



Mandić, David (2021) *Glottalisation in Scottish Gaelic*. MRes thesis.

<http://theses.gla.ac.uk/82669/>

Copyright and moral rights for this work are retained by the author

A copy can be downloaded for personal non-commercial research or study,  
without prior permission or charge

This work cannot be reproduced or quoted extensively from without first  
obtaining permission in writing from the author

The content must not be changed in any way or sold commercially in any  
format or medium without the formal permission of the author

When referring to this work, full bibliographic details including the author,  
title, awarding institution and date of the thesis must be given

Enlighten: Theses

<https://theses.gla.ac.uk/>  
[research-enlighten@glasgow.ac.uk](mailto:research-enlighten@glasgow.ac.uk)

# **Glottalisation in Scottish Gaelic**

David Mandić

MA

Submitted in the fulfillment of the requirements for the

Degree of MRes in Gaelic

School of Humanities – Sgoil nan Daonnachdan

College of Arts

University of Glasgow

Supervisors

Prof. Roibeard Ó Maolalaigh

Prof. Jane Stuart-Smith

September 2021

## **Abstract**

This thesis is dedicated to glottalisation in Scottish Gaelic, recorded in various south-western dialects. Glottalisation has been reported to occur, optionally or inconsistently, between a stressed short vowel and another vowel, in hiatus or with an intervening consonant, but not in svarabhakti groups. Less commonly, it is found in other contexts, for example, after a long vowel. It has been described either as glottal stop or a period of creaky phonation. This thesis presents the results of an analysis of two types of primary sources – the dialectological materials (word lists) collected in the mid-20<sup>th</sup> century as part of the Survey of the Gaelic dialects of Scotland, and the audio recordings of native speakers made about the same time in different areas by the School of Scottish Studies. The data obtained from the *SGDS* records was expected to help determine the geographical area in which glottalisation occurs, its frequency in particular dialects, and the phonological contexts in which it occurs in these dialects. A closer examination of various types of examples, considering other related linguistic phenomena (such as epenthesis), was expected to answer the question of the phonological status of glottalisation in Gaelic dialects. The audio recordings were used for phonetic analysis aiming to provide a phonetic description of Gaelic glottalisation, and to find out whether it is related to other prosodic phenomena, such as stress and pitch.

## Table of contents

0. Introduction .....	6
0.1. Primary sources .....	6
0.2. Data analysis .....	7
0.3. The structure of this thesis .....	8
0.4. Transcription of Gaelic words .....	9
0.5. Quoting examples from the <i>SGDS</i> records and audio recordings .....	10
1. Some notes on glottalisation .....	11
2. Earlier studies of Gaelic glottalisation .....	13
3. Representation of glottalisation and hiatus in the <i>SGDS</i> records .....	14
4. Phonological contexts of glottalisation .....	22
4.1. Hiatus .....	23
4.1.a. Old Gaelic hiatus .....	25
4.1.b. Secondary hiatus .....	25
4.1.b.α. Secondary hiatus after a stressed short vowel .....	26
4.1.b.β. Secondary hiatus after a stressed long vowel or diphthong ...	26
4.1.b.γ. Secondary hiatus following the epenthetic vowel .....	27
4.2. Consonantal contexts .....	28
4.2.a. Voiced consonants .....	29
4.2.a.α. Stops .....	29
4.2.a.β. Fricatives .....	30
4.2.a.γ. Unlenited sonorants .....	31
4.2.a.δ. Lenited sonorants .....	31
4.2.a.ε. Approximants .....	32
4.2.b. Voiceless stops .....	32
4.3. Glottalisation at the word boundary .....	33
4.3.a. Glottalisation in sandhi .....	33
4.3.b. Word-final glottalisation .....	34
4.4. Glottalisation and stress in connected speech .....	35
4.5. Exceptions .....	36
4.5.a. Epenthesis .....	36
4.5.b. Long vowels or diphthongs .....	37
4.5.c. Unstressed syllables .....	37
4.5.d. Other exceptions .....	38

5. Realisation of glottalisation in Scottish Gaelic .....	39
5.1. Intensity .....	39
5.2. Location (timing) and extent .....	39
5.3. Glottalisation and epenthesis .....	41
6. Geographical distribution of glottalisation in Gaelic .....	42
7. Phonetic nature of Gaelic glottalisation .....	45
7.1. Introduction .....	45
7.2. Methodology .....	46
7.2.a. Participants .....	46
7.2.b. Materials .....	46
7.2.c. Analysis .....	47
7.3. Results .....	50
7.4. Discussion .....	64
7.5. Conclusion .....	65
8. Phonological status of glottalisation in Gaelic .....	67
9. The origin of Gaelic glottalisation .....	72
Conclusion .....	74
Bibliography .....	75
Appendix 1: Modifications to the symbolisation used in the <i>SGDS</i> materials and other sources .....	80
Appendix 2: Primary sources – <i>SGDS</i> fieldwork notes and fair copies .....	81
Appendix 3: Primary sources – audio recordings .....	83
Appendix 4: The <i>SGDS</i> survey points by fieldworker .....	86
Appendix 5: Transcription of non-initial unaspirated stops in the <i>SGDS</i> materials .....	86
Appendix 6: Maps .....	87
Appendix 7: Glottalisation in the <i>SGDS</i> records – statistics .....	93
Appendix 8: Praat script used in the phonetic analysis .....	102

This work was supported by the Dr Peter Davies Scholarship, the Duncan and Morag MacLean Studentship, and the Paul Burns Scholarship.

## 0. Introduction

A form of glottalisation has been recorded in the south-western Scottish Gaelic dialects, spoken in the islands south of Eriskay and Skye (including Arran), and in parts of mainland Argyll, mostly along its western coast. It was first reported to occur after a stressed short vowel, either in hiatus or preceding certain sonorants, in dialects such as Arran, Gigha, and Islay.<sup>1</sup> Impressionistically, Gaelic glottalisation usually sounds like a glottal stop and it has often been described as such, especially in earlier publications.<sup>2</sup> The same term was used in the *SGDS* questionnaire (section 27d). In more recent studies, it has been described as a period of creaky voice rather than a distinct segment.<sup>3</sup> Relatively little has been written on Scottish Gaelic glottalisation. It is addressed, usually briefly, in a number of books or articles dedicated to particular dialects (see §2), but no detailed research, involving data from a variety of dialects, has been carried out yet.

The objective of this thesis is to contribute to the general understanding of Gaelic glottalisation by providing answers to the following questions: (1) What are the dialects in which glottalisation occurs? (2) In which phonological contexts does it occur? (3) Is there any dialectal variation based on the context of glottalisation? (4) What is its most common phonetic realisation and does it vary across dialects? (5) Is glottalisation related to prosodic phenomena such as stress or pitch? (6) Does the presence of phonetic voicing play any role in its realisation? (7) Is glottalisation a purely phonetic phenomenon or a phonological feature? (8) What is the historical origin of glottalisation in Scottish Gaelic? Due to the limited scope of this thesis, some of these issues will not be discussed in great detail.

### 0.1. Primary sources

A large part of this thesis is based on the analysis of the dialectological materials collected mainly between the years 1950 and 1963, as part of the Linguistic survey of Scotland. The phonological data, which is only a part of these materials, was published in 1994-1997, in a five-volume atlas titled *Survey of the Gaelic Dialects of Scotland*.<sup>4</sup> After the dialects in which glottalisation occurs had been identified by the initial examination of the published lists, the digitised copies of the original *SGDS* fieldwork records (questionnaires) from the majority of the relevant survey points were obtained from the School of Scottish Studies. However, the original records from a number of points do not exist

---

<sup>1</sup> See e.g. Holmer (1938; 1957).

<sup>2</sup> Holmer (1938; 1957; 1962); Jones (2006); Iosad (2015).

<sup>3</sup> Scouller (2017); Morrison (2019).

<sup>4</sup> *SGDS* I-IV.

anymore and the corresponding fair copies have not been digitised. Since the latter were impossible to access until a fairly late phase of this research, due to Covid 19 restrictions, the published lists were used as the source of data for a number of dialects (see Appendix 2). The fair copies were examined only briefly after the rest of the data had already been processed – primarily in order to find out if they might contain any interesting notes written by fieldworkers, concerning glottalisation or other related phenomena.

Another source of data was the audio recordings of native Gaelic speakers published on *Tobar an Dualchais*, the online resource dedicated to Scotland’s cultural heritage.<sup>5</sup> For the purpose of this project, 36 recordings of various dialects – mainly ones in which glottalisation was expected to occur – were identified on *TanD*, and audio files in the .wav format were obtained from the School of Scottish Studies (see Appendix 3). These recordings were made in the period between the years 1950 and 1980 (mostly in the 1950s and 1960s) and many of the contributors were born before 1900, so their speech reflected the traditional dialects, similar to those represented in *SGDS*.

## 0.2. Data analysis

The analysis of the fieldwork records identified 936 words or short phrases containing any of the phonological contexts in which glottalisation had been attested in Gaelic dialects. A great majority of these words or phrases are represented by questionnaire headwords. A few words occur in more than one section of the questionnaire, e.g. *abhainn*, *balach*, *coire*, *tobar*; and different realisations of the same word have sometimes been recorded in the same dialect, including the presence of glottalisation. In any case, all instances of the same word were included in the analysis. The informants occasionally provided responses that differed from the questionnaire headwords, e.g. *coimhearsnach* for *nàbaidh*, or *mughairle* for *adhbrann*, in some southern dialects. Such responses were also included in the analysis if they contain a context which triggers glottalisation (as the two afore-mentioned examples do). Additional examples were found in marginal notes written by the fieldworkers. A few questionnaires contain incomplete phonological data, collected at additional survey points or from other informants, which have not been published in the *SGDS* volumes. All these were considered to be a valuable source of information on glottalisation and were included in the analysis. Instead of the 17 unavailable questionnaires, the materials from the published lists were used. These included 267 words containing various phonological contexts in which glottalisation had been found to occur. It has to be mentioned that not all of these words (or phrases) have been attested at all survey points so

---

<sup>5</sup> [www.tobarandualchais.co.uk](http://www.tobarandualchais.co.uk).



the number of recorded examples was usually much lower than 936 (or 267 in the case of the published lists).

The relevant words and phrases were listed then in an Excel spreadsheet with a separate column for each survey point, and the presence or absence of glottalisation was indicated for each one of them in accordance with the data from each survey point. The presence of certain hiatus symbols was also indicated since they were thought to represent a form of glottalisation (see §3). Different codes were used depending on the type of context because the realisation of words (especially those that involve the reflexes of Old Gaelic voiced fricatives, see §4.1.) can differ considerably in various dialects. The frequency of glottalisation was then calculated for each context and survey point. These values were expected to reveal a pattern in the geographical distribution of dialects characterised by different frequency of glottalisation in various phonological contexts (see §6).

These results, however, should not be taken at face value, since the frequency of glottalisation can differ significantly among speakers of the same dialect.<sup>6</sup> The data could also have been influenced by the fieldworkers' perception or the quality of the recordings.<sup>7</sup> Additionally, it became apparent in the course of the analysis that certain hiatus symbols did not have the same value in all fieldworkers' transcriptions. Another problem was that the precise meaning of some of these symbols is not explained in the survey documentation. This is discussed in §3. The information obtained from the fieldwork records was then compared to the speech realisations in the audio recordings of the dialects spoken in the same areas, by auditory assessment and by inspecting the spectrograms and waveforms of the recorded speech. The primary purpose of that was to identify the phenomena represented by the unclear hiatus symbols. Six audio recordings were analysed in much greater detail, as explained in §7.

### **0.3. The structure of this thesis**

The main text of this thesis is divided into nine primary sections. The first one, bearing the title *Some notes on glottalisation*, provides some general information on glottalisation and a few examples from other languages. The following section, *Earlier studies of Gaelic glottalisation*, gives an overview of previous scholarly work dedicated to this topic. The third section, *Representation of glottalisation and hiatus in the SGDS records*, discusses the phonetic symbols used in the fieldwork materials to indicate glottalisation and hiatus: their phonetic values, the possible differences in their use between

---

<sup>6</sup> Cf. Holmer (1957: 38).

<sup>7</sup> See the comments on the survey points 36 and 37 in *SGDS I*, 85.

fieldworkers, and their transcription in the published *SGDS* lists. Section 4, *Phonological contexts of glottalisation*, is dedicated to the phonological environment in which glottalisation occurs in various dialects. It is divided into a number of sub-sections, each addressing a different type of context. Each type is illustrated by a number of examples found in the *SGDS* fieldwork records, and by some obtained from the audio recordings. The phonetic realisation of glottalisation in certain environments has been illustrated by spectrograms. Section 5, *Realisation of glottalisation in Scottish Gaelic*, is based solely on the *SGDS* data. Its goal is to point to certain aspects of the transcription found in the materials which might reflect details of the realisation of glottalisation and might require further study. Section 6, *Geographical distribution of glottalisation in Gaelic*, provides a short overview of the distribution of glottalisation in various contexts across dialects. The conclusions presented there have been based on the results of the afore-mentioned frequency calculations made using the *SGDS* data. These results can be found in Appendix 7, and the distribution and frequency of glottalisation in various dialects is shown on a number of maps (Appendix 6). The following section, entitled *Phonetic nature of Gaelic glottalisation*, presents the results of a phonetic analysis carried out using six audio recordings, each from a different dialect area. It has been suggested that glottalisation is a prosodic phenomenon in Gaelic.<sup>8</sup> The main aim of this analysis was to determine the basic phonetic properties of glottalisation in Gaelic, and to find out whether it is related to phenomena such as stress, voicing, and pitch. Section 8, *Phonological status of glottalisation in Gaelic*, discusses the question whether glottalisation is a (predictable) phonetic phenomenon or a distinctive feature which belongs to the phonology of the language. Possible differences between dialects in this respect were also considered. The final section, *The origin of Gaelic glottalisation*, briefly discusses the possible origins of glottalisation in Gaelic dialects.

#### **0.4. Transcription of Gaelic words**

Most Gaelic examples adduced in the following text come from the *SGDS* records and reflect the transcription used by the fieldworkers. Some symbols, however, have been replaced by others, as explained by Appendix 1. This has been done mostly for technical reasons. In quoting examples from published sources, the original transcription has been maintained. IPA notation has been used in my own transcriptions.

---

<sup>8</sup> See Scouller (2017).

### 0.5. Quoting examples from the *SGDS* records and audio recordings

Despite the standard practice, the phonetic transcriptions of Gaelic examples are written in bold in this thesis, so that they would stand out from the surrounding text and be more clearly visible. The square brackets are not used either since the phonetic character of the transcription is indicated by the bold typeface. Each example is preceded by a number indicating the survey point and followed by its standard orthographic form enclosed in round brackets. The numbers marked by an asterisk refer to the unpublished materials found in the same questionnaires as those collected at the survey points indicated by the same numbers. Since the present-day Gaelic orthography has changed slightly since the time of the Survey, the spelling of some headwords was modernised, e.g. *gu'n gaibh* > *gun gabh*, *tadhall* > *tadhal*, *gabhar* > *gobhar*, except when the older spelling reflects the pronunciation better, e.g. *deaghaidh* (instead of *dèidh*). For the same reason, non-standard spelling is used in a few examples, e.g. *mnathadh* (instead of *mnatha*). Where a word or its spelling differs from the *SGDS* headword, the original form has been provided in a footnote.

