfqvist and Yoshioka (1981a,b) noted that this glottal gesture was quite large but smaller than the glottal gesture they observed in postaspirated stops, while Pétursson (1972) and Hoole and Bombien (2010) found them to be quite comparable in size. We also know from various studies, including the present one presented in Chapter 3, that preaspiration is indeed considerably longer in duration than postaspiration and quite comparable in duration to other consonants. However, even though phonetic descriptions can often be useful in informing phonological accounts, we should be wary of placing too much importance on them. Helgason (2002) questions arguments, put forward by Thráinsson (1978) among others, claiming that preaspiration cannot be the reverse of postaspiration due to its duration. He writes:

Consequently, Thráinsson opposes the view that preaspiration is a “component” or a “phonetic feature” of the stop that follows. However, the question itself is imprecise. Are we asking whether preaspiration is an exact phonetic mirror image of postaspiration? Or whether preaspiration and postaspiration are phonological correspondences? Or both? (Helgason 2002:15)

This is a very important distinction to make. When we express doubt that such a thing as a ‘preaspirated’ stop exists, are we simply claiming that the exact phonetic reverse of a postaspirated stop does not exist or are we claiming that preaspiration cannot be phonologically linked to a following stop because it sounds too much like a segment in the phonetic output? Helgason (2002) has this to say on the latter issue:

Let us consider the phonological aspects. As to whether preaspirations are components or features of the following stop, this is only relevant if we have a strictly segmental view of phonology. In a less segmental view, the question of whether or not preaspiration “belongs to” the stop is less of an issue. [...] As a matter of definition preaspiration *is* postaspiration reversed (Helgason 2002:15-16).

What Helgason means by his last point is that if we abandon all notions of a segment, then preaspiration is simply a period of aspiration preceding a stop whereas postaspiration is a period of aspiration following a stop, i.e. the two kinds of aspiration are mirror images of each other. We have reviewed ample evidence that shows us that ‘aspiration’, whether it occurs before, during or after the articulation of a stop, is simply an independent movement of the glottis that is timed in various ways with respect to the oral constriction. The fact that the appearance of pre- or postaspiration in Icelandic is contingent on there being an adjacent stop consonant in the output effectively means that these two articulations are phonologically linked in some way. If we let go of notions of ‘segmenthood’ then preaspiration is simply a concomitant laryngeal movement of a voiceless stop that is timed in such a way that it precedes the stop closure.

Leaving intervocalic preaspirated stops aside for the time being, we can now state, as was hinted at by Hoole and Bombien (2010), that the various types of aspirated stops found in Icelandic are all variations of the same phoneme /P^h/ and stand in complementary distribution. In SD, postaspirated stops are only found in word-initial position, preaspirated stops appear in coda, and acoustically unaspirated stops surface elsewhere (4). In ND, preaspirated stops appear in coda and postaspirated stops surface elsewhere (5).

(4)	a.	<i>tala</i>	/t ^h ala/	[t ^h aː.la]	‘to speak’
	b.	<i>fitna</i>	/fit ^h na/	[fi ^h t.na]	‘to get fat’
	c.	<i>mata</i>	/mat ^h a/	[maː.t _[sg] a]	‘to feed’
	d.	<i>setja</i>	/set ^h ja/	[sɛː.t _[sg] ja]	‘to put’

(5)	a.	<i>tala</i>	/t ^h ala/	[t ^h aːla]	‘to speak’
	b.	<i>fitna</i>	/fit ^h na/	[fi ^h t.na]	‘to get fat’
	c.	<i>mata</i>	/mat ^h a/	[maːt ^h a]	‘to feed’
	d.	<i>setja</i>	/sɛt ^h ja/	[sɛːt ^h ja]	‘to put’

Several questions remain to be answered: where does this distribution stem from, why is it different between the two dialects, and where do our notions of segmenthood and moraicity fall into this picture? Furthermore, we have yet to address the issue of intervocalic preaspirated stops as well as sequences of sonorant + aspirated stop. These problems will be the subject of the following sections.

4.3 Gestural Coordination of Aspiration

Tilsen (2014) presents a theory about the nature of gestural coordination. In his view, there are two distinct cognitive mechanisms involved in the control of speech articulation, selection and coordination, the interaction of which results in two kinds of control regimes, competitive selection and co-selection. Here, selection is the choice of which gestures to articulate and in which order, and coordination “involves finer control over when movements are initiated relative to one another (Tilsen 2014:25)”.

This idea comes from general motor theory where competitively selected gestures are performed sequentially whereas co-selected ones are performed in synchrony or in a highly overlapping manner. Tilsen gives the example of piano playing, where notes, that are selected in parallel, can either be played one by one, i.e. competitively, or in a chord, i.e. with precisely controlled relative timing. To

extend the analogy to speech articulations, the production of a single consonant involves the co-selection of all the gestures involved in articulating that consonant whereas two consonants in a sequence are often competitively selected with respect to each other (excluding onset clusters which tend to be more tightly coordinated).

As to our notions of a segment, Tilsen has this to say:

Selection-coordination theory invites us to reconceptualize the theoretical construct of the “segment”. Instead of corresponding to a distinct level of motor organization, segments are viewed as instantiations of a more general type of motor unit, a *co-selection set*. Other sorts of units such as moras and syllables are likewise viewed as co-selection sets (Tilsen 2014:41-42).

In Tilsen’s view, speech segments, i.e. co-selection sets, differ from each other in various respects, including the degree of phase asynchrony between the component gestures, i.e. the gestures that make up that particular segment, and the point at which these component gestures become a co-selected set during speech acquisition. The latter point has to do with children’s development of motor control, where competitive control precedes coordinative control and the coordination of highly overlapping gestures is more easily acquired than one that requires more nuanced control and asynchrony. Thus, segments such as simple vowels, plain stops, nasals, and glides, which involve highly synchronous coordinated gestures, are acquired early and are frequently observed in babbling, whereas segments involving more complicated control, i.e. more asynchronous gestures, are acquired later. As examples of this group of segments, Tilsen mentions affricates, ejectives, and implosives. For all of these segments, the asynchrony of gestures serves some perceptual purpose, i.e. some aerodynamic or acoustic effects cannot be achieved if the gestures overlap too much. Despite this asynchrony, “adults do not appear to produce errors in which the component gestures of affricates are split, which

suggests that these gestures are co-selected (Tilsen 2014:45)”.

Tilsen (2014) does not mention aspirated stops specifically (although he does refer to consonants with secondary articulations as probably belonging to the second group of segments discussed above) but we hypothesize that both pre- and postaspirated stops in Icelandic belong to the group of asynchronized co-selection sets. In other words, both of these stop types are *units* in the sense that their gestures are co-selected, albeit with considerable asynchrony.

4.3.1 Gestural coordination and acquisition

We have suggested that preaspirated, postaspirated, and plain (aspirated) stops all belong to the same phoneme in Icelandic. However, the story doesn't end here. As we mentioned above, Tilsen (2014) argues that the relative complexity of different co-selection sets, i.e. segments, may be reflected in the order in which they are acquired by children. Under this view, we expect plain (aspirated) stops to be acquired sooner than postaspirated stops, which require a finer control of the asynchronous laryngeal and oral gestures. This prediction is indeed borne out in Icelandic, where plain stops are frequently substituted for postaspirated ones in the speech of young children. Másdóttir (2008) reported that this happened roughly half the time in the speech of 28 month old children whereas 40 month old children in her study seemed to have more or less mastered control of postaspiration.

When it comes to the acquisition of preaspirated stops, however, the pattern seems to fall apart. According to Másdóttir's (2008) data, 28 month old children were successful in producing preaspirated stops 84% of the time, a much higher percentage than observed for postaspirated stops. Not only are young Icelandic

children good at articulating preaspirated stops in appropriate environments, they also have a high tendency for substituting preaspirated stops for any clusters of aspirated consonants and stops, such as [st], [p], [rk], etc. In fact, insofar as we can view preaspirated stops as clusters, i.e. a sequence of two speech articulations that are not vowels, they are by far the earliest acquired clusters in Icelandic.

According to Tilsen’s (2014) theory, we might expect word-internal consonant clusters, i.e. sequences of competitively selected consonants, to be acquired earlier than highly nuanced co-selection sets, such as stop consonants produced with asynchronous laryngeal coarticulations. After all, we are told that competitive selection precedes co-selection in motor control development. However, it is necessary to consider what types of consonants make up the consonant clusters in question. Tilsen informs us that what he informally refers to as Class B segments, i.e. fricatives, liquids, and vowels with a secondary feature, are acquired after the babbling stage despite being composed of highly synchronized gestures. He suggests that this “may be attributable to the incorporation of a greater number of oral gestures or finer control requirements on individual effectors (Tilsen 2014:45)”. He places the development of these segments around the same time as that of the aforementioned Class C segments, with which we have chosen to group both pre- and postaspirated stops.

The majority of heterosyllabic consonant clusters in Icelandic consist of a Class B segment (or a Class C segment depending on how we categorize aspirated liquids, nasals and rhotics) followed by a stop. Other types of heterosyllabic clusters include a nasal + stop or [s], an unaspirated stop + liquid or nasal, and a preaspirated stop + liquid or nasal. Data on the acquisition of any unaspirated nasals in the speech of Icelandic children seems to be scant, let alone clusters of nasals and

stops. However, Kristinsson (2014) looked at the speech of a single 38 month old child who replaced the cluster [lt] with [nt] in the word *halda*. Gíslason et al. (1986) reported that 10% of the 4 year old children in their study showed the same substitution. A couple of studies have reported on clusters of stop + liquid. Gíslason et al. (1986) showed that 92% of 4 year old children in their study were able to produce [tl] and 79% produced [kl] (compared to 94% who produced [hk]). In Másdóttir's (2008) study, 75% of 28 month old children were able to pronounce [pl]/[tl]/[kl], a number that rose to 89% at the age of 40 months. We were unable to find any acquisition data on clusters of preaspirated stop + liquid or nasal but an informal inquiry into the acquisition of 5 Icelandic children of 2 linguistically trained mothers³ revealed that these children had shown a tendency to produce [hpn] and [hkn] clusters in the words *opna* 'to open' and *vakna* 'to wake up' as [hn] or [ht], and the cluster [hpl] in the word *epli* 'apple' as [hp].

What these data suggest is that the relative ease with which children acquire word-medial consonant clusters in Icelandic unsurprisingly depends on the complexity of each of the consonants contained in that cluster. Clusters that consist of segments that are acquired early are also acquired early. Children's strategies for producing clusters that have sounds they have difficulty with vary depending on the position of the cluster. In word-initial position it is common for them to drop one of the segments (Kristinsson 2014 gives the interesting example of his subject's production of the word *flauta* 'flute' which adult speakers of Icelandic pronounce as [fløy:ta]; at age 38 months the subject produces [løy:ta], at 43 months of age the aspiration of the fricative is thrown into the mix, the outcome being [løy:ta]). In word-medial position it is much more common for the Icelandic children to sub-

³The mothers were contacted through a personal message on 2/2/2015 and asked to give their judgements on how their children pronounce/used to pronounce words that contain clusters of preaspirated stop + [l] or [n]. One mother has 4 children, ages ranging from 3 to 10 years at the time of inquiry; the other one has one child aged 17 months at the time of inquiry.

stitute a ‘simpler’ consonant for the one they have trouble with. This can likely be viewed as a strategy to preserve the syllabic structure of a word, or in Tilsen’s (2014) terms, the number of selection events in a word. Onset clusters are viewed as having a {CCV} type structure, i.e. dropping a consonant will not reduce the number of selection events since both consonants belong to the same one. Heterosyllabic clusters, on the other hand, are competitively selected and therefore have a {V}{C}{C} structure, where each consonant is its own selection event.

As we mentioned earlier, substituting preaspiration for an aspirated consonant, [ŋ̥], [l̥], [r̥], [x], [s], [f], in heterosyllabic clusters where these consonants are followed by a stop, is by far the most common strategy employed by Icelandic children before they have mastered the articulation of these clusters. The question we want to answer is this: do the children treat these sequences of [h] and stop as a cluster, i.e. a competitively selected sequence of two co-selection sets, or are they simply omitting the first consonant altogether and treating the stop as preaspirated, i.e. one co-selection unit? In other words: are they producing {C}{C} or {C}? It may seem obvious, given the children’s tendency for substitution, i.e. structure preservation, in other kinds of heterosyllabic clusters, to conclude that these early acquisition preaspirated stops are simply competitively selected clusters, where the child is reducing the first consonant to mere aspiration. However, the issue is not necessarily that simple. For one thing, it is not quite clear what structure we should assign to some of these aspirated consonants in Icelandic, specifically the velar fricative, nasal, lateral and rhotic. As we went over in Chapter 2, the distribution of these sounds is limited to coda position before a phonemically aspirated stop, see (6).

(6) Aspirated clusters in SD

a.	<i>vanta</i>	[vaŋ.ta]	‘to lack’
b.	<i>maðkur</i>	[maθ.kʏr]	‘maggot’
c.	<i>vakta</i>	[vax.ta]	‘to watch over’
d.	<i>úlpa</i>	[ul.pa]	‘parka’
e.	<i>varpa</i>	[var.pa]	‘to throw’

As we discussed thoroughly in Chapter 3, dialectal variation is found in the treatment of these clusters in Icelandic. For some speakers of ND (some of the time at least), the nasal, lateral and/or dental fricative remains unaspirated before an aspirated stop which, in turn, is produced with postaspiration. This is never the case with the rhotic nor the velar fricative which are always aspirated in both dialects. Some ND examples are given in (7).

(7) Aspirated clusters in ND

a.	<i>vanta</i>	[van.t ^h a]	‘to lack’
b.	<i>maðkur</i>	[mað.k ^h ʏr]	‘maggot’
c.	<i>vakta</i>	[vax.ta]	‘to watch over’
d.	<i>úlpa</i>	[ul.p ^h a]	‘parka’
e.	<i>varpa</i>	[var.pa]	‘to throw’

The limited distribution of these aspirated segments and the trade-off relationship observed between the two dialects which each allow aspiration on only one of the consonants suggests that the aspiration is shared in some sense.⁴ Phonet-

⁴This is also supported by Helgason’s (2002) data from other Nordic dialects. He found that all dialects that have aspirated sonorants preceding a stop also have normatively preaspirated stops.

ically speaking we know this to be true. When looking at laryngeal activity in obstruent clusters in Icelandic, Löfqvist and Yoshioka (1981b) found that clusters of fricative and plain stop as well as clusters of two fricatives have only one glottal opening gesture. Hoole and Bombien (2010) reported the same finding for clusters of aspirated sonorants followed by a stop. This has also been noted several times in the phonological literature. While Thráinsson (1978) and others have taken an autosegmental approach to this problem, i.e. assuming a transfer of the feature [spread glottis] from the stop to the preceding sonorant or fricative, others, including Hoole and Bombien (2010), have suggested that the stop is preaspirated in this environment and that the aspiration on the preceding consonant results from coarticulation with the preaspirated portion of the stop.

From a phonological standpoint Hoole and Bombien’s (2010) approach is appealing. Rather than explaining why aspiration would transfer from a stop consonant to a preceding consonant, we can simply refer to allophonic variation in the distribution of the stops. In SD, then, we have the following distribution of aspirated stops:

- (8) Postaspirated stops: word-initial position.

<i>tölva</i>	/t ^h œlva/	[t ^h œl.va]	‘computer’
--------------	-----------------------	------------------------	------------

- (9) Acoustically unaspirated stops: onset position of unstressed syllables, following a long vowel.

a.	<i>fata</i>	/fat ^h a/	[fa:t _[sg] a]	‘bucket’
b.	<i>sníkja</i>	/snik ^h ja/	[stni:k _[sg] ja]	‘to mooch’

(10) Preaspirated stops: elsewhere, i.e. syllable codas and syllable onsets following a consonant (where the preaspiration is coarticulated with the preceding consonant).

- | | | | | |
|----|--------------|-----------------------|-------------------------------------|-----------|
| a. | <i>epli</i> | /ɛp ^h li/ | [ɛ ^h p.li] | ‘apple’ |
| b. | <i>vanta</i> | /vant ^h a/ | [van. ^h ta] ⁵ | ‘to lack’ |

An obvious question to ask at this point is: what motivates this distribution? What distinguishes words like [van̥.ta] in (10-b), where we hypothesize that the aspiration on the nasal is actually due to the following stop being preaspirated, from words like [fa:t_[sg]a] in (9-a)? In both words, the stop forms a simplex onset to the unstressed syllable, yet it has only become preaspirated in the post-consonantal environment. Since the stop occupies the same syllable position in both cases we cannot appeal to syllable structure to solve this problem. Looking at both examples in (9) one might be tempted to attribute the lack of audible aspiration to the long vowel that precedes the stop in both cases. It is not entirely clear, though, why a long vowel would block preaspiration, especially since the vowel duration is not phonemic.

We suggest that the premise of the question is wrong. Instead of asking why the stops in (9) have not become preaspirated like other word-internal stops in Icelandic, we should be asking why they have *stopped* being preaspirated. As we mentioned briefly above, Helgason (2002) concluded from his Nordic dialect data that Old Norse fortis stops probably had a tendency to be non-normatively preaspirated. He finds support for this in the surprisingly vast distribution of optionally preaspirated stops in modern Nordic dialects. Postaspirated stops, on

⁵The unconventional transcription of [van̥.ta] here is just to drive home the point that the aspiration on the nasal is due to coarticulation with the preaspirated stop. We will henceforth revert back to the more traditional way of transcribing these sounds.

the other hand, are rarely found word-internally, the Northern dialect of Icelandic being a notable exception.

It is interesting in this context to look at the distribution of aspiration in other languages that are reported to have preaspirated stops. Silverman (2003) gives a comprehensive account of these languages, including Tarascan, Scottish Gaelic, and Mazatec, which all have postaspirated stops in addition to the preaspirated ones but only in word-initial position, and Eastern Ojibwa, Goajiro, Chamicuro, and Hopi, which lack postaspirated stops altogether. Nance and Stuart-Smith (2013) list a few preaspiration languages not mentioned by Silverman (2003), including Irish and several dialects of English, none of which have word-internal postaspirated stops, and a couple of dialects of Italian, where no postaspirated stops are found. What these data indicate is that, whereas preaspirated stops may be relatively rare in the world's languages compared to postaspirated stops, they seem to be universally *preferred* over postaspirated stops in the languages where they do arise. This is further substantiation that the word-internal postaspirated stops of the Northern Dialect of Icelandic are an anomaly (and almost certainly an innovation) that needs to be explained. We will return to that discussion in Section 4.3.2.

Let us assume that, at some point, all aspirated stops in Icelandic (excluding word-initial position) had a tendency to be produced with some degree of preaspiration. Eventually this non-normative preaspiration became normative in the environments in (10) but failed to do so in the environments in (9). Instead, the stops in the latter environment came to be produced in such a way that the laryngeal gesture is completely synchronized with the oral articulation, which we argue is the optimal way of producing an aspirated consonant in the sense that it requires the least amount of effort and is the most easily learned co-selection pat-

tern. We argue that this did not happen in the environments where we now have obligatory preaspiration due to systemic pressure. The consequence of synchronizing aspiration with complete oral closure is that the aspirated stop is not easily distinguished from a stop that lacks a glottal opening altogether (an non-passive one at least). This doesn't matter in environments where the language doesn't have any lenis stops, such as in unstressed onset position following a long vowel. In those environments we expect the system to settle on an unmarked articulation of the underlying sound, which we argue is, due to articulatory reasons, the aforementioned synchronized pattern. The positions where we find preaspirated stops in Icelandic, on the other hand, are ones where the aspirated stops contrast with lenis stops in the output, as shown in (11) and (12).

- | | | | | |
|------|----|---------------|-------------------------|------------------|
| (11) | a. | <i>epla</i> | [ε^h p.la] | ‘apple, GEN.PL.’ |
| | b. | <i>efla</i> | [ε p.la] | ‘to strengthen’ |
| (12) | a. | <i>lampa</i> | [lam̥.pa] | ‘lamp, GEN.PL.’ |
| | b. | <i>lambda</i> | [lam.pa] | ‘lamb, GEN.PL.’ |

As indicated by the orthography of the example in (11-b), the obstruent was probably a fricative at some point, not a stop. It is quite likely that preaspiration of the aspirated stop in (11-a) did not become normative until the sound change that hardened fricatives to stops before [l] and [n] had taken place, an event that started around the 14th century and had become systematic by the 16th century (Thórólfsson 1925). The lenis stop in (12-b), however, is assumed to have been produced as a stop in Old Norse, as Helgason (2002) discusses in his work:

[...] sources indicate that only one stop series occurred in V(:)C

syllables, and thus there was not a contrast between two stop series for phonologically short stops. These stops were written as *p*, *t*, *k* [...]. The graphemes *ð* and *g* are both found in V(:)C syllables, but are thought to have indicated voiced fricatives rather than stops. [...] A graphemic distinction was also made between two types of nasal + stop clusters (e.g. *-mp-* vs. *-mb-*; *-nt-* vs. *-nd-*; *-nk-* vs. *-ng-*), which is thought to have reflected a stop contrast (i.e. *b*, *d*, *g* were not produced as voiced fricatives). However, comparative evidence suggests that similar distinctions in graphemic clusters of liquid + stop (e.g. *-rk-* vs. *-rg-*; *-lk-* vs. *-lg-*) are less likely to have represented stop contrast, and *-d-* and *-g-* were probably produced as voiced fricatives. Still, *lt* vs. *ld* probably constituted an exception involving a genuine stop contrast, at least in P[roto] N[orse] (Helgason 2002:215-216).

Based on what we know about stop contrasts at earlier stages in the language, it is thus quite possible that (at least some) post-sonorant stops became normatively preaspirated in Old Norse before they did in other word-internal positions.

It seems likely that *lt* as well as *r + p*, *t*, *k* sequences were normatively voiceless in much of Scandinavia already in the P[roto] N[orse] period. This can be inferred from the geographical distribution of voiceless variants in such sequences in the Nordic dialects [...]. Normatively voiceless nasals are far less common. In fact, they only occur in dialects that also have normatively preaspirated stops. In this sense, preaspiration is linked more intimately with nasal voicelessness than with voicelessness in laterals and *r*-sounds. However, note that some dialects have preaspirated stops but no voiceless nasals (Helgason 2002:227-228).

To summarize, we assume that all fortis stops had a tendency to be preaspirated in Old Norse. This non-normative preaspiration then became normative in Icelandic in contexts where there was structural pressure for the aspiration of the stop to be perceptually recoverable. In other positions, the laryngeal movements settled into a completely synchronized relationship with the oral stop closure.

4.3.2 The ND pattern

A question that remains to be answered is how did we get from a pattern of non-normative *preaspiration* to that of normative *postaspiration* in the Icelandic ND? While this may seem like an unlikely course of events it is not unprecedented. An example from the literature on historical linguistics is given in Vaux (1998) who writes that Pali is known for displaying voiceless aspirated (geminate) stops in contexts where Sanskrit exhibited unaspirated stops preceded by /s/ (e.g. *hásta-* > *hatt^ha-*). Vaux hypothesizes that the *postaspiration* in the Pali form originates in the [spread glottis] feature of the fricative, which clearly involves some temporal reorganization of the laryngeal gesture with respect to the oral constriction.

A more recent example comes from the Andalusian dialect of Spanish, where considerable within subject variation has been found in the production of /s/ + stop clusters, most notably /st/, which varies from the faithful form [st] to a form with total loss of /s/ and with *postaspiration* on the stop [t^h], other possible variants including [ʰt] and even [ʰt^h] (cf. Horn 2013, Parrell 2011, Torreira 2007). Parrell (2011) reported that there is “a switch from productions with *preaspiration* and short VOT to those with long VOT as rate increases. Additionally, there is a trade-off between VOT and pre-closure aspiration, indicating that they may result from the same gesture (Parrell 2011:37).” He hypothesizes that the *postaspirated* stop is a more stable form of articulation than the *preaspirated* one, predicting that once a speaker has established the organization of the former (which he views as simultaneous to the oral closure), they will not revert back to the more unstable gestural organization involved in producing a *preaspirated* stop. In other words, he views the Andalusian Spanish data as an ongoing sound change whereby stops are becoming *postaspirated* following an intermediate stage of *preaspiration*.

Moya Corral (2007) looked at the sociolinguistic causes of the aforementioned on-going Andalusian Spanish sound change and concluded that, at least in the Seville area, it is being proliferated by prestige, with factors such as higher education levels being correlated with the emerging pronunciation of a postaspirated stop. This is in fact what we would argue is the most likely explanation for the emergence of postaspirated stops in the Icelandic Northern Dialect: *prestige*. As we will review in Chapter 6, Iceland has a long history of prescriptivist-type arguments regarding the proper way the language should be spoken. The proponents of such discussions in the 19th and early 20th centuries typically pointed to orthography as the golden standard for proper articulation. With Iceland's long history of literacy (with earliest manuscripts dating back to the 12th century) it is not at all inconceivable that a desire to sound more prestigious could have driven a group of speakers to modify their speech in accordance to orthographic convention. There is certainly evidence to suggest that hard speech, i.e. the postaspiration of post-vocalic stop consonants in unstressed onsets, is being retained better as a dialectal variant in Icelandic than sonorant voicing, i.e. the production of a voiced sonorant or fricative before a postaspirated stop, due to the perceived prestige of the former speech pattern. In other words, if it is possible for an articulation to be *retained* due to prestige, it might be just as likely that such an articulation could *emerge* for the same reason.

Perhaps the most famous example of prestige-driven sound change comes from Labov (1966), who showed that employees at a high-end department store in New York City were more likely to produce a post-vocalic [r] in the words *fourth* and *floor* than their colleagues at lower-end stores, the implication being that the arguably clearer pronunciation was considered more prestigious. Labov also found that, most notably in the speech of the lower-end store employees, [r] was produced

more frequently in careful speech than in spontaneous speech. Labov suggested that this was due to these speakers being less confident in their production of [r] in the appropriate contexts. This is an interesting observation in light of our results in Chapter 3 which showed that the rate of sonorant voicing in ND speech is lower at a faster speech rate than at a normal speech rate. This may indicate that the sonorant voicing pattern is becoming less internalized in, at least, some ND speakers.

4.3.3 Two types of preaspiration

An interesting observation from the Andalusian Spanish data discussed above, where [st] has in some cases become [t^h], is that a glottal gesture, originally belonging to the fricative, has in some sense become a part of the articulation of the following stop consonant. This ties into our discussion of how exactly we should view Icelandic preaspiration, i.e. as an independently selected entity or as a gesture co-selected with the oral articulation.

As we discussed earlier, one potential problem with viewing preaspiration as, in some sense, the mirror image of postaspiration is the time frame in which these articulations are acquired by children. We pointed out that preaspirated stops emerge earlier than postaspirated ones, in fact various clusters of aspirated consonants followed by stops are generalized as preaspirated stops by Icelandic children. This could point to the children treating a sequence of [h] and a stop as just that, a sequence of two competitively selected gestures. On the other hand, we gathered impressionistic data suggesting that children tend to forego the oral closure in clusters which are articulated as a preaspirated stop + [n] in adult speech, i.e. pronounce [vahna] instead of [va^hkna]. This could be interpreted as them reducing

the stop to merely the glottal opening, in other words assuming that the aspiration and the stop belong together.

We argue that both of these explanations have some merit. First of all, it is absolutely clear that from a phonological standpoint preaspiration in Icelandic is dependent on the following stop. By that we simply mean that preaspiration can only be present if there is a stop closure present. It is also clear that word-internal sonorants and fricatives are only aspirated in the vicinity of a fortis stop so we can assume that the glottal opening during the production of those consonants is also dependent on the following stop. Given these phonological dependencies it seems most logical, as we suggested above, to view preaspirated stops as allophones of a phonemically aspirated stop. One problem with that analysis remains to be discussed however. So far, we have focused on preaspirated stops in consonant clusters but preaspirated stops also appear intervocalically (14). The only thing that sets these preaspirated stops apart from intervocalic stops without audible aspiration (or with postaspiration in the case of ND) (13) is the duration of the preceding vowel.