## 1. Some notes on glottalisation

The term ‘glottalisation’ can refer to the degree of glottal constriction during the articulation of one or more segments, or to the effect produced by this constriction, such as creaky phonation or glottal stop.<sup>9</sup> Creaky voice is particularly interesting in this case since it seems to play an important role in Gaelic glottalisation (see §7). Creaky phonation is described by L. Davidson<sup>10</sup> as produced by ‘shortened and thickened vocal folds that vibrate at a low and quasi-regular fundamental frequency with a long period of damping’. In other words, it is characterised by low airflow, low open quotient – meaning that the closed phase during the glottal cycle is longer than the open phase – adducted and thick vocal folds; and its most salient acoustic cue is low frequency, in the cca 40-90 Hz range.<sup>11</sup> This type of phonation can be used in various ways in languages: as a phonemic or allophonic segment (glottal stop), a prosodic element, or a contrastive feature characteristic of particular segments (opposed to modal voice and/or other types of phonation), and it can have a social use.<sup>12</sup> If glottal constriction is full and obstructs the flow of air through the vocal folds, glottal stop is realised: this involves a period of silence during closure.<sup>13</sup> Full glottal stop, however, seems to be rare, and its more common realisation is a short period of creak.<sup>14</sup> Creaky phonation can be realised over a wider domain, including more than one segment.<sup>15</sup>

Glottalisation has been recorded in numerous varieties of English, where it occurs as pre-glottalisation of voiceless stops usually after a stressed vowel, as in *stop* [stɒʔp] or *packs* [p<sup>h</sup>æʔks],<sup>16</sup> or as an allophone of /t/ perceived as glottal stop, as in *bottle* [bɒʔl] or *it* [ɪʔ].<sup>17</sup> Glottal replacement of /k/ and /p/ has also been reported in some varieties of English.<sup>18</sup> Gaelic glottalisation differs from this, since it is not associated with voiceless environments. A different use of glottalisation in a European

---

<sup>9</sup> Laver (1994: 330-31). Various types of glottalisation are discussed in Keating *et al.* (2015).

<sup>10</sup> Davidson (2020: 1).

<sup>11</sup> Davidson (2020: 2).

<sup>12</sup> Davidson (2020: 1-2).

<sup>13</sup> Davidson (2020: 5).

<sup>14</sup> Davidson (2020: 5); Docherty & Foulkes (2005).

<sup>15</sup> Laver (1994: 330).

<sup>16</sup> See Davidson (2011, 2018); Docherty & Foulkes (1999, 2005); Milroy *et al.* (1994); Roach (1973); Wells (1982).

<sup>17</sup> See Davidson (2018); Docherty & Foulkes (1999, 2005); Gordeeva & Scobbie (2011, 2013); Macaulay (1977); McCarthy & Stuart-Smith (2013); Milroy *et al.* (1994); Penney *et al.* (2020); Seyfarth & Garellek (2020); Stuart-Smith (1999a).

<sup>18</sup> Stuart-Smith (1999b); Wells (1982).

language can be exemplified by the Danish phenomenon known as *stød*.<sup>19</sup> *Stød* has been described as a phonological prosodic feature, reminiscent of creaky voice, occurring in syllables which contain a long vowel or a sequence comprised of a vowel and a sonorant.<sup>20</sup> It is related to the system of word tones found in Swedish and Norwegian: both *stød* in Danish and the so-called accent 1 in Swedish and Norwegian evolved in original monosyllables and became phonemic when an epenthetic vowel was inserted in some of these words.<sup>21</sup> This has been compared to the situation in Gaelic, where tonal accent is also found in some dialects, with the distribution of one of the tones partially corresponding to that of glottalisation (see §8).<sup>22</sup> However, the contexts in which Gaelic glottalisation developed differ markedly from those in which *stød* arose in Danish (see §4).

---

<sup>19</sup> For a phonetic approach to *stød*, see Fischer-Jørgensen (1989); Grønnum & Basbøll (2001); Grønnum *et al.* (2013); for a phonological analysis of so-called short-vowel *stød*, see Iosad (2016).

<sup>20</sup> Fischer-Jørgensen (1989: 2).

<sup>21</sup> Fischer-Jørgensen (1989: 50).

<sup>22</sup> See Ternes (2006).

## 2. Earlier studies of Gaelic glottalisation

Glottalisation has been addressed in a number of books and articles dedicated to various Gaelic dialects: Islay and Gigha (Holmer 1938), Arran (Holmer 1957), Kintyre (Holmer 1962), Barra (Borgstrøm 1937, 1940).<sup>23</sup> The information found in some of these publications, however, does not always agree with the *SGDS* data, especially regarding the context in which glottalisation occurs. According to Holmer, for example, it does not occur in Islay and Gigha with unaspirated stops and unlenited sonorants, which he described as geminates: **k-op:ir** (ag obair), **fal:an** (fallain);<sup>24</sup> cf. *SGDS* 40 **to'bh̥ar** (tobar), **ʃa'ħay** (sealladh). A detailed discussion of Gaelic glottalisation is found in the articles by G. Jones (2000, 2006) on the glottal stop in the Jura dialect, and in the doctoral thesis written by A. Scouller (2017) on the dialect of Colonsay. The latter also offers some remarks on the phonetic properties of glottalisation in that dialect. Glottalisation is addressed briefly in *LASID* and *SGDS*.<sup>25</sup> Gaelic glottalisation was discussed in detail by R. Ó Maolalaigh, in his plenary lecture at the 8<sup>th</sup> Celtic Linguistic Conference, held in 2014 at the University of Edinburgh.<sup>26</sup>

A number of authors, e.g. Iosad (2015, 2021), Morrison (2019) and Ternes (1980, 2006), have approached Gaelic glottalisation within the framework of various phonological theories, in relation with other related features and the corresponding phenomena in the non-glottalising dialects. This research was usually based on the data obtained from the afore-mentioned earlier works.

The *SGDS* questionnaire included a separate section dedicated to glottalisation in consonantal contexts and one on hiatus, where glottalisation commonly occurs in many dialects (see §4): section 27d *Glottal stop before l, n* (page 19) and section 35 *Hiatus* (page 31). The inclusion of no consonantal contexts other than *l* and *n* in the former section might have been motivated by the earlier studies, reporting glottalisation only before lenited sonorants (and hiatus).<sup>27</sup> However, glottalisation is well-attested in the *SGDS* materials, in numerous words recorded in other sections and in marginal notes. The unpublished materials found in the sections dedicated to morphological topics are particularly interesting since they include various examples of sandhi and connected speech (see §§4.3-4.).

---

<sup>23</sup> Glottalisation is not mentioned in the descriptions of the Islay dialect by S. Grandd (1985, 2000).

<sup>24</sup> Holmer (1938: 68-70). Cf. also Holmer (1957: 38).

<sup>25</sup> *LASID* IV, ix; *SGDS* I, 121-22, 135.

<sup>26</sup> Ó Maolalaigh (2014).

<sup>27</sup> Cf. Holmer (1938: 36-37; 1957: 38; 1962: 35-36).

### 3. Representation of glottalisation and hiatus in the *SGDS* records

In order to indicate glottalisation, fieldworkers used the glottal stop symbol (ʔ), the raised glottal stop symbol (ʔ̚), and the apostrophe ('). Other forms of hiatus were indicated by the pipe symbol (|), the hyphen (-), two special symbols indicating pitch change, or by the space between vowels, or were left unmarked.<sup>28</sup> In the latter case, it can be unclear whether or how these vowel sequences differ from diphthongs.

**Eric P. Hamp** used the raised glottal stop symbol to indicate glottalisation in all contexts. In consonantal contexts, this symbol usually precedes the consonant and is rarely found above or after it in the records from most survey points. A weaker degree of glottalisation is indicated by enclosing the symbol in brackets. Unless glottalised, hiatus was not specially marked by Hamp, except in a few examples collected at pt 16, where he used the pipe: **ḃo|oḃ** (bodhar), **f[iʔ̚]|rɕ** (fiadhaich), **ku[au]|ɛv** (claidheamh).<sup>29</sup> Occasionally, the second vowel in hiatus is raised, possibly pointing to weaker articulation. Only in the materials collected at pt 81, the symbol indicating pitch drop was used more frequently. Diphthongs are marked by the bottom ligature in Hamp's materials.<sup>30</sup>

**Terence McCaughey** used the apostrophe to indicate glottalisation in consonantal contexts: 64 **kó'gǫ̃y** (cogadh). Different forms of hiatus are indicated by the pipe symbol and the hyphen: 64 **l'ó|ǫ̃y** (leaghadh), **tǫ̃-ǫ̃s** (tomhas); and the apostrophe is found in only a few examples of hiatus: 63 **fo'm'** (fodhainn). Diphthongs are sometimes indicated by the bottom ligature.

**Fred MacAulay** used the apostrophe in all contexts in the materials collected at pts 31-35. Hiatus is also indicated by the hyphen or by the space between vowels here: 32 **la'v** (latha); **rom-ɪn** (romhainn); **rom ɪy** (romhaibh). Elsewhere, MacAulay used the glottal stop: 46 **trɔʔə** (treabhadh); or the hyphen, and occasionally the space between vowels or nothing in hiatus. The raised glottal stop symbol is common in the records from pt 39. The raised dot (i.e. the half-long mark) was sometimes used where hiatus is expected, unless it is in fact the hyphen.<sup>31</sup> In consonantal contexts, the raised glottal stop predominates in the records from pts 37, 39, 41, 44, 49, 50, 58 and 60. The regular glottal stop symbol is found in some examples, but never with original voiceless stops. In the materials from pts 42, 45-48, 62 and 65, the glottal stop is used with sonorants, and the raised glottal stop with stops and rarely

---

<sup>28</sup> See *SGDS* I, 121.

<sup>29</sup> This has been replaced by the syllabicity mark in the published lists: **ḃooḃ**, **f[iʔ̚]rɕ**, **ku[au]ɛv**.

<sup>30</sup> See *SGDS* I, 117, for the use of this symbol by some fieldworkers.

<sup>31</sup> *SGDS* I, 122.

with sonorants (only in the latter four points): 46 **jiʔʌə** (gille), **laʔgan** (lagan).<sup>32</sup> Diphthongs are not marked specially in MacAulay's records.<sup>33</sup>

**Anthony Dilworth** used the glottal stop symbol in consonantal contexts: 67 **jeʔhy** (gealladh); and the glottal stop, the pipe symbol, and the hyphen in hiatus: 67 **thʔyʔyʔ** (tadhail), **o|o** (ogha), **u-ı̄ı̄'** (uibhir). Occasionally, the hyphen is found before **w**: 91 **la-wuı̄ı̄ʔ** (labhairt), **sã-wın'** (samhain). The apostrophe is used in a handful of examples from Muck: 94\* **r'ə'ı̄** (roimhe). In part of Dilworth's fieldwork records, however, the hyphen indicates a stronger form of hiatus than the pipe.<sup>34</sup> In the published lists, the pipe has been replaced with the hyphen and vice versa in the materials collected at pts 66, 67, 69-74, 76-80, 86, 88, 89, 91-93, 167, 168, 171, 172, and 188. The original distribution of the two symbols has been retained in the materials from pts 36 and 38, and from pts 94 and 95, where the pipe does not occur. In the fair copies of Dilworth's records from pts 96-103, and 116, they are used in the same way as in the published lists. Interestingly, the pipe and the hyphen also occur, in part of Dilworth's records, in transcriptions corresponding to traditional diphthongs in other dialects: 167 **ji:|ä** (sia), **'fe|ə:ı̄l'** (feòil); **grı̄-ɔ̄n** (grian); 188 **ı̄u|y** (ruadh), **fi-|äı̄** (feur); but cf. **bi-|at** (beul); or to long monophthongs: 73 **thʔ:|ı̄ı̄ı̄** (taobh); cf. **hı̄ı̄:ɔ̄** (a h-aon<sup>35</sup>) and **sə:|ı̄ı̄** (saoghal). Both symbols have been omitted from these and similar examples in the published lists.

**Kenneth H. Jackson** used the pipe symbol to indicate weak hiatus glottalisation at pts 28-30. He recorded no glottalisation and left most examples of hiatus unmarked at pt 75: **ɔ̄** (ogha), **l'əy** (leaghadh), **sl'ı̄əjı̄n'** (sleamhainn), **vı̄araı̄y** (mharbhadh); except a few in which hiatus is indicated by the hyphen: **dɔ̄-ı̄n'** (domhainn).

In the published lists, glottalisation is indicated by the apostrophe in consonantal contexts, and this precedes, co-occurs with, or follows the consonant, in accordance with the fieldwork notes.<sup>36</sup> The

---

<sup>32</sup> The two groups of survey points are situated in two different areas: (1) along the Argyll coast and (2) east of that.

<sup>33</sup> Cf. *SGDS* I, 118.

<sup>34</sup> Cf. the note on page 31, pts 171 and 172, section *Hiatus*: '[ ] = a slight break, hardly noticeable. [-] = a clear break.'; and the note by Kenneth H. Jackson on page 31 of the fair copy of A. Dilworth's records from pt 168: 'Dilworth's definition of the type transcribed here by [-] is "a slight break; hardly noticeable"; that transcribed [ ] "a clear break".' Jackson replaced the hyphen by the pipe and vice versa in the fair copies of Dilworth's materials. Cf. also the note by Cathair Ó Dochartaigh, the editor of *SGDS*, on the front page of the questionnaire for pts 79, 80, 86, 89: 'Note the reinterpretation of the [-] and [ ] hiatus symbols here in AD's retranscriptions CÓD 17/1/92'.

<sup>35</sup> *Aon*.

<sup>36</sup> *SGDS* I, 135.



glottal stop, the pipe symbol, the hyphen, and two pitch movement symbols are used to indicate hiatus.<sup>37</sup>

It is not completely clear what phonetic features are represented by the pipe and the hyphen in the fieldwork records, since their phonetic values and the difference between them are not discussed in the survey documentation.<sup>38</sup> According to Ó Dochartaigh,<sup>39</sup> the hyphen might indicate hiatus where no ‘glottal catch’ is heard, but only a break in the tension of the muscles<sup>40</sup>; and the pipe could represent a break which is more noticeable than that. On a closer look, however, it becomes apparent that the two symbols might not have been used in the same way by different fieldworkers and that they may not represent the same phonetic realities in different fieldworkers’ records.

According to his own notes, A. Dilworth used the hyphen in his records from pts 171 and 172, to indicate what he described as a ‘clear break’, different from a slight, hardly noticeable break which he represented by the pipe.<sup>41</sup> He also used these symbols in the representation of diphthongs – the pipe at pts 73, 167, 171, 172, and 188 (frequently), and at pts 66, 67, 69, 70, 76, and 78 (rarely); and the hyphen at pt 167 (frequently), and at pts 171, and 172 (rarely). According to his notes, the difference between hiatus groups and diphthongs was not clear-cut in some dialects<sup>42</sup> – although diphthongs were monosyllabic,<sup>43</sup> they could be realised as disyllabic sequences there.<sup>44</sup> Elsewhere, he noted that the articulation of certain diphthongs involved a ‘slight break’, and the only difference between them and the phonetically similar disyllabic sequences appeared to be related to quantity.<sup>45</sup>

---

<sup>37</sup> See *SGDS* I, 121-22.