(13) Intervocalic singleton stops

a.	<i>fata</i>	/fat ^h a/	[fa:ta]	‘bucket’
b.	<i>sekur</i>	/se ^h kʏr/	[se:kʏr]	‘guilty’
c.	<i>lopa</i>	/lɔp ^h a/	[lɔ:pa]	‘lopi yarn, OBL.SG.’

(14) Intervocalic preaspirated stops

a.	<i>fatta</i>	/fa [?] a/	[fah.ta]	‘to realize’
b.	<i>sekkur</i>	/se [?] ʏr/	[seh.kʏr]	‘sack’

c. *loppa* /lɔʔa/ [lɔh.pa] ‘paw’

As we went over in Chapter 2, vowel duration is predictable (and thus not phonemic) in Icelandic; vowels are long in open syllables and short in closed syllables. Since all vowels in (14) are short, it follows that the stressed syllable must be closed by the preaspiration (unstressed syllables must have onsets in Icelandic so the stop closure itself must belong to the following syllable). The preaspiration in these forms must thus have some kind of independent existence which poses a problem for traditional phonological theories because, as an independent moraic segment, the aspiration must correspond to something in the underlying structure and not simply belong to the following stop.

A common way to solve this problem has been to appeal to orthographic and historical evidence and posit a geminate fortis stop in the input of these forms (see e.g. Thráinsson 1978). It is quite likely that these stops were in fact geminates at some stage of the language. As reported in Helgason (2002), the Western Åland dialect of Swedish still has (post)aspirated geminates in these forms and many of the dialects examined in his study seem to have preaspirated geminates to the best of our understanding. The oldest linguistic description of the Old Norse spoken in medieval Iceland, referred to as the *First Grammatical Treatise*⁶ (published in its entirety with commentary in Benediktsson 1972), is thought to date back to the 12th century. Unfortunately for our purposes the (unknown) author does not address the issue of aspiration in consonants. He does, however, use minimal pairs to demonstrate the difference between single and double consonants—which he prefers to denote using a single capital letter to save space—describing them thus

⁶The name is not meant to imply that it was the first treatise of its kind ever written, but rather that it is the first in a series of four grammatical treatises preserved in the vellum manuscript Codex Wormianus (Benediktsson 1972).

(in Benediktsson’s translation):

f, l, m, n, r, s [he extends this discussion to stop consonants later on in the text]. These letters can each have the sound of two consonants, if one wants to sound (the letter) that much—as each of them (may do) that is placed after the vowel—as is witnessed (by the fact) that we name them with such a long sound as we should (do), if their names were to be written like this: *eff, ell, emm, enn, err, ess* (Benediktsson 1972:231).

The minimal pairs he gives for long and short stop consonants are the following:

- (15) u be ~ uBe
sęcr ~ sęKr
hędo ~ hęDo
þagat ~ þaGat
crapa ~ craPa
scéot ~ scéoT

Given these evidence it seems fairly likely that Old Norse did indeed have geminate stops where Icelandic now has preaspirated stops in intervocalic position. We can therefore assert that the intervocalic preaspirated stops developed from geminate stops at some point. However, this historical development doesn’t necessarily tell us anything about the *current* underlying representation of these stops. If we are to accept that Icelandic children acquire preaspirated stops in intervocalic position as surface representations of an underlying geminate, then they have to have access to some evidence to base that underlying representation on. Unlike the pre-liquid and pre-nasal preaspirated stops, which frequently alternate with unaspirated stops as shown in (3) above, intervocalic preaspiration usually appears within a single

morpheme and doesn't alternate with anything. This is for instance true of all the examples given in (14) above. The only exceptions to this are (i) neuter adjectives that end in [ht] when the neuter ending *-t* is suffixed to a root ending in *t*- (16), and (ii) one class of weak verbs that have [ht] in the preterite tense when a root ending in *-t* meets the preterite suffix for that class, *-t*- (17).

- | | | | | |
|------|----|--------------|---------|------------------------|
| (16) | a. | <i>feit</i> | [feirt] | ‘fat, NOM.SG.F.’ |
| | b. | <i>feitt</i> | [feiht] | ‘fat, NOM.SG.N.’ |
| (17) | a. | <i>ýta</i> | [irta] | ‘to push, INF.’ |
| | b. | <i>ýtti</i> | [ihtɪ] | ‘to push, 3P.SG.PRET.’ |

Both of these scenarios only extend to *t*; *k* and *p* never alternate between preaspirated and unaspirated forms in prevocalic or word-final position. We could perhaps surmise that, based on word forms such as the ones in (16) and (17), children learn that prevocalic and word-final preaspirated dental stops are really geminates in underlying structure and then extend that pattern to other stop consonants (and other forms) that do not alternate. However, it is far more likely given the extremely restricted context that these alternations take place in that they are morphologically conditioned and not induced by a synchronic phonological process.

We therefore assume that, while realizing that these types of preaspirated stops in Icelandic originated as geminates, at this point their underlying structure is simply /hp/, /ht/ and /hk/, respectively. The forms given in (14) above are repeated in (18) with the underlying structure proposed here.

(18) Intervocalic preaspirated stops

a.	<i>fatta</i>	/fahta/	[fah.ta]	‘to realize’
b.	<i>sekkur</i>	/sehkyr/	[seh.kyr]	‘sack’
c.	<i>loppa</i>	/lɔhpa/	[lɔh.pa]	‘paw’

Note that even though we assume the preaspiration to be underlying in these forms, we still acknowledge that its presence is dependent on the following stop since, diachronically speaking, it originated as a part of that stop consonant. We are simply asserting that there is no reason to believe that preaspirated stops in this environment have not become phonologized in Modern Icelandic.

As we have already argued in some detail, we do not assume that the other type of preaspirated stop in Icelandic, i.e. the type that appears before a liquid or a nasal, is preaspirated in underlying structure. On the contrary, we have given some evidence to show that this type of stop is most straightforwardly analyzed as an allophone of an underlying aspirated stop. In other words, we assume that the preaspiration in these stops is more tightly coordinated with the oral closure than in the case of the intervocalic and word-final preaspirated stops where the aspiration has essentially taken on an identity of its own.

A question we need to ask at this point is how or whether these hypothesized differences between types of preaspirated stops in Icelandic are reflected in the acoustic signal. While our phonetic data, discussed in Chapter 3, did reveal some differences in the mean duration of preaspiration depending on environment (see Tables 3.22 and 3.21 for reference), with intervocalic stops having both longer preaspiration and longer closure than pre-consonantal ones, we do not necessarily predict that kind of an acoustic difference based on the phonological context alone.

To clarify, even though the preaspiration is clearly phonologically dependent on the following stop, its articulation is still clearly initiated well before the stop closure occurs. We even have Löfqvist and Yoshioka's (1981b) articulatory data suggesting that the glottal abduction is mostly over by the time closure begins (although it should be kept in mind that these are data for intervocalic stops and it is possible that pre-consonantal ones might show more overlap). There are numerous aerodynamic and other phonetic factors that can effect the articulation of a particular gesture and the coordination of gestures is language-specific to some extent. Earlier we discussed preaspirated stops in Andalusian Spanish which have a considerably shorter preaspiration period than their Icelandic counterparts. Nevertheless, we consider these stops to be preaspirated in both languages. The same holds for postaspiration, the degree of which can vary significantly depending on factors such as syllable type (stressed vs. unstressed) and language or dialect (recall that our data showed word-initial postaspiration to be significantly longer in SD than ND stops). The point here is that the phonetic output of a single phonological entity can vary considerably based on many factors.

The opposite can also hold true, i.e. phonetically similar outputs can correspond to more than one phoneme. Consider English stop consonants for example. It is well documented that the voicing of stop consonants in English is somewhat context-dependent. In word-initial position voicing is not always realized since it is redundant due to the fact that voiceless stops are postaspirated in that position, i.e. the postaspiration suffices to distinguish between voiceless and voiced stops. Just like voiced stops, English aspirated stops vary in their phonetic output depending on environment; when they follow [s] they are not aspirated. In English, then, we have a situation where a voiceless unaspirated stop in the output can correspond to two different phonemes depending on context: a voiced stop and a voiceless

aspirated stop. The same can hold for preaspirated stops in Icelandic. Regardless of whether their phonological input is /hp/ or /p^h/, they are made up of exactly the same gestures: a labial closing gesture and a laryngeal gesture. It seems completely reasonable to assume that the speakers of a particular language have settled on one optimal way of coordinating these two gestures, such that the glottal gesture precede the oral gesture, and that they utilize that coordination for both phoneme types.

As a side note, even though we choose to use the conventional notation, /p^h, t^h, k^h/, to refer to the phonological attributes of aspirated stops it is important to stress that we do not assume that this underlying structure corresponds in any way to a phonetically *post*aspirated stop. We simply view these phonemes as a set of gestures, i.e. a complete oral closure that is always produced in some sort of coordination with a glottal opening and closing gesture. The exact nature of the gestural coordination is determined by historical as well as articulatory factors. Contrary to what is usually assumed in the literature, we assume that the most natural way of articulating these stops is with complete coordination, i.e. overlap, of both oral and laryngeal gestures. (Consider e.g. the effect of changes in speech rate on the production of preaspirated stops, discussed in Chapter 3. Several examples were found in our data of preaspiration disappearing completely at a faster speech rate, arguably because the coordination of aspiration and oral closure reverted to the default state of complete overlap.) However, perceptual considerations can force these gestures apart as has happened across the Nordic dialect speaking area, usually resulting in pre- rather than postaspirated stops.

4.3.4 Aspirated clusters and questions of gestural affiliation

Let us turn back for a moment to the acquisition of preaspirated stops by Icelandic children. Given the phonetic similarity of different types of preaspirated stops in Icelandic, it should come as no surprise that they get acquired at the same time. After all, early acquisition is, more than anything else, phonetic imitation. We assume that later on in the process, when the children have absorbed enough vocabulary to internalize phonetic alternation and apply it to phonemic structure, they start differentiating between different types of preaspiration in the language. The same may apply to aspirated sonorants and fricatives in Icelandic. It is possible that, early on, children perceive the aspiration as belonging solely to the consonant it is coarticulated with, realizing later that there is a relationship between the aspiration and the following stop. However, given the fact that children tend to reduce clusters of aspirated consonant + stop down to what is essentially a preaspirated stop, it is equally possible that they associate the aspiration with the stop from the time they start producing these gestures in tandem.

We assume here that word-internal aspirated sonorants and fricatives are allophones and not independent phonemes because they predictably only surface before fortis stops. However, based on minimal pairs such as the one in (19), one could just as well argue that children perceive these forms as differing in the quality of the sonorant, not the stop itself.

- (19) a. *vanda* [van.ta] ‘trouble, OBL.SG.’
b. *vanta* [van̥.ta] ‘to lack’

Under our analysis the sonorant/fricative is aspirated as a result of coarticulation

with the following preaspirated stop. Diachronically speaking, at least, this seems like a plausible explanation for how these sounds came to be aspirated. But do we have any reason to believe that this process hasn't become phonologized? The main appeal of avoiding a description of aspirated sonorants and fricatives as phonemic is the considerable variation we observed in ND speech between forms with a voiced sonorant/fricative followed by a postaspirated stop on the one hand, and an aspirated sonorant/fricative followed by a plain stop on the other hand ([van.t^ha] vs. [vaŋ.ta]). This trade-off relationship between aspirated segments is much easier explained if it is merely a matter of the stop being either pre- or postaspirated and not a matter of individual speakers storing two different strings of phonemes in their mental lexicon. Of course, there could simply be a difference between the two dialects in that aspirated sonorants/fricatives have become phonemic in SD where there is no variation between voiced and aspirated variants, whereas the relationship between the two is still allophonic in ND where more variation is observed. Still, there is no need to posit separate phonemes for these sounds in SD since their appearance is completely predictable. While children acquiring language might initially view the aspiration as belonging to the sonorant/fricative, we argue that they will eventually detect a pattern in their distribution and re-analyze the aspiration as belonging to the stop.

Word-initial aspirated sonorants are a different issue. As we've discussed briefly above, sonorants contrast for aspiration in Icelandic when they appear word-initially (20).

- (20) *hnýta* [n̥i:ta] 'to tie a knot' ~ *nýta* [ni:ta] 'to make use of'
hræða [r̥ai:ða] 'to scare' ~ *ræða* [rai:ða] 'to discuss'
hljóð [ljou:ð̥] 'sound' ~ *ljóð* [ljou:ð̥] 'poem'

There is not much reason to assume that aspirated sonorants are *not* separate phonemes in word-initial position. Historically (as indicated by orthography) these originated in [h] + sonorant clusters but in Modern Icelandic the aspiration is completely coarticulated with the sonorant. A child acquiring the language would therefore not have any reason to posit a cluster in the underlying form as has been suggested in some of the literature (see e.g. Haugen 1958). However, the child might have some indication that word-initial aspirated sonorants differ from word-internal ones. Hoole and Bombien (2010) point towards some phonetic evidence to that effect:

Although often referred to as voiceless, it appears from a recent study (also including photoelectroglottographic recordings) that [word-initial voiceless sonorants] often involve only a rather small amount of glottal abduction and may actually show uninterrupted –but non-modal– voicing. This is rather a different situation from the voiceless sonorants before plosives, which appear to be really completely voiceless, and where the amplitude of glottal opening (extending of course into the following plosive) is clearly extensive (Hoole and Bombien 2010).

As we discuss below, we don't necessarily subscribe to the view that these kinds of subtle phonetic differences have to reflect a difference in phonemic structure. However, in this case we do believe, for separate reasons, that there is in fact a structural difference. Since we assume that aspirated sonorants do exist as separate phonemes in Icelandic (i.e. in word-initial position), it is not for the purpose of economy that we refrain from analyzing word-internal sonorants as phonemically aspirated. Note that even though the rhotic, lateral and alveolar nasal can be argued to be phonemically aspirated on the base of the evidence given in (20), there are other aspirated consonants in the language which only surface before fortis stops, namely [x] and [m̥]. Furthermore, [θ] does appear word-initially but

not contrastively so. Word-initial position aside, it only surfaces before fortis stops just like the other aspirated consonants. It can be argued that the extremely limited distribution of these latter consonants provides the child with important evidence as to the general phonological status of aspirated segments that appear before fortis stops, namely that the aspiration is tied to the following stop. We thus believe that views such as those expressed by Jessen and Pétursson (1998), who argued that word-internal sonorants should be seen as phonemic in Icelandic on the grounds of their objection to “the assumption that the voicelessness of sonorants is derived by characteristics of the following stop that are accessible not in concrete phonetic, but only abstract phonological terms” are simply based on misguided notions of what it means to acquire a phonology of a language. It is true that looking at minimal pairs such as [van.ta] vs. [vaŋ.ta] there is no a priori reason for attributing the difference between the two forms to a difference in stop quality rather than sonorant quality. However, acquiring a phonology involves detecting patterns and the exclusively pre-plosive distribution of these aspirated sounds in a language that also has preaspirated stops is a rather glaring pattern.

An issue that needs addressing is what, if any, we expect the articulatory consequences of the phonemic association of aspiration to be. In other words, do we expect the temporal phasing of the glottal gesture to be different depending on whether it belongs to the sonorant or to the following stop? Hoole and Bombien (2010) attempted to find evidence in the articulation of the glottal gesture to show that aspirated nasals were the result of a coarticulation with a preaspirated stop. More specifically, they looked for evidence that the glottal gestures of preaspiration and the aspirated nasal, respectively, were essentially the same. What they found was that, while the duration of the glottal gesture was comparable in both cases, peak glottal opening occurred much earlier in the nasal than it did in the preaspi-

rated stop (where it more or less coincided with the onset of the oral occlusion).

Hoole and Bombien (2010) seem oddly conflicted in their discussion. On the one hand they rightly dismiss arguments that preaspiration can't possibly be tied to a stop in the same way that postaspiration is due its more segment-like duration and point out that "there may be psycho-acoustic reasons why aspiration linked to vowel offset needs to be longer for perceptual saliency than aspiration linked to vowel onset (Hoole and Bombien 2010:173)". On the other hand they seem quite preoccupied with proving that preaspiration can't be an independent segment because its articulation differs from that of a word-initial /h/, although later admitting that "it is probably arbitrary at this level of analysis whether a particular type of voiceless segment is described as /h/ or as pre-aspiration (Hoole and Bombien 2010:187)". They struggle with their finding that the timing of the gestural phasing differs between aspirated nasals and preaspirates, noting that "it does mean that our hypothesis cannot simply claim that a voiceless nasal results from placing a nasal in front of a pre-aspirate which remains otherwise unchanged (Hoole and Bombien 2010:191)". They offer as an explanation that the motor system's job of maintaining linguistically meaningful distinctions, in this case between clusters such as [m̥p] and [mp], can be "accomplished more reliably by devoicing the nasal completely, and at the same time perhaps more economically by using the glottal activity pattern for normal pre-aspirates (Hoole and Bombien 2010:197)", stating finally that in a sense "it may simply not be appropriate to ask which segment the devoicing gesture 'belongs' to (Hoole and Bombien 2010:197)".

This tension between an inclination to take articulatory data at their face value and a desire to hold on to interpretations of the data that comply with our notions of what a segment is and how a common phonemic source translates into the out-

put is understandable but at the same time, in our view, completely unnecessary. Uncovering a phonological pattern should not be about finding phonetic similarities. To clarify, when a segment takes on some properties of a following segment due to coarticulation, that property, in this case aspiration, becomes a part of its new host segment in some sense and as such it is not unexpected that the articulation of the coarticulating gesture be modified to some extent to accommodate its host. Consider e.g. the case of vowel nasalization in English that occurs when the velum is lowered early in anticipation of a following nasal consonant. The effect of nasalization varies depending on the shape of the oral cavity, i.e. the quality of the vowel on which the nasalization is superimposed (Fant 1970). Here we, then, have a case of a coarticulating gesture adapting its size to fit the target gesture. In the case of aspirated consonants in Icelandic, we can conceive of both perceptual and articulatory reasons for why the glottal gesture would be extended in order to overlap completely with the consonant it is coarticulated with. Perceptually speaking, a consonant is more likely to be conceived of as aspirated the larger the portion of it is actually coarticulated with a glottal gesture. From an articulatory standpoint we assume, once again citing Tilsen's (2014) theory of competitive selection and co-selection of speech gestures, that initiating both the glottal and the oral gesture at the same time allows for more ease of articulation since that is the type of coordination that comes most naturally to us. In the case of aspirated sonorants and fricatives, unlike plosives, there is no perceptual reason for why these gestures should not overlap completely since overlap does not render one of the gestures unrecoverable.

4.4 Is Aspiration Segmentally Bound?

To wrap up our discussion, a few words should be said about ‘segmenthood’. We argued above that even though we posit different inputs for preaspirated stops in Icelandic, i.e. /hp, ht, hk/ in intervocalic and word-final positions and /p^h, t^h, k^h/ elsewhere, based on how we can reasonably assume that children acquire phonology we do not necessarily expect these phonological differences to be reflected in the phonetic output. In other words, we do not take the similar duration of preaspiration in each of these contexts to mean that it cannot have separate phonological origins. This does raise some questions about segmental quality, more specifically what distinguishes an independent articulation (that can bear weight) from a secondary one, i.e. one that is a part of a larger selection of gestures. As we have gone over before, we assume that preaspiration is a weight-bearing coda consonant in words like [pah.ka] whereas we assign that role to the entire stop, i.e. preaspiration + occlusion, in words like [ɛ^hp.li].

As a side note it is worth mentioning that complex codas are not allowed in Icelandic. It is therefore not possible, for the sake of uniformity, to posit a form like [ɛhp.li], where the preaspiration would be a segment, perhaps derived from a gemination process (suggested by e.g. Thráinsson 1978). Evidence for a ban on complex codas in the language comes from an argument about cluster simplification presented in Vennemann (1972) (see also Itô 1986). He observes that in Icelandic, [t] is lost between [s] and a consonant, except if this consonant is [r]:

- | | | | | | |
|------|----|----------------|--------------------------------------|-----------|---------------|
| (21) | a. | <i>systkin</i> | /sist ^h k ^h m/ | [sis.ciŋ] | ‘siblings’ |
| | b. | <i>vestra</i> | /vɛst ^h ra/ | [vɛs.tra] | ‘in the west’ |

This happens, Vennemann argues, because [tr] is a permissible onset in Icelandic while [tk] is not. By correlation, we observe that this process of cluster simplification also suggests that complex codas are not allowed in Icelandic because deleting a consonant is preferred over creating a complex coda in situations where resyllabification is blocked by restrictions on possible onsets.

Another possibility, if we want to give segmental status to preaspiration, is to syllabify it as a single coda followed by a complex onset: [ɛh.plɪ]. There is no phonotactic reason why this cannot be a valid syllabification despite claims in the literature (see e.g. Morén 2001) that onsets such as [pn], [tn] and [tl] (which would arise if were to syllabify words like [ɔhpna], [pahtna] and [k^hihtla] that way) are not licit in Icelandic because they do not appear word-initially. This is an invalid claim.

The process of cluster simplification is not only useful to determine the structure of Icelandic syllables, it is also indicative of the kinds of onset clusters allowed in the language (other than those attested in word-initial position). For example, the forms shown in (22) below (from Árnason 2005), that all have simplified clusters in the output, predict that [tk], [kt], [vð] and [ts] should not be possible onsets in Icelandic and that seems to be a correct prediction since these clusters never appear word-initially or post-consonantly for that matter.

(22)	<i>holdgast</i>	/hɔltkast ^h /	[hɔl.kas.t]	‘be incarnated’
	<i>telgdi</i>	/t ^h ɛlktɪ/	[t ^h ɛl.tɪ]	‘carved’
	<i>erfðir</i>	/ɛrvðɪr/	[ɛr.ðɪr]	‘genes’
	<i>lands</i>	/lants/	[lan.s]	‘country, gen.sg.’

Vennemann (1972) correctly pointed out that /st^hk^h/ clusters are simplified to [sk] on the surface while /st^hr/ clusters stay intact and attributed that to the fact that [tk] is not a possible onset in Icelandic. Vennemann did, however, overgeneralize when he stated that [t] is lost between [s] and *all* consonants other than [r] as the following example shows.

(23) *fastna* /fast^hna/ [fas.tna] ‘get engaged’

In addition, clusters of /s/ and /l/ are always broken up on the surface by an epenthetic [t] which must suggest that [tl] is a permissible onset as well:

(24) *sýsla* /sisla/ [sis.tla] ‘county’

As far as other phonotactically possible combinations of stops and sonorants are concerned, the only one not attested word-initially in Icelandic is [pn]. As the following example shows, [pn] too is a permissible onset:

(25) *vespna* /vɛsp^hna/ [vɛs.pna] ‘vespas, gen.pl.’

Despite the evidence above indicating that an output like [ɛh.plɪ] is phonotactically possible in Icelandic, we argue that it is not phonologically possible. For one thing, it is hard to explain how we derive the different outputs in (26-a) and (26-b) without referring to syllable contact. In other words, if both /t^hr/ and /t^hn/ syllabify as complex onsets then why are there two different strategies at play here to ensure that the stressed syllable is bimoraic?

- (26) a. *titra* /t^hit^hra/ [t^hi.tra] ‘to tremble’
 b. *fitna* /fit^hna/ [fih.tna] ‘to get fat’

Secondly, if we accept that the preaspirated stops in this environment are not simply derived from an underlying cluster of /h/ + stop (as we have shown is unlikely to be the case), then we would have to explain why a single phonological entity gets split up into two segments in the output, one of which is moraic. This brings us back to the question of what a segment is and what gives a segment its weight. Tilsen (2014) suggests that whether or not a coda is moraic might have to do with how it is selected, i.e. a consonant co-selected with a preceding vowel, {VC}, shares a mora with that vowel whereas a consonant that is competitively selected with the vowel, {V}{C}, has its own mora. There is certainly some evidence that suggest that moraic consonants *can* differ phonetically from non-moraic ones (see Tilsen’s discussion) but that doesn’t always need to be the case. In our view, moraicity is more of an abstract feature than anything else. In the Icelandic case, what sets moraic preaspiration apart from non-moraic preaspiration (i.e. where the entire stop is moraic as opposed to just the preaspiration) is simply that the former exists as an independent entity on a phonological level. In other words we assume that during the initial gesture selection process, the underlying representation of the entity selected will determine its phonological status in the output, i.e. whether it is seen as a segment or not. This phonological reality may or may not be reflected in the phonetic output as we have discussed above. By saying this we are not rejecting Tilsen’s (2014) insights regarding how gestures are selected and how that determines phonological status, we are simply stating that gestural selection is a nuanced process which is influenced by both phonological and articulatory factors.

4.5 Conclusion

In this chapter we have proposed that the key to understanding the relationship between different speech gestures is to account for how their phonological relationship can reasonably be inferred by children adopting the language. By understanding how the gestures relate to each other phonologically, the children will learn to coordinate them in a manner that reflects that structure. Furthermore, we discussed theories of gestural coordination and showed that from a gestural standpoint the frequency of preaspirated stops in Icelandic is not unexpected since they ensure the perceptual recoverability of aspiration while having a relatively simple internal coordination.

Another issue we discussed in this chapter is that of segmenthood. We argued that, in the case of aspiration at least, whether or not something is a segment is determined by phonological structure rather than phonetic factors such as duration. In our view, the articulation of a preaspirated stop does not have to differ substantially from that of an [h] + stop cluster as long as there is phonological motivation for treating the preaspirated stop as a single entity. This is not to say that gestural coordination never reflects phonological structure. There is ample evidence to suggest that it does. It is simply our view that phonological structure is not the only deciding factor in how gestures coordinate with each other. Other factors to consider are ease of articulation and perceptual requirements.

Our discussion of the gestural coordination of aspirated consonants in Icelandic will continue in Chapter 5, where we will give our discussion in the present chapter a more formal structure by proposing an Optimality Theory account of gestural phasing in the language.

A PHONOLOGICAL ANALYSIS OF ASPIRATION IN ICELANDIC

5.1 Introduction

The goal of this chapter is to formally analyze the temporal coordination of glottal and oral articulations in Icelandic speech production. We will argue for an approach to aspiration as a semi-independent gesture whose relationship to its accompanying oral articulation is governed by phonological constraints that specify the exact gestural phasing coordination between the two. To ground our ideas in phonological theory, we will present an Optimality Theory type analysis of the gestural coordination that determines the phonetic realization of aspirated stops and other aspirated consonants in Icelandic. Our view is that there is no default preference for how this coordination should take place beyond that determined by articulatory factors and diachronic development, which get coded into the phonology by way of constraint ranking.

The Icelandic patterns that we intend to account for in this chapter involve aspiration in various shapes and forms. One of our main goals is to show that the variation found between the two Icelandic dialects, SD and ND, can be reduced to differences in constraint ranking. In other words, we assume a common underlying representation for both dialects. Crucial to this analysis is the view we will present of aspiration as a sub-gesture whose phasing relationship with its head gesture is determined by phonological constraints. Based on our discussion in previous chapters, our formal analysis of the Icelandic data must account for the following facts:

- (a) Fortis stops are unaspirated in SD ([fa:ta]) but postaspirated in ND ([fa:t^ha]).
- (b) Stops in borrowed vocabulary are unaspirated in both dialects ([si:kou]).
- (c) Both pre- and postaspirated stops are found in ND ([fa:t^ha] vs. [fa^htla]).
- (d) Clusters of sonorant/fricative + fortis stops either surface with an aspirated sonorant/fricative (SD) or a postaspirated stop (ND) ([vaŋta] vs. [vaŋt^ha]).
- (e) Clusters of fortis stop + [r, v, j] surface with an unaspirated/postaspirated stop preceded by a long vowel whereas clusters of fortis stop + [l, n, m] surface with a preaspirated stop (vɪ:t^(h)ja vs. [vɪ^htna]).