<sup>38</sup> See *SGDS* I, 121.

<sup>39</sup> *SGDS* I, 121.

<sup>40</sup> As described by Borgstrøm (1937: 74).

<sup>41</sup> See footnote 34.

<sup>42</sup> Pts 171/172, the note on page 31, section *Hiatus*: ‘However, as the difference between these breaks is not significant, & indeed the difference between hiatus & diphthong also (it seems) the categories seem to overlap & there are always words which cannot be definitely put into one category any more than the other & words which vary as to category.’

<sup>43</sup> Pts 171/172, the note on page 4: ‘not dissyllabic’. Pts 167/168, page 4: ‘definitely not dissyllabic’ and ‘Examination of tone patterns will probably show them to be quite different from words like ‘fitheach’ – raven.’

<sup>44</sup> Pts 171/172, the note on page 6: ‘a general rule with diphthongs is that they are liable to be dissyllabic in isolation & diphthongs in speech. However, they can be dissyllabic in speech & diphthongs in isolation. The dissyllable is most common, tho’. Examination of tone patterns will probably show dissyllables & diphthongs to be quite different’.

<sup>45</sup> Pts 171/172, the note on page 6, section *io*: ‘seems to be always a slight break between the two elements. e.g. fi|ɔx – fitheach fi|ɔxɪn – fiachan The only difference seems to be in the length of [i]. [i] seems to have 3 lengths in these diphthongs i i i:’, and section *iu, iui*: ‘[i] is not the same as [j]. It is shorter than a short vowel & slightly longer than a very short vowel. This is typical of ‘iu’, ‘iui’ & ‘eo’ in Glengarry. [p‘i-u:ɪ] may well be the same as [c‘iũ·ɪnʲ].’ Page 9,

Both symbols seem to be more frequent in Dilworth's records in contexts involving a more significant change in vowel quality, as in 167 **bru-in** (bruidhinn); **li:-ɔn** (lìon); and even in examples such as: 167 **su-i** (suidh), **lu-i** (luibh); cf. also 188 **luji** (laoigh). The pipe co-occurs with the glottal stop in a few examples from pt 66: **lɔʔ|à** (latha); **mɔʔ|ò** (motha); **juʔ|us** (giuthas);<sup>46</sup> cf. also: 66 **u|j-ën** (uighean); so it cannot symbolise glottalisation. In his article on the mainland dialects,<sup>47</sup> however, Dilworth claimed that long vowels and diphthongs did differ from hiatus groups in all these dialects and that the difference was based on tone patterns. The symbols used by him in such examples could, therefore, be interpreted as the indication of intonation/pitch change.

In T. McCaughey's records, the pipe occurs at pts 64, 87 and 90 (frequently), and at pts 43, 61, and 63 (occasionally), but no explanations of what it represents have been found in the analysed materials.<sup>48</sup> K. H. Jackson used the pipe in his records from pts 28-30 to indicate what he described as a distinct 'break in tension' in hiatus, but 'hardly a glottal stop'.<sup>49</sup> F. MacAulay seems to have used the hyphen to indicate a 'distinct break in tension'.<sup>50</sup> Cf. MacAulay's examples such as 41 **foaj-əl** (fuaigheal<sup>51</sup>) vs. 37 **foajal** (fuaigheal); or 62 **fatai-ı** (falbhaidh); where such a break was perceived even following an approximant or glide.

In other words, the feature described as a 'distinct' or 'clear break' was indicated using the hyphen by F. MacAulay and A. Dilworth, and Dilworth also used the pipe to indicate a weaker 'hardly noticeable' break (also occurring in diphthongs in some dialects). The hyphen could also have represented a stronger form of hiatus than that indicated by the pipe in McCaughey's records, since that is what he described as the 'normal usage in a word spoken on its own',<sup>52</sup> where clearer and less

---

section *iù, iù:* 'i|u type of 'iu' is most pronounced in Glengarry itself. Elsewhere the first part is shorter & the break slightly less prominent.'

<sup>46</sup> In the original transcription, the glottal stop is written over the pipe, which was impossible to reproduce here.

<sup>47</sup> Dilworth (1972: 2-3).

<sup>48</sup> Cf. the note on page 31 of the fair copy of his records from pt 90: 'Both [i] and [-] occur. [i] (i.e. pitch drop) also occurs in connected speech. [-] is the normal usage in a word spoken on its own.'

<sup>49</sup> Cf. the note on page 31 of the questionnaire: 'In slow speech, as when a word is stressed, the break in tension is perfectly distinct and marked, tho' hardly a glottal stop: I write [i].'

<sup>50</sup> Cf. pt 14, the note on page 31: 'There evidently may be a distinct break in tension, = [-]; but in a number of cases with M. elsewhere (e.g. p. 25) there was a glottal stop.' However, these materials were transcribed by K. H. Jackson, so this might be his remark rather than MacAulay's.

<sup>51</sup> *Fuaghail*, p. 10.

<sup>52</sup> See footnote 48.

reduced pronunciation is expected. This might mean that only K. H. Jackson used the pipe to represent a stronger form of hiatus, as is evident from his note in the records from pts 28-30.<sup>53</sup>

It is interesting, additionally, that both the use and the frequency of these symbols can differ greatly in the materials collected at neighbouring survey points by different fieldworkers. For example, hiatus is mostly unmarked and only occasionally indicated by the hyphen at pts 169 and 170 (collected by F. MacAulay), not distant from pts 167 and 171, where A. Dilworth frequently used the pipe and the hyphen. Similarly, hiatus is usually unmarked and sometimes indicated by the hyphen at pt 75 (collected by K. H. Jackson), whereas the pipe and the hyphen are common in A. Dilworth's records from neighbouring pts 76 and 74. The glottal stop symbol is not infrequent in the records from pt 65 (collected by F. MacAulay), but it is absent from the materials collected by T. McCaughey at pt 64, where the pipe is common. A. Dilworth used the pipe, as well as the apostrophe, in his transcriptions from pts 36 and 38, but only the apostrophe is found in F. MacAulay's records from neighbouring pts 37 and 39.<sup>54</sup>

In an attempt to find out whether the pipe symbol (or the hyphen in A. Dilworth's records) represents a form of glottalisation, the audio recordings of speakers of various local dialects have been examined auditorily (see Appendix 3). The analysis has demonstrated that the type of glottalisation which may be perceived auditorily as glottal stop seems to occur only extremely rarely in the mainland dialects spoken north of Loch Ailort, Loch Eil, and Ben Nevis (see Appendix 6, map 1), the area in which various examples containing the pipe symbol in the published materials were recorded by Dilworth. Two adjacent vowels (forming hiatus) appear to differ primarily in pitch (the first one being higher-pitched) in these dialects, and it is often difficult to determine whether they belong to separate syllables or not. These sequences also seem to be audibly shorter than traditional long vowels.<sup>55</sup> Diphthongs involving a significant change in quality sometimes appear to involve a type of 'break' in these dialects; the impression presumably created by the difference in both quality and pitch between the two phases of the diphthong. A degree of creaky phonation can also be present (Figures 2 and 3, cf. Figure 1 for a glottalising dialect).<sup>56</sup> On the other hand, the recordings of a dialect spoken in the Castlebay (Barra) area (where K. H. Jackson consistently used the pipe symbol in his notes) show that hiatus glottalisation, realised as creaky voice, is fairly common there. Similar realisation has been recorded in neighbouring Vatersay (see Figure 4). This implies that the pipe symbol (as used

---

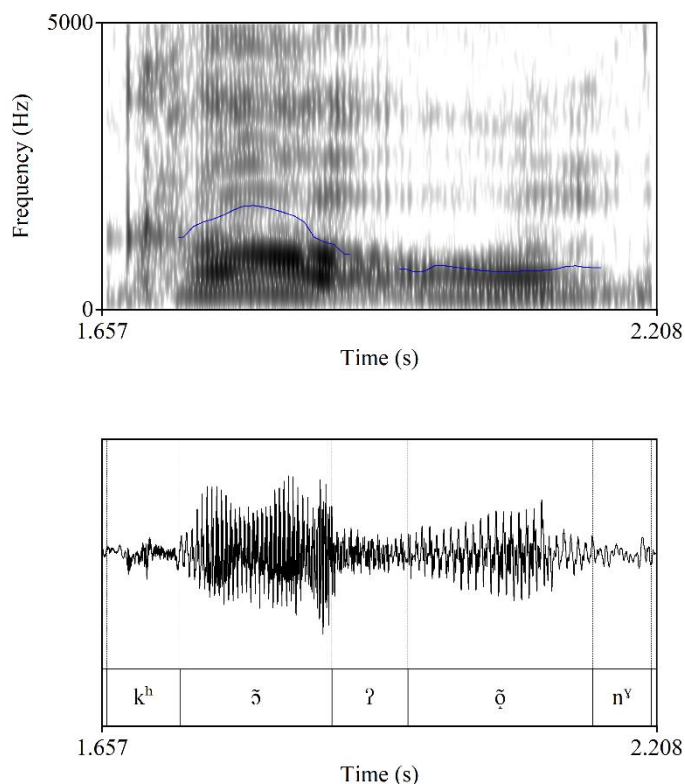
<sup>53</sup> If this is correct, it would mean that the values of the two symbols should not have been changed in part of the materials collected by A. Dilworth.

<sup>54</sup> The materials from pts 36 and 37 were collected from the same informant (see Appendix 2 and *SGDS I*, 85).

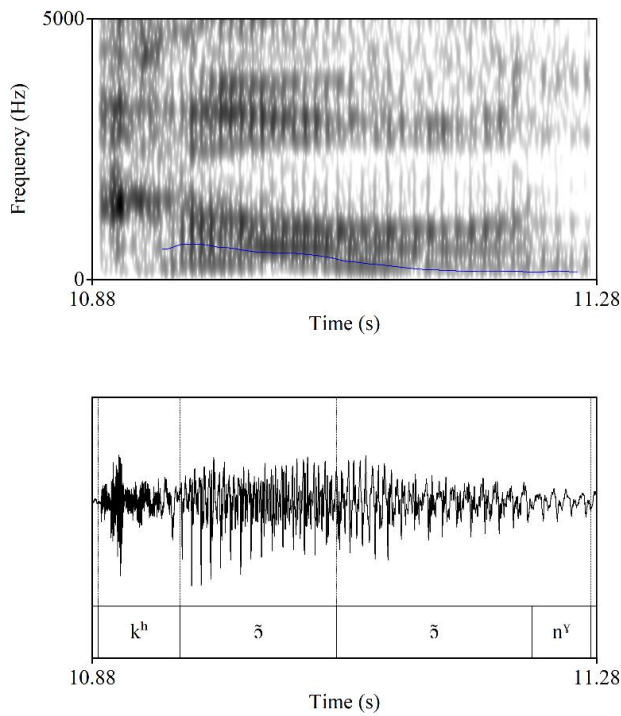
<sup>55</sup> Cf. Ternes (2006: 86-88).

<sup>56</sup> Cf. the auditory perception of long vowels in the Applecross dialects as described by Ternes (2006: 86).

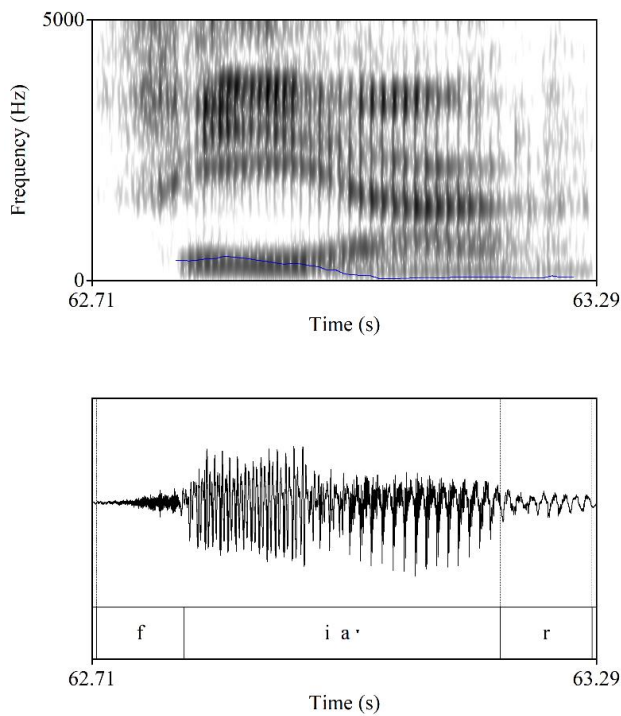
in the published *SGDS* volumes) does not represent the same phenomenon in Jackson's examples from Barra and those collected by Dilworth in various survey points north of Loch Ailort.



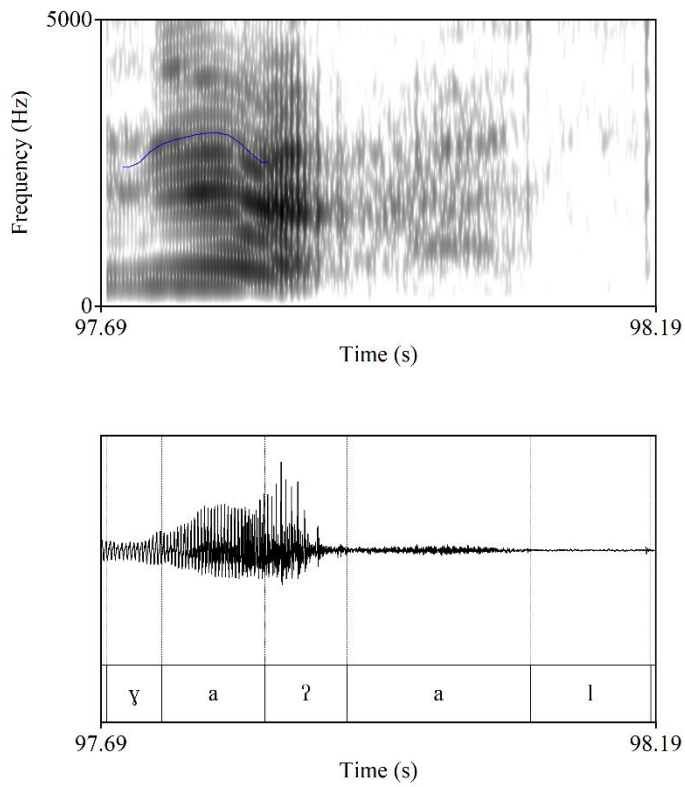
**Figure 1:** Spectrogram and wave form of the word *Comhann* (Easdale) showing a period of creaky voice (represented by the wider vertical striations) starting in the final phase of the stressed vowel, and a break in the pitch contour (the blue line). Abrupt pitch drop often accompanies glottalisation in Gaelic.



**Figure 2:** Spectrogram and waveform of the word *Comhann* (Morar) with the blue line indicating the gradually descending pitch contour characteristic of long vowels. Despite some creaky voice in the second vowel, no glottalisation was perceived auditorily in this example.



**Figure 3:** Spectrogram and waveform of the word *feur* (Morar), showing creaky phonation (represented by the wider vertical striations) in the second phase of the diphthong [ia·]. The blue line represents the pitch contour characteristic of long vowel segments.



**Figure 4:** Spectrogram and waveform of the word *ghabhail* (Vatersay) showing a short period of creaky voice in the final phase of the stressed vowel. This is perceived auditorily as glottal stop.

#### 4. Phonological contexts of glottalisation

The analysis of the *SGDS* materials has shown that glottalisation occurs most commonly after a **stressed short vowel** followed either (1) by another vowel (i.e. in hiatus), or (2) by a single voiced consonant followed in turn by a vowel (see Appendix 7). In other words, it is mainly found in a stressed short open syllable, in what seems to be voiced contexts. This syllable normally has to be followed by another one, but other than that, the length of the word is irrelevant. Glottalisation has also been recorded after a stressed long vowel, after an unstressed vowel, with consonant clusters, and with voiceless consonants, but this appears to be much less common and limited to small areas or to single dialects. Following is a more detailed list of contexts:<sup>57</sup>

- hiatus
  - Old Gaelic hiatus
  - secondary hiatus
    1. after a short stressed vowel
    2. after a long stressed vowel
    3. after an epenthetic vowel
- with consonants
  - voiced consonants
    1. stops<sup>58</sup>
    2. fricatives
    3. historically unlenited sonorants
    4. historically lenited sonorants<sup>59</sup>
    5. approximants<sup>60</sup>
  - voiceless stops

Glottalisation can also occur at the word boundary, especially in sandhi, when the suitable context is formed between two words (see §4.3.a). A few examples of glottalisation in other contexts have been found in the materials, but they represent phenomena irrelevant to this discussion, for example, before the initial (stressed) vowel: 45 **dəʔi-ãn** (do dh'Iain), 66 **pʰriʔʔàʔàɹ** (prìomh athair<sup>61</sup>), 83 **leʔegəʔ** (le eagal). Glottalisation seems to depend partially on sentence stress (see §4.4).

---

<sup>57</sup> The explanations of each context and numerous examples can be found in the following sub-sections.

<sup>58</sup> For voicing in Gaelic stops, see §7.3.

<sup>59</sup> The opposition lenited vs. unlenited has been lost in some sonorants in various dialects.

<sup>60</sup> These are reflexes of earlier fricatives < lenited stops (see §4.1).

<sup>61</sup> *Pàpa*.

#### 4.1. Hiatus

The term *hiatus*, normally referring to a break between two consecutive vowels which belong to separate syllables, is used here in a wider sense: to refer to sequences of two syllabic segments – usually simple vowels, but occasionally also diphthongs or syllabic sonorants. Where the first segment is a diphthong, the sequence can be interrupted by a glide-like element. Syllabic sonorants are phonetic realisations of /ə/ and a sonorant: 84 **ũ'ṃ** (ionnam). Modern Gaelic hiatus has two sources: Old Gaelic hiatus, inherited from Old Gaelic/Irish, and secondary hiatus, the result of the loss or vocalisation of historical consonants. A number of hiatus structures have been identified in the fieldwork materials (Table 1). In all dialects discussed here, glottalisation seems to occur after a short stressed vowel, which includes all examples of Old Gaelic hiatus and most examples of secondary hiatus. Strong glottalisation seems to be rare in structures involving a long vowel or/and a glide.

V_V	36 <b>oʔo</b> (ogha); 54 <b>piu'uṛ</b> (piuthar); 57 <b>pi'uṛ</b> (piuthar); 72 <b>ɣʔi</b> (aghaidh), 78 <b>l'eʔoʔ</b> (leabhar), 82 <b>ni'ən</b> (nighean), 86 <b>ʔheʔu</b> (threabhadh <sup>62</sup> ); 67 <b>ne ɣxk<sup>h</sup></b> (naidheachd); 91 <b>fe os</b> (feabhas); 88 <b>t<sup>h</sup>ʔ yʔ</b> (tadhail); 171 <b>u ir</b> (uibhir);
VV_V	46 <b>klai'ri</b> (claidheamh); 80 <b>k<sup>h</sup>lai'ɣv</b> (claidheamh); 50 <b>taɣ'ri</b> (taighe); 33 <b>kɔi'ax</b> (coimheach), <b>trɔi'et</b> (tromhad); 82 <b>fɔi'ɣnə</b> (fodhainne <sup>63</sup> ); 47 <b>buɣ'ri</b> (buidhe); 69 <b>g<sup>h</sup>ymfai'liɣ</b> (gum faigheadh); 167 <b>d'ʔɣi i</b> (deaghaidh); 92 <b>fɔi e'ri</b> (famhair); 71 <b>k<sup>h</sup>ɔi ɣx</b> (coimheach); 93 <b>ui i'in</b> (uighean); 167 <b>g<sup>h</sup>yu uɣ</b> (gobhar);
V <sup>v</sup> _V	82 <b>bu<sup>v</sup>ʔə</b> (bogha), <b>g<sup>v</sup>ʔəʔ</b> (gobhar);
V_ <sup>v</sup> V	57 <b>ta<sup>v</sup>ʔi</b> (taighe); 84 <b>t<sup>v</sup>e'ʔə</b> (teotha <sup>64</sup> ); <b>o'ʔə</b> (ogha); 85 <b>bo'ʔə</b> (bogha); <b>fo<sup>v</sup>i'v</b> (fodhaibh);
V:_V <sup>65</sup>	86 <b>lɑ:ʔun</b> (lámhan); 84 <b>mɑ:ʔiz</b> (màthair), <b>sɔ:ʔəʔ</b> (saoghal); 78 <b>sɔ:ʔir'</b> (saothair); 72 <b>fu:á'ʔal</b> (fuaghail); 91 <b>sɑ: oʔx</b> (sámhach); 92 <b>skri: uɣ</b> (sgriobhadh); 172 <b>sɔ: uʔ</b> (saoghal); 93 <b>fɔa at</b> (fuaghail);
V:_V_V	94 <b>rhɑ:ɣ-ɣy</b> (thràigheadh); 66 <b>nɑ:ɣ it'ʔ</b> (námhaid); 67 <b>bu:ɣ ɣx</b> (bòidheach); 92 <b>k<sup>h</sup>ru: oʔ ɣ</b> (cruaidhe).

**Table 1:** Segmental structures considered as involving hiatus

These structures, however, are part of a cline reflecting various degrees of reduction of Old Gaelic voiced fricatives (see Table 2) and it can be difficult to determine where exactly in this cline some of the recorded examples should be located. More precisely, it is not always clear whether the symbols

<sup>62</sup> *Dol a threabhadh.*

<sup>63</sup> *Fodhainn.*

<sup>64</sup> *Nas teotha.*

<sup>65</sup> Long vowels are often marked as half-long (V<sup>·</sup>) in the *SGDS* records.



for high vowels, with or without the subscript arch, represent glides (as part of diphthongs preceding hiatus) or approximants (i.e. consonants occurring between two vowels, in which case there is no hiatus) (see §4.2.a.ε).<sup>66</sup> Variation can exist even in the speech of a single person: 85 **l'feuiuy** (leughadh), **bl̥ɣu<sup>h</sup>əŋ** (bleaghan), **feui<sup>h</sup>ŋ** (feadhainn).

Fricative	Approximant	Glide	Weak glide	Vowel	Zero
33 <b>a'viŋ</b>	78 <b>á?wɪŋ</b> 91 <b>á?owɪŋ'</b> 70 <b>á?owɪŋ'</b> 82 <b>a'uɪŋ</b>	30 <b>ǣō ɪŋ</b>		84 <b>a'u<sup>h</sup>ŋ</b> 53 <b>o'u<sup>h</sup>ŋ</b>	44 <b>ǣ?ɪŋ</b>
	55 <b>ɸo'uə</b> 40 <b>ɸo'u<sup>h</sup></b>		82 <b>ɸo'u<sup>h</sup>ə</b>	83 <b>bo'u</b> 66 <b>ɸo?u</b>	31/35 <b>ɸo'ə</b> 57 <b>ɸo'o</b>
	82 <b>ənd<sup>h</sup>a'ɲi</b>	50 <b>taɪ?ɪ</b>	57 <b>ta<sup>h</sup>ɲi</b>	31 <b>ta'ɪ</b>	30 <b>tɛ ə</b>

**Table 2:** Reflexes of voiced fricatives in the words *abhainn*, *bogha*, (*an*) *taighe*.

These glides do not always represent the reflexes of voiced fricatives. In some cases, they arose by epenthesis in Old Gaelic hiatus: 84 **o'u<sup>h</sup>ə** (*ogha*); or where the fricative had been lost completely: 188 **á|ɲiŋ'** (*abhainn*). They can also reflect the second part of a diphthong: 84 **t'<sup>h</sup>e'u<sup>h</sup>ə** (*teotha*<sup>67</sup>). The same applies to approximants in these contexts (cf. §4.2.a.ε). Examples such as 86 **ɸo?ɲiŋ'** (*domhain*) probably represent glottalisation occurring in the final phase of the first vowel (see §5.2).<sup>68</sup>

In some dialects, **h** occurs in hiatus occasionally instead of glottalisation,<sup>69</sup> cf. 79 **t'<sup>h</sup>ɲiŋ'** (*tighinn*) vs. **n'ɲi?ɲgh** (*nigheadh*<sup>70</sup>); 95 **nɲ mrāhən** (*na mnathan*) vs. **nɲmrā?āy** (*na mnathadh*<sup>71</sup>). A significant number of examples have been found at pt 92, where hiatus is fairly often indicated by the pipe: **ɸuhux** (*dubhach*) vs. **ɸ|uɸ** (*ubhal*). Similar examples have been recorded at pt 75, most often between **a** or **ɤ** and **a** or **ə**: **tɲ(h)əɸ** (*tadhál*), **ɸohər** (*lobhar*), **rō·ahər** (*ruamhair*).<sup>72</sup> Cf. also 102 **ɲar`á|hɲ<sup>h</sup>** (*arbhar*), with **h** after the epenthetic vowel. This can be explained by the phonetic nature of these phenomena: both involve a different type of phonation and are mutually exclusive.<sup>73</sup>

<sup>66</sup> See *SGDS* I, 117-18, 126-27.

<sup>67</sup> *Nas teotha*.

<sup>68</sup> The subscript arch can indicate a markedly short vowel. See *SGDS* I, 116.

<sup>69</sup> Watson 1996; Ó Maolalaigh (2003).

<sup>70</sup> *Nighidh*.

<sup>71</sup> *Na mnatha*.

<sup>72</sup> Cf. the note, pt 75, page 31: 'both here and under §§31-33, hiatus consists of a faint [h] between the vowels, or a distinct break in the tension [-], or a decrease in tension (not recorded here) according to the degree of clearness of articulation (rather than stress)'.

<sup>73</sup> Cf. the explanation of the mutual incompatibility of glottalisation and voiceless fricatives due to the laryngeal features associated with them, by Morrison (2019: 423).

The vowel following hiatus can be somewhat reduced: 84 **hoʷʰʰʰ** (thabhairt). This seems to be fairly common at pt 51, where glottalisation has not been recorded: **fiʷ** (figheadh<sup>74</sup>), **l'oʷr** (leabhar), **ʃl'ʰʰ** (sleamhainn). Both glottalisation and hiatus can be unrealised in unstressed contexts, under secondary stress, or in rapid speech, cf. 54 '**χaʷar** (chathair) vs. ə.χar'veg̊ (a' chathair bheag) (see §4.4).<sup>75</sup>

#### 4.1.a. Old Gaelic hiatus

Old Gaelic hiatus is the result of the loss of certain intervocalic consonants in the prehistory of Gaelic. Some examples are: 40 **kruʷə** (cnotha<sup>76</sup>); 53 **piuʷur̥** (piuthar); 54 **haʷaʰ** (chaidh); 57 **g̊'uʷus** (giuthas); 67 **ɸʷ j̥ʰʰ** (do dh'Iain); 82 **daʷəg** (dathadh). Some examples arose by analogy: 95 **n̥imr̥āʰāʷ** (na mnathadh);<sup>77</sup> 31/32/33 **heʷir'** (their); 53/54 **heʷir** (their/bheir); 55 **feʷir** (bheir); 31765 **haʷa** (tha).<sup>78</sup> Synchronically, there is no difference between the reflexes of Old Gaelic hiatus and secondary hiatus (cf. §4.1.b).

#### 4.1.b. Secondary hiatus

Secondary hiatus is the result of the loss of a consonantal segment, mainly by vocalisation of voiced fricatives, represented in writing by *mh*, *bh*, *dh*, *gh* (see the examples in §4.1 & in the following subsections).<sup>79</sup> Other examples, which appear to be less common, arose through the loss of /h/, /ç/, a stop, or a nasal, or of consonant clusters involving nasals:

- 37 **aʷar** (athair), **k'eʷir** (ceithir<sup>80</sup>)
- 31 **fiʷəð** (fichead)
- 88 **āʰāv** (agaibh<sup>81</sup>)
- 57 **iʰiʰ** (dh'innis); 84 **ūʷum** (ionnam<sup>82</sup>)

<sup>74</sup> *Fighe*.

<sup>75</sup> Cf. *SGDS* I, 121.

<sup>76</sup> *Cnò*.

<sup>77</sup> Old Gaelic *mná* (and *mnaa*), cf. eDIL *s. v. ben 1*.

<sup>78</sup> In the last four examples, hiatus arose under the influence of disyllabic forms such as *bithidh* or *thubhairt*, and might be of fairly recent origin.

<sup>79</sup> See Ó Maolalaigh (2006).

<sup>80</sup> *Ceathrair*.

<sup>81</sup> Via [aʷəv].

<sup>82</sup> Or possibly *umam* with the loss of *-m-* as the consequence of dissimilation.

- 34 **tʃa'ɛ** (teanga); 53 **ĩĩ'ĩndəɣ** (iongantach<sup>83</sup>)
- 94 **ɣ̃:-ĩ'** (Dhòmhnaill<sup>84</sup>)

#### 4.1.b.α. Secondary hiatus after a stressed short vowel

The majority of the recorded examples belong to this group: 86 **tʰʃʒʒs** (tomhas); 66 **kʰũʒqkʰ** (cumhachd); 54 **rɔ'ĩ** (roimhe); 83 **ga'al** (gabhail); 52 **u'ĩr** (uibhir); 36 **ʒoʒo** (bodhar); 40 **kri'ĩ** (cridhe); 67 **ʒuʒĩ** (buidhe); 46 **oʒĩ** (aghaidh); 84 **l'e'ĩs** (leigheas).