Our analysis is motivated by a desire to move phonological analyses away from segment-based approaches and to give serious consideration to the role of motor control and gestural coordination in the shaping of a language's phonology. While the framework of Articulatory Phonology (AP), first proposed by Browman and Goldstein (1986), has made many advances towards reaching that goal it is commonly criticized for being more accurately described as articulatory *phonetics* rather than a theory of phonology. AP has provided us with a fresh perspective on the mechanisms behind many phonological processes, most notably the insight that speech is not a string of discreet segments but rather a constellation of often overlapping gestures whose temporal properties are a key element in explaining the organization reflected in the acoustic output. Furthermore, by utilizing coupling relations known from theories of motor control (i.e. in-phase vs. anti-phase coupling), AP has offered physical grounding for the existence of syllable structure. However, by effectively rejecting the existence of speech segments in favor of a purely gesture-based account, AP fails to adequately account for the internal organization of what are referred to as 'segments' in traditional phonological theory. While we do not subscribe to the existence of segments in the traditional sense,

we argued in the previous chapter that some gestures are more tightly coordinated with each other than others and that accounting for this more nuanced aspect of gestural coordination requires a theory of phasing that goes beyond the idea of in-phase and anti-phase coupling relations. What we attempt to do here is to use the insights of both AP and more standard theories to give a phonological analysis of how we can reasonably expect speech to be temporally and gesturally organized in light of known patterns of acquisition and sound change. In other words, we use facts of speech articulation to build a plausible phonological reality of speech organization that goes beyond simply explaining how gestures get coarticulated but also reflects the more abstract structure of language, the structure acquired by observing patterns of organization across morphological paradigms rather than just analyzing isolated speech signals.

The chapter will proceed as follows. Section 5.2 contains a general discussion of aspiration and how we might want to conceive of it in gestural terms. In Section 5.3 we take a phonologically oriented approach to articulatory gestures and propose a model for incorporating them into a standard phonological analysis. Section 5.4 gives a brief overview of some main findings of our acoustic study and their relevance to our phonological analysis and Section 5.5 discusses how the analysis is informed by patterns of language acquisition. A formal Optimality Theory analysis is presented in Section 5.6 and concluding remarks are found in Section 5.7.

5.2 Aspiration as a Gesture

Lisker and Abramson (1964) argued that the main feature distinguishing different types of stops, voiced, voiceless, and voiceless aspirated, was voice onset time

(VOT). At the time, there was some confusion as to how exactly these differences could best be categorized. Recognizing that in some languages, such as English, where stops differ in voicing word-internally but aspiration word-initially, simply referring to stops as either ‘voiced’ or ‘voiceless’ was not sufficient, many scholars had adopted the terms ‘lenis’ and ‘fortis’ to distinguish the more forcefully articulated voiceless (sometimes aspirated) stops from their voiced counterparts. Lisker and Abramson disputed the idea that deserting the phonetically grounded terms ‘voiced’ and ‘voiceless’ for the more vague ‘lenis’ and ‘fortis’ gained us anything in accurately describing the phonetic differences in question. Instead they proposed that these different stop categories were simply a variation of different VOTs and found support for this in their study of stop production in 11 languages. In their own words, their results indicated that “[it] would seem that such features as voicing, aspiration and force of articulation are predictable consequences of differences in the relative timing of events at the glottis and at the place of oral occlusion.”

Following this line of thought, Kohler (1984) asserted that laryngeal contrasts among the obstruents of English, as well as many other Germanic languages, would best be encoded as a difference of ‘spread’ vs. ‘non-spread glottis’, recognizing that a non-spread glottis does not necessarily entail voicing. This distinction has been adopted by many, including Kingston (1990) and Iverson and Salmons (1995) to name a few, although scholars have differed in their opinions on whether or not [spread glottis] should be considered a privative feature.

In a series of studies, Anders Löfqvist, in collaboration with other researchers (see e.g. Löfqvist and Pétursson 1978, Löfqvist and Yoshioka 1981a,b), collected data on laryngeal activity in various languages, including Icelandic, using the combined techniques of transillumination and fiberoptic filming of the larynx.

These studies showed that contrasts of preaspirated, unaspirated, and postaspirated voiceless stops were basically produced by differences in laryngeal-oral timing. More specifically, the studies found that in Icelandic voiceless, unaspirated (i.e. lenis) stops glottal abduction starts at implosion and peak glottal opening occurs close to the implosion. In voiceless, postaspirated stops glottal abduction begins at implosion but glottis continues to open until stop release. Peak glottal opening achieved is much larger than for unaspirated stops. In preaspirated stops both glottal abduction and peak glottal opening precede oral closure, but the glottal opening gesture is considerably smaller than in postaspirated stops. This last finding was contradicted by Hoole and Bombien (2010) who found the gesture for the preaspirates to be quite large, even larger than the gesture produced in association with fricatives.

His findings pertaining to laryngeal articulation prompted Löfqvist to make the following comment regarding the phonological representation of stop consonants:

As interarticulator timing appears to be an essential feature of voiceless obstruent production, one may question the descriptive adequacy of feature systems with timeless representations for modeling speech production, whatever their merits may be for abstract phonological analysis (Löfqvist and Yoshioka 1981b:15).

He, however, backtracked somewhat on his previous claims in a later paper (Löfqvist 1995) where he noted the following:

In fact, when the relation between oral-laryngeal coordination and VOT is examined across individual tokens, it turns out that the correlation between a measure of interarticulator timing and VOT is low, and that interarticulator timing explains less than 50% of the variance in VOT. This finding suggests that, besides timing, aerodynamic and myodynamic factors also play a role in determining the onset of glottal vibrations following stop consonants. Among these factors are most

likely the size of the glottal opening as well as the thickness and the viscosity of the vocal folds (Löfqvist 1995:106).

Ridouane (2006) made some important observations about the phonetic implementation of the feature [spread glottis]. He noted, citing his own research on Tashlihyt Berber yielding fibroscopic and photoelectroglottographic data, that for a stop to be aspirated, the glottis must be wide open but a large glottal opening, however, is not necessarily an indication of aspiration. He found this to be the case e.g. for the unaspirated uvular stop which was produced with a wide open glottis but with a mere 20 ms. VOT. In other words, Ridouane's findings strongly suggest that the timing of laryngeal gestures with respect to supralaryngeal articulations is more important than the size of these gestures.

At first glance, Ridouane's (2006) findings regarding the irrelevance of the size of the laryngeal gesture in determining VOT duration seem to contradict the results of Löfqvist (1995), who found only a weak correlation between interarticulator timing and VOT and suggested that one of the missing elements in his analysis was the size of the glottal gesture. The solution to this discrepancy might be to view the size of a laryngeal gesture as a function of its timing with respect to the oral gesture it accompanies.

5.3 Gestures and Phonology

5.3.1 Previous work

Despite the considerable availability of data on how the production of laryngeal gestures ties to oral articulations, this knowledge is not often utilized in phonolog-

ical models of aspirated segments. Many have called for models that incorporate temporal aspects of gesture coordination; Hoole (1987), for instance, stated that “[the] widely diverging views for the small problem discussed here may simply reflect the fact that principles of temporal coordination have not yet been well integrated into phonological representations, and more surprisingly, often not even into phonetic accounts.” It would in fact seem that remarkably little progress has been made in this regard since Lisker and Abramson (1964) published their work, showing that VOT is essential in distinguishing between different kinds of stop consonants.

Gafos (2002) argues that the only phonologically relevant notion of time is the overlap of dynamic units and called for a shift from phonological representations utilizing static, linearly ordered autosegments to ones referring to the kinds of dynamically defined gestures argued for in Browman and Goldstein’s (1986) Articulatory Phonology (AP), i.e. gestures whose state changes during the course of its articulation. His main claim is that information about the temporal organization of gestures that constitute speech segments is included in phonological representations and expressed through coordinate relations between individual gestures. In Gafos’ words:

As a gesture unfolds, we may identify a set of states or *landmarks* such as onset of movement, achievement of target, and release away from target. These landmarks constitute the *internal temporal structure* of gestures. Gestures enter into *temporal relations* of overlap that refer to these landmarks. (Gafos 2002:270)

A coordination relation, Gafos explains, specifies that some landmark within the temporal structure of one gesture is synchronous with some landmark within the temporal structure of another gesture. By referring to these specific temporal

landmarks, Gafos goes a step further than Browman and Goldstein (1986) who, while proposing that a fundamental aspect of the gestural model is that temporal relations among gestures are an explicit part of their representation, do not explicitly lay out what these temporal relations are.

A fundamental claim in Gafos' (2002) paper is his distinction between oral 'head gestures' and secondary gestures, such as laryngeal gestures and velic opening and closing gestures, that are to some extent subordinate to their heads. In support of this claim, Gafos points towards OCP violations which in Moroccan Colloquial Arabic (MCA) can result in schwa insertion. From Gafos's gestural point of view, the Obligatory Contour Principle (OCP) states that "overlapping identical gestures are prohibited (Gafos 2002:290)". In his view, two gestures are identical if they employ the same articulator and the same values for constriction degree (CD) and constriction location (CL). In MCA only adjacent *oral* gestures incur OCP violations whereas sequences of e.g. two heterorganic nasals or heterorganic consonants with identical laryngeal specifications do not incur such violations. However, when two identical nasals drift apart to avoid an OCP violation the velic gestures follow along with the oral gestures they are associated with even though their proximity to each other is structurally fine. Gafos interprets this as an indication that the velic gesture is subordinate to the oral gesture, and that oral gestures alone drive segment-to-segment coordination. The same can be argued for glottal gestures and that is the view that we will take in the phonological analysis proposed here.

The focus of Gafos's (2002) paper is the inter-segmental coordination of consonants, which he argues is driven by phonological constraints on the phasing relations between oral head gestures. These relationships are represented in the grammar as a set of alignment constraints. Gafos assumes a Linguistic Gestural Model

which takes as its input a linear sequence of phonetic characters and generates a gestural score consisting of gestures and their coordination relations based on the intended utterance. He proposes a family of COORDINATION constraints including CV-COORD (which requires the c-center of the C gesture to be synchronous with the onset of the V gesture), VC-COORD (which requires that the target of the C gesture is synchronized with the release of the V gesture), and CC-COORD (which is a language-specific constraint whose parameters depend, in general terms, on whether a language favors an ‘open’ or a ‘close’ transition between consonants, i.e. whether or not consonants are acoustically released in pre-consonantal position). These constraints interact with a RECOVERABILITY constraint, which requires that two consonants not overlap completely.

Gafos (2002) does not address the coordinative relationship of subordinate gestures to their head gestures beyond stating that “segment-internal gestures are temporally organized in a characteristic way particular to that segment” (Gafos 2002:284). However, the Icelandic data show us that there is not always a single characteristic way of organizing a particular segment. On the contrary, aspirated stops in Icelandic convey three distinct internal coordinative patterns and analyzing these stops clearly necessitates a formal account of how the internal organization of the gestures that make up a single aspirated consonant is determined.

Studies conducted within the realm of Articulatory Phonology have found evidence that the temporal relationship between gestures that form what is traditionally viewed as segments differs from the temporal relationship between segmental units. For instance, Saltzman et al. (2000) analyzed changes in an utterance’s temporal structure as a result of mechanical perturbations delivered to the articulators during speech production. They found that the intergestural temporal cohesion

was greater *within* segments than *between* segments. These kinds of findings have inspired researchers (see e.g. Nittrouer et al. 1988, Löfqvist 1991) to suggest a difference in the phasing mechanism employed within a segment as opposed the one used for between-segment relations. However, not many have attempted to model this different type of a gestural timing relationship. In its most basic form (cf. Browman and Goldstein 1986), Articulatory Phonology makes no distinction in the mechanism for coordinating two within-segment gestures as compared to coordinating gestures between segments. Furthermore, it assumes that timing relationships are *lexically specified*.

Byrd (1996) addresses the issue of different timing relations. She proposes a framework which describes articulatory timing in terms of phase windows, i.e. temporal ranges within which a particular coordination, such as V-to-C or C-to-C, can take place. She diverges from AP in assuming that precedence relations between gestures are coded as *associations* in the gestural score (the implementation of which is then determined by phase windows which in turn are limited by motor, auditory, and cognitive constraints as well as language-specific permissible patterns) rather than exact patterns of gestural overlap. In other words, Byrd's framework assumes that the gestural score contains information as to which gestures are to be temporally coordinated but the information regarding the exact nature of the coordination is applied postlexically. However, Byrd views gestures that belong to a single segment differently:

[T]here are many temporal relations that are crucial in making a phonological contrast. For example, the differences between /p/ and /p^h/ or /mb̆/ and /m/ lie significantly in the timing relationship between an oral and a non-oral gesture – glottal opening in the first case and velum lowering in the second. Articulatory Phonology makes no distinction in the mechanism for coordinating two such gestures as compared to coordinating gestures, for example, between words. No

differences in variability are predicted, and there is no theory-internal reason to expect the degree of overlap to be different (Byrd 1996:159).

Byrd goes on to explain that in her view “the percept and functionality of the segmental unit, to whatever extent it exists, results from *its* characteristic pattern of coordination (Byrd 1996:159)”. She proposes that this characteristic pattern of coordination is stability, i.e. a narrow phase window that is lexically specified. In other words, Byrd claims that within-segment timing relations differ from between-segment timing relations in that the former are lexically specified while the latter are not.

The goal of this chapter is to propose a formal analysis of the within-segment coordinative relationship of aspirated consonants. In doing so, we will take some inspiration from previous work, particularly Gafos’s (2002) distinction of head gestures and subordinate gestures. Whereas we agree with Byrd’s (1996) insight that temporal relationships vary depending on segmental status, we argue that this difference is not one of lexical vs. postlexical specification but rather a difference in abstract phonological associations defined in the gestural score. In other words, the ‘segmental’ nature of aspirated consonants is a result of different constraints influencing the temporal coordination of a subordinate gesture to its head than apply to the coordination of two head gestures. The categorization of gestures into head gestures and subordinate gestures, we argue, is the result of phonological associations made during the acquisition of a language as we discussed extensively in the previous chapter.

Figure 5.1 gives a preliminary illustration of how the coordination between a laryngeal gesture and an oral closure can be conceived of. In Figure 5.1(a) the laryngeal gesture is completely coextensive with the oral gesture, resulting in



(a) Full overlap; no postaspiration (b) Partial overlap; postaspirated stop

Figure 5.1: Gestural representation of the coordination between a laryngeal gesture and its oral ‘head gesture’. The solid line represents the oral gesture and the purple dotted line represents the laryngeal gesture.

negligible VOT. In Figure 5.1(b), on the other hand, the overlap between the two gestures is only partial as the glottal gesture exceeds the oral gesture in duration, resulting in increased VOT, compatible with a postaspirated stop. The internal coordination of preaspirated stops will be discussed in later sections.

5.3.2 The Icelandic data

Before introducing our proposed phonological constraints to capture patterns of Icelandic aspiration, let us recall the patterns that need to be accounted for. The ND pattern, where intervocalic stop consonants are postaspirated, is an unusual one. It has been argued in the literature (see e.g. Yu 1992) that aspiration, i.e. the occurrence of [spread glottis], is predictable from prosodic context, i.e. it is not expected to be encountered outside of foot-initial position. This is clearly not the case in Icelandic –at least not in ND– where the aspirated stops in question are not foot-initial. Furthermore, the result of our discussion of foot structure in Icelandic in Chapter 2 was that it was unlikely to be a factor in the distribution of aspiration in the language. Jessen and Ringen (2002) presented the results of their acoustic experiment on, among other things, intervocalic stop consonants in

German. The goal of their study was to find evidence to support that German stops contrast for the [spread glottis] feature, rather than voicing. They found that orthographic *p*, *t*, *k* were produced with a VOT consistent with them being [spread glottis] ($\mu=40$ ms., $sd=7.6$ ms.) whereas orthographic *b*, *d*, *g* had a short VOT and were sometimes voiced. While the German fortis stops are not as aspirated as the Icelandic ND stops ($\mu=51$ ms.) they are nevertheless clearly postaspirated (note that intervocalic SD stops in our experiment had a mean VOT duration of 24 ms.). Just like the Icelandic stops, the German ones are uttered in foot-final position and are therefore another counterexample to the claim that [spread glottis] is tied to heads of feet.

The interesting thing about Icelandic, of course, is that postaspiration of intervocalic stops is only found in one dialect. In the standard SD, stops appear to lose the [spread glottis] feature in intervocalic position. But does that mean that SD stops are like German lenis stops, i.e. lack a [spread glottis] feature without being voiced, while ND stops behave like German fortis stops? One argument against this view is that, unlike German lenis stops, SD stops never show any voicing. In their paper, Jessen and Ringen (2002) argue that the voicing observed in German lenis stops is passive, i.e. a phonetic consequence of their voiced environment. In other words, they maintain that the feature [voiced] does not have to be present for a stop to become voiced.

In light of this we might ask ourselves why SD stops are never passively voiced when they are flanked by voiced segments on both sides. What we will argue here is that, contrary to traditional analyses, SD stops do not *lose* their [spread glottis] feature in intervocalic position. The laryngeal feature is still present in these stops but overlapped completely by the oral gesture due to temporal relations coded

in the phonology, making it seem on the surface as if the stop lacks a laryngeal gesture altogether. This approach accounts for why intervocalic stops in loanwords appear to be identical to native stops in SD but differ from native stops in ND. We assume that the timing of the laryngeal gesture with respect to the oral gesture is determined by phonological constraints. Therefore, we expect all intervocalic stops in ND, that have an underlying glottal gesture, to realize that gesture as postaspiration. The lack of postaspiration in borrowed stops in ND suggests that there is no glottal gesture present in those stops and we can assume that the same holds true for SD. However, our findings in Chapter 3, suggest that there is some structural difference between native and borrowed stops in SD because vowels are considerably longer before borrowed stops than native ones. We argued that the difference lies in the presence of a hidden laryngeal gesture in native stops vs. the absence of any glottal activity in borrowed stops.

While there are some electroglottographic data available on Icelandic, no study has looked specifically at intervocalic singleton stops, let alone compared laryngeal movements between borrowed and native stops in SD. However, there is some circumstantial evidence available that indicates that there is some merit to our analysis. Figure 5.2 shows two figures from Hoole and Bombien (2010).

The two figures show a comparison between the words *dembi* [tɛmpɪ] and *hiti* [hɪ:ti] in the speech of an SD speaker, i.e. a speaker who does not postaspirate intervocalic stop consonants (the relevant laryngeal gestures are encased by a red square for clarity). The first word has a word-initial lenis stop, which we argue has the same structure as a borrowed stop in Icelandic, i.e. lacking an underlying laryngeal gesture, whereas the second word has an intervocalic fortis stop which is assumed in traditional analyses to lack a laryngeal gesture in the output since no

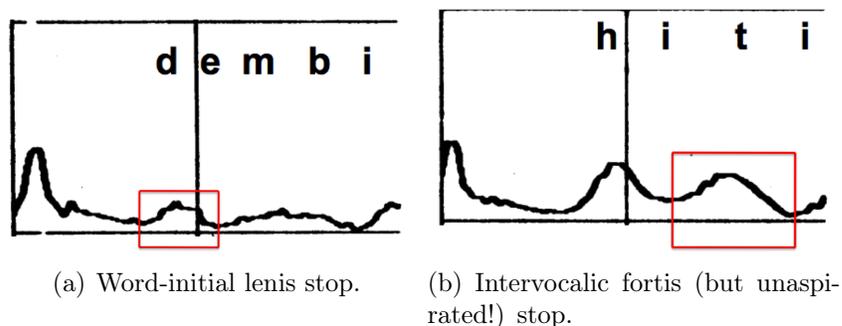


Figure 5.2: Glottal opening data from Hoole and Bombien (2010). Comparison of a voiceless unaspirated stop on the left and what I analyze as a voiceless unaspirated [spread glottis] stop on the right.

postaspiration is present. The fact that both figures show that a glottal opening is present on the stop consonants despite the lack of postaspiration is not surprising. As Jessen and Ringen (2002) note, a small glottal opening can be created passively in the absence of a [spread glottis] specification due to aerodynamic factors. What we notice about the figures, however, is that the glottal gesture that occurs during the production of the intervocalic [t] in *hiti* (5.2(b)) is much larger than the gesture coinciding with the word-initial [t] in *dembi* (5.2(a)). This is not what we expect if we assume that both stops lack a specification for [spread glottis]. In fact, since the [t] in *dembi* is produced in a stressed syllable, we expect the opposite results, i.e. a larger gesture in *dembi* (recall that results in Chapter 3 showed that postaspiration in ND is stronger word-initially than intervocalically, presumably due to stress). We argue that this difference in the size of the glottal gesture is due to the fact that the glottal opening in *dembi* is purely phonetically motivated (passive glottal opening on a non-[spread glottis] stop) whereas *hiti* has a fully articulated (phonologically motivated) glottal gesture which does not result in postaspiration because it is completely overlapped by the oral constriction. We further argue, that this timing relationship is coded in the phonology of SD and that the main difference between SD and ND is the *timing* of glottal gestures, as

opposed to the presence vs. absence thereof.

In Chapter 4 we hypothesized that ND word-internal postaspirated stops emerged late in the language and compared them to stops in other languages that have developed postaspiration over time. It is important to note that under our analysis of aspirated stops in Icelandic, the emergence of intervocalic postaspirated stops in ND is less far-fetched than it might otherwise seem. Our suggestion is that an intermediate point in this development was the production of these stops the way they are currently produced in SD, with a laryngeal gesture present but completely overlapped by the oral gesture. The emergence of postaspiration in ND did therefore not involve the reintroduction of a glottal gesture into the speech signal, it simply involved a realignment of an already present glottal gesture. We furthermore assume that the introduction of postaspiration in clusters of sonorants/fricatives + fortis stop was a later development influenced by the intervocalic stops. This is supported by some of the evidence we will introduce in Chapter 6, i.e. written accounts from the 19th century stating that this pronunciation is newer in Icelandic than the more ubiquitous pronunciation of an aspirated sonorant/fricative followed by an unaspirated stop.

5.4 Relevant Acoustic Findings

The formal analysis we will present in Section 5.6 is heavily inspired by Articulatory Phonology and the notion of speech gestures as phonological primitives rather than the more standard segments and features. Nevertheless, a lot of relevant information can be discerned from acoustic speech data alone. In Chapter 3 we gave a detailed account of the findings of our acoustic study on the two Icelandic

dialects, SD and ND. Before continuing on, let us reiterate some results from the acoustic study that will inform our phonological analysis.

As we discussed in Chapter 4, a frequently debated subject in the literature on Icelandic phonology is the status of word-internal aspirated sonorants/fricatives, i.e. whether they are separate phonemes or alternatively allophones of their voiced counterparts. We argued the latter point, maintaining that their predictable appearance before phonemically aspirated stop consonants is sufficient evidence for a child to associate the aspiration with the stop and not the sonorant. A key finding in our study was the high rate of intra-speaker variation among ND speakers producing these aspirated clusters. Speakers frequently alternated between producing an aspirated sonorant and a postaspirated stop, respectively. This refutes the notion that the aspiration might be phonologically linked to the sonorant since that would entail that these speakers store two different representations of each cluster in their lexicon. This is not to say that aspirated sonorants do not exist as separate phonemes in Icelandic. Since they do appear contrastively in word-initial position there is no reason to doubt their phonemic status in that environment. However, these word-initial aspirated sonorants are of a different origin than the word-internal ones (orthographic as well as comparative evidence suggest that they developed from clusters of /h/ + sonorant) and should be treated differently in a phonological analysis.

Another finding in our study was that vowels seem to be longer in duration before intervocalic stop consonants in SD loanwords than in native vocabulary. While these results were not statistically conclusive due to some flaws in the study design, they do support our claim that these stops are structurally different from one another, i.e. that non-native stops are produced without an active glottal open-

ing gesture whereas the native stops are produced in complete synchrony with such a gesture. This is a very important finding because it goes against the standard view that the two dialects, ND and SD, mainly differ in that stop consonants in the latter *lose* their aspiration in unstressed syllables whereas aspiration is *retained* in the former. Instead we argue that the difference between ND and SD is solely due to different constraints on intergestural timing.

Finally, our study revealed some interesting facts about the production of preaspirated stops in Icelandic. A comparison of these stops in two different environments, intervocalically and pre-consonantly, revealed a slight difference in the duration of both preaspiration and the preceding vowel. This could very well indicate a tighter coordination between the preaspiration and the oral closure in the pre-consonant environment, where we argue that these two articulations form a phonological unit, i.e. a constellation of a head gesture and a subordinate gesture, than in the intervocalic environment, where we treat the preaspiration and the oral closure as distinct phonemes. It should be emphasized, however, that even though we argue that the phasing relationship between a subordinate gesture and its head is governed by different phonological constraints than the relationship between two head gestures, we do not assume that this difference should result in vastly different coordinative patterns. Therefore, the fact that the durational differences we did observe between the two types of preaspirated stops in Icelandic were rather small and not always statistically significant does not contradict our assertion that the two types are phonologically distinct from one another.

5.5 Language Acquisition and the Phonology of Aspiration

Aside from acoustic and articulatory evidence regarding the coordination of aspiration and oral gestures in Icelandic, our phonological analysis of aspirated consonants in the language is informed by patterns of speech acquisition as we discussed thoroughly in Chapter 4.

Our key assumption about language acquisition as it relates to phonology is that phonological structure is applied to speech when certain patterns start to emerge during the acquisition period. More specifically, we assume that the phenomenon traditionally referred to in the literature as a ‘segment’ is more accurately described as a group of gestures that form a meaningful unit and adhere to each other irrespective of morphological variation. In fact, variation is key to determining whether something is a segment or not. As we discussed in Chapter 4 we assume that pre-consonantal preaspirates are single units because they alternate with postaspirated stops within morphological paradigms. However, even though intervocalic preaspirates always surface as a unit, the lack of any morphological alternation or phonological processes targeting these stops means that we have no grounds for assigning a segmental status to them.

Another finding of Chapter 4 was that data on the time frame in which preaspirated stops are acquired by children compared to postaspirated stops seem at first glance to contradict our assertion that preaspirated stops are single phonological units in certain environments. More specifically, the relatively early acquisition of preaspirates compared to postaspirated stops suggests, using the terminology of Tilsen (2014), that they behave more like competitively selected clusters than co-selected units. However, in our view this supports the idea that phonological structure is assigned during the acquisition process when patterns begin to emerge.

Children may start out viewing these stops as clusters but their phonological status is redefined before acquisition is complete. One of the main assumptions of our phonological analysis presented in the following section is that preaspirated stops are in general preferred over other coordinative types of aspirated stops in Icelandic. Perhaps it is the cluster-like nature of their articulation, evidenced by acquisition patterns, that gives them an advantage over postaspirated and acoustically unaspirated stops in the language.

5.6 Formal Analysis

Based on our discussion of gestures and gestural coordination in this chapter as well as the previous one, we propose the OT constraints in (1) to account for the coordination of glottal gestures to oral ones in the two dialects of Icelandic. Recall that crucial to our analysis is the assumption that glottal gestures are subordinate to the oral head gestures they are phonologically linked to.

- (1) Phonological constraints on the coordination between laryngeal and oral gestures.

RECOVERABILITY	[spread glottis] and its head gesture must be aligned in such a way that [sg] is perceptually recoverable.
*PARTIALOVERLAP (*PO)	Do not coordinate gestures in such a way that they overlap partially.
*PREASPIRATIONONSET	A preaspirated stop cannot appear in a syllable onset.

COINITIATION	Subordinate gestures are initiated simultaneously to their head gestures.
HEADFAITHFULNESS	Do not coordinate a subordinate gesture with an oral gesture that is not its phonological head.
CC-COORD	The release of C_1 is synchronous with the target of C_2 .
ASPVOICELESSSTOP	Voiceless stops are [spread glottis].

First, we have RECOVERABILITY, a constraint which we have adopted, with modifications, from Gafos (2002). The idea of recoverability of gestures is quite intrinsic to Articulatory Phonology due to the assertion that many phonological processes can be explained in terms of differing degrees of gestural overlap. In their analysis of gestural phasing in Georgian, Chitoran et al. (2002) have this to say about the tension between efficient speech and recoverability of phonological information:

[I]t seems that there are competing influences on intergestural timing; the first is the need to ensure recoverability of linguistic units from the signal, and the second is the need to encode and transmit information at a high rate (Chitoran et al. 2002:437).

Whereas Gafos's (2002) RECOVERABILITY constraint applies to the relationship between two head gestures, stating that in a CC cluster complete overlap between the two consonants is prohibited, our RECOVERABILITY constraint ensures that subgestures are aligned in such a way with their head gestures that they are perceptually recoverable. In order for a glottal gesture to be audible, its duration must outlast the duration of the oral constriction, as shown in Figure 5.1(b)

above. The result is a postaspirated stop consonant. However, as we discussed in Chapter 4, while partially overlapping two speech gestures may be perceptually optimal, it is not optimal from an articulatory standpoint to align them in such a way. The constraint *PARTIALOVERLAP is meant to capture an aversion to what we —based on speech acquisition data— take to be the most complicated way of coordinating a subordinate gesture (in this case glottal opening) with its head gesture (oral occlusion), i.e. with the release of the former occurring later than the release of the latter (as opposed to producing them in complete synchrony or sequentially). The difference, then, between the Icelandic ND and SD is the mutual ranking of *PARTIALOVERLAP and RECOVERABILITY; in SD, *PARTIALOVERLAP outranks RECOVERABILITY, resulting in [spread glottis] stops without postaspiration, whereas in ND this ranking is reversed, resulting in postaspirated stops. We assume that these constraints are positional. In word-initial position, which is stressed and more perceptually salient than the unstressed medial position where this dialectal contrast is found, fortis stops are postaspirated in both dialects. Word-initial position is also the only environment where aspirated stops contrast with native plain stops in Icelandic, so recoverability of the aspiration is more important. As we discussed in Section 4.3.1 above, this pattern of postaspirated stops being limited to word-initial position is far from being unique to the Icelandic SD. Our brief survey of other languages that have preaspirated stops revealed that none of them contrast preaspirated stops with postaspirated stops in word-internal position; postaspirated stops in these languages are always limited to word-initial position if they appear at all.

There is one possible way to satisfy RECOVERABILITY without incurring a violation of *PARTIALOVERLAP, i.e. by producing a preaspirated stop. However, preaspirated stops violate the constraint COINITIATION which requires that sub-

ordinate gestures, such as glottal opening gestures and velum lowering gestures, be initiated simultaneously to their head gesture, i.e. the oral constriction gesture. Furthermore, the constraint *PREASPIRATIONONSET (Keer 1999) accounts for why preaspirated stops are not found syllable-initially in either dialect of Icelandic. This constraint seems to apply more or less universally to word-initial syllable onsets in preaspirating languages, with Mazatec being the only language reported to have word-initial preaspirated stops (Silverman 2003). However, as far as word-internal syllable onsets are concerned the issue is more complicated, at least in Icelandic, where it is necessary to distinguish between constraints on aspirated stops in post-vocalic and post-consonantal onsets, respectively. We argued in Chapter 4 that clusters of aspirated sonorants followed by plain stops in Icelandic arise when the the sonorant is coarticulated with a following preaspirated stop. Since these clusters are heterosyllabic they contradict our assertion that preaspirated stops do not emerge in syllable onsets in the language. What these data suggest is that, more so than syllabic position, it is what precedes aspirated stops that determines how their aspiration is realized. In this respect, both a long vowel and a word boundary have the effect of blocking preaspiration on a following stop whereas a consonant will attract the preaspiration, resulting in complete coarticulation. This is perhaps due to the pattern of coordination between an onset consonant and a following vowel, which requires considerable overlap between the two. Since the preaspiration would not be produced in tandem with the vowel, this would delay the onset of the vowel gesture compared to other types of CV onsets and thus disrupt the speech flow (this argument extends to the aversion to word-initial preaspiration as well). Whatever the articulatory reasons behind it may be, the constraint *PREASPIRATIONONSET is only relevant to post-vocalic and word-initial syllable onsets in Icelandic.

To summarize our discussion so far, we have proposed three phonological constraints on the coordination of a subordinate glottal opening gesture to its oral head gesture, each of which penalizes one type of possible coordinative pattern. Thus, acoustically unaspirated stops incur a violation of RECOVERABILITY, postaspirated stops violate *PARTIALOVERLAP, and preaspirated stops violate COINITIATION. The mutual ranking of RECOVERABILITY and *PARTIALOVERLAP varies between ND and SD but COINITIATION is low-ranked in both dialects which, in practice, means that the emergence of preaspirated stops in Icelandic is only restricted by an aversion to preaspirated onsets, represented by the markedness constraint *PREASPIRATIONONSET.

Turning our attention to clusters of sonorant/fricative + fortis stop, we have proposed two constraints to account for the patterns of aspiration in these clusters in Icelandic. First, we follow Gafos (2002) in assuming that each language poses specific constraints on the the relative coordination of two head consonant gestures in a sequence. Information about a preferred coordination pattern is encoded in the constraint CC-COORD which, for Icelandic consonant clusters, ensures that they are produced in ‘close transition’, i.e. without an acoustic release of the first consonant. Articulatory Phonology assumes that consonant gestures are superimposed on vocalic gestures (cf. Browman and Goldstein 1986). Hence, a consequence of a more open transition between consonants is the presence of a vocalic transition between C_1 and C_2 . The fact that such a transition is never found in Icelandic is a reflection of the close coordination of consonants with one another. The close coordinative pattern of oral head gestures in Icelandic is relevant to the production of aspirated stops because it blocks the emergence of preaspiration *between* two consonants. In other words, since CC-COORD only refers to the coordination of *head* gestures, a period of aspiration before the initiation of the oral closure

of C_2 will violate the requirement that the two head gestures overlap *unless it is superimposed on C_1* . This is illustrated in Figure 5.3.



(a) Preaspiration emerges between C_1 and C_2 . CC-COORD is violated. (b) Preaspiration of C_2 overlaps C_1 . CC-COORD is satisfied.

Figure 5.3: Two ways of coordinating a preaspirated stop with a preceding consonant. Only the pattern in 5.3(b) is attested in Icelandic due to the high ranking of CC-COORD.

Due to the high ranking of CC-COORD in both dialects of Icelandic there are only two possible ways of coordinating aspiration with C_2 in the language while ensuring its perceptual recoverability; either the stop must be *post*aspirated or the preaspiration must be coarticulated with C_1 . However, coarticulating preaspiration with a preceding consonant instead of its own head violates the constraint HEADFAITHFULNESS. The motivation for positing this type of a constraint is the assumption made in AP that the default laryngeal specification of any articulation is [voiced]. More specifically, it is assumed that the absence of a laryngeal gesture in the gestural score results in a phonologically voiced consonant. Thus, articulating a glottal gesture in tandem with an oral gesture which is not phonologically associated with a laryngeal sub gesture is equivalent to realizing a [spread glottis] feature on a voiced consonant, an articulation which is often avoided (cf. Davis and Cho's 2003 constraint *[s.g., +voice]). The ranking of HEADFAITHFULNESS relative to *PARTIALOVERLAP will determine the strategy for producing an aspirated cluster in Icelandic. In SD the ranking is *PARTIALOVERLAP » HEADFAITHFULNESS, ensuring that aspirating C_1 is preferred over postaspirating C_2 , while the reverse ranking is found in a subset of ND speech.

Finally, we have a constraint termed `ASPVOICELESSSTOP` which militates against voiceless stops in the output that are not specified for [spread glottis] in the input, a structure not found in native stop consonants. This constraint is violated by borrowed stops in both dialects of Icelandic, which are neither voiced nor aspirated. However, by ranking `DEPASP`, a constraint against adding features to the output that are not specified in the input, higher than `ASPVOICELESSSTOP`, we ensure that borrowed stops do not acquire a [spread glottis] feature to satisfy the constraint.

In addition to these constraints, we assume a highly ranked `MAXASPIRATION` constraint in Icelandic, i.e. a constraint against deleting aspiration in output.

5.6.1 Intervocalic stops

First, we look at intervocalic stops and present an analysis of the realization of aspiration in both of the Icelandic dialects. Note that input forms of the type /P^h/ are meant to convey that the underlying stop is associated with a glottal opening subgesture. This denotation does not imply any sort of bias towards *postaspirated* stops in output, i.e. we do not assume that aspirated stops are *postaspirated* by default. The plosive in the winning output in (2) is denoted with a [sg] subscript which signifies that the stop is articulated with a fully open glottis despite the lack of acoustic *postaspiration* resulting from the fact that the glottal and oral gestures overlap completely. The candidate in (b) is the winner because it is aspirated, thus not violating `MAXASP`, while it avoids the more marked structures in (a) and (c) where the glottal and oral gestures are staggered in time.

- (2) Intervocalic stops are aspirated but not audibly so in SD due to the requirement that the glottal gesture not partially overlap with the oral constriction gesture.

Input: /mat ^h a/	MAXASP	*PREASPONS	*PO	RECOV
a. ma:t ^h a			*!	
b.  ma:t _[sg] a				*
c. ma: ^h ta		*!		

The difference between SD and ND lies in the relative rankings of *PARTIALOVERLAP and RECOVERABILITY. Ranking RECOV higher than *PO ensures that the stop is acoustically aspirated even though that requires a more complex gestural coordination pattern. Ensuring recoverability by preaspirating the stop is not possible due to a constraint against preaspirated stops in onset.

- (3) Intervocalic stops are postaspirated in ND due to the high ranking of RECOVERABILITY.¹

Input: /mat ^h a/	MAXASP	*PREASPONS	RECOV	*PO
a.  ma:t ^h a				*
b. ma:t _[sg] a			*!	
c. ma: ^h ta		*!		

¹The subscript _[sg] in candidate a. denotes a [spread glottis] gesture that is not realized as postaspiration due to it being overlapped completely by the oral gesture.

Non-native stop consonants are not associated with aspiration in underlying structure and, thus, do not surface with aspiration either. Acoustically, they sound similar to native SD stops but the two kinds of stops differ crucially with respect to glottal activity. This is evidenced by the fact that non-native stops behave the same in both dialects, SD and ND, which otherwise differ in their treatments of voiceless stops.

(4) Non-native stops in both dialects of Icelandic.

Input: /ratar/	DEPASP	ASPVOICELESSSTOP
a. ra:t _[sg] ar	*!	
b.  ra:tar		*

5.6.2 Word-initial stops

Word-initial stops in Icelandic differ from intervocalic ones in that they contrast for aspiration.² For that reason it is more important that the aspiration be perceptually recoverable and thus we propose a separate RECOVERABILITY constraint for word-initial position. Preaspirating the stop to satisfy the positional constraint RECOV#_ is not possible because the constraint *PREASPONS, which militates against preaspirated stops in syllable onsets, is ranked higher than *PARTIALOVERLAP.

²Of course the addition of loanwords to the language has created such a contrast between aspirated and unaspirated stops in intervocalic position as well. However, these kinds of words are rare so far and almost never form minimal pairs with native words so there is little pressure to ensure that the aspiration in the native words is acoustically salient.

- (5) Word-initial aspirated stops.

Input: /k ^h mta/	RECOV#_	*PREASPONS	*PO
a. k _[sg] in.ta	*!		
b. ☞ k ^h m.ta			*
c. ^h km.ta		*!	

5.6.3 Preaspirated stops

As we have discussed extensively above, we assume that aspirated stops surface as preaspirated in two environments in Icelandic: in coda position and in unstressed onsets following a fricative or a sonorant consonant. This happens because in both dialects COINITIATION, which requires the initiation of subgestures to coincide with the initiation of their head gestures, is ranked lower than both *PARTIALOVERLAP and RECOVERABILITY. The dialectal difference in the mutual ranking of the latter two constraints does not affect the selection of the preaspirated form as a winning candidate as shown in Tableaux (6) and (7).

- (6) Preaspirated stop in coda (SD).

Input: /εp ^h li/	*PO	RECOV	CoIN
a. εp ^h .li	*!		
b. ☞ ε ^h p.li			*
c. εp _[sg] .li		*!	

(7) Preaspirated stop in coda (ND).

Input: /εp ^h lɪ/	RECOV	*PO	COIN
a. εp ^h .lɪ		*!	
b.  ε ^h p.lɪ			*
c. εP _[sg] .lɪ	*!		

As we discussed in the previous section, we view clusters of an aspirated fricative/sonorant + stop as arising when the former is coarticulated with a preaspirated stop. This coarticulation is necessary since letting the preaspiration emerge between the two consonants in the cluster would result in a violation of the high-ranked CC-COORD which requires considerable overlap between adjacent consonants in Icelandic. Furthermore, since the complete coarticulation results in the glottal opening gesture becoming a part of the sonorant/fricative articulation in the coda of the stressed syllable, these forms do not violate a constraint against preaspirated stops in onsets even though the stop itself forms an unstressed onset. The SD pattern, shown in Tableau (8), emerges due to HEADFAITHFULNESS, the constraint against associating a subgesture with a head gesture it is not phonologically linked to, ranking lower than any of the markedness constraints on the coordination of aspiration with the oral closure.

(8) Clusters of sonorant/fricative + aspirated stop SD

Input: /vant ^h a/	CC-COORD	*PO	RECOV	HEADFAITH
a. van.t ^h a		*!		
b. van. ^h ta	*!			
c. van.t _[sg] a			*!	
d.  van̩.ta				*

The ND pattern, where the fricative or sonorant remains voiced and the stop is produced with postaspiration, emerges when HEADFAITHFULNESS ranks higher than *PARTIALOVERLAP, making it more optimal to postaspirate the stop than to separate the aspiration from the stop.

(9) Clusters of sonorant/fricative + aspirated stop ND

Input: /vant ^h a/	CC-COORD	HEADFAITH	RECOV	*PO
a.  van.t ^h a				*
b. van. ^h ta	*!			
c. van.t _[sg] a			*!	
d. van̩.ta		*!		

5.6.4 Heterorganic stop clusters

Finally, let us consider what happens when two heterorganic aspirated stops form a consonant cluster in the underlying structure. The output that emerges is that of an aspirated fricative followed by an unaspirated stop. In other words, the aspiration is solely concentrated on the first element of the cluster which also loses some of its oral constriction. We attribute this pattern to two things: a ban on two adjacent glottal gestures, represented by the constraint OCP[ASP], and a ban on two adjacent stops, enforced by the constraint OCP[STOP]. Both of these gestures are justified given the phonotactic patterns of Icelandic; adjacent heterorganic aspirated consonants never surface with aspiration on both segments and the same restriction applies to heterorganic stops, plain as well as aspirated.

(10) Clusters of two heterorganic fortis stops in SD and ND.

	$\text{vak}^{\text{h}}\text{t}^{\text{h}}\text{a}$	OCP[ASP]	OCP[STOP]	MAXASP
a.	vax.ta			*
b.	$\text{va}^{\text{h}}\text{k.ta}$		*!	*
c.	$\text{vax.t}^{\text{h}}\text{a}$	*!		
d.	$\text{vak.t}^{\text{h}}\text{a}$		*!	*
e.	$\text{vak.t}_{[\text{sg}]}^{\text{h}}\text{a}$		*!	*

One theoretically possible candidate not shown in the tableau in (10) is $[\text{vak.pa}]$, where the second stop in the cluster is realized as an aspirated fricative instead of the first stop. The reason we do not consider this candidate is that there is

not historical motivation for doing so. As we have argued extensively in this dissertation there is a preference for preaspirated stops over any other type of stop in Icelandic. This is believed to have been the case at older stages of the language as well. It is therefore reasonable to assume that these clusters were at some point produced akin to candidate (b) in (10) above, i.e. with preaspiration preceding the cluster, and that the preaspirated stop eventually developed into an aspirated fricative. In other words, there is no reason to assume that there was ever any aspiration realized on the second stop and therefore no grounds for hypothesizing that an aspirated fricative could have developed in that position.

5.6.5 Complex onsets

Earlier we mentioned that the output of fortis stop-initial consonant clusters differs depending on what follows the stop. While a cluster of stop + nasal or liquid surfaces with a preaspirated stop in the coda, the more sonorous /j, v, r/ attract the stop into the onset of the unstressed syllable, where it is postaspirated in ND (11-a) and acoustically unaspirated in SD (11-b).

- | | | | | | |
|------|----|--------------|-----------------------|------------------------|----------|
| (11) | a. | <i>sitja</i> | /sit ^h ja/ | [sɪ.t ^h ja] | ‘to sit’ |
| | b. | <i>sitja</i> | /sit ^h ja/ | [sɪ.tja] | ‘to sit’ |

As we discussed in Chapter 2, we attribute this to a constraint on syllable contact, that requires two consonants of a certain sonority distance to syllabify together (see Vennemann 1972 as well as Gouskova’s 2004 discussion of relational sonority hierarchies). The sonority hierarchy we proposed for Icelandic in Section 2.3 is shown in Table 5.1.

<i>0</i>						<i>+1</i>	<i>+2</i>	<i>+3</i>	<i>+4</i>	<i>+5</i>							
p ^h	t ^h	k ^h	p	t	k	s	f	θ	x	ɣ	ð	m	n	l	r	v	j

Table 5.1: Sonority hierarchy in Icelandic.

Referencing the sonority scale in Table 5.1 we now propose the (simplified) constraint on syllable contact shown in (12) below. We assume, following Gouskova (2004), that a constraint on syllable contact exists for every possible sonority distance between segments found in the language. These constraints are a part of a relational hierarchy which means that if, for example, a sonority distance of +4 is unacceptable between syllables in Icelandic then a sonority distance of +5 will be as well. For the sake of succinctness, we use one constraint here, SYLLABLECONTACT, to represent a resistance to heterosyllabic +4 and +5 clusters in Icelandic.

(12) Phonological constraint on syllable contact in Icelandic.

SYLLABLECONTACT A sonority rise of +4 or more is not
allowed across a syllable boundary.

SYLLABLECONTACT is unranked with respect to STRESSTOWEIGHT, the constraint that requires stressed syllables in Icelandic to be bimoraic, and both constraints rank higher than NO LONG VOWEL, ensuring that undesired syllable contact is resolved by forming a complex onset to the unstressed syllable even though the stressed vowel must be lengthened in the process to satisfy the weight requirements on the stressed syllable. These rankings are the same in both dialects, SD and ND. As a result, the winning candidate is identical for both dialects in terms of

syllabification although the different mutual rankings of *PO and *RECOV result in a difference as far as aspiration is concerned, with the stop being postaspirated in ND but not in SD, see tableaux (13) and (14).

(13) Syllable contact SD

Input: /sɪ ^h tʰja/	SYLLCONT	StoW	NLV	*PREASPONS	*PO	RECOV
a.  sɪ.t _[sg] ja			*			*
b. sɪ.t ^h ja			*		*!	
c. sɪ. ^h tja			*	*!		
d. sɪ ^h t.ja	*!					
e. sɪ.t _[sg] ja		*!				*

(14) Syllable contact ND

Input: /sɪ ^h tʰja/	SYLLCONT	StoW	NLV	*PREASPONS	RECOV	*PO
a. sɪ.t _[sg] ja			*		*!	
b.  sɪ.t ^h ja			*			*
c. sɪ. ^h tja			*	*!		
d. sɪ ^h t.ja	*!					
e. sɪ.t ^h ja		*!				*

Note, that since SYLLABLECONTACT specifically targets clusters that rise in sonority by 4 or more points across a syllable boundary, clusters of aspirated stops + liquid or nasal, i.e. clusters that have a sonority rise of 3 points as shown in Table 5.1, are not affected by this constraint. Instead, as we discussed in a previous

section, these clusters have a preaspirated stop in the coda of the stressed syllable, followed by a heterosyllabic liquid or nasal.

(15) Preaspirated stop in coda (both dialects)

Input: /εp ^h lɪ/	SYLLABLECONTACT	NO LONGVOWEL	COINITIATION
a. ε:p ^(h) lɪ		*!	
b.  ε ^h p.lɪ			*

Note that the analysis of the preaspirated stop in (15) rests on the assumption that the preaspirated stop forms a single coda consonant. As we discussed in Chapter 4 the status of preaspiration has been much debated in the literature on Icelandic and many have suggested (cf. Thráinsson 1978, Keer 1999, Heimisdóttir 2014) that it is a segment of its own, in which case the preaspiration alone would occupy the coda position (we showed in Section 4.4 that complex codas are not allowed in Icelandic) and the stop would form a complex onset with a following sonorant, as in (16-a) below.

- (16) a. *fitna* /fit^hna/ [fɪh.tna] ‘to get fat’
 b. *titra* /t^hɪt^hra/ [t^hɪ.tɾa] ‘to tremble’

Heimisdóttir (2014) argued that this was an instance of phonological opacity in Icelandic since it is impossible to derive both the output in (16-a) and the output in (16-b) by simultaneous application of constraints and therefore an intermediate step must be assumed in the derivation of the preaspirated stop. The tableaux

in (17) and (18) illustrate the conundrum. Instead of the umbrella constraint SYLLABLECONTACT we have two constraints, *DIST+3 and *DIST+4, which each target a different level of impermissible syllable contact as per the sonority scale in Table 5.1 above.

- (17) Preaspirated stop emerges to resolve illicit syllable contact while ensuring the bimoraicity of the stressed syllable

Input: /ɛk ^h la/	SToW	*DIST+4	NLV	*DIST+3	DEP
a. ɛk ^h .la				*!	
b. ☞ ɛh.kla					*
c. ɛ:. ^h la			*!		

- (18) A long vowel fails to emerge to resolve illicit syllable contact

Input: /lɛp ^h ja/	SToW	*DIST+4	NLV	*DIST+3	DEP
a. ☞ lɛh.pja					*
b. lɛp ^h .ja		*!		*	
c. ☺ lɛ:. ^h ja			*!		

As the tableaux show, there is no constraint ranking possible under which the two levels of illicit syllable contact would result in two different repair strategies. This is because one repair strategy will always be less marked than, and thus preferred over, the other. The main problem here, however, is that the preaspirated stop is assumed to be a cluster of two segments, [h] and [p], derived from a single underlying segment, /p^h/. Therefore the analysis must include an intermediate stage in which the underlying stop is, for instance, geminated before losing the

place features of the first half of the geminate: $\varepsilon k^h l a > \varepsilon k^h k^h l a > \varepsilon h.k l a$. Under a gestural view of phonology this seems like an unlikely sequence of events. Analyses like this one, which assume that preaspirated stops are always clusters, are mainly motivated by a desire to explain the segment-like duration of preaspiration (as compared to the considerably shorter postaspiration) as well as to provide a uniform approach to all preaspirates in Icelandic (since there is much more evidence to suggest that intervocalic preaspirates are indeed clusters). These are important problems to address under a segmental view of phonology. However, as we have shown in this chapter as well as in Chapter 4, approaching preaspiration from a gestural standpoint and conceiving of it as merely reflecting a different intergestural coordinative pattern to that of postaspirated and acoustically unaspirated stops, allows us to move beyond questions of duration and uniformity and ask more interesting questions regarding its origin and role in the phonological system.

5.7 Conclusion

In this chapter we have discussed the status of aspirated consonants in Icelandic and proposed an analysis of their distribution based in a theory of gestural selection and coordination. Our main goal has been to show that the production of aspiration is not one best described or explained by traditional segment-based approaches. Rather, we argue for a view of aspiration as a separate entity although phonologically linked to and oral gesture. We have chosen to adopt an approach developed Gafos (2002) and refer to this phonological relationship as a relationship between a head gesture and a subordinate gesture. There are reasons why this kind of a distinction between different types of gestures seems relevant. Unlike the oral closure, the glottal opening gesture cannot stand by itself. Whereas it can

move around and coordinate with the stop in different ways, it never surfaces as an entirely independent entity. We view this relationship as a result of phonological structure and not a property inherent to the gesture itself. After all, aspiration can surface as an independent entity in the form of [h] as well as in clusters of [hp], [ht] and [hk] which we argued in Chapter 4 are phonologically underlying in Icelandic but originally derived from aspirated stops.

In most traditional accounts, Icelandic fortis stops are analyzed as having two surface representations: a postaspirated stop and an unaspirated stop (in SD). Preaspirated stops are either considered to stem from underlying geminates or sometimes seen as allophones of singleton fortis stops. The assumption of these approaches is usually that aspirated stops are underlyingly *postaspirated* and that any deviation from that surface realization must be explained by the application of phonological rules or constraints. What we have proposed, however, is that the underlying representation of fortis stops simply entails that an oral gesture is accompanied by a laryngeal gesture. Any coordination between the two in the phonetic output is governed by phonological constraints that develop over time due to factors such as ease of articulation and perceptual recoverability. Crucial to this analysis is our claim that acoustically unaspirated stops, that appear word-internally in SD and derive from fortis stops, are not unaspirated at all. They simply exhibit the simplest of coordination relationships that exist between two gestures, one of complete overlap. This is an extremely important point to make to account for the fact that stops can be both pre- and postaspirated in the language. Under segment-based approaches, it is difficult to explain how an aspirated stop can develop from being postaspirated to preaspirated. An analysis like that must assume either fission or metathesis, depending on the phonetic structure attributed to the preaspirated stop, and it must explain why such a faithfulness

violation would occur as a regular rule in certain environments. In our analysis, the aspiration can be coordinated with the oral closure in a number of different ways without resulting in an unfaithful output. One way to coordinate these two gestures is by overlapping them completely, which can be seen as an intermediate stage between a postaspirated stop and a preaspirated stop. Furthermore, this solves the problem of why aspirated stops are so rarely *postaspirated* in Icelandic and other Nordic dialects, there is simply no preference for them to be so.

CHAPTER 6
SOCIOLINGUISTIC FACTORS - ATTITUDES TOWARDS
DIALECTAL DIFFERENCES IN ICELAND

6.1 Introduction

In this chapter we take a look at language planning and language purism and the effect it has had on the development of the Icelandic language. We will look at these factors from both a diachronic and a synchronic perspective and discuss how people's attitude towards the language may have contributed to certain dialectal differences arising and still have a hand in maintaining these differences today. We also explore grammatical writings from the 17th century onwards and discuss what early grammarians had to say about dialectal differences in Icelandic, with a special focus on aspiration. While our quest to find out the age of these differences in the language yielded inconclusive results, we hypothesize that they are much older in the language than the earliest sources indicate, and attribute the absence of discussion on the subject until the late 19th century to lack of sufficient phonetic knowledge.

Section 6.2 focuses on the history of language purism in Icelandic, and gives a couple of notable examples of how language changes have either been incited or thwarted due to language planning efforts. In Section 6.3 we focus on dialectal differences and aspiration in Icelandic and give an overview of what early grammarians had to say on the subject. Furthermore, we discuss if and how early grammars and language descriptions can cast a light on the origin of aspiration distinctions in Icelandic. Section 6.4 contains the results of a questionnaire that was given to the participants in our phonetic study and was aimed at probing their awareness

of the nature of dialectal differences in Icelandic and their attitudes towards the different dialects. Final remarks are found in Section 6.5.