#### 4.1.b.β. Secondary hiatus after a stressed long vowel or diphthong

Hiatus glottalisation appears to be regular after /a:/ originally followed by /h/ at pt 84: **mā:ʒz** (màthair), **ra:ʒ** (ràithe), **ʒla:ʒĩ** (blàithe<sup>85</sup>); and after /uə/ at pt 78: **u·ãʒã** (uamha), **fuəʒal** (fuaghail), **ʒu·ɔʒĩ** (luaithe/luaidhe), **rũãʒãr** (ruamhar). Cf. also: 83 **sɣ:ʒʒ** (saoghal), **fĩĩ'ũç** (fiadhaich), **ũãʒ'ar'** (ruamhar); 86 **lã:ʒun** (lãmhan); 72 **fu·ã'ʒal** (fuaghail); 94\* **ũãʒãr** (ruamhar) (see Figure 5). Some examples have been recorded in dialects in which glottalisation is generally rare: 14 **ua'ə** (uamha); 16 **ũ[ʒəĩ]<sup>(9)</sup>ʌ** (luaidhe). Hiatus is indicated very consistently by the pipe symbol in the materials collected at pts 28-30: 28/29 **hr'a:|əɣ** (thràigheadh), **ʒu·ɛ|ʒ** (luaidhe); 28/29/30 **ʒo:i|əɣ** (bòidheach), **fĩ·ə|rɣ'** (fiadhaich); 30 **sũ:|əʒ** (saoghal), **ũ·ã|ə** (uamha), **rũ·ã|ar'** (ruamhair).<sup>86</sup> Glottalisation is more common where the long vowel has been shortened: 59 **ðã'ãŋ**, 79 **ʒɛʒun**, 84 **lã'əŋ** (lãmhan).<sup>87</sup>

In most dialects, however, glottalisation does not occur in this context: 42 **se:əʒ** (saoghal), 45 **sã:əɣ** (sàmhach); 46 **fə:ər** (faobhar); 47/48 **mɛ:ər** (màthair). See Appendix 7. Additionally, in many southern dialects, /ə/ is reduced after a long vowel or diphthong, and there is no glottalisation:<sup>88</sup> 31/32/35 **se:ʒ** (saoghal); 31/32/33 **se:ʒr** (saothair); 40 **trə:ʒ** (tràigheadh); 41 **lɔsgə ʒra:ət** (lɔsgadh bràghad<sup>89</sup>); 44 **mɛ:ər** (màthair); and /ə/ has been completely absorbed by the previous segment in the southernmost islands: 40 **mɛ:r** (màthair); **ɣo'l'** (Dòmhnaill); **fʒuəʒ** (fuaghail), **ʒuəʒĩ** (luaidhe), **fĩəʒĩ** (fiadhaich); 53 **hɣa:ʒ** (thràigheadh); 54 **mɛ:r** (màthair), **sɣ'ʒ** (saoghal), **fʒuaʒ** (fuaghail); 57 **gʒrʒuaŋ**

<sup>83</sup> Possibly via [ĩɣəntəɣ].

<sup>84</sup> *Taigh Dhòmhnaill*.

<sup>85</sup> *Nas blàithe*.

<sup>86</sup> The use of this symbol is discussed in §3.

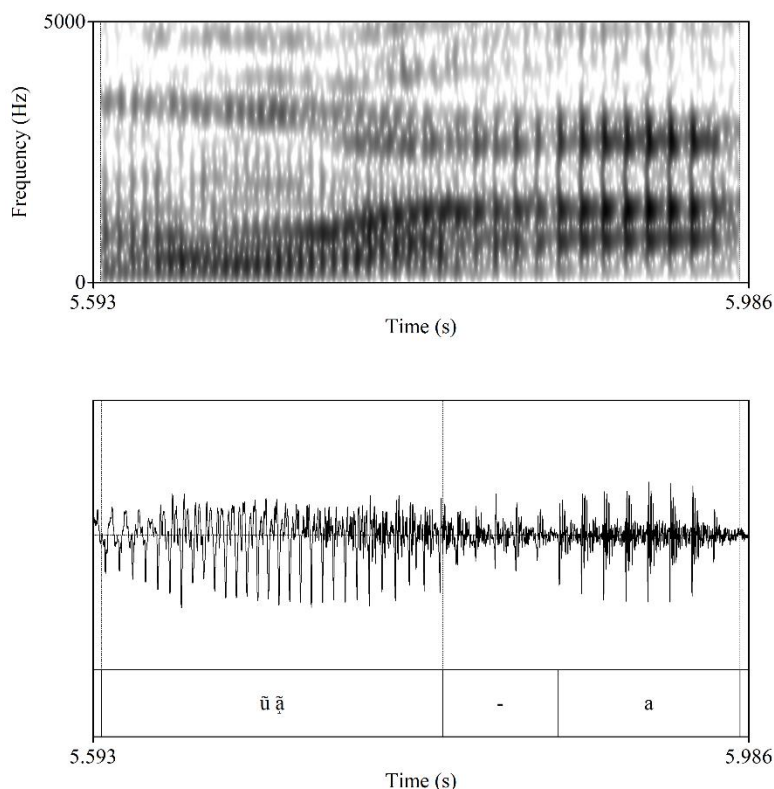
<sup>87</sup> Shortening has been recorded in this example at numerous survey points.

<sup>88</sup> For the symbolisation, see *SGDS I*, 116.

<sup>89</sup> *Bràghad*.

(grùthan), **f̥i̯u̯i̯ç** (fiadhaich). Isolated examples are also found elsewhere: 84 **ḡr̥i̯ũ̯i̯ḡ** (grùthan); 85 **ḡr̥i̯u̯ə̯i̯ḡ** (grùthan). Cf. §4.1.b.γ. See Appendix 6, Map 2.

In certain dialects, glottalisation may be more likely to occur after a long vowel or diphthong where the change of vowel quality is more significant: 33 **fi̯a'i** (fiadhaich) vs. **fu:aɫ** (fuaghail), **se:əɫ** (saoghal), **se:ʳ** (saothair), **ḡr̥e:t** (bràghad); or 31 **vua'i** (bhuaithe), **lu'a'i** (luaidhe).



**Figure 5:** Spectrogram and waveform of the word *uamha* (Eigg) showing creaky phonation (wider vertical striations) starting in the final phase of the diphthong [ua] and continuing throughout the following vowel. This is perceived auditorily as a weak glottal stop followed by creaky voice.

#### 4.1.b.γ. Secondary hiatus following the epenthetic vowel

Hiatus occurs where a voiced fricative has been lost between the epenthetic vowel and the one that follows.<sup>90</sup> Glottalisation is not common in this context; a significant number of examples have been attested only at pt 83: **[araj]ʳ** (arbhar), **v[araj]ʳ** (mharbhadh), **g[araj]ʳ** (gainmheach), **k[araj]ʳ** (coingheall), **ḡ[araj]ʳ** (dh'fhalbhadh), **f[araj]ʳ** (falbhaidh), **[ɲn̥j]ʳis** (Aonghas), **s[ũj]ʳis** (soirbheas);

<sup>90</sup> For epenthesis in Gaelic, see Ó Baoill (1980). Cf. also *SGDS* I, 113-14, re. duration.

**m[ɔrə]ʷəi** (moraire<sup>91</sup>). Few examples have been recorded elsewhere: 72 '**ʎ'nyʎys** (Aonghas), '**mə'ɔʎiɣ** (moraire); 78 '**á'ɾáʎɔɾ** (arbhar), '**fá'ʎáʎi** (falbhaidh).

Hiatus is indicated quite regularly in this context by the pipe, in K. H. Jackson's records from Barra: 28/29/30 **f[afaf]i** (falbhaidh), **g[ʔen'ɛ]ɣ** (gainmheach); 28 **ɣ[afaf]əɣ** (dh'fhalbhadh), **s[ɛʔɛ]əs** (soirbheas); 29 **[unuu]əs** (Aonghas); 30 **s[uʔi]ə** (suirghe), **k[ɔn'ɛ]əʎ** (coingheall), **[ara]ɔɾ'** (arbhar), **v[ar'a]əg<sup>h</sup>** (mharbhadh), **m[ɔr'ɔ]iʔ** (morair), **s[ʔʔɛ]əs** (soirbheas). Cf. also: 72 '**g[ʔen'ɛ]ɣx** (gainmheach); 93 '**á'ɾáʎɔɾ** (arbhar); 171 '**fə'ʎáʎi** (falbhaidh).<sup>92</sup> See Appendix 6, Map 3.

In many dialects, the second hiatus vowel has been reduced: 41 **araʎɾ** (arbhar); or absorbed by the first one: 40 **fəʎi** (falbhaidh), **varaɣ** (mharbhadh); 53 **g[ʔɛ]ɣ** (gainmheach); 53/57 **fəʎəɣ** (falbhaidh); 57 **araɾ** (arbhar). Absorption seems to be more likely to occur where the two vowels are similar: 171 **va'rag** (mharbhadh) vs. '**fə'ʎáʎi** (falbhaidh); or in longer words: 84 **m[ɔra]iə** (moraire) vs. **[ara]ʔɾ** (arbhar), **f[əʎa]ʔ** (falbhaidh). Cf. §4.2.b.β. The intervening consonant has been preserved in a significant number of examples only at pts 31-39: 34 **ɛɾ<sup>ə</sup>vɔɾ** (arbhar), **fəʎvi** (falbhaidh). Glottalisation has not been attested in this context.

## 4.2. Consonantal contexts

Glottalisation occurs in sequences comprised of a stressed short vowel followed by a voiced consonant which is in turn followed by another vowel. This phenomenon is less widespread than hiatus glottalisation and is found mainly in the south-west (see Appendix 6, Map 4). Glottalisation does not normally occur in the following consonantal contexts (see §4.5):

- with voiceless fricatives: 84 **ʃifag** (siobhag); 54 **jesəv** (seasamh); 53 **miʃi** (mise); 57 **kloçi** (cloiche); 46 **droçɣɪf** (drochaid); 31 **ahar** (athair);
- with devoiced sonorants (spelled *thr*, *thl*, *thn*): 81 **pɛɾiçin** (peathraichean); 82 **ɾaɾəɣ** (raithneach);
- with consonant clusters starting with a sonorant or a fricative, including those that arose by preaspiration of voiceless stops:<sup>93</sup> 40 **k'ɪndəɣ** (ciontach<sup>94</sup>); 52 **ɬalt'ʃiŋ** (bailtean); 57 **úʃg'i** (uisge); 82 **səɣkɪɾ** (socair);

<sup>91</sup> Old Gaelic *mormaer*. Cf. eDIL *s. v. mormaer*.

<sup>92</sup> For the meaning of this symbol, see §3.

<sup>93</sup> For preaspiration, see Ó Maolalaigh (2010).

<sup>94</sup> *Cionta*.

- before an epenthetic vowel:<sup>95</sup> 82 **gr̥r̥ʲm** (gorm);
- after a long or unstressed vowel or diphthong: 54 **d'zɛnəy** (dèanadh); 52 **ḃruaɫay** (bualadh); 46 **ḃuaɣiɫə** (buachaille).

Glottalisation can occur after a short diphthong: 53 **múɫ'mi** (muime).<sup>96</sup> It is also found (albeit inconsistently, as it seems) with historically voiceless stops in the dialects in which these consonants have not been preaspirated (see §4.2.b). Glottalisation can also occur across the word boundary where there is a suitable context (see §4.3.a). Occasionally, it is also found in monosyllables before pause (see §4.3.b).

#### 4.2.a. Voiced consonants

A great majority of the examples found in the materials involve a single (historically) voiced consonant flanked by vowels. There are, however, also a few examples containing a stop-sonorant cluster (see §4.2.a.α). The following classification of consonants is based partially on their presumed historical values, rather than on their modern reflexes or realisations. Whilst this is probably not the optimal approach, basing the classification exclusively on the modern state of affairs would make this overview too complex due to dialectal variation, cf. the affrication of palatalised dental stops: 55 **o'ḃ'zə** (oide); the merger of Old Gaelic //L// and //l//: 57 **g'a'ɫəy** (gealladh), **ɛ'ɫə** (eala); or the development //r̥// > non-rhotic [i]: 85 **vɛɫ'əy** (bheireadh), **χado'ɫəy** (cha thoireadh). It would be equally unsuitable to adopt a purely historical classification, for instance, due to the variation in the modern realisations of Old Gaelic voiced fricatives (see §4.1).

##### 4.2.a.α. Stops

The difference between the two series of stop consonants, orthographical *b d g* and *p t c*, has been interpreted as based on aspiration rather than voice in most Gaelic dialects,<sup>97</sup> and the stops written *b*

---

<sup>95</sup> Broadly speaking, there are two types of epenthesis in Gaelic, occurring in two different sets of contexts: (1) in non-homorganic consonant clusters starting with a sonorant, and (2) in certain clusters starting with an obstruent (see Ó Baoill, 1980). The latter type is much less common. Only the former type blocks glottalisation in the contexts discussed here. For glottalisation occurring *after* the epenthetic vowel, see §4.1.b.γ.

<sup>96</sup> In this example, the glide is the reflex of the historical palatalisation of the following labial.

<sup>97</sup> According to Eska (2018; 2019), although orthographical *b d g* can be phonetically voiced in some environments, the phonological opposition is based on aspiration in all Celtic languages, and this may have been inherited from Proto-Celtic.

*d g* have often been described as phonetically completely voiceless or only slightly voiced.<sup>98</sup> This fact is also reflected in their transcription in the *SGDS* materials: 55 **l'a'bi** (leabaidh), **kla'dəχ** (cladach), **ʃl'i'g'ə** (slige), **rú'gəy** (rugadh); 66 **brá'tán** (bradan), **t'o'pɣr** (tobar), **ho'kɣy** (thogadh<sup>99</sup>).<sup>100</sup> However, glottalisation is very well-attested in the context of these stops, although it otherwise normally occurs only in voiced environments (with few exceptions). It is possible, therefore, that orthographical *b d g* are in fact regularly (partially) voiced in the glottalising dialects. This question will be addressed in §7. Cf. also §4.2.b.

Glottalisation also seems to occur with consonant clusters comprised of a stop and a sonorant. Examples are few but widely attested: 48 **e'brɪç** (oibrich); 54 **e'gɪɸ** (eaglais), **y'brɪç** (oibrich); 57 **e'gɪɸ**, **y'brɪç**, **a'brɪç** (abraidh); 67 **e'kɪɸ**; 70 **nɣ he'kɪɸ** (na h-eaglaise), **á'pri** (abraidh). Although some of these examples can be explained as the consequence of analogy: 70 **á'pri** (abraidh), cf. **xán a'pɪr'** (chan abair); this is impossible in the case of *eaglais*. In some dialects, however, these clusters can be broken up by epenthesis:<sup>101</sup> 67 **nɣ he'kɪɸɪɸ** (na h-eaglaise); cf. also syllabic **ɸ** in 66 **e'kɪɸ** (eaglais). It is interesting that stop-sonorant clusters are probably tautosyllabic, which may mean that glottalisation can occur with consonant clusters as long as the preceding syllable is open.