6.2 A Brief History of Language Purism in Iceland

Ottósson (1990) gives a comprehensive overview of the history of Icelandic language purism and the following summary is in large part based on his work.¹ In his opinion the history of Icelandic language purism begins around the time of the Icelandic Reformation in the mid 16th century which is when we first see written evidence of an interest in language cultivation. The Reformation brought with it a surge in translations and publications aimed at firmly establishing the new state religion. Most of this translated literature came from German or Danish and an emphasis was placed on staying true to the original text rather than presenting it in ‘good’ Icelandic. The first person to notably resist this influx of foreign influence (seen both in vocabulary and syntax) on the Icelandic language was bishop Guðbrandur Þorláksson (d. 1627) whose devotion to language purism is e.g. seen in his work on the first Icelandic Bible publication (in 1584). This new publication was to some extent based on older translations of various parts of the Old and New Testaments and Þorláksson claimed that it had taken him a lot of effort to mend the broken and Danish-influenced language on these passages. A few years later, in 1589, in the preface to his collection of Icelandic hymns, Þorláksson lamented the state of poetic translations, describing the Icelandic language as e.g. “bæði ljóst og fagurt og ekki þarf í þessu efni úr öðrum tungumálum orð til láns að taka, eða brákað mál né bögur að þiggja (Ottósson 1990:18)” or “both clear and beautiful and it is not necessary in this material to borrow words from other

¹The summary given here is also based on an overview I gave in Heimisdóttir (2008).

languages or to accept broken or ugly language”.²

A more clearly stated propensity for language purism is found in *Crymogæa* (1609), a description of the people and country of Iceland, where the author Arngrímur Jónsson (1568-1648) declares his opinion that modern day Icelandic is more or less the same language as the one spoken in all of Scandinavia in antiquity. He furthermore encourages his fellow countrymen to seek inspiration from the mother tongue itself rather than imitating the language of the Danes and Germans (Jónsson [1609] 1985:103-104). These writings have earned its author the reputation of being the first Icelandic language purist since no one before him had referred in direct terms to the importance of upholding the purity of the language (see e.g. Árnason 2004).

About a century or so after the Reformation took place, an interest in the country’s literary heritage started to awaken inside and outside of Iceland, which had been the epicenter of Norse literature production in the middle ages. In the latter half of the 17th century, the Danish king—Iceland was under Danish rule at the time—began appointing scholars to collect old manuscripts in Iceland and bring them to Denmark. The most prolific of those scholars was Árni Magnússon (1663-1730), whose careful research of the language of these manuscripts laid the groundwork for what was to come in terms of Icelandic language purism. With greater knowledge of the structure of Old Norse came a desire to amend the current Icelandic language and bring it closer to the language that had been spoken in what was considered the golden age of Icelandic culture and society. This attitude was mainly reflected in orthographic changes but Árni Magnússon also had a profound influence on Icelandic grammar by advocating for the revival of the Old Norse

²All translations in this chapter from Icelandic, Danish, Swedish, or Latin to English are mine unless otherwise stated.

plural middle suffix *-umst* (instead of the *-unst* or *-ustum* being used at that time), which is still considered standard in modern times.

A notable spokesman for the conservation of the Icelandic tongue in the latter half of the 18th century, a time when Icelandic was heavily contaminated by Danish due e.g. to an influx of Danish merchants and officials, was the patriot and scholar Eggert Ólafsson, who advocated for the coining of new Icelandic words as well as suggesting improvements to orthographic conventions. These ideas were echoed by the members of the Icelandic Society for Learned Arts (Hið íslenska lærdómslistafélag) which was established in Copenhagen in 1779 and published periodicals until the year 1796 that focused on science and industry. Since these subject matters had scarcely been written about in Icelandic before, quite some effort was made by the publishers to coin Icelandic words for innovations and scientific terms. Many of these early attempts at neologisms were rather clumsy direct translations that never caught on but a few are still widely used today.

6.2.1 19th century: the golden age of language purism

With the Icelandic people's fight for independence from Denmark in the 19th century began what Ottósson (1990) refers to as the 'golden age' of Icelandic language purism. A monumental event in this battle was the restoration of the Althing, the national parliament (first established in 930 AD), as a consultative assembly to the Danish crown. The new Althing became a venue to discuss matters of independence and a burning issue was the right of the Icelandic people to have their official business conducted in their mother tongue. The language came to be seen as an essential part of the national identity of Icelanders and with that the desire to purge it of foreign influence and bring it closer to the language spoken

in the glory days of Icelandic civilization became stronger (cf. Böðvarsson 1964, Pálsson 1979). In Ottósson's (1990) words:

The fight for independence, which was in full force during that period, had the effect on the public's opinion towards the language that the indifference, which had been commonly observed, gave way to strong enthusiasm. It became clear to the people that the language played an important role in the fight for independence and they saw it as their duty to attend to it the best they could. The language was considered to be the foremost thing which defined Icelanders as a unique nation with certain rights, as well as being in some way a living testament to ancient glory and as such a great encouragement to contemporary folks (Ottósson 1990:76).

The 19th century saw a considerable growth in various printed publications available to the Icelandic public. The Icelandic Literary Society (Hið íslenska bókmenntafélag), whose goal was to “conserve the Icelandic tongue and book writing and with that the education and honor of the nation (Ottósson 1990:53)”, was established in 1816 at the behest of the Danish linguist Rasmus Kristian Rask, who was an avid student of Icelandic and resided in Iceland in the years 1813-1815. Rask was quite concerned with the state he found the language in and famously wrote this in a letter to an Icelandic friend regarding the future of Icelandic:

I can sincerely tell you that I think that the Icelandic language will soon become extinct; I reckon that hardly anyone will understand it in Reykjavík when 100 years have passed, and hardly anyone in the country another 200 years later if everything goes the way it has so far and if severe resistance will not be put up; even among the best of men every other word is spoken in Danish, among the common public it will persevere the longest (Rask et al. 1941:164).

Rask was the first person to write a comprehensive grammar of the Icelandic language. His grammar, *Vejledning til det oldnordiske eller gamle islandske Sprog* or *A guide to the Old Norse or Old Icelandic language* was first published in 1811,

before Rask ever travelled to Iceland. It is evident from his writings on Icelandic grammar that Rask does not distinguish between Old Norse and Modern Icelandic. The difference between these two stages of the Icelandic language became clearer to him in later years as he started looking more at Old Norse literature but Ottósson (1990) hypothesizes that the lack of distinction in his older work contributed significantly to the tendency of language purists to want to restore Icelandic to its older form.

The single most influential publication in the history of Icelandic language purism is by many considered to be the periodical *Fjölnir* which was established in 1835 and published annually till 1839 and again between the years 1843 and 1847. Most of the articles published in *Fjölnir* were regarding current events as well as practical and cultural issues. The kind of language favored in *Fjölnir* was of a more common nature than the more learned style, full of foreign vocabulary and convoluted syntax, that had previously been exclusively seen in printed materials. This had an immense influence on the language style of publications that followed *Fjölnir* and in its effort to imitate the style and language of the Old Norse sagas while avoiding the use of dated and unfamiliar grammar structures (which had been the pitfall of some earlier attempts to purify the language), it set the tone for a language policy which is still being upheld in Iceland to this day.

One of the four creators of *Fjölnir* was a linguist by the name of Konráð Gíslason, whose series of literature reviews, that were published in *Fjölnir* in the years 1843-1845 and were almost exclusively concerned with the language of the publications reviewed, had a great influence on the Icelandic people's attitude towards the Icelandic language as it developed in the 19th century. In his reviews, Gíslason pointed out several orthographic and syntactic choices that he found fault

with and suggested improvements, often inspired by the linguistic features of Old Norse. He was also particularly concerned about the amount of Danish slang found in various publications which was very much in the spirit of the language purists that came before him. Gíslason's ideas about orthography were essentially that it should resemble pronunciation as closely as possible (Gíslason 1836). These ideas were met with resistance, however. Sveinbjörn Egilsson, a renowned theologian and classicist, wrote an article (the article is not actually authored but it was rumored to have been written by Egilsson) where he stated that not only would this allow for various speech atrocities and pathologies to make their way into the language, but furthermore each person's orthography would differ depending on their own pronunciation of the language (Egilsson 1836:180).

6.2.2 Examples of language planning successes and failures

Konráð Gíslason's most remarkable contribution to the preservation of Icelandic was in the realm of morphology and concerned the inflection of nouns belonging to the category of masculine *ija*-stems (for a detailed overview cf. Heimisdóttir 2008). The inflection of these nouns had changed from Old Norse to the present language in that the masculine nominative singular ending *-r* had been reinterpreted as belonging to the word stem and had, thus, made its way into all four noun cases, both in the singular and plural, as seen in the example from Gíslason (1845) in Table 6.1.

In Gíslason's words:

To inflect masculine words, that end in *ir* throughout the singular, the way it is done in *leiðarvísir* [gives an example of the 'new' inflection], is certainly quite correct according to current convention; but

		Old inflection	New inflection
Singular	Nom	hellir	hellir
	Acc	helli	hellir
	Dat	helli	hellir
	Gen	hellis	hellirs
Plural	Nom	hellar	hellrar
	Acc	hella	hellra
	Dat	hellum	hellrum
	Gen	hella	hellra

Table 6.1: Two ways of inflecting the masculine *ija*-stem *hellir* ‘cave’ in Icelandic. The Old Norse inflection is shown on the left hand side, the new inflection, i.e. the inflection that was dominant in the 19th century, is shown on the right hand side.

wouldn't it be appropriate to return to the older paradigm? Because it cannot be defended, that it is much more beautiful, especially in the plural [...] and still, the plural is even uglier in other words, where i is not deleted, e.g. *vísirar*, *vísira*, *vísirum* [...] (Gíslason 1845:65-66).

Gíslason's writings about this particular aspect of Icelandic morphology turned out to be quite influential and by the early 20th century it had become quite common to see the old inflection of masculine *ija*-stems alongside the new one in grammar books (often accompanied by comments on the ugliness of the new inflection compared to the old one) (see e.g. Jónsson 1908, Ólafsson 1920, Briem 1918, Jónasson 1920, Smári 1923). Ever since the middle of the 20th century, the old inflection of these words has been the only one cited in grammar books as ‘correct’ and even though the new inflection is still commonly heard in speakers of all ages (although rarely in the plural), it is evident that the old inflection, which had all but disappeared from the language in Gíslason's time, has been successfully revived in Icelandic due to the vigorous language policing of teachers, linguists, and other language enthusiasts.

This particular instance of morphological revival is a perfect example of an interesting aspect of Icelandic language policy, which has often been concerned with reversing language change and bringing Icelandic closer to what it was in the golden age of literature production in the country. In fact, Árnason (2004) suggests that perhaps the strong tendencies for language purism in Iceland are related to the almost millennium old writing tradition in the country, i.e. that the abundance of linguistic specimens in the form of old manuscripts has inspired people to take care of the language, especially at times when the language was all there was that defined Icelanders as a nation.

The revival of the old inflection of the masculine *ija*-stems is far from being the only example of successful efforts to steer the Icelandic language towards or away from change. From the 1920s onwards several articles began to appear in Icelandic newspapers that condemned a certain linguistic phenomenon referred to as *flámæli* (see e.g. Jóhannsson 1920, Anonymous 1931, Sigurjónsson 1939). This highly stigmatized pronunciation, which was particularly prevalent in the southern part of the country, is characterized by a near-merger of the vowels [ɛ] and [ɪ] on the one hand, and [œ] and [ɣ] on the other hand. This language variant was commonly described as *hljóðvilla* or ‘sound error’ as well as ‘wrong’ and ‘ugly’. In the 1940s Björn Guðfinnsson, a prominent Icelandic linguist, undertook the massive project of traveling around the country and researching pronunciation in every single town. Much to his dismay, Guðfinnsson discovered that *flámæli* (literally ‘wrong speech’) was on the rise in many parts of the country, which he attributed to children rejecting the vowels of *réttmæli* (i.e. ‘right speech’) if they could get away with it. To counteract this development, Guðfinnsson came up with a method of instructing elementary school teachers on how to teach children who suffered from *flámæli* to speak ‘correctly’. In an effort to do this, he held two

seminars for teachers in 1946 where the main focus was on eradicating *flámæli* and promoting *réttmæli* although other dialectal features, which Guðfinnsson deemed superior, were also discussed and encouraged, including the northern ‘hard speech’ (Guðfinnsson 1947).

Guðfinnsson went on to make suggestions regarding the standardization of Icelandic pronunciation. His vision was that a single standard dialect, containing the dialectal features of Icelandic that were better or more beautiful than others in his and the public’s opinion (based on conversations he had had with people during his fieldwork), would be taught to children in schools and advocated in the media. Among the features he wanted included in the standard pronunciation was *réttmæli*, hard speech, and *hv*-pronunciation, i.e. the production of an orthographic *hv*-cluster with a velar fricative [x] instead of a plosive [k^h], mainly found in the southern and southeastern parts of Iceland. He, however, rejected sonorant voicing as a possible standard pronunciation because he felt that it was not universally liked in Iceland despite his own opinion that the voiced sonorants were both more original and sounded better than the devoiced ones:

Some have maintained that the voiced pronunciation is not original in Icelandic but rather an innovation of later centuries. This is wrong. This pronunciation was around in antiquity, at least in some parts of the country. However, we do not know now when these sounds started to become devoiced. [...] I think that the voiced pronunciation is much more beautiful than the devoiced one—and those who still use it should not let themselves be repelled from it for the time being even though they are sometimes made fun of because of it and even called ‘soft spoken’—and not as a sign of respect (Guðfinnsson 1947:29-30).

Guðfinnsson’s ideas were presented to the minister of education in 1950 who in turn sent them to the University of Iceland’s college of arts and sciences for review. There the consensus was that *flámæli* was wrong and should be tackled

full force, e.g. by making sure that people who possessed this dialectal feature be kept away from public radio and the national theatre. Some effort was made to establish official rules regarding the pronunciation of Icelandic but those efforts were soon abandoned, perhaps since after the death of Björn Guðfinnsson in 1950 no one was there to advocate for his vision of a standardized pronunciation.

As a result of the endeavors of Guðfinnsson and others, who made sure that *flámæli* was widely considered to be a highly stigmatized and undesirable way of speaking, it all but disappeared from the language and is rarely heard nowadays (Árnason and Thráinsson 2003). As an interesting side note, Arnbjörnsdóttir (1990) looked at the occurrence of *flámæli* in North American Icelandic and found it to be quite common long after it had been eradicated in Iceland. North American Icelandic is spoken by the descendants of Icelanders who emigrated to Canada and the United States of America in the late 19th and early 20th centuries (cf. Matthíasson 1976-1977, Kristinsson 1983), i.e. well before the effort to systematically get rid of *flámæli* in children's speech began in Iceland. The presence of *flámæli* in North American Icelandic is thus indirect evidence that the disappearance of this dialectal feature in Icelandic was mostly due to language policing (as opposed to a natural development).

Björn Guðfinnsson was not the only advocate for a standardized pronunciation of Icelandic in the 20th century. In the beginning of the century a series of articles appeared in newspapers and magazines regarding the pronunciation as well as the orthography of the language, often written by people who had no formal education in linguistics. For instance, a series of articles by a medical doctor by the name of Guðmundur Björnsson appeared in various periodicals at the beginning of the century (see e.g. Björnsson 1912, 1913). The articles argued that a standardized

pronunciation, that preserved (in the author's opinion) an older and more beautiful pronunciation of Icelandic, should be taught in schools. Many of Björnsson's suggestions were quite archaic and not likely to catch on—among other things he suggested that processes such as the hardening of fricatives to stops before [l] and [n], and the dissimilation of geminate *l* and *n* to [tl] and [tn], respectively, both of which had taken place as early as the 14th century, be reversed— but he persisted with his ideas for quite a few years. Regarding other sound changes, that were acceptable in his opinion, Björnsson suggested that the orthography be changed to reflect them so that people might become accustomed to speaking the way they wrote. Others had less radical ideas for standardizing pronunciation, most often involving the eradication or promotion of a particular regional variant. For instance, both Kristleifsson (1935) and the anonymous author (H. 1920) argued that the cluster *hv* should always be produced the way it was normally produced in the southeastern part of Iceland, with a fricative rather than a plosive, and the latter was also adamant that the (currently soon to be extinct) northern pronunciation of [p] instead of [v] and [k] instead of [ɣ] before [ð] should disappear from the language.

It is difficult to speculate about the general public's reaction to the kinds of ideas outlined above. Björn Guðfinnsson's campaign against *flámæli* aside, none of these modifications to pronunciation were successfully implemented or had any effect on the way people saw the Icelandic language. Hjörvar (1920), reflecting on the series of articles written by Guðmundur Björnsson a few years earlier, implies that Björnsson's ideas for changing the way Icelandic was spoken were certainly a hot topic at the time but met with ridicule rather than genuine enthusiasm.

The director of health upheld this matter for a while, gave lectures here in Reykjavík using this new pronunciation etc. For a while this

was talked about a lot, though rather as a strange undertaking than a serious matter. Later everything went quiet again and nowadays nobody mentions whether it is more beautiful to say *bar-n* or *baddn*, *sag-ði* or *saggði* (Hjörvar 1920).

As we will discuss in Section 6.3, much less was written about postaspiration of stops as well as sonorant voicing and devoicing, perhaps because variation involving aspiration is not as obviously reflected in adherence to or divergence from orthography as some of the other dialectal features that occupied people's minds in the 20th century.

6.2.3 Language planning in modern times

Language purism is still thriving in Iceland and has been for the past century. With the establishment of the University of Iceland in 1911 and major advances in technology, the need for neologisms grew rapidly and it was considered the duty of faculty at the university to coin new words to describe terms in their respective fields. Several committees have been formed to take on this job, starting with the Engineering Society's Word Committee (Orðanefnd Verkfræðingafélagsins) in 1919, which published a dictionary of technological words in 1928 (Ottósson 1990). Other fields that have shown a systematic effort to coin Icelandic words include those of fishermen, medical professionals, musicians, and lawyers to name a few. In 1964 a special Icelandic language committee was established at the order of the minister of education. Its job is to give consultation to public offices and the general public on matters related to language use as well as facilitating the introduction of neologisms in Icelandic (Ottósson 1990).

Language purism has also found support in the Icelandic media, which has

manifested itself both in an effort to use ‘pure’ language but also in the publishing of columns and articles about the Icelandic language. For instance, one of the largest newspapers in Iceland, *Morgunblaðið*, ran the popular weekly column *Íslenskt mál* ‘the Icelandic language’ for decades, which served the purpose of educating readers about various aspects of the language and teaching them the ‘right’ way of speaking it. Similarly, educational programs about the language have appeared on both public radio and television in Iceland, often engaging the public with invitations to write to the show with questions or concerns about a particular language use they have noticed.

A relatively recent grammatical battle that has consumed a subset of the Icelandic public is the fight against what is referred to by laymen as *þágufallssýki* ‘dative sickness’, or more neutrally by linguists as *þágufallshneigð* ‘dative tendency’. This is a tendency to produce subjects of experiencer verbs in the dative case instead of the standard accusative case or in some instances nominative case. In a study of this syntactic variation, Jónsson and Eypórssón (2003) found that 90.8% of their 11 year old participants showed some tendency for producing the dative case where a different case was expected. This is in spite of a considerable effort in the school system to teach the ‘right’ case for these verbs. Despite the clear indication that the dative case is taking over, this kind of language use remains highly stigmatized and efforts continue to eradicate it from the language. Perhaps it is a sign of different times that these efforts are proving to be futile. With technical innovations such as the internet, exposure to more casual language use has increased exponentially and, thus, the spread of non-standard language use has without a doubt become more difficult to contain.

According to recent studies by Hanna Óladóttir (see e.g. Óladóttir 2007), Ice-

landers still put the language first when asked to consider what defines Iceland as a nation. Out of 24 participants, 20 people in her study identified the language as the number one characteristic defining the Icelandic nationality. When asked to elaborate on their answers, many of Óladóttir's participants expressed a desire to preserve the language so that ancient literature will remain accessible to the general public (with the added perk of the opportunity to brag about this supposed continuity of the Icelandic language from Viking times to the present). Whatever the motivation, it remains clear that Icelanders place an enormous importance on keeping their language pure from foreign influence and free of grammatical aberrations. In the next two sections we will learn that this desire extends, at least for some speakers, to upholding the 'purest' form of Icelandic pronunciation.

6.3 Dialectal Differences and Aspiration: An Overview

Determining the approximate age of dialectal differences involving aspiration of stop consonants in Icelandic is not an easy task. This is mainly because differences in the level of stop aspiration are not necessarily reflected in the orthography the way many other language variations are (either due to the orthography evolving to reflect a change or due to spelling errors made by writers of manuscripts). This is especially true of clusters of sonorants and aspirated stops, which always contrast with clusters of sonorants and plain stops irrespective of the placement of the aspiration and are therefore rarely if ever subject to variation in spelling. In addition to lack of direct evidence from orthography, exploring the age and origin of these dialectal differences is impeded by the fact that authors of the earliest grammars written about Modern Icelandic seem to have been either indifferent to or unaware of differences involving the aspiration of stop consonants. These two is-

sues are undoubtedly related; while most early grammars are primarily focused on morphology they do contain information about phonology and phonetic changes but these are more often than not limited to alternations within paradigms as well as changes, such as umlaut and assimilations, that have taken place during the progression from Old Norse to Icelandic and are reflected in spelling. These include e.g. *u*-umlaut, whereby [a] > [œ], which is commonly seen in morphological alternations such as *saga* ‘story, NOM.SG.’ ~ *sögu* ‘story, OBL.SG.’, and the dissimilation of [ll] and [nn] to [tl] and [tn], respectively, a sound change that is not reflected in the orthography and must therefore have stood out to writers of grammars as something worth mentioning.

Despite these obstacles there is some evidence to suggest that a difference in the postaspiration of intervocalic stop consonants had emerged as early as the middle of the 18th century. Guðfinnsson (1946) states that several examples of intervocalic fortis stops being spelled as *b*, *d*, *g* instead of *p*, *t*, *k* (an indication that the writers produced these stops without aspiration) can be found in letters written by Southern Icelanders around the turn of the 19th century, and even mentions two examples of this from the mid 18th century. Unfortunately he doesn’t provide examples or references for this information so it cannot be verified. However, Jónsson (1964) makes the same claim in a book chapter about Icelandic dialects:

The oldest examples of *b*, *d*, *g* being written instead of *p*, *t*, *k* are only just over 200 years old. The sound change must, of course, be considerably older in the spoken language than the oldest examples indicate, as is also the case with other phonetic variation. There are a few examples of soft speech [i.e. *linmæli*] from around the year 1800 and all of them come from southern letters.

Finally, in his book about sound changes in medieval Icelandic, Jóhannsson (1924) writes regarding the SD unaspirated pronunciation that “I am told, that this

pronunciation first emerges after the year 1800, but that is completely uncertain”. It is, of course, entirely possible that all three aforementioned authors got their information from the same source but we have no reason to believe that these letters do not exist. Regardless of that, it is interesting to note that these three linguists all assume that *linmæli* (soft speech, i.e. unaspirated stops) is newer in the language than *harðmæli* (hard speech, i.e. postaspirated stops) and take the exemplified deviations from standard orthography as evidence of that. In other words, they assume that southerners lost their postaspirated stops and subsequently started spelling them differently. However, we can just as easily hypothesize that these spelling mistakes merely reflect the writers’ awareness that their intervocalic *p, t, k* sounded more like their word-initial *b, d, g* than word-initial (postaspirated) *p, t, k* (note that Icelanders did not used to receive much in the way of formal education in those times) and had nothing to do with an emerging sound change. These kinds of evidence simply do not suffice to make assumptions about the relative age of the two dialectal variants in question.

6.3.1 Aspiration in early grammatical literature

As we mentioned earlier, authors of early grammars on the Icelandic language did not see a reason to discuss dialectal differences regarding aspiration of stop consonants, either because these differences did not exist at the time these grammars were written or perhaps because the authors weren’t aware of them or considered them uninteresting. Moreover, as we already discussed thoroughly in Chapter 5, the articulation of fortis stop consonants at earlier stages of the language, i.e. before the dialects began to diverge, cannot be determined from grammatical writings because they do not describe the exact nature of these consonants. This is e.g.

true of the oldest preserved work on Icelandic grammar, *The First Grammatical Treatise* (see Benediktsson 1972), which is thought to have been written in the 12th century.

After *The First Grammatical Treatise* not much was written about the Icelandic language for the next half a millennium. From the mid 17th century there exists a description of Icelandic grammar written by Runólfur Jónsson in Latin but nothing can be gleaned from that regarding the nature of stop consonants (Jónsson 1651). There are two language descriptions from the 17th century that do mention aspirated sonorants, but only in word-initial position. The first one is found in *Crymogæa*, a history of Iceland written by the scholar Arngrímur Jónsson. He writes:

Nowadays people sometimes produce l, n, r with aspiration, rarely or never done by people in antiquity, e.g. *hlutur*, earlier *lutur*, *hnífur*, earlier (sometimes still) *knífur*, *hrútur* earlier *rútur*. The same sometimes applies to j and v as consonants, e.g. *hjól*, *hvalur*, but those I think were the same in antiquity (Jónsson [1609] 1985:98).

A similar description (with different examples so it is unlikely that either author copied the other) is given in a Latin manuscript which is attributed to bishop Oddur Einarsson, who was born in Möðruvallaklaustur in the north of Iceland in 1559 (see an Icelandic translation in Einarsson 1971:147). The fact that both authors only mention word-initial aspiration does not have to imply that word-internal sonorants were not aspirated. As we will see in this section, it is not until the late 19th century that authors of Icelandic grammars and language descriptions begin to display some awareness of aspiration as a phonetic feature. Until then, whatever was written about aspiration seems to have been grounded in orthography and since the presence of aspiration in word-internal consonants is not marked by

an orthographic *h* it went unnoticed. Due to this reason, the possibility should not be excluded that linguists of those times did notice some dialectal differences in the production of aspiration but simply lacked the terminology to describe what they were hearing and therefore didn't make note of it in their grammars.

From the 18th century we have *Grammatica Islandica* written by Jón Magnússon in the years 1737-1738 (published with an Icelandic translation in Magnússon 1997). Magnússon does not address the aspiration of stop consonants but he does pay some attention to the phonetic attributes of other consonants. He mentions that the letters *d*, *f* and *g* have two phonetic realizations: “hard and somewhat aspirated” in word- or syllable-initial position, and “soft” in word-medial and word-final positions. Judging by his description, he seems to be contrasting the ‘hard’ stop consonants [t] and [k] and the ‘aspirated’ fricative [f] with the ‘soft’ fricatives [ð], [ɣ], and [v], respectively. There is no reason to believe that Magnússon is attributing aspiration to the stop consonants in this case (he is most certainly referring to lenis stops), rather it must be the [f] that he thinks of as ‘somewhat aspirated’. Regarding other consonants he simply says that “reliqvæ omnes Consonantes communiter nobis ut aliis sonant” or “all other consonants sound the same in our language as in other languages”.

As we mentioned in the previous section, the Danish linguist Rasmus Kristian Rask wrote and published a grammar of Icelandic in the early 19th century. The first edition of his work came out in 1811, before Rask had visited Iceland, but it was later edited and re-published (see e.g. Rask 1854). It is clear from the earliest edition of Rask's Icelandic grammar that he considered Old Norse and Icelandic to be more or less the same. However, he does comment quite a bit on Modern Icelandic pronunciation. He distinguishes between ‘hard’ and ‘soft’ *k* and *g* but

that distinction refers to tongue position: the ‘hard’ stops are velar and the ‘soft’ stops are palatal. He does not have much else to say about the pronunciation of stops consonants. One possibly relevant point to our discussion of aspiration has to do with Rask’s comments about the voiceless dental fricative *þ* [θ]. He says: “*þ* sounds like the English *th* in *think, thought*, i.e. it is like a breathy or lisping *t*. It only appears in the beginning of words, and it never geminates (Rask 1854:8).” Rask’s assertion that *þ* only appears word-initially is interesting because in the speech of modern SD speakers, [θ] is produced word-internally before [k] in words like *maðka* ‘maggots’ whereas it appears as a voiced [ð] in ND. It is possible that fricative voicing in this environment was predominant in the early 19th century and that Rask simply never heard a word-internal [θ]. After all, we don’t know for certain which pronunciation is older in Icelandic. However, it is just as possible that Rask’s ideas about the distribution of *þ* were solely based on orthography and that he simply never noticed the presence of a word-internal voiceless dental fricative in a handful of Icelandic words.