#### 4.2.a.β. Fricatives

Intervocalic voiced fricatives are not common in Scottish Gaelic dialects due to the historical vocalisation of these sounds (see §4.1):<sup>102</sup> 55 **l'o'ur** (leabhar); 53 **kə'ɔrə** (comhartha); 83 **fə'up** (feadhainn); 40 **rə'ɔɸ** (roghain). Velar **ɣ** (dh/gh) seems to have been preserved more consistently between a high front vowel and **a**: 57 **i'yaɸ** (iodhal); in some dialects as a stop: 82 **fɪ'gan** (fiodhan). Labial **v** (mh) is frequently found after **a** and **ɛ**: 84 **klā'van** (clamhan); 57 **sɛ'vɪɸ** (samhain); 40 **ɸl'ɛ'vɪɸ**

<sup>98</sup> According to *SGDS* I, 126, ‘historical lenis plosives appear as voiceless in many Gaelic dialects’. See also Ó Murchú (1985) for various Gaelic dialects; Holmer (1938, 1962) for Islay and Gigha, and Kintyre; Borgstrøm (1940, 1941) for the Outer Hebrides, Skye, and Ross-shire; Oftedal (1956) for Leurbost (Lewis); Wentworth (2005) for Gairloch; Ternes (1980, 2006) for Applecross; and Scouller (2017) for Colonsay. Phonetic descriptions of these sounds are available in Shuken (1979, 1980) for Lewis and Harris; Ladefoged *et al.* (1998) for Bernera (Lewis); and Nance & Stuart-Smith (2013) for Lewis. Voiced realisations of these consonants have been reported for some peripheral dialects – see Holmer (1957) for Arran, and Dorian (1978) for East Sutherland. Voiced realisation of stops after a nasal, common in all dialects, is irrelevant here.

<sup>99</sup> *Thogainn*.

<sup>100</sup> The subscript or superposed ring indicates voicelessness. Partial or incomplete devoicing is indicated by the ring enclosed in brackets. See *SGDS* I, 135.

<sup>101</sup> See footnote 95.

<sup>102</sup> See Ó Maolalaigh (2006).

(sleamhainn). Labial **v** (bh) is also common after **a**, but only in Colonsay, Arran and Kintyre: 57 **g̃a'val'** (gabhail), **a'vĩṅ** (abhainn); 31/33 **sa'vəɫ** (sabhal), **la'vəɫʃ** (labhairt); 37/39/41 **ɣavəɣ** (ghabhadh). Glottalisation has not been recorded with **v** (bh) in Kintyre. Palatalised voiced fricatives have been reduced to approximant /j/ or lost in almost all attested examples (see §4.1. and §4.2.a.ε); but cf. 53 **d'zɛ'vĩṅ** (deimhin). If the diphthong in 31 **sa'ivrəs** (saibhreas<sup>103</sup>) is short, as in 31 **mũĩ'mə** (muime), this may be an example of glottalisation before a tautosyllabic consonant cluster starting with a fricative (cf. §4.2.a.α).

#### 4.2.a.γ. Unlenited sonorants

Glottalisation has been well-attested in this context: 55 **h̃a'rən** (barran), 40 **u'rə** (oirre); 41 **koʎĩṅ** (callainn), 39 **ke'ʎə** (coille); 46 **k'āʎmɪç** (ceannaich), 33 **h̃ā'jə** (bainne); 48 **i'mɑr** (iomair). Glottalisation also occurs with reflexes of //ŋg// and //ŋg'//: 53 **ɛ'jəɫ** (aingéal).<sup>104</sup> Unlenited sonorants can be realised as long or half-long segments in southern dialects. Glottalisation does not seem to occur with fully long realisations, but too few such examples have been recorded to allow for a firm conclusion: 38\* **ʎem:imi** (leumaidh mi); cf. **mu'ɫʎx** (mullach); **kʎĩ'əɫ** (coinneal).<sup>105</sup>

Glottalisation does not occur if the sonorant is voiceless: 57 **u'rə** (oirre), **ɔ'rəsən** (orrasan<sup>106</sup>) vs. 40 **u'rə** (oirre), 54 **ɔ'rə** (orra).<sup>107</sup> No other examples of devoiced unlenited sonorants have been found in the materials, but cf. §4.2.a.δ.

#### 4.2.a.δ. Lenited sonorants

Examples of glottalisation in this context include: 47 **g̃a'ɫər** (galar); 39/41/44 **h̃a'lə** (baile); 82 **dər'əst** (doras); 39 **g̃e'rɛɫʃ** (goirid); 53 **l'ɛ'niç** (leanaidh); 55 **du'jĩ** (duine); cf. also 85 **vɛĩ'əɣ** (bheireadh); 84 **hadə'jəɣ** (cha toireadh); with **j̃** as the realisation of /r̃j/. Glottalisation never occurs with voiceless sonorants, the reflexes of earlier sequences of //h// and a sonorant: 57 **pɛr̃içĩṅ** (peathraichean); **fr̃ɔj̃ʎɣ** (raithneach); 82 **k'ɛ'r̃h'ĩr'** (ceathrair); **(s)aj̃ĩ** (aithne). Cf. examples from dialects that lack devoicing:

<sup>103</sup> *Saibhir*.

<sup>104</sup> Other sonorant reflexes of //ŋg// are found in dialects in which glottalisation rarely or never occurs in consonantal contexts: 69 **çhɛŋĩɫ** (ceangail); **aj̃'jɫ** (aingéal). The other reflexes can be exemplified by 66 **çhɛŋgĩɫ** (ceangail); 53 **t'ʃɛ'g̃ə** (teanga); **k'ɛ'ɫ** (ceangail); 38 **ə'j̃ɫ** (aingéal).

<sup>105</sup> Cf. Jones (2006).

<sup>106</sup> *Orra*.

<sup>107</sup> Voicelessness could be the reflex of earlier //h// in these examples, cf. Irish *uirthi*, *orthu*.



55 **frʲnaχ** (raithneach); 53 **ɣʲni** (aithne), **pɛʲriçɪŋ** (peathraichean); 40 **kɛʲrar** (ceathrair); 58 **k'eʲra** (ceathramh).<sup>108</sup> There are no examples of the reflexes of //hl// in the materials.

#### 4.2.a.ε. Approximants

Examples involving approximants include: 40 **kʎoʲuʲ** (clobha); 55 **ɸoʲuə** (bogha); 82 **ɸl'eʲuən** (bleoghan<sup>109</sup>); 55 **uʲ(u)in** (uighean); 40 **kɔʲiaχ** (coimheach); 53 **króʷiaḡ** (cnoimheag<sup>110</sup>); 54 **sʲʷiaχaχ** (suidheachadh); cf. also: 51 **oʲuə** (ogha); 84 **piʲuiri** (piuthar), reflecting Old Gaelic hiatus.<sup>111</sup> In the mainland area comprising most of the pts 70-103, the approximant is preceded by a glide or a (reduced) vowel following (the onset of) glottalisation in some examples: 71 **feʲowɪŋ** (feadhainn); **ɸʲʒeʲowɪ** (deaghaidh); 70 **áʲowɪn'** (abhainn); 91 **áʲowɪn'** (abhainn); **sl'ɛʲiḡwɪn'** (sleamhainn); 80/86 **ḡoʲowɪn'** (gobhainn<sup>112</sup>); 67 **ɸl'eʲowɪn'** (sleamhainn); **uʲijɪŋ** (uighean) (cf. §5).

#### 4.2.b. Voiceless stops

Glottalisation has been attested in the context of (historically) voiceless stops in the dialects of Gigha, Kintyre, Knapdale, and Cowal (pts 36-49), where some or all of these sounds lack preaspiration:<sup>113</sup> 39/40/44 **kaʲbət** (capall<sup>114</sup>); 39/41 **taʲbi** (tapaidh); 39 **liʲdʒɛr** (litir); 40 **l'iʲdʒir** (litir); 41 **toʲtʃəm** (tuiteam); **roʲbə** (romhpa); **hanɛʲḡə** (chan fhaca); and with consonant clusters: 41 **mə ʎaʲtsə** (mo shlat-sa<sup>115</sup>); 41/44 **roʲtsə** (riutsa); 44 **yoʲtʃə** (dhuitse); 41/44/49 **lɛʲtsə** (leatsa); 46 **lɛʲtsə** (leatsa).

It seems that the two series of stops have fallen together in these dialects, which could explain the spread of glottalisation into historically voiceless contexts (see Table 3).<sup>116</sup> On the other hand, the opposition between the two series has been reported for Kintyre Gaelic at least.<sup>117</sup> Interestingly, at

<sup>108</sup> Glottalisation is generally very uncommon at pt 58.

<sup>109</sup> *Bleaghan*.

<sup>110</sup> *Cnuimh*.

<sup>111</sup> For the origin of intervocalic approximants in Gaelic, see §4.1.

<sup>112</sup> *Gabha*.

<sup>113</sup> Orthographical *p t c* are preaspirated after a stressed short vowel in most Gaelic dialects. For preaspiration in Gaelic, see Ó Murchú (1985) and Ó Maolalaigh (2010).

<sup>114</sup> *Làir*.

<sup>115</sup> *Mo shlat*.

<sup>116</sup> Cf. the note, pt 40, page 12: **taʲbi** (tapaidh): 'same C as **toʲbər** well'. On the other hand, no glottalisation is indicated in *suipeir* and *cipean*, but there is a note saying: 'perhaps less glottalisation than in well'. Cf. Appendix 5.

<sup>117</sup> Holmer (1962: 13-15).

pts 39, 42 and 44, glottalisation appears to be more consistent with historically voiceless stops than in other environments, cf. 42 **lɛbɪ** (leabaidh) vs. **lɛʰbɪçən** (leapaichean<sup>118</sup>). In Arran (pts 31-35), the two stop series differ, at least non-finally:<sup>119</sup> 31 **toʰbər** (tobar), **gɔʰp** (gob) vs. **tapi** (tapaidh), **krɛp** (cnap); and interestingly, only one example of glottalisation with a voiceless stop has been recorded in Arran: 33 **iʰtʃak** (iteag<sup>120</sup>).

Both series of stops	Points
voiceless (p t k)	36, 38
devoiced (b̥ d̥ ɡ̥)	40
devoiced internally, voiceless finally	37, 39, 42, 45-49
devoiced/voiceless internally, voiceless finally	41, 43, 44

**Table 3:** The use of symbols in the transcription of stops in the materials from pts 36-49.

### 4.3. Glottalisation at the word boundary

#### 4.3.a. Glottalisation in sandhi

Glottalisation can occur in sandhi when a stressed monosyllable is followed by a clitic or by a word with non-initial stress, if a suitable context is formed between the two words. This has been reported in earlier works, for Jura,<sup>121</sup> Colonsay,<sup>122</sup> and Arran.<sup>123</sup> Examples involving hiatus include: 46 **pɪ ʔa** (nigh e), 64 **g̊ɔŋ gaʰɛ**: (gun gabh e). If there is an intervening consonant, it can belong to either of the two words: 54 **hadʰziʰgʰ(a)** (cha tig (e)), 70 **hiʰc ɛ** (thig e); 41 **heʰr at** (their iad); 46 **mbeʰro** (am beir thu); 44 **beʰr ɛr** (beir air); 57 **beʰrer** (beir air); **kʰeʰl(a)** (ceil (e)); 53 **kʰeʰla** (ceil e); 55 **sleʰp(a)** (is leinn (e)); 54 **lɛnʰa** (lean e<sup>124</sup>); 57 **ɣa ɣtɛʰnɛ** (cha ghlan e); **g̊ɔŋgaʰv(a)** (gun gabh (e)); **h̊reʰɯja** (threabh e) vs. 46 **ha h̊ɔʰmɪ** (cha shuidh mi<sup>125</sup>); 64 **mən ɛʰmɪ** (mun fhaigh mi<sup>126</sup>). The example 46 **ɔʰzeʰ mar** (cé mar) may be perceived as a single word (cf. modern spelling *ciamar*). Cf. also 41 **amfɛʰg̊o** (am fac' thu), with glottalisation in the context of an originally voiceless stop. Examples have been found in the audio materials: 5320 **fɛʰrə ʃɪn** (fear an sin); 31765 **ɣaʰva** (ghabh e). See more examples in §4.4.

<sup>118</sup> *Leabaidhean*.

<sup>119</sup> They also differ word-finally, according to Holmer (1957: 13-14).

<sup>120</sup> *Ite*.

<sup>121</sup> Jones (2006).

<sup>122</sup> Scouller (2017: 261, 292).

<sup>123</sup> Holmer (1957: 38).

<sup>124</sup> *Leum*.

<sup>125</sup> *Cha suidh*.

<sup>126</sup> *Mus faigh*.

As expected (see §4.2), glottalisation does not usually occur before heterosyllabic clusters:<sup>127</sup> 46 **vermi er** (bheir mi air), **əhog̊ mī** (a thog mi<sup>128</sup>); 84 **r'üg mi** (rug mi); but cf. 66 **hu?g̊mī** (thug mi), where glottalisation might have spread by analogy with combinations such as *thug e*. Glottalisation does not occur with unlenited sonorants realised as geminates (see §4.2.a.γ): 38\* **xadolem:i** (cha do leum i); **hiλ:ε** (thill e)<sup>129, 130</sup>. Examples like these are scarce in the materials.

#### 4.3.b. Word-final glottalisation

Glottalisation has been reported to occur in monosyllables in absolute word-final position: in Jura,<sup>131</sup> and Islay and Gigha.<sup>132</sup> A few examples can be found in *SGDS* and more have been recorded in the fieldwork materials, but they still form an insignificant minority amongst all attested monosyllabic examples, and it is possible that glottalisation spread there from sandhi situations (see §4.3.a) or that these examples were produced in sandhi by the informants.<sup>133</sup> Examples involving an open syllable are less common: 66 **xá ro?** (cha robh), **ɣn dro?** (an robh), **e?cɣndro?** (aig an robh), **xan ɛ?** (chan fhaigh); 67 **ni?** (nigh), **fɪo?** (feadh); 72 **g̊ɣngá?** (gun gabh), **h̊re?** (breith), **nji?** (nigh); 90\* **xá n'í?** (cha nigh). There are many examples of monosyllables ending in a consonant: 31/33/35 **g̊o'p** (gob); 40 **ned?** (nead); 66 **n'ε?tʰ** (nead); 57 **ɹü'ɖ** (rud); 57 **g̊o'ɖ'ʃ** (goid); 66 **h̊e?kʰ** (beag); **g̊ö?t'** (goid); 40 **lag?** (lag); 54 **ɖa'g̊** (lag); 66 **ɬa'g̊** (lag); 66 **ɛ?kʰ** (aig); 70 **ɛ?cʰ** (aig); 66/67/70 **hi?cʰ** (thig); 31 **ha ne'l** (chan eil); 46 **əm ve?r** (am fear), **ndə ve?r** (an do bheir); 46 **ɖə v̊e?n** (do/de bhean), **ha λ̊e?n** (cha lean).<sup>134</sup> No examples of glottalisation in monosyllables ending in a fricative (e.g. *damh*, *lagh*) or approximant (e.g. *suidh*, *faigh*) have been found, except in sandhi (see §4.3.a). Examples ending in **g/k** < //ɣ//, recorded in certain dialects, lack glottalisation, perhaps accidentally, cf. 31 **fik** (fiodh) vs. **fi'g̊an** (fiodhan). The forms 35 **so'ɹ** and 38 **sɪ?i|i** (*suidh*) seem to represent the verbal noun *suidhe*.

Examples of word-final glottalisation in the context of voiceless stops have also been attested: 44 **ɹõɹ'p** (troimhpe), **ɹo'p** (tromhpa); 45 **ɹo'p** (romhpa); 39/44 **sla't** (slat); 41 **ɣo'tʃ** (dhuit), 44 **kö'tʃ** (cait);

<sup>127</sup> Cf. Jones (2006).