The first grammar of Icelandic in the native language was written by Guttormur Pálsson in 1822 and is preserved in a paper manuscript (Yelverton 1971). No mention is made of dialectal differences involving aspiration of stop consonants in this work. Sometime after the year 1832, Sveinbjörn Egilsson, a renowned classicist and a teacher, wrote a manuscript of an Icelandic grammar that he undoubtedly intended to use in his teachings. In his work, Egilsson relied heavily on Rask’s grammar as well as the one written by Guttormur Pálsson a few years earlier. Much like his predecessors’ work, Egilsson’s discussion of pronunciation is quite limited. He categorizes stop consonants based on their place of articulation, the same way Rask had done, and makes the same observations about palatal vs. velar stops. The one comment he makes about aspiration is in a section he calls *Barbarismus*,

which contains some observations about the ‘misuse’ of language. There he notes that there is a tendency to add aspiration where it doesn’t belong, i.e. replace *rammastan* with *hrammastan*, and reversely to remove aspiration, i.e. produce *lakkar* instead of *hlakkar* (Wolf 1977:64). Unfortunately, Egilsson’s manuscript is very fragmented in that many of the sections merely contain notes and bullet points instead of a full text so it is not clear whether he is talking about actual speech or simply orthography when he states that aspiration is removed or added. However, it appears from some of Egilsson’s other work (see e.g. Egilsson 1849) that he specifically uses the word *áblásning* ‘aspiration’ to refer to orthographic *h* so there is no particular reason to assume that he was aware that individual consonants could differ with respect to aspiration, which might be why he sees no reason to discuss it with respect to word-internal sonorants and stops. Another indication that Egilsson (and other linguists of his generation for that matter) was simply not attuned to differences in aspiration is his observation that “if *ð* is deleted in monosyllabic words [...] the *t* geminates, or *ð* becomes *t* before *t*, e.g. *leitt*, *rautt*, *gott* (*leiður*, *rauður*, *góður*).” What he refers to here as a geminate *t* was almost certainly a preaspirated *t* at that point, a fact that is not observed in any grammar books until a few decades later.

6.3.2 Postaspiration of intervocalic singleton stops

The oldest reference to SD *linmæli* or ‘soft speech’ that we were able to find comes from Storm (1881). He writes that in the southern part of Iceland, especially in the Reykjanes (i.e. southwestern) peninsula, voiceless consonants have a tendency to become half-voiceless. As examples he gives the words *matur*, *úti*, and *taka* which become (in his transcription) *maður*, *úði*, *taða*. This sound change became

possible, he says, because the original voiced stops have spirantized intervocally in Icelandic, becoming θ and δ , allowing the voiceless stops to become half-voiceless without the distinction being lost between the two categories. Storm's choice of the term 'half-voiceless' to describe what are without a doubt unaspirated voiceless stops is interesting. As we discussed in reference to Sveinbjörn Egilsson's grammar above, language descriptions of that time seem to lack awareness of the existence of aspiration.

Storm goes on to say that this change from voiceless to half-voiceless stops also appears in the speech of certain individuals in the North. He furthermore remarks that, as far as he knows, this change has not affected p ; the words *tapa* and *gapa*, according to him, are never produced with b instead of p (it is possible that the difference between a postaspirated and an acoustically unaspirated p was less noticeable since labial stops tend to be produced with less aspiration than alveolar and velar stops). Finally, Storm mentions that this sound change has been referred to as "latmæli" or "lazy speech" by one Eiríkur Jónsson (the author of *Oldnordisk ordbog* from 1863). We were unable to find that reference in print but Storm's remark is interesting because it indicates that unaspirated stops had become somewhat stigmatized already in the latter half of the 19th century. This sentiment is echoed in an 1888 article about school children and reading where the author, Jón Þórarinnsson writes:

Children, who are allowed an unclear or wrong pronunciation of the letter-sounds, will hardly ever become literate in the proper sense of the word. In some places in the South there is not nearly enough caution exercised with respect to this. [...] Furthermore, the k -sound e.g. is pronounced so softly in some places that it sounds more like a g -sound than a k -sound (Þórarinnsson 1888:10).

In a review of the grammar *Íslensk réttitan* by Finnur Jónsson (published in

1909), Jóhannsson (1911b) expresses concerns about spelling mistakes caused by *linmæli* (he has no problems with the pronunciation itself, just the state of the written language). He suggests that mistakes such as writing *tegið* instead of *tekið* occur because people are used to seeing intervocalic *g* in the orthography, where it denotes the voiced velar fricative [ɣ] (as in *dagur* [ta:ɣʏr]), whereas neither *b* nor *d* are utilized for purposes other than denoting lenis stops in word-initial and post-consonantal positions. The solution he proposes is to introduce a barred *g* (ḡ) into the orthography to denote the velar fricative sound and thereby eliminate any confusion caused by the presence of an intervocalic *g*.

6.3.3 Aspiration in consonant clusters

In an article about the age of sonorant devoicing in Icelandic, Böðvarsson (1951) states that the first printed references to Icelandic clusters of devoiced sonorants followed by stops were by Björn Ólsen in *Zur neuisländischen Grammatik* (Ólsen 1882) and Jón Ólafsson in the first edition of his Icelandic grammar for school children (Ólafsson 1911). This is actually not the case. In his book about early English pronunciation, Alexander Ellis writes regarding Icelandic that “l is usually and always intentionally (l), but the sound of (lh) is sometimes produced by a following *t*, as *alt* (alht) (Ellis 1869:545)” and that “m is always intentionally (m), but may be voiceless (mh) before *t* (Ellis 1869:546)”. Furthermore, he writes in footnotes, where he references Henry Sweet as his source, that “[b]efore *t*, *n* is voiceless as *beint* (beeinht).—H.S. (Ellis 1869:546)” and that “[i]n *rt*, the *r* is voiceless, as *hart* (Harht).—H.S (Ellis 1869:547)”. Ellis mentions in a different footnote that examples where he references Sweet are where Sweet’s impressions differ from those of Ellis:

Mr. Henry Sweet, of the Philological Society, having acquired the pronunciation of Icelandic from another teacher, Mr. Hjaltalín, I requested him to inform me where his impressions differed from mine. The observations which he has been kind enough to furnish, are added in the shape of footnotes, signed H.S.(Ellis 1869:538).

All of the examples Ellis gives are of sonorants before [t] and he indicates that he does not believe that this pronunciation is found before [k]. Regardless, it is evident that the Icelandic pronunciation known to Henry Sweet had sonorant devoicing before stop consonants (note that Sweet makes no mention of these kinds of clusters in his phonetics handbook, Sweet 1877) whereas Ellis's pronunciation was mixed, with /l/ and /m/ emerging as voiceless but /n/ as voiced. Oddly enough, he also seems to assume that the rhotic is voiced which is never the case in these clusters. The differences in Ellis's and Sweet's impressions of Icelandic pronunciation are most likely due to dialectal variation. Neither Ellis nor Sweet were native speakers of Icelandic but they each had a different Icelandic mentor. According to Ellis, he himself learned Icelandic pronunciation from a Mr. Eiríkur Magnússon, who he describes as a translator and editor of a revised edition of the Bible. Sweet on the other hand, according to Ellis, was taught by a Mr. Hjaltalín, a teacher by profession. The man who Ellis refers to as his mentor was a librarian in Cambridge, born in 1833 in Berufjörður in the eastern part of Iceland (Einarsson 1933). Sweet's mentor, Jón A. Hjaltalín, who for several years served as the headmaster of an elementary school at Möðruvellir in northern Iceland, was born in Súgandafjörður in the western part of the country in 1840. Neither of these men, therefore, came from areas which have been associated with the sonorant voicing dialect in later studies, although Hjaltalín, at least, spent considerable time in that area. However, as far as we can tell Eiríkur Magnússon's father, Magnús Bergsson, was born in Þingeyjarsýsla in northeastern Iceland in

1799 (Ólafsson 1948-1976), an area which still has considerable sonorant voicing. We can therefore perhaps assume that, despite growing up in Berufjörður where his father was a priest, Eiríkur Magnússon must have spoken the same dialect as his father did.

Jón Hjaltalín, Sweet's teacher, later became the subject of controversy when two of his former students engaged in an argument about his teaching methods in the form of opinion pieces in local Icelandic newspapers. Friðjónsson (1916, May 31) writes:

The authors of dictionaries are accustomed to promoting that pronunciation, which is traditional in their neck of the woods and to assume it to be valid and universal. When I was a student at Möðruvallaskóli, we studied a grammar written by headmaster Hjaltalín. He had included a chapter regarding the pronunciation of our language in which he assumed that the pronunciation, which he had grown up with, was universal and some of his claims were wrong, when applied eastwards to the pronunciation of Þingeyarsýsla [a county in the north-eastern part of Iceland]. The pronunciation of the language is very wrong in many parts of the country. *t* is e.g. pronounced as *d* in some counties. [...] The pronunciation of the language is usually the most correct in Þingeyjarsýsla.

Árnason (1916, June 15) wrote a rebuttal:

He accuses Hjaltalín of having taught us a wrong pronunciation of the Icelandic language and uses the pronunciation of Þingeyjarsýsla as his point of reference. But he doesn't give an example of a single word or sentence from Hjaltalín's grammar to prove his erroneous point. I believe that this would be difficult for Gvendur. I think that whatever is written about pronunciation in Hjaltalín's grammar—I still have it—is more correct than the pronunciation of Þingeyjarsýsla and the bragging of Guðmundur from Sandur [i.e. Friðjónsson] regarding it.

This amusing exchange of opinions is a great example of the public mindset in the early 20th century, when the proper use of the Icelandic language was a

hot topic and people tended to have strong opinions about their own pronunciation being correct and beautiful, but others much less so. Unfortunately, Jón Hjaltalín's grammar was never published or written down by himself (the copy Árnason refers to in the above quote must have been his own notes from Hjaltalín's in-class dictations) and is therefore not accessible. We can, however, deduce from Friðjónsson's (1916, May 31) words and from the pronunciation that got passed on from Hjaltalín to Henry Sweet that Hjaltalín's grammar must have advocated both soft speech and sonorant devoicing. The author of the rebuttal, Árni Árnason, was from a farmstead called Höfðahólar in the county of Austur-Húnavatnssýsla in the northwestern part of Iceland. He must surely have shared dialectal features with Jón Hjaltalín, i.e. spoken SD. The northwestern part of Iceland is a mixed dialectal area. Guðfinnsson (1946) found that 30% of the population in this part of the country aspirated either all (3%) or some (27%) of their fortis stops, but only 8% of the population pronounced voiced sonorants before fortis stops. It is therefore more than likely that Árni Árnason spoke SD but it is interesting that he seems to agree with Guðmundur Friðjónsson that the ND pronunciation is specifically characteristic of Píngeyjarsýsla in the northeast when he himself came from a mixed dialectal area and must therefore have been exposed to ND speech characteristics in his own part of the country (unless they only started emerging over there later on).

A collection of letters written by Konráð Gíslason, the linguist and one of the founders of the periodical *Fjölnir* whose contribution to Icelandic language planning we discussed in the previous section, was published in Kristjánsson (1984). Gíslason lived and worked in Denmark for most of his adult life, having moved there in 1831 at the age of 23. In a letter dated 2 January 1886, written to the linguist Björn M. Ólsen, Gíslason writes:

[...] to thank you for what you have written regarding Southerners' pronunciation of *ð* in front of *k*. I have not noticed that they say for instance *blaþka* and *maþkur* but I find it interesting and remarkable.

It is interesting that Konráð Gíslason, who lived in the southern part of Iceland for several years before moving to Denmark and also had several Icelandic friends and colleagues over there, was never aware of dialectal differences in terms of fricative voicing before Ólsen pointed them out to him. It is of course possible that he was aware of differences in sonorant production in this environment but had not noticed that the pattern extended to the alveolar fricative. It is also possible, although unlikely, that sonorant devoicing was not a feature of the Icelandic language when Gíslason still lived in Iceland in the early 19th century. A third possibility is that these kinds of differences in aspiration were simply overlooked, even by linguists, until the late 19th century, possibly because they are not reflected in orthography. What we can say for certain is that a voiced alveolar fricative before a postaspirated *k* was already a part of some Icelanders' speech at the end of the 18th century (assuming that Gíslason's father, who was born in 1787, also had this feature and passed it on to his son).

6.3.4 Characterization of aspiration in early grammars

In a chapter about Icelandic phonology, contained in Sigfús Blöndal's (1920-1924) Icelandic-Danish dictionary, Ófeigsson (1920-1924) writes that linguists disagree regarding the phonetic quality of stop consonants in Icelandic. At this point it was well established that dialectal differences existed with respect to stop and sonorant production (Ófeigsson gives a detailed description of those differences which agrees with the current definition) but scholars had different ways of characterizing those

differences. Ófeigsson himself believed that all Icelandic stop consonants were voiceless and that they only differed in aspiration. Others, Ófeigsson says, typically distinguish between voiced (or half-voiced), voiceless, and aspirated stops, but tend to disagree on the occurrence of voicing. One of the authors he specifies is Bürgel Goodwin (see e.g. Goodwin 1905, 1908). Goodwin distinguishes between aspirates, i.e. postaspirated stops in word-initial position, pure fortis stops, i.e. intervocalic *p*, *t*, *k* and *bb*, *dd*, *gg*, voiceless lenis stops, i.e. pre- and post-consonantal *b*, *d*, *g*, half-voiced lenis stops, i.e. word-initial *b*, *d*, *g*, and voiced lenis stops, mostly occurring in initial position of the second half of compounds, e.g. *inn-gangur* ‘entryway’ and *inn-dæll* ‘lovely’. Sweet (1877) has similar ideas, except he categorizes lenis geminates as half-voiced in intervocalic position. It is clear from Goodwin’s (1905, 1908) placement of geminates in the same category as intervocalic fortis stops that he must assume the fortis singletons to be produced without postaspiration. No mention is made in his work of postaspirated word-internal stops, that category belongs to word-initial stops alone.

Ófeigsson (1920-1924) notes that the phonetician Sveinbjörn Sveinbjörnsson has claimed that *p*, *t*, *k* are aspirated word-initially (although slightly less than their Danish counterparts) while taking after French stop consonants word-medially (i.e. voiceless unaspirated). He furthermore claims that, in Sveinbjörnsson’s opinion, *b*, *d*, *g* have the same phonetic quality as in Danish, i.e. they are voiced. Sveinbjörn Sveinbjörnsson was one of the first people to study Icelandic phonetics in detail, although without any use of recordings. His book on the subject, *Icelandic phonetics*, was not published until 1933, 9 years after his death, but according the introduction written by his editor, Ole Oleson, Sveinbjörnsson finished a first draft of his book in 1895 (see Sveinbjörnsson 1933). He kept working on it for the next 20 years by observing speech and taking notes as well as familiarizing himself with

scientific methods used in phonetics. His book gives a very detailed and interesting account of Icelandic speech sounds. He must undoubtedly have changed his analysis through the course of the two decades he worked on this project. For instance, despite Ófeigsson's (1920-1924) claims to the contrary, Sveinbjörnsson does not assume that voiced stops appear in any systematic way in Icelandic (although he does note that lenis stops can sometimes be voiced when they follow *l* or *m*). Aside from word-initial aspirated stops, he uses the same notation for all Icelandic stops, lenis and fortis, i.e. [b̥, d̥, g̥], while noting that "feebly aspirated" [p, t, k] are produced word-internally in North- and East-Icelandic. Sveinbjörnsson's (1933) characterization of preaspirated stops is interesting. This is what he writes about bilabial aspirated stops:

Written *pp* before a vowel and *p*, *pp* in the combinations *pl*, *pn*, *ppn* in medial position are weakened into [b̥] but develop at the same time a flated sound, which assumes the nature of the preceding vowel. Written *p* in the medial combinations *lp*, *mp*, *rp* is likewise weakened into [b̥] but devoices the prepositive consonants (Sveinbjörnsson 1933:44).

He transcribes these preaspirated stops as sequences of a devoiced vowel followed by a voiceless stop, e.g. [ḁɑ̥d̥] for what is more commonly transcribed as [aht]. In other words, he assumes that the preceding vowel takes on an aspirational quality from the following stop, rather than the aspiration occurring between the vowel and the stop. Similarly, he assumes that word-initial [h] + vowel clusters are sequences of a devoiced vowel followed by a voiced vowel of the same quality, i.e. [̥aa] instead of [ha]. Essentially, he assumes that aspiration cannot stand on its own; rather, it is always superimposed on other sounds, be it a vowel or a consonant (in the case of voiceless sonorants).

Ófeigsson himself, and Sigfús Blöndal the main compiler of the Icelandic-Danish dictionary where Ófeigsson's chapter on Icelandic pronunciation was included, re-

ceived some criticism for using SD pronunciation as the foundation to the dictionary's pronunciation guide. The criticism seems to have primarily been directed at the decision to transcribe word-internal stops without aspiration and pre-plosive sonorants as voiceless. Ófeigsson responded by saying that:

The pronunciation transcription assumes the pronunciation which the author considers **most common**; this, the author and his co-authors believe is the most correct thing to do and reflects the subject of the book in other respects; he does not want to, there or elsewhere, make judgements about what is **most beautiful** or **most correct** with respect to origin, because that would undoubtedly be a prejudiced decision (Ófeigsson 1922).

In a literary review of Blöndal's Icelandic-Danish dictionary, Ólafsson (1923) defends the authors' decision to use SD pronunciation as a guideline and calls for a detailed study of dialectal variation in the entire country of Iceland.

The pronunciation of every Icelandic word in the dictionary is shown and that is a great convenience to foreigners who use it. It may well be that some fault can be found with this pronunciation and that some people pronounce some words somewhat differently than what is shown in the dictionary. But whatever merit there is to that claim, it should not be forgotten that the pronunciation, the way it is shown there, is the pronunciation of an educated person of the Icelandic language, the way it is now spoken in most places. However, it is impossible to make judgements about this aspect of the dictionary until the pronunciation has been studied in detail all over the country (Ólafsson 1923).

In a review of a recently published Icelandic grammar, Jóhannsson (1911a) discusses voiceless sonorants before fortis stops and adds: "Whether or not they receive the same treatment when the plosive immediately precedes them e.g. in *ökli*, *opna* etc. I cannot say for certain (Jóhannsson 1911a:120-121)".

Jóhannsson seems to have trouble adequately describing the phonetic characteristics of words like *ökli* and *opna*, that are produced with a preaspirated stop.

He is aware that there is some aspiration there but is unsure of whether or not to attribute that to the production of the sonorant (even when talking about sonorant devoicing before stop consonants, he doesn't seem to attribute the aspiration or devoicing of the sonorant to a feature of the following stop and he doesn't mention that the voiced sonorants of the North are followed by aspirated stops, unlike in his own dialect). Other sources from a similar time ignore the presence of aspiration in these clusters altogether and simply describe them as being produced with a geminate stop (undoubtedly noticing that they sound the same as intervocalic orthographic geminates). For instance, in a grammar first published in 1915, Ólafsson (1920) writes:

p is geminated in pronunciation before *l* and *n*: *epli*, *opna* (eppli, oppna). The same is also true of other speech sounds, e.g. both *k* and *t*: *jökklar*, *katlar* (pronounced jökklar, kattlar) and *vakna*, *vitna* (vakkna, vitna) [...].

Goodwin (1908) is aware that there is some aspirational quality to fortis geminates in Icelandic but miscategorizes it as spirantization:

Lenis geminates and fortis geminates are mainly distinguished by the fact that the former category merges with pure tenuis stops in word-internal position [...], the latter category, on the other hand, loses the extra quantity and becomes spirantized (Goodwin 1908:95).

In a phonetic table that he provides, Goodwin transcribes *kk* as [xk], indicating that he viewed the pronunciation of these geminates as a period of aspirated frication followed by a stop closure. Goodwin doesn't seem aware of any preaspiration or spirantization in clusters of fortis stops followed by *l/n* but he does make a point of saying that these are distinct from lenis stops in the same environment (Goodwin 1908:101). According to his phonetic table, however, he seems to assume that

the sonorants in these clusters are voiceless, i.e. he attributes the aspiration to the sonorant rather than the previous stop (Goodwin 1908:93).

The same characterization seems to be assumed much earlier by Ellis (1869) who writes “In the doubled *tt*, the first *t* indicates an assimilated guttural, which however is generally more or less heard (Ellis 1869:539)” and more specifically “*T* is the usual (t), but in *tt*, where the first *t* stands for an assimilated guttural, while both letters are pronounced (t,t), the guttural still generally asserts itself (Ellis 1869:547)”. The phonetic transcriptions he gives in association with these descriptions indicate that what he refers to as a ‘guttural’ is really a voiceless velar fricative (he transcribes the sound as [kwh] and in his transcription key he e.g. gives the German word *auch* as an example of a word where this sound appears).

It isn’t until 1922, in a grammar of Icelandic written in Danish, that Valtýr Guðmundsson comments on the presence of an *h*-like sound in these clusters as well as in orthographic geminates:

When the consonants **k**, **p**, **t** appear in the orthography as geminate consonants **kk**, **pp**, **tt** or as singleton consonants followed by **l**, **n**, an **h**-like sound (aspiration) is inserted into the pronunciation: *þökk* [þöhk] [...] (Guðmundsson 1922).

It is, thus, perhaps not surprising, given the rather erratic nature of phonetic descriptions of aspiration until the early 20th century, that dialectal differences, that are mainly characterized in terms of this elusive aspiration feature, did not receive much attention in the literature early on.

6.3.5 Questions of origin

At the turn of the 20th century, as linguists and language enthusiasts in general became more aware of stop aspiration and the role it plays in dialectal division in Icelandic, questions of which pronunciation is the most original became more prominent. Most people who have since addressed that question have assumed that intervocalic postaspirated stops are older in the language than the SD unaspirated ones (e.g. Storm 1881, Jóhannsson 1924, Guðfinnsson 1946, Jónsson 1964), and even attributed the emergence of the latter category to laziness. Opinions on voiced and voiceless sonorants have not been quite as uniform. In a review of recently published grammars of Icelandic, Jóhannsson (1911a) criticizes a recent grammar (*Móðurmálsbókin* by Jón Ólafsson, published in 1908) for its failure to discuss the presence of voiceless sonorants and fricatives in certain environments in Icelandic. He writes:

It should also have been pointed out, that the sonorants *l*, *r*, *m*, *n* become voiceless in a hard and good Icelandic pronunciation (except in some districts in the North) when the hard plosives follow them, and it is as if they acquire some sharp h-like sound, e.g. in *stúlka*, *þurka*, *lampi*, *vanta*. Whether or not they receive the same treatment when the plosive immediately precedes them e.g. in *ökli*, *opna* etc. I cannot say for certain. However, that this was the case in Old Norse [i.e. sonorants being voiceless before stops] is witnessed by the fact that the preterite suffix *ða* becomes *ta* after *l*, if a voiceless sonorant had originally immediately preceded it, e.g. *mæltta* (from *maþl* = ‘speech’) (Jóhannsson 1911a:120-121).

It is evident from Jóhannsson’s writings that he considered voiceless sonorants to be more original than voiced ones in Icelandic but that opinion of his does not seem to have been shared by many. A letter by a person referring to themselves as *H.* appeared in the newspaper *Lögberg*, published by Icelandic people in Winnipeg

Canada, on December 23rd, 1920. The author, who is concerned with the state of Icelandic pronunciation, objects to Jóhannsson's (1911a, 1911b) claims about the originality of voiceless sonorants. He counters these claims by pointing out that languages closely related to Icelandic, such as Danish, German, and English, have voiced sonorants in environments where SD has voiceless ones (H. 1920). A similar sentiment was expressed a few decades later in Böðvarsson (1951, 1964), i.e. that the presence of voiced sonorants in Iceland's neighboring languages proves that they are older than voiceless sonorants. What is flawed about this argumentation, however, is that while it is true that none of these languages have voiceless sonorants they do not have word-internal postaspirated stops either, a fact that doesn't seem to prevent either of the authors from claiming that ND voiced sonorant clusters must be more original in Icelandic than SD clusters with voiceless sonorants.

Larsen (1908) goes against the grain and assumes that Old Norse *p*, *t*, *k* must have been pure tenuis stops, i.e. produced such that the vocal cords come together and start to vibrate almost immediately after the burst. He writes:

Unlike the old change from tenuis to affricate in High German, we can assume that the Old Norse language had pure tenuis stops, but that the more or less pronounced aspiration which they now have (except for the Eastern Swedish dialects) has been introduced in the latter half of the middle ages; it may be reasonable to assume that the change $b > t$ was to some extent what led to *t* becoming aspirated, although Iceland has preserved its *b* despite having an aspirated *t*. I considered it certain that this aspiration of tenuis stops began in heavily stressed syllables, with tenuis stops in initial position. In Danish there are not really any tenuis stops outside of initial position where their aspiration is stronger than in other Nordic dialects and where the weakening of short tenuis stops following vowels is the oldest and most advanced [he explains elsewhere that he is referring to $t > d > \delta$]. Furthermore, other evidence more or less shows that aspiration in initial position and weakening in post-vocalic position are correlated [...] (Larsen 1908:44).

Larsen also discusses the presence of unusually heavily aspirated word-initial stops in Norway's Lister and Dalerne regions and is quite clear on the fact that even in that position he does not assume the postaspiration to be original. Finally, he goes on to describe the dialect of some older generation speakers in the Norwegian districts of Valle and Bykle who produce their word-initial fortis stops without any aspiration, which in Larsen's opinion is a remnant of how these stops used to be produced.

6.3.6 Other references to dialectal differences

Various old grammars, language descriptions, and articles about the Icelandic language mention that there are dialectal differences in the country without referring to or giving examples about aspiration. As we have already discussed, some of these may have been written before such differences emerged in the language, but another likely explanation is that linguists seemingly did not start paying attention to or understanding speech variation involving aspiration until the late 19th century, which is when a discussion of this phenomenon in Icelandic first appears in print.

Páll Vídalín, an attorney and poet, traveled around Iceland along with the manuscript collector Árne Magnússon in the beginning of the 18th century (they started their journey in 1703) and was undoubtedly exposed to whatever variation there was in the speech of different regions. During and after this journey, Vídalín wrote a manuscript that explains legal terms in an old law code (published in Vídalín 1854). In the manuscript he includes a passage from an older manuscript, describing an encounter between two men and an exchange of words they have regarding each other's dialect. This prompts Vídalín to explain the current situation

in Iceland regarding dialectal variation:

This [the fact that each of the two men was able to recognize the language the other spoke] must have been due to some hint of pronunciation, just as people are still able to distinguish Norwegians from the Danish from their *sono enunciandi*, even though they speak Danish, just as we know people from the Eastern fjords because of this same *spiritu efferendi*, and our Westfjord people from various vocabulary items; people from Jökull because of their *ai* instead of *á*; Southerners from their *o* in front of *r*, as in ‘hvorigur, morauðt’. In such words they pronounce the letter *o* like the common public pronounces the first syllable of *Norvegur*. The Northerners we recognize because of *generibus vocum grammaticis*, such as ‘skúr’ is in their speech masculine while it is feminine among Southerners [...], thus we have here four dialects in one tongue (Vidalin 1854:126).