<sup>128</sup> *Far an do thog*.

<sup>129</sup> Similarly pts 59, 63 and 64.

<sup>130</sup> Cf. Holmer (1938: 68-70).

<sup>131</sup> Jones (2006).

<sup>132</sup> Holmer (1938: 36-37).

<sup>133</sup> This possibility has also been mentioned by Scouller (2017: 146, 150).

<sup>134</sup> However, glottalisation is rarely indicated in *beag/big*, *bean*, *fear/fir* in the section of the questionnaire dedicated to declension.

37/39 **kr̥ʷk** (cnoc); 42 **l̥ʷt** (leat); and before a consonant cluster: 45 **l̥ʷts** (leatsa<sup>135</sup>). Cf. 44 **p̥ʷtʃ y̥o** (poit dubh), with glottalisation occurring before a heterosyllabic consonant cluster, where the following syllable (i.e. word) most likely bore primary stress (cf. §4.4). Examples of glottalisation in clusters composed of a sonorant and a (historically) voiceless stop have been recorded in two survey points: 45\* **f̥ʷt̥** (falt); 50 **kʷer̥ʷk** (cearc), **kr̥ʷj̥ə** (coirce). Word-final glottalisation appears to be slightly more common with voiceless stops than with voiced stops at pts 41 and 42.

#### 4.4. Glottalisation and stress in connected speech

The occurrence and degree of glottalisation in connected speech appear to correlate with the relative prominence of the relevant word. Glottalisation is more likely to occur in words bearing sentence stress, whereas less prominent words tend to lack it.<sup>136</sup> Although stress has rarely been indicated in the materials, its place and the patterns of prominence can be predicted. Examples of the lack of glottalisation in words bearing secondary stress (italicised) include: 53 **n̥ə, kar̥iç̥n̥' b̥eç̥** (na *cathraichean* beaga<sup>137</sup>); 53 **f̥er̥'nd̥h̥a'ʷi** (*fear* an taighe); 86 **d̥əʃ̥ a r̥h̥eʷ** (*dol* a threabhadh); 53 **ç̥ura 's̥gr̥ev̥ ər̥im̥** (*chuir* e sgreamh orm); 85 **hu̥g̥a n̥a'ʷi̥ ʷa'** (*thug* e an aire dha); 37 **har̥iʃ̥ ʊ' r̥ə** (*thairis* oirre<sup>138</sup>); and in unstressed words: 53 **ɛ̥g̥'əroa** (*aig* an robh e); 57 **f̥ər̥ən̥d̥a'g̥** (*far* an d'fhàg); 40 **had̥ə lem̥** (*cha* do leum). Cf. the more significant reduction in 54 **ə, ç̥ar' veç̥** (a' *chathair* bheag) vs. 'ç̥a'ar; 72 **b̥ə s̥əʃ̥i̥t̥h** (*bogha*-saighead<sup>139</sup>) vs. 71 **b̥əʃ̥ə**.

This, however, is not a strict rule since glottalisation has also been recorded under secondary stress and in proclitics: 40 **g̥ə'lan̥ g̥ə'ç̥** (*gòbhlan*-gaoithe<sup>140</sup>); 53 **g̥ə'lan̥ g̥y'ç̥** (*gòbhlan*-gaoithe); **g̥r̥ə'ux̥ du'li** (*gnothach* duilich); 57 **u'ir̥ e'li** (*uibhir* eile); 46 **t̥əʃ̥əp̥ər̥ v̥o:r̥** (*taigh* an fhir mhóir); 54 **d̥əv̥e'n̥ənd̥h̥a'ʷi** (*do bhean* an taighe), **b̥e'n̥əb̥[ai]ʃ̥i** (*bean* na bainnseadh<sup>141</sup>); 52\* **ha'r̥iʃ̥er̥əv̥ur̥** (*thairis* air a' mhuir<sup>142</sup>); 57 **hu'n̥ən̥' d̥ha'ʷi** (*chun* an taighe); **ha'r̥ənar̥iç̥'i** (*thar* an fhairrge); 55 **ha'r̥ə ç̥uḁn̥** (*thar* a' chuain);

<sup>135</sup> *Leat*.

<sup>136</sup> Cf. the notes, pt 54, page 39: 'NB ʷ appears with /ʷ/, but not with /,ʷ/, and pt 40, page 13: 'ʷ dropped when not primary stress'; pts 28-30, page 31: 'In slow speech, as when a word is stressed, the break in tension is perfectly distinct and marked (...) In rapid speech, as when a word is unstressed, it glides over without any noticeable break.'; pt 45, page 18, **d̥u̥p̥ə** (*duine*): 'If very emphatic produces [d̥u̥p̥ə]'.

<sup>137</sup> Glottalisation normally occurs with the reflexes of //hr̥// and //hn̥// in this dialect (see §4.2.a.δ).

<sup>138</sup> *Thairte*.

<sup>139</sup> *Bogha*.

<sup>140</sup> *Gaoithe*. For glottalisation in *gòbhlan*, see §8.

<sup>141</sup> *Bean na bainnse*.

<sup>142</sup> *Farais air*.

53 **fʲəʔəndʰəʔi** (*feadh an taighe*); 82 **fəʔəntʰəʔə** (*feadh an taighe*); 66 **eʔcʲxaxtʰ** (*aig a' chat*); **eʔcʲndroʔ** (*aig an robh*); 57 **χaʔdəχaʔriç** (*cha do charaich*); 53 **χaʔdə ʲtʰuàɪ** (*cha do ghluais*); 52\* **haʔdə ver mi** (*cha do bheir mi*); 66 **xəʔdə .ɹuʔki** (*cha do rug i*); 53 **faʔləndaːg̊** (*far an d'fhàg*); and with weaker glottalisation under secondary stress: 54 **χaʔ(ʲ)də χaʔriçʌ** (*cha do charaich e*). Cf. examples of tertiary stress: 54 **teʔnduʲiveg̊** (*taigh an duine bhig*); but note: 53 **tʲəʔnduʲiveg̊**; 57 **tʲəʔnduʲi viʔg̊ʰ**.

In 57 **χaʔdʲziʔg̊ʰiv** (*cha tigibh*<sup>143</sup>), glottalisation immediately precedes primary stress at the word boundary, which is unusual. Cf. also 46 **kaʔmoʔɲaʔ** (*gath-muineil*<sup>144</sup>); and 39248 **'krəʔg'ɔ:r** (*crog òir*).

#### 4.5. Exceptions

This section addresses the examples of glottalisation occurring in contexts in which it is not expected (see §4.1. and §4.2). Most of them have been recorded in a few southern dialects, along with more numerous examples without glottalisation in the same contexts.

##### 4.5.a. Epenthesis

A few examples of glottalisation occurring before the epenthetic vowel have been found in the materials collected in the area comprising pts 38-57: 39 **ɛʔmɛʃɪr / ɛmʲɛʃɪr** (*aimsir*), **iʔnaʃ** (*Aonghais*<sup>145</sup>), **muʔləçɪɲ** (*muinchill*); 41 **'dʒaʔtək** (*dealg*), 44 **ʲmərəʌ** (*iomradh*), **ʲməliç** (*imlich*), **'ɛʔɲəm** (*ainm*), **moʔrʌχɪ** (*Murchadh*), **tʲəʔrəi** (*tairbh*), **nəs dʒəʔriçə** (*nas doirche*<sup>146</sup>), **soʔri** (*suirghe*); 46 **dʒəʔnʌχə** (*Donnchadh*), **dʒaʔtək** (*dealg*); 53/55 **suʔri** (*suirghe*); 54 **kəʔɲaʔ** (*coingheall*), **sùʔri** (*suirghe*); 57 **suʔriç** (*suirghe*); 66 **ɔʔrənʰ** (*oirn*), **ɔʔrɛʃ** (*oirbhse*<sup>147</sup>);<sup>148</sup> 68 **tʰeʔg̊əɲ** (*teagmhach*).<sup>149</sup> It is interesting that ʔ is normally used before sonorants in the materials from pt 46, so the ʔ symbol might point to a weaker degree of glottalisation in the two afore-mentioned examples. See also §8.

<sup>143</sup> *Na tigibh.*

<sup>144</sup> *Muing.*

<sup>145</sup> *Aonghas.*

<sup>146</sup> *Doirche.*

<sup>147</sup> *Oirbh.*

<sup>148</sup> These could actually represent variant forms *orainn*, *oraibh*, judging by the quality of the vowel in the second syllable.

<sup>149</sup> Glottalisation is very rare at pt 68.

#### 4.5.b. Long vowels or diphthongs

Glottalisation has been recorded in consonantal contexts after long vowels or diphthongs in some southern dialects: 31 **la:’dʒɪr** (làidir), **k’e:’li** (céilidh), **ū:’hən** (ùbhlan), **ɸliã’nə** (bliadhna), **se:’vən** (sàibhean<sup>150</sup>), **rũã’vər** (ruamhar), **krua’ji** (cruaidhe); 31/33 **ɸə se:’rə** (bu saoire<sup>151</sup>); 33 **ɸə:’jɛɰ** (bòidheach); 66 **ʔɰ:’prán** (odhbrann), **ʔi:’pɰ.ɰst’ʃ** (ìobairt), **he:’ʔd’ɰɰ** (thèideadh<sup>152</sup>); 82 **fa·(ʔ)ḡ(a)** (fàg (e)), **fɸ·(ʔ)nɪx’** (foghnaidh), **ua<sup>i</sup>ḡiḡəɰ** (uaigneach); word-finally: 66 **sɰndá:’k<sup>h</sup>** (san d’fhàg<sup>153</sup>); 31/33 **fe:’i** (fèidh); with historically voiceless stops: 41/44 **pa:’panəɰ** (pàpanach<sup>154</sup>); 44 **ɸa:’dɸ** (bàta); 66 **fɰ:’tɪn<sup>h</sup>** (faotainn), **qɰ:’t’fɰ** (dh’fhaoidte<sup>155</sup>); 46 **rɸi’ɸə** (roimhpe); and word-finally: 41 **ji:’t** (dhìot). Glottalisation is indicated within diphthongs in a few examples from Arran: 31 **ɸĩ’ãɰ** (riamh), **ɪ’arɪ** (iarraidh), **ɸu’atɸk** (bualadh); 33/35 **fu’aɪjɸt** (fuaigheal), **lu’a’i** (luaidhe); 35 **ũ’a’i** (uaimhe<sup>156</sup>), **vu’a’i** (bhuaith<sup>157</sup>). This does not seem to differ from the situation in hiatus, cf. 31 **ĩ’ãɸ** (Iain). See also §8.

#### 4.5.c. Unstressed syllables

Few examples of pre-consonantal glottalisation in unstressed syllables have been recorded in the materials:

- following hiatus: 70 **fiʔi’ʔtɛɰɰk<sup>h</sup>** (figheadaireachd<sup>158</sup>);
- following a consonant: 46 **k’ãm’dʒɸ** (ceannaichte); 70 **k<sup>h</sup>ɸra’kɰn** (corragan<sup>159</sup>), **hɛ:ni’c mi:’ɛ:** (thàinig mi/e<sup>160</sup>); 66 **hɛ’ni’c<sup>h</sup>** (thàinig); but cf. **hɛ’nyḡi** (thàinig mi); but cf. 83 **d’zɛ’xũnãm’id’zɛ’** (an té a chunnaic mi an-dé);
- after an epenthetic vowel (1): 82 **ua<sup>i</sup>ḡiḡəɰ** (uaigneach);
- after an epenthetic vowel (2): 40 **farĩḡ’i** (fairrge);<sup>161</sup>

---

<sup>150</sup> *Sàibh.*

<sup>151</sup> *Ba saor.*

<sup>152</sup> *Rachadh.*

<sup>153</sup> *Far an do thog, or dh’fhàg.*

<sup>154</sup> *Pàpa.*

<sup>155</sup> *Maith dh’fhaoidhte.*

<sup>156</sup> *Uamha.*

<sup>157</sup> *Uaidhe.*

<sup>158</sup> *Fighe.*

<sup>159</sup> *Medìrean.*

<sup>160</sup> *Thig, morphology.*

<sup>161</sup> Glottalisation does not normally occur with this type of epenthesis (see §4.2).

- word-finally: 46 **lɔʔməʔ** (lomadh), **moʔhəʔ** (moladh), **jaʔhəʔ** (eala), **duʔiʔ** (duibhe).

At least in some of these examples, glottalisation might in fact have persisted throughout the second syllable (having started in the final phase of the first one) (see §5.2).

#### 4.5.d. *Other exceptions*

There are a few examples of glottalisation before a heterosyllabic consonant cluster: 41 **hɛʔjʃə**, 39 **hɛʔjʃə**, 37/58/62/65 **lɔʔjʃə** (laigse); and in sandhi: 66 **huʔɡmi** (thug mi).<sup>162</sup> Glottalisation is otherwise fairly rare in most of these dialects, so these examples are difficult to explain. In 70 **ɪŋɡɪʔs** (iongantas<sup>163</sup>), **ŋ** could represent very strong nasalisation rather than a separate segment. There are two examples of glottalisation occurring with a voiceless fricative: 39 **tɔʔʃɹk** (toiseachd<sup>164</sup>); 41 **ən tɔʔʃɹk ɔ:ɹnə** (an toiseachd oirne<sup>165</sup>).

---

<sup>162</sup> Glottalisation has not been recorded in the words *cionta(ch)* and *bailtean* in *SGDS* in any dialect, including those that lack preaspiration. Other examples of heterosyllabic clusters start with a voiceless fricative (*uisge*, *cupan* /k<sup>h</sup>uhpan/) or with a sonorant which either lengthens the previous vowel or is itself long (*cinnteach*).

<sup>163</sup> *Iongnadh*.

<sup>164</sup> *Toiseach*.

<sup>165</sup> *Romhainn*.

## 5. Realisation of glottalisation in Scottish Gaelic

The symbolisation used in part of the fieldwork records reveals differences in the realisation of glottalisation in various dialects or in various contexts within the same dialect, in terms of intensity, location, and extent.

### 5.1. Intensity

As outlined in §3, some fieldworkers used different symbols to indicate glottalisation in various contexts and sometimes in the same context. In part of the materials collected by Fred MacAulay, the glottal stop is mostly used in hiatus and the raised glottal stop in consonantal contexts: 37 **koʔər** (cobhair) vs. **ɖʊʔnə** (duine); **maʔdəy** (madadh<sup>166</sup>). Elsewhere, MacAulay used the regular glottal stop with sonorants, very rarely with stops, but never with voiceless stops: 46 **øʔɪ** (aghaidh); **tʃāʔmɪç** (teannaich) vs. **laʔgʌn** (lagan); **kraʔp** (cnap); but note: **eʔglaf** (eaglais). This seems to point to a difference in the intensity of glottalisation in these contexts, possibly related to the degree of sonority of particular types of sounds. A similar difference (but in the same context) might be reflected by the transcription of 39 **beʔ rər** vs. 44 **beʔr ər** (beir air): the space following the glottal stop symbol in the former example might point to a more intense and/or prolonged glottalisation. Eric Hamp, who used the raised glottal stop in all contexts, occasionally enclosed it in brackets, probably indicating a lower intensity of glottalisation:<sup>167</sup> 40 **gōʔdʒ** (goid), **keʔr** (ceithir<sup>168</sup>); 82 **uʔlɒv** (ullamh); 55 **kuʔrɪç esən** (cuiridh esan<sup>169</sup>). Glottalisation can be weaker after long vowels in certain dialects: 82 **fɔʔnɪxʔ** (foghnaidh) (see §4.1.b.β); and under secondary stress (see §4.4).