Here, Vídalín identifies four dialects of Icelandic, none of which have anything to do with aspiration judging by his description. According to Vídalín, Northerners are best distinguished from Southerners by the gender they assign to nouns.

In the middle of the 18th century, Eggert Ólafsson, a writer and a language enthusiast, and Bjarni Pálsson, a doctor and a geologist, traveled around Iceland and wrote a travel account describing what they observed on the way (published in Ólafsson 1943). They wrote quite a bit about the language and, while they gave no detailed account of pronunciation, they did mention that they observed dialectal differences on their travels (which could, however, mainly be due to differences in vocabulary).

Rasmus Kristian Rask, the Danish linguist who stayed in Iceland and traveled around the country in the years 1813-15, later described Iceland as a place “where very nearly the same pronun. reigns in all classes and over the whole immense island, in districts which have little or no intercourse with one another (Rask 1976:26)”. Of course the phrase “very nearly the same pronunciation” is open to

interpretation but more importantly, while he was an accomplished linguist, Rask was not a native speaker of Icelandic and was possibly not as attuned to subtle phonetic variation as a native speaker might have been.

In a speech he gave on April 13th 1866, Jón Sigurðsson, the president of the Icelandic literary society, claimed that the lack of dialectal variation in Icelandic was proof that Iceland's rich literary heritage had been key to maintaining the language. However, without going into any detail, he concedes that:

We do, however, know special dialects from various districts, both in the names of various objects and in pronunciation, but we cannot refer to these small variations as the special language of districts, or fjords, or valleys, such as we notice in other countries and especially among the nations closely related to us (Sigurðsson 1867:7).

A few years earlier, the teacher Halldór Kr. Friðriksson wrote a grammar of the Icelandic language (Friðriksson 1861). Despite giving a detailed account of the pronunciation of the language, Friðriksson failed to address any regional differences in speech production.

On a more amusing note, people have throughout the years suggested that various factors contribute to dialectal variation in Iceland. Thus, a column that appeared in the newspaper *Fróði*, published in the north of Iceland, on May 26th 1887 suggested that there might be a link between speech characteristics and the speakers' temperament when mentioning in passing that "Northerners are more hard spoken than all other Icelanders, and most probably also harder to deal with". Another writer suggested that the weather was responsible for variation in speech:

The climate, for example, seems to play a large part in shaping speech. Everyone knows the difference between the hard speech of

Northerners and the soft speech of Southerners. The speech of people from the Eastern fjords lies somewhere between. The weather or the climate is undoubtedly to some extent responsible for this difference (Vigfússon 1911).

6.3.7 Final remarks

As we have reviewed in this section, the origin of dialectal differences in Icelandic involving varying degrees of aspiration cannot be determined from old language descriptions and other literature discussing the pronunciation of the language. The oldest source we were able to find on variation in clusters of sonorants and fortis stops comes from the latter half of the 19th century (Ellis 1869). The oldest reference to differences regarding the aspiration of intervocalic stop consonants is even younger (Storm 1881) even though there is indirect evidence to suggest that this particular speech variation had caught people's attention as early as the beginning of the 19th century. Towards the end of the 19th century aspiration starts becoming an increasingly large part of discussions about dialects and pronunciation of the Icelandic language. Around that time people also start hypothesizing about the origin of these differences, i.e. which pronunciation is older in the language. As we discussed in Section 6.2 a somewhat widely held opinion at the time was that Icelanders should strive to keep the pronunciation of the language as close as possible to what it was in Old Norse and for those purposes it was of course important to determine what exactly Old Norse sounded like. As we went over in this section opinions diverged on which dialect, ND or SD, is more original in Icelandic and speculations on the subject were rarely grounded in any linguistic reality.

A question that is still unanswered is whether or not the fact that references to

differences in aspiration appear late in the literature on Icelandic grammar suggests that these differences are relatively new in the language. Our view is that that is not necessarily the case. As we discussed in this section, any references to aspiration of consonants are rare in the literature on Icelandic grammar until the latter half of the 19th century. It appears as if the authors of earlier language descriptions simply lacked the tools to adequately characterize differences that they may or may not have noticed in the aspiration of consonants. As we will see in the next section, where we discuss the results of a questionnaire given to the participants of our phonetic study, non-linguistically trained people are generally not particularly good at describing the difference between ND and SD. The word ‘aspiration’ rarely came up when participants were asked to characterize those differences.

Another explanation is offered by Helgason (2002) who comments on the lack of references to aspiration in early descriptions of Swedish and Norwegian. In his view, this is not necessarily due to the authors not being aware of differences in aspiration. Rather, Helgason surmises that the presence of aspiration (or e.g. the difference in aspiration levels of word-initial and word-medial stops, respectively) is knowledge assumed by the authors to be shared between them and their readers and therefore deemed superfluous. Helgason further notes that the transcription systems used did not specify differences that were considered to be a result of phonetic context. Thus, an author writing about Icelandic might not see reason to transcribe an intervocalic stop with preaspiration in words like *hattur* ‘hat’ if they assumed the preaspiration to be a by product of a phonetic context where a stop follows a short stressed vowel. However, neither of these explanations given in Helgason (2002) suffice to account for the fact that dialectal differences in Icelandic went unmentioned in the literature for so long. Surely the levels of aspiration in certain contexts cannot have been assumed to be known by the reader or to be

the result of phonetic context since these levels vary between speakers of different areas rather than between phonetic contexts.

As far as the origin of the two dialectal phenomena we have focused on is concerned there are several things to consider. It is evident that the literature on Icelandic pronunciation is somewhat biased towards considering postaspiration as a default state for fortis stops in the language. This view is undoubtedly colored by orthographic considerations since the absence of voiced consonants in Icelandic means that unaspirated fortis stops (orthographic *p, t, k*) sound more or less identical to lenis stops (orthographic *b, d, g*). It is therefore not surprising, especially given the decades of bickering that took place in Iceland regarding the appropriateness of various pronunciation features in light of orthographic evidence, that ‘soft speech’, i.e. the lack of postaspiration in fortis stops became frowned upon and even considered ‘wrong’ or ‘lazy’. However, as we discussed in some detail in Chapter 4, a look at the typology of Nordic dialects (see Helgason 2002) reveals that postaspirated stops are extremely rare in word-internal position. Therefore, there is at least no typological reason to assume that all fortis stops were postaspirated at some stage of the Icelandic language. Furthermore, the infrequency of voiceless sonorants before voiceless stops in Iceland’s neighboring languages is not a reliable indicator that these are a later development in Icelandic. As we discussed in Section 6.3 these clusters lack aspiration altogether in languages like English and Danish whereas the aspiration is always present on either the sonorant or the stop in Icelandic.

If fortis stops were not postaspirated in Old Norse, then a sound change must have taken place in the Icelandic ND whereby word-internal fortis stops developed postaspiration. It is difficult to speculate as to why such a sound change would

take place, especially in a phonological environment where audible aspiration is not necessary to distinguish between different stop categories. One possibility to entertain is that this sound change was to some extent a conscious one. In the previous section we discussed the history of language planning in Iceland, for instance the fact that a morphological change that had taken place in the entire inflectional paradigm of a class of masculine nouns was reversed due to the efforts of linguists and language teachers. A few decades later, a regional high vowel merger was completely eradicated from the language. It is, thus, not completely unreasonable to hypothesize that something similar could have taken place with regards to stop aspiration. The fact that ‘soft speech’ has been and still is a more stigmatized pronunciation than ‘hard speech’, despite being the standard pronunciation of Icelandic and spoken by a vast majority of speakers, further supports the theory that stops may have become more aspirated as a result of a conscious effort to speak the language more clearly (as we will learn in the following section, ‘clear’ is a word that frequently comes up when speakers are asked to explain how ND differs from SD). These are merely speculations though and unfortunately cannot be supported or refuted by historical data.

6.4 Survey on Dialectal Attitudes in Iceland

A questionnaire was given to the participants in our phonetic study, the results of which we discussed in Chapter 3. The questionnaire (see Appendix B) consisted of questions regarding the participants’ characterization of dialectal differences in Icelandic and their own dialectal features as well as questions about attitudes towards the different dialects. As we mentioned in Chapter 3, the purpose of giving the questionnaire to participants was twofold. First, it was of some concern

that speakers of SD, in particular, would exaggerate certain characteristics of their own speech to make it sound more like ND speech, which, as we discussed in the previous section has long been considered by some to be the clearer and more aesthetically pleasing of the two. Consider e.g. this passage from Pálsson (1979), discussing tendencies of SD speakers to imitate ND speech:

‘Soft speech’ is also an example of a phonetic variant which is often discussed among language purists. But because ‘hard’ pronunciation is considered ‘better’ language the ‘hard speech’ has caused some hypercorrection among some of those who usually speak ‘softly’. In this way, certain groups of people have a tendency to harden the pronunciation of words like *standa* (and say e.g. [stant^ha] instead of [standa]) even though that pronunciation goes against the language tradition of Northerners who still use ‘hard speech’ (Pálsson 1979:187).

It was expected that any major outliers in the speech of an SD speaker might be reflected in their answers to specific questions in the questionnaire, i.e. that SD speakers, who felt strongly that ND was in some way superior to SD, might e.g. have unusually long VOTs in their intervocalic aspirated stops. This did indeed turn out to be the case for one SD speaker, who exhibited a strong preference for ND in his responses and whose data were excluded due to his unnatural speech. Second, sociolinguistic factors, such as attitudes towards different dialects in Iceland, have not been widely studied. Furthermore, it was of interest to us, especially given the lack of references to aspiration in older linguistic descriptions of Icelandic, to get a sense of how aware laypeople are of what the differences between SD and ND entail, and how adequately they can describe them.

6.4.1 Main results

A total of 28 people participated in the survey, 15 ND speakers and 13 SD speakers. The questionnaire was administered in the form of an interview following the recording of the participant's speech for the phonetic study discussed in Chapter 3. It should be noted that 5 out of 13 SD speakers who participated have had some linguistic training as well as one of the ND participants. A linguistic background not only affected how well participants were able to describe the differences between the two dialects but also undoubtedly had an effect on the answers they gave to questions gauging their attitude towards either dialect being superior to the other. More specifically, we expect a linguistically trained person to be less inclined to favor one dialect over the other because they have a deeper understanding of the nature of speech differences. Finally, it should be noted that participants were simply asked about differences between how 'Northerners' and 'Southerners' speak. While there is little ambiguity in the term 'southern' speech, 'northern' speech can mean different things to different people. For instance, some participants might be aware of intervocalic postaspiration (although not necessarily able to articulate that) but simply not have been exposed to sonorant voicing to any extent. The reverse situation is also possible, although perhaps not likely.

Descriptions of dialectal differences

To the exclusion of the answers given by the linguistically trained participants (all of whom correctly characterized the difference between SD and ND as one of 'hard speech'/postaspiration and sonorant voicing), the word 'aspiration' hardly came up at all in response to the question "How would you describe the difference between northern speech and southern speech?" (one naive participant did use the word

‘postaspiration’ to describe ND and another one described ND as having stronger guttural sounds). A total of 9 participants described the difference between ND speech and SD speech as a difference between **soft** and **hard**. This can undoubtedly be attributed to the fact that the terms *harðmæli* ‘hard speech’ and *linmæli* ‘soft speech’ are quite commonly used to distinguish between the speech of Northerners and Southerners and are thus likely to be familiar to some participants. 6 participants felt that ND has more **emphasis** or **stress** (the Icelandic word used was *áhersla* which can mean both of these things). 5 participants felt that ND is **clearer** than SD and 3 participants thought ND is more **correct**. 5 participants (all ND speakers) gave examples of **specific sounds** that are different between the two dialects; all examples were of either *t* vs. *d* (i.e. that Northerners pronounce *t* where Southerners pronounce *d*) or *k* vs. *g*. 2 participants felt that ND pronunciation is **stronger** than SD pronunciation and 2 participants mentioned that ND pronunciation **matches the orthography** better. Other descriptors used included ‘lazy’, ‘wrong’ and ‘careless’ in relation to SD speech. ND speakers were said to speak slower, to lengthen their words, and to have longer or more open vowels whereas SD speakers supposedly shorten their words.

It is interesting to look at these results in light of what we discussed in Section 6.3 above regarding early descriptions of Icelandic dialectal differences. One of the findings of that section was that characterizations of these differences in terms of aspiration emerge quite late in grammars and other language descriptions. We did find several generally worded references to dialectal differences and perhaps their lack of specificity is not that surprising if we consider that in many cases the authors of these descriptions did not have much more phonetic knowledge than the present survey’s naive speakers, simply due to the fact that phonetics hadn’t developed as a field (consider e.g. that an international phonetic alphabet was not

developed until the year 1888, see Passy 1888 for reference).

Attitudes towards the dialects

When asked to consider if one dialect was in any way superior to the other one, all of the ND participants indicated that they favored their own dialect in some way (one participant did claim initially that he had no opinion on the matter but followed up by saying that he still thought that ND often sounded more beautiful than SD). 11 out of 15 ND participants expressed that ND is more **beautiful** than SD and ND was also said to be **better** by some. When asked to elaborate on their answers, 9 speakers explained that ND is clearer and/or better to understand, 4 participants thought that it is simply more correct than SD and 3 participants mentioned that it is superior in that it matches the orthography better. Other explanations included that ND is **pure** and more **polished** but only one participant admitted that perhaps they only favored ND because they are used to it.

In comparison to the ND participants, the SD participants were much more egalitarian in their answers (keep in mind, though, that 5 out of 13 SD participants have had some linguistic training). 8 out of 13 participants simply answered ‘no’ when asked if either dialect was superior in their opinion, 2 people thought that ND is more beautiful than SD and one person favored SD slightly, explaining that she was more used to it when asked to elaborate. One person felt that ND is more **fun** than SD (because it’s different) and one person thought that each dialect had some advantages over the other.

One of the questions the participants were asked to consider was whether they thought Icelanders’ attitudes towards different pronunciations differed depending on which dialect they speak. Again, the ND participants and the SD participants

diverged in interesting ways in their answers. While both groups seemed to have some agreement that ND speakers are more aware of and more likely to discuss dialectal differences (5 participants from each group mentioned this), 6 out of 13 SD participants, compared to only one ND participant, answered that it is generally agreed upon that ND is a more beautiful dialect than SD. The ND participants, on the other hand, frequently mentioned (5/15) that SD speakers tend to make fun of them for the way they speak. ND participants were also more prone to assume that speakers' pride in their own way of speaking transcends dialectal boundaries, with 4 people indicating that everyone has an opinion on the matter and that people tend to prefer their own dialect. None of the SD participants felt the same way. Two participants (one ND speaker and one SD speaker) may have been spot on when they expressed their opinion that ND speakers' views on dialectal differences reflect their position as a minority group. Reviewing all the answers given to this particular question, the trend seems to be that ND speakers, while taking pride in their dialect, are far more self-conscious about the way they speak and are sensitive to criticism and mockery. SD speakers on the other hand assume that their own dialect is aesthetically less preferred but are not bothered by it.

In light of the opinions above it is interesting to note that, when asked if they believed that their pronunciation might change if they moved to a different dialectal area, 8 out of 15 ND participants answered that they would (or had already in the case of those who had previously lived in the south) actively resist any change while 4 participants indicated that they wouldn't be bothered if their pronunciation changed. Only one SD participant noted that they would be resistant to their dialect changing and 8 out of 11 participants thought it would be quite likely to.

As we discussed in Chapter 3, postaspiration of intervocalic stop consonants

is a much more robust feature of ND than sonorant voicing is. Most of the ND participants, who had any sonorant voicing at all, exhibited mixed pronunciation, i.e. only voiced their sonorants some of the time. During informal conversations with the participants who have this dialectal feature, some of them mentioned that, in their own experience, other people find it strange (some of our ND participants, who do not voice their sonorants but are likely more used to hearing that dialectal feature in their immediate environment, even referred to sonorant voicing as funny or strange when it came up in conversation). This is in contrast to postaspiration of intervocalic stops which seems to have a much more positive connotation, so much so that SD speakers sometimes try to imitate it (as we mentioned above one SD participant's data were excluded due to his unnaturally long VOTs; the same participant exhibited a strong preference for the 'hard' ND pronunciation when interviewed). One ND participant described herself (unprompted) before her speech was recorded as having the sonorant voicing dialectal feature. She did not, however, voice a single consonant in any of the 12 trials recorded. When asked about this afterwards she mentioned that she may have suppressed this aspect of her dialect due to some negative feedback she received while attending junior college in a different part of the country. We can only speculate as to the reasons why 'hard speech' remains a stable feature of the ND dialect while sonorant voicing seems to be disappearing but it is not unreasonable to suggest that prestige may play a part in it. In other words, we hypothesize that the pride ND speakers take in their 'hard' stops has prevented postaspirated singletons from disappearing in favor of the standard dialect's unaspirated stops, while the fact that many Icelanders find sonorant voicing strange and even stigmatize it has perhaps accelerated the loss of that dialectal feature.

6.4.2 Final remarks

Participants in our phonetic study were given a questionnaire designed to probe their attitudes towards the two Icelandic dialects discussed here, ND and SD, as well as to examine how aware they are of the exact differences in pronunciation between the two dialects. Answers given by linguistically trained participants aside, the word ‘aspiration’ was rarely used to describe the differences in pronunciation. Rather, people tended to use terms like ‘hard’, ‘clear’ and ‘correct’ to describe ND and ‘soft’ and ‘lazy’ to describe SD. In terms of dialectal attitudes, ND participants felt strongly that ND is more beautiful than SD while the SD participants were more agnostic on the subject. Finally, while a majority of the SD participants had no preference for one dialect over the other, quite a few of them still expressed the belief that ND is generally considered more beautiful than SD. The ND participants, on the other hand, frequently mentioned that they get made fun of for the way they speak. We hypothesized that the fact that sonorant voicing is rapidly disappearing from ND speech might, in part, be due to it being a somewhat stigmatized pronunciation whereas postaspirated singletons, which are often associated with prestige, remain a robust feature of ND.

6.5 Conclusion

In this chapter, we have given a brief overview of the history of language purism and language planning in Iceland, as well as reviewing how dialectal differences, particularly ones involving aspiration, have been characterized in the Icelandic grammatical literature throughout the ages. Finally, we discussed answers given by participants in our phonetic study when asked about the differences between

SD and ND and their attitudes towards those differences.

One of the main findings of Section 6.2 was that there is a precedence in Iceland for the pronunciation to be steered in a certain direction and we raised the question of whether it is possible that the emergence of ‘hard speech’, assuming it is younger in the language than the SD ‘soft speech’, was a planned process to some extent. As we discussed in Section 6.3, one of the problems with determining the age and origin of dialectal differences in Icelandic involving aspiration of stop consonants is that they are not mentioned in any literature until the late 19th century. This could either be evidence that the dialects did not start diverging until fairly recently or, as we suggested, this could simply be a consequence of the fact that the authors of earlier language descriptions lacked the knowledge or the descriptive tools to adequately characterize subtle differences in speech that they may still have been aware of. We found some support for this in the results of the questionnaire discussed in Section 6.4, where we observed that naive speakers did not do a particularly good job of describing the differences between SD and ND. Many of them used the phonetically meaningless terms ‘soft’ and ‘hard’ which is probably due to the fact that the two dialects are commonly referred to using those adjectives.

A final point worth making has to do with the originality of the two dialects, ND and SD. As we have discussed quite extensively in this chapter, orthography played a huge part in arguments about the appropriateness of several pronunciation features in Icelandic in the 19th and 20th centuries and still does, judging from several responses to our questionnaire claiming that ND is better than SD because it adheres more closely to the orthography. Many of the naive participants in our survey chose to describe the differences between ND and SD by giving examples

of specific speech sounds or letters, namely that ND speakers say *t* where SD speakers say *d*. This begs the question of why this kind of a simple characterization of differences in aspiration levels is not found in early grammatical literature. Surely it would have been straightforward for the linguists of those times to utilize orthography in the same way to convey regional differences they heard in people's speech. Unless the speech was not shifting away from postaspiration but towards it. In other words, if it was standard speech to produce word-internal *p*, *t*, *k* with postaspiration then it would have made sense for grammarians to observe that a speech variant was emerging in which these sounds were produced more like *b*, *d*, *g*. However, if it happened the other way round and a certain subset of the population gradually started producing *p*, *t*, *k* with what may have been perceived as more harshness or emphasis for a lack of better phonetic understanding, it wouldn't necessarily have made sense to refer to this new variant as people producing *p*, *t*, *k* as *p*, *t*, *k* and not *b*, *d*, *g*. The lack of such descriptions in early literature may thus be indicative of the fact that word-internal postaspirated stops are newer in Icelandic than the acoustically unaspirated ones.

CHAPTER 7

CONCLUSION

In this dissertation we have looked at aspirated consonants in Icelandic from various aspects. The primary goal was to propose a complete phonological analysis of aspiration in the language that takes into account articulatory timing relationships as well as factoring in diachronic changes, dialectal variation, and learnability. The main question we asked in Chapter 1 pertains to the exact manner of coordination that exists between glottal gestures and their oral counterparts and in Chapter 5 we offered some insights and answers to what that might be. We presented an analysis of glottal gestures as subordinate speech gestures tied to oral head gestures and took inspiration from motor theories regarding different types of coordination mechanisms that might be encoded in the phonology of a language. We furthermore argued that the key to understanding the relationship between gestures is to account for how their phonological relationship can reasonably be inferred by children adopting the language. By understanding how the gestures relate to each other phonologically, the children will learn to coordinate them in a manner that reflects that structure.

One of the key elements in understanding the phonological structure of aspirated consonants in Icelandic is to account for differences that exist between the two dialects of the language that we have referred to as SD and ND here. In Chapter 3 we presented the results of an acoustic study we conducted in both dialectal areas with the goal of obtaining an accurate description of the phonetic correlates of aspiration, which is the main feature that sets these two dialects apart. We looked at both native and non-native vocabulary and found evidence to suggest that two series of acoustically unaspirated stop consonants might exist in Icelandic,

one where the oral closure is accompanied by a coextensive glottal opening gesture, and one where the glottal opening is merely passive. This inspired our categorization of native Icelandic fortis stops into three categories, differing primarily in the timing of the glottal gesture with respect to the oral closure. More specifically, glottal gestures in Icelandic can either precede, completely overlap with, or partially overlap with an oral gesture. One of the advantages of such an analysis is that it allows us to view acoustically unaspirated stops as a natural articulatory medium between pre- and postaspirated stops and thus provides us with a more plausible account of how the articulation of Icelandic fortis stops has developed in these two different directions within one dialect. Another crucial aspect of our analysis is our view that the underlying representation of fortis stops simply entails that an oral gesture is accompanied by a laryngeal gesture. Any coordination between the two in the phonetic output is governed by phonological constraints that develop over time due to factors such as ease of articulation and perceptual recoverability. We hypothesized that the common occurrence of preaspirated stops in Icelandic and other Nordic dialects, as opposed to postaspirated stops, might be due to them involving an easier coordination of glottal and oral gestures, and presented some acquisition data from Icelandic children in support of that theory. A theoretical consequence of viewing glottal gestures as phonologically agnostic to the nature of their coordination with a head gesture is that aspiration can be coordinated with the oral closure in a number of different ways without resulting in an unfaithful output. We even went so far as to suggest that the most optimal way of coordinating these two kinds of gestures from an articulatory standpoint is by overlapping them completely, which would explain the frequent loss of acoustic aspiration in the Icelandic SD.

One of the main differences between SD and ND is the treatment of clusters

that, in their underlying form, consist of a sonorant followed by an aspirated stop. In ND these clusters have a tendency to remain faithful to the underlying form while in SD the aspiration shifts from the stop to the sonorant. What we found in Chapter 3 is that so-called sonorant voicing is extremely variable in the ND speakers who have it in their speech in the first place. The frequency of sonorant voicing was sensitive to changes in speech rate and a small effect of participant's age was also detected (younger speakers were less likely to voice their sonorants). These results suggest that sonorant voicing is slowly disappearing from the ND dialect and in Chapter 6 we suggested that this development might be accelerated by negative opinions of that dialectal feature compared to that of 'hard speech', i.e. the postaspiration of word-internal stop consonants, which remains a salient feature of ND speech.

In Chapter 6 we gave a brief overview of the history of language purism and language planning in Iceland, as well as reviewing how dialectal differences, particularly ones involving aspiration, have been characterized in the Icelandic grammatical literature throughout the ages. One of our findings was that there is a precedence in Iceland for the pronunciation to be steered in a certain direction and we raised the question of whether it is possible that the emergence of 'hard speech', assuming it is newer in the language than the SD 'soft speech', was a planned process to some extent. The relative age of the two dialects cannot be determined with any certainty as we found out in Chapter 6. This is due to a lack of written sources on the subject, possibly because of the of the extensive understanding of phonetics needed to describe a phenomenon as subtle as aspiration. While the literature on this subject has traditionally been rather biased towards considering ND a more original dialect (partly for aesthetic reasons, partly because of a tendency to view postaspirated stops as a more faithful output than other types of

aspirated stops), our phonological discussion in Chapters 4 and 5 led us to assume the opposite based on the data at hand, historical considerations, and our ideas about the nature of articulatory coordination.

At the core of our discussion in this dissertation has been the issue of speech segments and how they fit into a phonological theory of aspiration, if they do at all that is. While the analysis we presented in Chapter 5 is inspired by ideas from Articulatory Phonology, that regards gestures rather than segments as the building blocks of speech, we do attribute some psychological reality to the notion of segmenthood. What we have suggested, regarding aspiration at least, is that there is some truth to the notion that speakers view certain sets of gestures, i.e. co-selection sets using Tilsen's (2014) terminology, as single entities and that these entities often correspond to units that have traditionally been referred to as segments. What we do not subscribe to is the idea, often promoted in discussions of preaspirated stops in Icelandic, that segmenthood is necessarily reflected in phonetic structure. While aspirated stops are clearly formed by an interaction of speech gestures that can surface independent of each other (e.g. in the case of aspirated sonorants followed by a stop closure and perhaps even in the case of preaspirated stops), and should therefore sometimes be considered independent segments by phonetic standards, we argue that it is their phonological relationship that matters, i.e. how they pattern with respect to each other. This is not to say that gestural coordination never reflects phonological structure. There is ample evidence to suggest that it does and, furthermore, there is reason to believe that the relationship between articulation and phonology is reciprocal in that each of these domains can influence the development of the other. However, speech is more than a one-to-one mapping of phonological structure to phonetic output as we have pointed out in our discussion of aspiration in Icelandic.

APPENDIX A
WORDLIST FROM PHONETIC STUDY

Word-initial stops

pata

tala

Kana

bana

dama

gala

Intervocalic stops

labba

gadda

bagga

súpa

túba

gata

radar

seka

Megas

Preaspirated stops

mappa

fatta

bakka

vopna

kapla

gatna

fatla

sakna

hekla

Clusters of sonorant/fricative + aspirated stop

maðka

Alpa

salta

Salka

lampa

fanta

bunka

Clusters of sonorant/fricative + plain stop

feðga

falda

felga

lamba

landa

lunga

[s] + stop clusters

spaka

stama

skata

raspa

fasta

maska

APPENDIX B

QUESTIONNAIRE ON DIALECTAL ATTITUDES

1. Hefurðu einhvern tíma búið annars staðar en á þessu svæði? (Have you ever lived anywhere else than this area?)
2. Finnst þér vera munur á því hvernig Norðlendingar tala og hvernig Sunnlendingar tala? (Do you think there is a difference between how Northerners speak and how Southerners speak?)
3. Hvora mállýskuna talar þú að þínu mati? (Which of the two dialects do you speak in your own opinion?)
4. Hvernig myndirðu lýsa muninum milli norðlensku og sunnlensku? (How would you describe the difference between Northern speech and Southern speech?)
5. Finnst þér önnur mállýskan fallegr/betri/virðulegri en hin? (Do you think that one dialect is more beautiful/better/more prestige than the other?)
6. Af hverju? (Why is that?)
7. Heldurðu að Íslendingar séu almennt á sömu skoðun og þú varðandi hvor mállýskan er fallegr eða heldurðu að það sé breytilegt eftir því hvora mállýskuna fólk talar? (Do you think Icelanders in general agree with your assessment of which dialect is prettier or do you think people's opinions vary depending on which dialect they speak?)
8. Finnst þér þú einhvern tíma breyta þínum eigin talsmáta eftir því hver og hvaðan viðmælandinn þinn er? (Do you think you ever change your speech depending on who you are talking to or where they come from?)

9. Finnst þér líklegt að talsmátinn þinn myndi breytast ef þú byggir einhvern tíma annars staðar á landinu? (Do you think it is likely that your speech would change if you ever lived in another part of the country?)

BIBLIOGRAPHY

- Anderson, Stephen R. 1974. *The organization of phonology*. Academic Press, New York.
- Anonymous. 1931. Málfegrun. *Austfirðingur* 46:2–3.
- Árnason, Árni. 1916, June 15. Gvendur á Sandi. *Vísir*, p. 2.
- Árnason, Kristján. 1977. Preaspiration in modern Icelandic: Phonetics and phonology. In *Sjöttíu ritgerðir helgaðar Jakobi Benediktssyni 20. júlí 1977*, 495–504. Stofnun Árna Magnússonar, Reykjavík.
- Árnason, Kristján. 1980. Quantity in historical phonology. Icelandic and related cases. In *Cambridge Studies in Linguistics*, volume 30. Cambridge University Press.
- Árnason, Kristján. 1986. The segmental and suprasegmental status of preaspiration in Modern Icelandic. *No* 9:1–23.
- Árnason, Kristján. 2004. á vora tungu. Íslenskt mál og erlend hugsun. *Skírnir* 178.
- Árnason, Kristján. 2005. Hljóð. In *Íslensk tunga*, volume I. Almenna bókafélagið.
- Árnason, Kristján, and Höskuldur Thráinsson. 2003. Fonologiske dialekttræk på Island. Generationer og geografiske områder. In *Nordisk dialektologi*, ed. Gunnstein Akselberg, Anne Marit Bødal, and Helge Sandøy, 151–196. Novus, Oslo.
- Arnbjörnsdóttir, Birna. 1990. The linguistic and social context of apparent vowel mergers in North American Icelandic. Doctoral Dissertation, University of Texas at Austin.

- Benediktsson, Hreinn (ed.). 1972. *The First Grammatical Treatise*. Institute of Nordic Linguistics, Reykjavík.
- Bird, Steven. 1995. *Computational phonology: A constraint-based approach*. Cambridge University Press, Cambridge.
- Björnsson, G. 1912. Rangritunarheimska og framburðarforsmán. *Lögrjetta* 52:196.
- Björnsson, Guðmundur. 1913. Hljómbætur. *Skólablaðið* 12:181–6.
- Blevins, Juliette. 1995. The Syllable in Phonological Theory. In *The Handbook of Phonological Theory*, ed. John A. Goldsmith, 206–244. Blackwell Publishers, Cambridge.
- Blöndal, Sigfús. 1920-1924. *Íslensk-dansk ordbog*. Verslun Þ.B. Þorlákssonar, Reykjavík.
- Böðvarsson, Árni. 1951. Uppruni óraddaðs framburðar á undan p, t, k. In *Á góðu dægri. Afmæliskeðja til Sigurðar Nordals 14. sept. 1951*, 102–107. Helgafell, Reykjavík.
- Böðvarsson, Árni. 1964. Viðhorf Íslendinga til móðurmálsins fyrr og síðar. In *Þættir um íslenskt mál eftir nokkra íslenska málfræðinga*. Almenna bókafélagið, Reykjavík.
- Briem, Halldór. 1918. *Ágrip af íslenskri málfræði*. Bókaverslun Guðm. Gamalíelssonar, Reykjavík, 3rd edition.
- Browman, Catherine P., and Louis Goldstein. 1986. Towards an Articulatory Phonology. *Phonology Yearbook* 3:219–252.
- Browman, Catherine P., and Louis Goldstein. 1988. Some notes on syllable structure in articulatory phonology. *Phonetica* 45:140–155.

- Byrd, Dani. 1996. A phase window framework for articulatory timing. *Phonology* 13:139–169.
- Chasaide, A. Ni. 1986. The perception of preaspirated stops. Presented at the 111th meeting of the Acoustical Society of America, Cleveland. *Journal of the Acoustical Society of America* 79:S7.
- Chitoran, Ioana, Louis Goldstein, and Dani Byrd. 2002. Gestural Overlap and Recoverability: Articulatory evidence from Georgian. In *Laboratory phonology* 7, ed. Carlos Gussenhoven and Natasha Warner, 419–447. Mouton de Gruyter, Berlin.
- Davis, Stuart, and Mi-Hui Cho. 2003. The distribution of aspirated stops and /h/ in American English and Korean: an alignment approach with typological implications. *Linguistics* 41:607–652.
- Egilsson, Sveinbjörn. 1836. Arnabjörn og Jeg. *Sunnanpósturinn* 12:177–185.
- Egilsson, Sveinbjörn. 1849. *Ritgjördir tilheyrandi Snorraeddu og Hattalykill Rögnvalds jarls*. Reykjavík.
- Einarsson, Oddur. 1971. *Íslandslýsing (Qualiscunque descriptio Islandiae)*. Bókaútgáfa Menningarsjóðs, Reykjavík.
- Einarsson, Stefán. 1927. *Beiträge zur Phonetik der Isländischen Sprache*. A.W. Bröggers Boktrykkeri A/S, Oslo.
- Einarsson, Stefán. 1933. *Saga Eiríks Magnússonar í Cambridge*. Ísafoldarprentsmiðja, Reykjavík.
- Ellis, Alexander J. 1869. *On Early English pronunciation, II*. Asher & Co., London & Berlin.

- Fant, Gunnar. 1970. *Acoustic theory of speech production*. Mouton, The Hague, Netherlands.
- Friðjónsson, Guðmundur. 1916, May 31. Óberja og óbyrja. *Lögrjetta*, p. 94.
- Friðriksson, Halldór Kr. 1861. *Íslensk málmyndalýsing*. Hið íslenska bókmenntafélag, Copenhagen.
- Gafos, Adamantios I. 2002. A grammar of gestural coordination. *Natural Language & Linguistic Theory* 20:269–337.
- Garnes, Sara. 1976. Quantity in Icelandic: Production and Perception. In *Hamburger Phonetische Beiträge*, 18. Buske Verlag, Hamburg.
- Gíslason, Indriði, Sigurður Konráðsson, and Benedikt Jóhannesson. 1986. *Framburður og myndun fleirtölu hjá 200 íslenskum börnum við fjöggra og sex ára aldur*. Kennaraháskóli Íslands.
- Gíslason, Konráð. 1836. Þáttur umm stafsetning. *Fjölnir* 1:3–37.
- Gíslason, Konráð. 1845. Ritdómur um Ágrip af merkis atburðum Mannkyns Sögunnar, í þýðingu Páls Melsteðs. *Fjölnir* 8:59–71.
- Goldstein, L., and C. P. Browman. 1986. Representation of voicing contrasts using articulatory gestures. *Journal of Phonetics* 14:339–342.
- Goldstein, Louis, et al. 2007. Syllable structure as coupled oscillator modes: Evidence from Georgian vs. Tashlihyt Berber. In *Proceedings of the 16th International Congress of Phonetic Sciences*.
- Goodwin, Buergel. 1905. Det Isländska ljudsystemet. *Svenska Landsmål ock Svenskt folklif* 1:99–113.

- Goodwin, Buerger. 1908. Utkast till systematisk framställning av det moderna isländska uttalet. *Svenska Landsmål ock Svenskt folklif* 1:77–115.
- Gouskova, Maria. 2004. Relational hierarchies in Optimality Theory: the case of Syllable Contact. *Phonology* 21, 2:201–250.
- Guðfinnsson, Björn. 1947. *Breytingar á framburði og stafsetningu*. Ísafoldarprentsmiðja, Reykjavík.
- Guðfinnsson, Björn. 1946. *Mállýzkur I*. Ísafoldarprentsmiðja h.f., Reykjavík.
- Guðmundsson, Valtýr. 1922. *Íslensk grammatik. Íslensk nutidssprog*. H. Hagerups forlag, Copenhagen.
- H. 1920. Framburður íslensku. Lögberg, 23rd December 1920, p. 15.
- Hankamer, Jorge, and Judith Aissen. 1974. The Sonority Hierarchy. In *Papers from the Parasession on Natural Phonology*. Chicago Linguistic Society.
- Hansson, Gunnar Ólafur. 2003. Laryngeal licensing and laryngeal neutralization in Faroese and Icelandic. *Nordic Journal of Linguistics* 26:45–79.
- Haugen, E. 1958. The phonemics of Modern Icelandic. *Language* 34:55–88.
- Haugen, Einar. 1982. *Scandinavian language structures. A comparative historical survey*. Max Niemeyer Verlag, Tübingen.
- Hayes, Bruce. 1995. *Metrical Stress Theory. Principles and Case Studies*. The University of Chicago Press.
- Heimisdóttir, Linda. 2014. Phonological Opacity and Icelandic Preaspiration. *University of Pennsylvania Working Papers in Linguistics* 20.

- Heimisdóttir, Linda Ösp. 2008. Yfirlit yfir beygingu karlkyns *ija*-stofna frá nítjándu öld til nútímamáls. BA thesis, University of Iceland.
- Helgason, Pétur. 2002. Preaspiration in the Nordic languages. synchronic and diachronic aspects. Doctoral Dissertation, Stockholm University.
- Hermes, Anne, et al. 2008. Articulatory indicators of syllable affiliation in word-initial consonant clusters in Italian. In *Proceedings of the 8th International Seminar on Speech Production*.
- Hjörvar, Helgi. 1920. Framburðarkensla og hljómbætur. *Skólablaðið* 6:73–76.
- Hoole, P. 1987. Velar and glottal activity in a speaker of Icelandic. In *Proceedings of the 11th International Congress of Phonetic Sciences*, volume 3, 31–34. Estonian Academy of Sciences, Tallin.
- Hoole, P., and L Bombien. 2010. Velar and glottal activity in Icelandic. In *Between the regular and particular in speech and language*, ed. C. Mooshammer S. Fuchs, P. Hoole and M. Zygis. Peter Lang, Frankfurt am Main.
- Hooper, Joan B. 1976. *An introduction to natural generative phonology*. Academic Press.
- Horn, Meagan E. 2013. An acoustic investigation of postaspirated stops in Seville Spanish. Master's thesis, Ohio State University.
- Indriðason, Þorsteinn G. 1994. *Reglvirkni í orðasafni og utan þess. Um lexíkalska hljóðfræði íslensku*. Málvísindastofnun Háskóla Íslands, Reykjavík.
- Indriðason, Þorsteinn G., et al. 1991. Mál er að mæla. Um samhljóðalengd í íslensku. *Íslenskt mál og almenn málfræði* 1:143–190.

- Itô, Junko. 1986. Syllable theory in prosodic phonology. Doctoral Dissertation, University of Massachusetts.
- Iverson, Gregory K., and Joseph C. Salmons. 1995. Aspiration and laryngeal representation in Germanic. *Phonology* 12:369–396.
- Jany, Carmen, Matthew Gordon, Carlos M Nash, and Nobutaka Takara. 2007. How universal is the sonority hierarchy?: A cross-linguistic acoustic study. In *Proceedings of the ICPHS XVI*.
- Jessen, M., and M. Pétursson. 1998. Voiceless nasal phonemes in Icelandic. *Journal of the International Phonetic Association* 28:48–53.
- Jessen, Michael, and Catherine Ringen. 2002. Laryngeal features in German. *Phonology* 19:189–218.
- Jóhannsson, Jóhannes L. 1911a. Álit um íslenskar málfræðisbækur í móðurtungu vorri, er út hafa komið á síðustu árum (1908-1911). *Skólablaðið* 8:118–123.
- Jóhannsson, Jóhannes L. 1911b. Framhald af *Áliti um íslenskar málfræðisbækur í móðurtungu vorri, er út hafa komið á síðustu árum (1908-1911)*. *Skólablaðið* 11:161–165.
- Jóhannsson, Jóhannes L.L. 1920. Um framburðinn. *Skólablaðið* 9:115–119.
- Jóhannsson, Jóhannes L.L. 1924. *Nokkrar sögulegar athuganir um helztu hljóðbreytingar o.fl. íslensku, einkum í miðaldarmálinu (1300-1600)*. Félagsprentsmiðjan, Reykjavík.
- Jónasson, Jónas. 1920. *Íslensk málfræði handa byrjendum*. Prentsmiðja Odds Björnssonar, Akureyri, 3rd edition.

- Jónsson, Arngrímur. [1609] 1985. *Crymogæa. Þættir úr sögu Íslands*, volume 2 of *Safn Sögufélags*. Sögufélag, Reykjavík.
- Jónsson, Finnur. 1908. *Málfræði íslenskrar tungu og helstu atriði sögu hennar í ágrípi*. Sigurður Kristjánsson, Copenhagen.
- Jónsson, Jóhannes Gísli, and Þórhallur Eypórsson. 2003. Breytingar á frumlagsfalli í íslensku. *Íslenskt mál og almenn málfræði* 25:7–40.
- Jónsson, Jón Aðalsteinn. 1964. Íslenzkar mállýzkur. In *Þættir um íslenskt mál, eftir nokkra íslenska málfræðinga*. Almenna bókafélagið, Reykjavík.
- Jónsson, Runólfur. 1651. *Grammaticæ Islandicæ rudimenta*. Petrus Harius, Copenhagen.
- Keating, Patricia A. 1988. The phonology-phonetics interface. In *Linguistic Theory: Foundations*, ed. Frederick J. Newmeyer. Cambridge University Press, Cambridge.
- Keer, Edward W. 1999. Gemimates, The OCP and The Nature of CON. Doctoral Dissertation, Graduate School-New Brunswick Rutgers, The State University of New Jersey.
- Kim, Chin-Wu. 1970. A theory of aspiration. *Phonetica* 21:107–116.
- Kingston, John. 1990. Articulatory binding. In *Papers in laboratory phonology I: Between the grammar and the physics of speech*, ed. Kingson and Beckman, 406–434. Cambridge University Press.
- Klatt, D. H. 1973. Interaction between two factors that influence vowel duration. *Journal of the Acoustical Society of America* 54:1102–1104.

- Kohler, Klaus. 1984. Phonetic Explanation in Phonology: The Feature Fortis/Lenis. *Phonetica* 41:150–174.
- Kress, Bruno. 1937. *Die Laute des modernen Isländischen*. Institut für Lautforschung, Berlin University.
- Kristinsson, Jóníus H. 1983. *Vesturfaraskrá 1870-1914*. Sagnfræðistofnun Háskóla Íslands, Reykjavík.
- Kristinsson, Sigfús Helgi. 2014. Hljóðkerfisfræðileg máltaka drengs á fjórða aldursári. Athugun á framburði samhljóða og mat á eðli framburðarfrávika. BA thesis, University of Iceland.
- Kristjánsson, Aðalgeir (ed.). 1984. *Bréf Konráðs Gíslasonar*. Stofnun Árna Magnússonar, Reykjavík.
- Kristleifsson, Þórður. 1935. Er söngnám í skólum aðeins dægradvöl? *Viðar* 1:104–116.
- Labov, William. 1966. The Social Stratification of English in New York City. Doctoral Dissertation, Center for Applied Linguistics, Washington DC.
- Ladefoged, Peter. 1972. *Preliminaries to linguistic phonetics*. University of Chicago Press, Chicago.
- Larsen, Amund B. 1908. Om «bløte» og «haarde» konsonanter in norsk. In *Sproglige og historiske afhandlinger viede Sophus Bugges minde*. H. Aschehoug & co., Kristiania.
- Liberman, A. 1972. Sidelight on Icelandic and Scandinavian preaspiration. *Travaux de l'Institut de Phonétique de Strasbourg* 1–17.

- Lindblom, B. 1983. Economy of speech gestures. In *The Production of Speech*, ed. P. F. MacNeilage, 217–246. Springer-Verlag, New York.
- Lisker, Leigh, and Arthur S. Abramson. 1964. A cross-language study of voicing in initial stops: Acoustical measurements. *Word* 20:384–422.
- Lodge, Ken. 2007. Timing, segmental status and aspiration in Icelandic. *Transactions of the Philological Society* 105:66–104.
- Löfqvist, A. 1991. Proportional timing in speech motor control. *Journal of Phonetics* 19:343–350.
- Löfqvist, Anders. 1995. Laryngeal Mechanisms and Interarticulator Timing in Voiceless Consonant Production. In *Producing Speech: Contemporary Issues*, ed. F. Bell-Berti and L.J. Raphael. AIP Press, New York.
- Löfqvist, Anders, and Magnús Pétursson. 1978. Swedish and Icelandic stops. A glottographic investigation. In *The Nordic languages and modern linguistics*, ed. J. Weinstock, volume 3, 454–461. The University of Texas at Austin Press, Austin.
- Löfqvist, Anders, and Hirohide Yoshioka. 1981a. Interarticulator programming in obstruent production. *Phonetica* 38:21–34.
- Löfqvist, Anders, and Hirohide Yoshioka. 1981b. Laryngeal activity in Icelandic obstruent production. *Nordic Journal of Linguistics* 4:1–18.
- Magnússon, Jón. 1997. *Grammatica Islandica*. Málvísindastofnun Háskóla Íslands, Reykjavík. Edited and translated by Jón Axel Harðarson.
- Malone, Kemp. 1952. The phonemes of Modern Icelandic. In *Studies in Honor of Albert Morey Sturtevant*. University of Kansas Press, Lawrence.

- Másdóttir, Póra. 2008. Phonological development and disorders in Icelandic-speaking children. Doctoral Dissertation, Newcastle University.
- Matthíasson, Þorsteinn. 1976-1977. *Íslendingar í Vesturheimi*. Ægisútgáfan, Reykjavík.
- Mellander, Evan W. 2003. (HL)-creating processes in a theory of foot structure. *The Linguistic Review* 20:243–280.
- Morén, Bruce. 2001. *Distinctiveness, coercion and sonority: A unified theory of weight*. Routledge, New York & London.
- Moya Corral, J.A. 2007. Noticia de un sonido emergente: La africada dental procedente del grupo -st- en Andalucía. *Revista De Filología De La Universidad De La Laguna* 25:457–465.
- Nance, Claire, and Jane Stuart-Smith. 2013. Pre-aspiration and post-aspiration in Scottish Gaelic stop consonants. *Journal of the International Phonetic Association* 43:129–152.
- Nittrouer, S., K. Munhall, J.A. Kelso, B. Tuller, and K.S. Harris. 1988. Patterns of interarticulator phasing and their relation to linguistic structure. *Journal of the Acoustical Society of America* 84:1653–61.
- Ófeigsson, Jón. 1920-1924. Træk af moderne islandsk lydlære. In *Islandsk-dansk ordbog*, ed. Sigfús Blöndal, XXI–XXVI. Verslun Þ.B. Þorlákssonar, Reykjavík.
- Ófeigsson, Jón. 1922. Athugasemd. *Tíminn* 46:149.
- Ohala, John J. 1992. Alternatives to the Sonority Hierarchy for Explaining Segmental Sequential Constraints. In *Papers from the 26th Annual Regional Meeting*

of the Chicago Linguistic Society : The Parasession on the Syllable in Phonetics & Phonology.

- Óladóttir, Hanna. 2007. “Ég þarf engin fornrit til að vita að ég er Íslendingur, ég vil samt tala íslensku”. Um viðhorf Íslendinga til eigin tungumáls. *Ritið* 1:107–130.
- Ólafsson, Bogi. 1923. Ritfregnir. Sigfús Blöndal: Íslensk-dansk ordbog. *Skírnir* 1:201–204.
- Ólafsson, Eggert. 1943. *Ferðabók Eggerts Ólafssonar og Bjarna Pálssonar um ferðir þeirra á Íslandi árin 1752-1757*. Ísafoldarprentsmiðja, Reykjavík.
- Ólafsson, Jón. 1911. *Móðurmáls-bókin*. Reykjavík.
- Ólafsson, Jón. 1920. *Litla móðurmálsbókin handa börnum og byrjendum*. Bókaverzlun Sigfúsar Eymundssonar, Reykjavík, 3rd edition.
- Ólafsson, Páll Eggert. 1948-1976. *Íslenzkar æviskrár frá landnámstímum til ársloka 1940*. Hið íslenska bókmenntafélag, Reykjavík.
- Ólsen, Björn. 1882. Zur Neuisländischen Grammatik. *Germania* 27:257–287.
- Orešnik, Janez. 1978. Modern Icelandic preaspiration from the phonological point of view. *Linguistica* 18:141–166.
- Ottósson, Kjartan G. 1990. *Íslensk málhreinsun. Sögulegt yfirlit*. Íslensk málnefnd.
- Pálsson, Gísli. 1979. Vont mál og vond málfræði. *Skírnir* 153:175–201.
- Parrell, Benjamin. 2011. The role of gestural phasing in Western Andalusian Spanish aspiration. *Journal of Phonetics* 40:37–45.
- Passy, Paul. 1888. Our revised alphabet. *The Phonetic Teacher* 57–60.

- Pétursson, Magnús. 1972. La préaspiration en islandaise moderne. examen de sa réalisation phonétique chez deux sujets. *Studia Linguistica* 26:61–80.
- Pétursson, Magnús. 1974a. Aspects acoustiques et articulatoires du phonétisme islandais. Doctoral Dissertation, Université de Lille.
- Pétursson, Magnús. 1974b. Recherche expérimentale sur le problème de quantité en islandais moderne et sur les caractéristiques secondaires des voyelles islandaises. *Travaux de l'Institut de Phonétique de Strasbourg* 6:23–64.
- Pétursson, Magnús. 1976. Quantität und vokalische Klangfarbe im modernen Isländischen. *Zeitschrift für Phonetik, Sprachwissenschaft und Kommunikationsforschung* 29:49–63.
- Pétursson, Magnús. 1977. Timing of glottal events in the production of aspiration after /s/. *Journal of Phonetics* 5:205–212.
- Pétursson, Magnús. 1978. L'élément temporel. Un problème de prononciation illustré par un exemple de l'islandais moderne, langue à quantité. *Arkiv för nordisk filologi* 93:174–181.
- Pind, Jörgen. 1995. Speaking rate, voice-onset time, and quantity: The search for higher-order invariants for two icelandic speech cues. *Perception & Psychophysics* 57:291–304.
- Pind, Jörgen, Friðrik Magnússon, and Stefán Briem (ed.). 1991. *Íslensk orðtíðnibók*. Orðabók Háskólans, Reykjavík.
- Price, P.J. 1980. Sonority and Syllabicity: Acoustic Correlates of Perception. *Phonetica* 37:327–343.

- Práinsson, Höskuldur, and Kristján Árnason. 1992. Phonological variation in 20th century Icelandic. *Íslenskt mál* 14:89–128.
- Rask, R. 1854. *Kortfattet Vejledning til det oldnordiske eller gamle islandske Sprog*. J. H. Schubothes Boghandling, Copenhagen.
- Rask, R. 1976. A Grammar of the Icelandic or Old Norse Tongue. In *Amsterdam classics in linguistics*, volume 2. John Benjamins B.V., Amsterdam.
- Rask, Rasmus K., et al. 1941. *Breve fra og til Rasmus Rask 1-2*. Louis Hjelmslev, Copenhagen.
- Ridouane, R. 2006. On the feature [spread glottis]. Unpublished.
- Ringen, Catherine O. 1999. Aspiration, preaspiration, deaspiration, sonorant devoicing and spirantization in Icelandic. *Nordic Journal of Linguistics* 22, 2:137–156.
- Rögnvaldsson, Eiríkur. 1980. Lengd íslenskra samhljóða: Vitoð er enn – eða hvat? *Íslenskt mál og almenn málfræði* 2:25–51.
- Saltzman, Elliot, Anders Löfqvist, and Subhobrata Mitra. 2000. ‘glue’ and ‘clocks’: intergestural cohesion and global timing. In *Papers in Laboratory Phonology V. Acquisition and the Lexicon*, ed. M.B. Broe and J.B. Pierrehumbert. Cambridge University Press.
- Shaw, Jason, Adamantios I. Gafos, Philip Hoole, and Chakir Zeroual. 2009. Temporal evidence for syllabic structure in Moroccan Arabic: data and model. *Phonology* 26:187–215.
- Sigurðsson, Jón. 1867. *Hið íslenska bókmenntafélag. Stofnan félagsins og athafnir um fyrstu fimmtíu árin 1816-1866*. Hið íslenska bókmenntafélag, Copenhagen.

- Sigurjónsson, Sveinbjörn. 1939. Eru Reykvíkingar hljóðvilltir? *Alþýðublaðið* 222:3.
- Silverman, Daniel. 2003. On the rarity of pre-aspirated stops. *Journal of Linguistics* 39:575–598.
- Smári, Jakob Jóh. 1923. *Íslensk málfræði*. Bókaverzlun Ársæls Árnasonar, Reykjavík.
- Storm, Joh. 1881. *Englische Philologie I*. G. Henninger, Heilbronn.
- Sveinbjörnsson, Sveinbjörn. 1933. *Icelandic phonetics*. Universitetsforlaget i Aarhus, Copenhagen.
- Sweet, Henry. 1877. *A handbook of phonetics*. Clarendon Press, Oxford.
- Pórarinsson, Jón. 1888. Lestur. *Tímarit um uppeldi og menntamál* 1:3–15.
- Thórólfsson, Björn K. 1925. *Um íslenskar orðmyndir á 14. og 15. öld og breytingar þeirra úr forn málinu*. Fjelagsprentsmiðjan, Reykjavík.
- Thráinsson, Höskuldur. 1978. On the phonology of Icelandic preaspiration. *Nordic Journal of Linguistics* 1:3–54.
- Tilsen, Sam. 2014. Selection-coordination theory. *Cornell Working Papers in Phonetics and Phonology* 3:24–72.
- Tilsen, Sam, et al. 2012. A cross-linguistic investigation of articulatory coordination in word-initial consonant clusters. *Cornell Working Papers in Phonetics and Phonology* 2:51–81.
- Torreira, F. 2007. Pre- and post-aspirated stops in Andalusian Spanish. In *Prosodic and Segmental Issues in Romance*, 67–82. John Benjamins Publishing Company.

- Vaux, Bert. 1998. The Laryngeal Specifications of Fricatives. *Linguistic Inquiry* 29:497–511.
- Vennemann, Theo. 1972. On the theory of syllabic phonology. *Linguistische Berichte* 18:1–18.
- Víðalín, Páll Jónsson. 1854. *Skýrínngar yfir fornýrði Lögbókar þeirrar, er Jónsbók kallast*. Hið íslenzka bókmenntafélag, Reykjavík.
- Vígfússon, S. 1911. Nokkrar athuganir við rétttritunarmálið. *Skólablaðið* 9:139–143.
- Waals, J. 1999. An experimental view of the Dutch syllable. Doctoral Dissertation, Utrecht University.
- Wolf, Christian A. 1977. Sveinbjörn Egilsson's grammatical writings in Lbs. 456, 4to. An edition and commentary, with special references to Rask. Doctoral Dissertation, University of North Carolina at Chapel Hill.
- Yelverton, John Raymond. 1971. The first grammar of Icelandic in the native tongue. an edition of Lbs. 1238, 8vo., and an investigation of its sources. Doctoral Dissertation, University of North Carolina at Chapel Hill.
- Yu, Si-Taek. 1992. *Unterspezifikation in der Phonologie des Deutschen*. M.Niemeyer, Tübingen.