### 5.2. Location (timing) and extent

As stated before (see §3), the symbol indicating glottalisation can occur in various positions with respect to various parts of the context:

- between vowels
- between a vowel and a glide

---

<sup>166</sup> *Cù*.

<sup>167</sup> Cf. the note, pt 68, page 6: ‘dʃʔnə very slight glottal constriction optionally after  $\check{V}$  – Never a stoppage – only a fading in (...)’. The symbol enclosed in brackets is located above **n** in the original note. Cf. *SGDS* I, 135.

<sup>168</sup> *Ceathrair*.

<sup>169</sup> *Cuiridh*.



- before a consonant
- above a consonant
- following a consonant

Since glottalisation is not a segment, but rather an interval of creaky voice which can extend through multiple segments (see §7), the position of the symbol may reflect the onset of glottalisation or the location in the sound sequence at which glottal constriction reaches its maximum. This often seems to coincide roughly with the syllabic boundary and with the boundary between the two vowels: 40 **bl̥oʷəŋ** (bleaghan); 53 **buʷi** (buidhe); 54 **l'eʷis** (leigheas); 57 **piʷuɾ** (piuthar). In some cases, however, glottalisation appears to reach its highest intensity before the end of the stressed vowel: 85 **boʷəŋ** (bogha); 86 **doʷɟin'** (domhain). The situation seems to be reverse in diphthongs – glottalisation is often indicated in the materials before the second phase of the diphthong: 38 **sɪʷi|i** (suidhe<sup>170</sup>); 46 **öʷi-in** (uighean), **ʃʌɛʷo-ɪŋ** (sleamhainn); 84 **tʰeʷə** (teotha<sup>171</sup>); even when followed by an approximant: 67 **uʷijɻn** (uighean); 91 **əʷowin'** (abhainn); and it rarely co-occurs with the second part of the diphthong: 66 **u-ɪ|jən** (uighean), **buɪ|i** (buidhe); or follows it: 46 **kl̥aɾ'i** (claidheamh). Cf. also 31 **lu'ai** (luaidhe); 35 **lu'a'i** (luaidhe); 33 **fi'a'i** (fiadhaich); and more examples in §4.1.b.β and §4.5.b. The following examples all come from the same dialect: 82 **aʷuɪ̥ / auʷi̥** (abhainn), **l'eʷəɾ'** (leabhar), **hɾeʷə** (threabh e); **u** represents a ‘non-fricative glide’ here,<sup>172</sup> but it could also be analysed as part of a diphthong (see §4.1. and 4.2.a.ε).

In consonantal contexts, glottalisation is indicated before the consonant in a great majority of examples from most dialects, implying that it usually starts in the final phase of the stressed vowel (see §7.2.c). In Eric Hamp’s records from pts 59, 82, 83, and 85, the glottalisation symbol is frequently found above the consonant: 59 **nas̥o̥m̥i** (nas luime<sup>173</sup>), **gop̥** (gob); 82 **h̥aj̥i** (bainne), **kl̥uj̥ɟ** (cluinnidh); 83 **m̥uim̥e** (muime), **kl̥j̥ix'** (cluinnidh); 85 **f̥e̥əɟ** (feannadh), **nḁi̥əɟ̥** (naidheachd); and mainly word-finally at pt 40: **lag̥** (lag), **neɟ̥** (nead). It often follows the consonant at pt 82: **h̥al̥'i** (baile), **doɾəst** (doras). A few examples are found elsewhere. In Anthony Dilworth’s records from pt 80, where glottalisation is rare, the glottal stop symbol is usually superscribed: **ruɪ̥ci** (ruigidh). Fred MacAulay recorded ‘simultaneous’ glottalisation at pt 45.<sup>174</sup> Interestingly, one of the informants from

<sup>170</sup> *Suidh*.

<sup>171</sup> *Nas teotha*.

<sup>172</sup> *SGDS I*, 119.

<sup>173</sup> *Luime*.

<sup>174</sup> The note, pts 45/46, page 18: ‘(2) Glottal stops precede consonants. Unlike (1) who, when she uses them at all, has simultaneous glottal stops’. Numbers 1 and 2 refer to points 45 and 46 respectively.

pt 40 produced realisations such as **u!ʲi** (uile),<sup>175</sup> and also **ʳr**.<sup>176</sup> It seems that glottalisation can sometimes persist throughout the following syllable: 70 **fiʲiʔterɣxk<sup>h</sup>** (figheadaireachd); 82 **ua<sup>h</sup>g̊i<sup>h</sup>ŋəɣ** (uaigneach); or perhaps have delayed onset in less prominent words: 83 **d'zɛxūæm̩id'zɛ** (an té a chunnaic mi an-dé).

### 5.3. Glottalisation and epenthesis

Glottalisation does not normally occur before the epenthetic vowel: 55 **h̥ɾɔɫɔ<sup>h</sup>g̊** (bolg). It has, however, been recorded (albeit rarely) in hiatus following the epenthetic vowel (see §4.1.b.γ): 83 **gɾa<sup>h</sup>ɾa<sup>h</sup>ʔaɣ** (gainmheach). This may be related to the fact that, prosodically, the epenthetic vowel acts as an extension of the stressed vowel in many dialects, i.e. the pitch contour of svarabhakti groups corresponds to that of stressed long vowels.<sup>177</sup> Glottalisation is most common in this context at pt 83 (see §4.1.b.γ), where it has also been recorded after long vowels and diphthongs: **ɾ[ūã]ʔa<sup>h</sup>r'** (ruamhar). Pitch drop has been indicated by a special symbol in many examples of hiatus in which glottalisation is absent in this dialect: **fua<sup>h</sup>ɾ<sup>h</sup>al** (fuaghail). See also §7.2.c.

In some of the dialects in which the epenthetic vowel is an allophone of /ə/, svarabhakti groups do not seem to differ from the original disyllabic sequences in pitch contour, which is reflected in the transcription of such groups in the materials:<sup>178</sup> cf. 55 **ʃa<sup>h</sup>ɫə<sup>h</sup>g̊** (sealg) vs. 83 **ʃ[ɔɫa]g̊** (sealg).<sup>179</sup> That is why the only example of glottalisation in a consonantal context after the epenthetic vowel, which has been found in the materials: 40 **fa<sup>h</sup>r̥i<sup>h</sup>g̊'i** (farrige); cannot be explained as related to pitch.<sup>180</sup>

<sup>175</sup> These have been recorded in notes on pages 8 and 9 of the questionnaire.

<sup>176</sup> Cf. the note, pt 40, page 12: ‘for his sister’s ʳr, C has ʳr mostly’.

<sup>177</sup> See Bosch & de Jong (1997: 5-11); Ladefoged *et al.* (1998: 30-31); Ternes (2006: 137-41); Nance (2015: 5).

<sup>178</sup> For svarabhakti and stress marking, see *SGDS I*, 119-21.

<sup>179</sup> Cf. the note, pt 57, page 33: ‘absence of [ʔ]; no distinctive pitch contour; much like Islay’; and pts 53 and 54, page 33: ‘1<sup>st</sup> syll. always well accented; but no ʔ’. Svarabhakti groups are marked with a subscript ligature (like diphthongs) in the records from pts 84 and 85, but cf. the note on page 33: ‘The total lack of a glottal constriction marks it more than the steady pitch’.

<sup>180</sup> See also Dilworth (1972: 6-7).

## 6. Geographical distribution of glottalisation in Gaelic

The following overview is based on fieldwork records for the majority of the relevant *SGDS* points, and where these were unavailable, the data from the published lists was used. The recorded examples have been organised into groups according to the context of glottalisation:

- hiatus glottalisation following a short stressed vowel;
- hiatus glottalisation following a long stressed vowel;
- hiatus glottalisation following the epenthetic vowel;
- glottalisation in the context of word-internal voiced consonants;
- glottalisation in the context of word-final voiced consonants;<sup>181</sup>
- glottalisation in the context of voiceless (aspirated) stops.

The tables in Appendix 7 show the percentages of examples involving the glottal stop and pipe symbols in the total number of words in which glottalisation is expected to occur, which have been recorded at each survey point. It is important to point out that the total number of examples involving a glottalising environment is not the same for each survey point, and is much lower for some dialects than for others, which could have influenced the overall picture.<sup>182</sup> Other factors that might have affected the accuracy of these values have been addressed in §0.2.

The geographical distribution of the dialects in which hiatus glottalisation has been recorded is shown on Map 1 (Appendix 6), based on the data presented in Table A (Appendix 7). The map also shows the survey points at which hiatus has been indicated by the pipe in the published lists (i.e. including A. Dilworth's hyphen). The highest frequencies of glottalisation have been recorded in this context in Islay, Gigha, the south of Jura, Colonsay, Easdale, the west of Mull, Tiree, Eigg, parts of Arran, and some mainland dialects, e.g. pts 46, 66, 72, 78, and 80. If the pipe symbol used in the records from pts 28-30 indicates creaky voice or similar phonetic phenomena, hiatus glottalisation also seems to be very consistent in some Barra dialects. A few examples (usually just one or two) have been found in some dialects outwith this area (pts 14, 16, 23, 74, 99).

Glottalisation has been recorded in hiatus after a long vowel and following the epenthetic vowel (Maps 2 and 3; cf. Tables B and C) mainly in some dialects of Lochaber and Mull. Glottalisation appears to be exceptionally consistent after the epenthetic vowel at pt 83, where it is found in nine

---

<sup>181</sup> Voiced consonants include unaspirated stops.

<sup>182</sup> The obtained percentages may not always reflect the real state of affairs, since the total number of examples of certain contexts in the materials is fairly small (e.g. hiatus after a long vowel, or the consonantal contexts involving fricatives). In cases like these, the numerical values should probably not be taken at face value.

out of ten recorded examples (see §4.1.b.γ). Following a long vowel, glottalisation is also fairly common at pt 78. In the materials from pts 29-30, hiatus is indicated very consistently by the pipe symbol in these contexts. No examples have been recorded in the southwestern dialects, where glottalisation is otherwise extremely common, since these two contexts have been lost there due to contraction affecting V:V sequences and unstressed VV sequences (see §4.1.b.β. and 4.1.b.γ). In some Arran examples, voiced fricatives have been preserved and hiatus has never developed, cf. 34 **εr<sup>ʷ</sup>vɔr** (arbhar).

Glottalisation in consonantal contexts has a somewhat narrower geographical distribution than hiatus glottalisation (see Map 4 and Table D). It is well-attested in Gigha, Islay, Colonsay, Easdale, Tiree, and at pts 82 (Mull) and 46 (Cowal), and is less frequent in Arran, Coll, parts of Mull, mainland Argyll, and in some Lochaber dialects. It also appears to occur less frequently than hiatus glottalisation in the dialects in which both exist. Occasional examples have been found in audio recordings of speakers from Barra (see §7.3). Glottalisation has also been attested in word-final contexts (pre-pausally) in some of these dialects, with the highest frequency in Gigha, Islay, and Colonsay, where it is very consistent in general, and at pt 66 (Benderloch) (see Map 5; Table F). Glottalisation seems to be more common with certain classes of consonants, e.g. it occurs more frequently with sonorants at pts 39, 43, 44, 45, and especially at pt 47 (see Table E). As has already been mentioned, however, not all consonant classes are represented sufficiently well in the materials (especially fricatives), which makes it difficult or impossible to draw a definite conclusion.

In the context of voiceless (aspirated) stops, orthographical *p t c*, glottalisation has been recorded in the southernmost mainland dialects: pts 36-49 (see Map 6, and §4.2.b). It appears to be very common and to occur more frequently in this environment than with voiced stops in some of these dialects. However, no firm conclusions can be made due to the low number of attested examples (see Tables G and H).

It appears that the frequency of the occurrence of glottalisation can also depend on individual speakers, i.e. that variation can exist within a single dialect depending on its speakers. Such variation has been reported, for example, for Arran.<sup>183</sup> One of the two *SGDS* informants from pt 52 (Craighouse, Jura) provided a considerably higher percentage of examples of glottalisation, although it has to be borne in mind that far fewer words involving suitable contexts were collected from this informant than the other (cf. pts 52 and 52\* in Tables A and D).<sup>184</sup> This might also (but not necessarily) be one of the

---

<sup>183</sup> Holmer (1957: 38).

<sup>184</sup> The materials from pt 52\* have not been published.

reasons for the considerable differences between some of the neighbouring *SGDS* points, for example, those in Arran, Cowal, Jura, Coll and Tiree, and in northern Argyll.

## 7. Phonetic nature of Gaelic glottalisation

### 7.1. Introduction

Some general information on glottalisation as a phonetic phenomenon has been provided in §1. There have been no extensive phonetic studies of Gaelic glottalisation yet, although an analysis has been carried out by A. Scouller as part of his doctoral thesis on the Colonsay dialect.<sup>185</sup> A few articles have been published which discuss the phonetic properties of certain features which are, or might be, related to glottalisation in Gaelic, such as pitch/tone accent<sup>186</sup> and epenthesis.<sup>187</sup> This section presents the results of a general analysis of Gaelic glottalisation, focused on its phonetic realisation and its relationship with such phenomena as stress, voicing, and pitch. The analysis sought to answer the following questions: (1) What are the basic phonetic properties of Gaelic glottalisation? (2) Is it related to voicing, stress, and pitch? (3) How is it related to these phenomena (in case it is)? (4) Does the absence of glottalisation in svarabhakti groups (see §5.3) depend on pitch phenomena? Not all these questions have been answered fully and will have to be re-addressed in a later study. Dialectal differences have been considered in this analysis since the contexts in which glottalisation occurs as well as its realisation can vary depending on the dialect. The realisation of glottalisation can also vary across speakers of the same dialect, as reported by Holmer for the Arran dialects,<sup>188</sup> but this variable has not been considered here. Since all speakers were older and most were male, sociolinguistic variables such as age or gender have not been considered either.

Glottalisation has been described as a prosodic phenomenon in Gaelic, a feature related to the pitch patterns and tonal accent characteristic of certain dialects (see §8). As explained in §4, it normally occurs between two vowels, whereby the first one is stressed and short, and the following one is unstressed. In many dialects, the two vowels can be separated by a single voiced consonant or by a tautosyllabic consonant cluster (see §4.2). Since glottalisation normally occurs with unaspirated stops, which have been transcribed as phonetically voiceless sounds in part of the *SGDS* records (see §4.2.a), attention has been paid to the realisation of these consonants in an attempt to find out whether they indeed can be completely voiceless in the contexts which trigger glottalisation. As described in §6, although glottalisation is fairly consistent in some dialects, it is not completely regular in any and tends to be absent in weakly stressed or unstressed environments. A special attention, therefore, has been paid, in this analysis, to the relationship between glottalisation and stress.

---

<sup>185</sup> See Scouller (2017).

<sup>186</sup> Ladefoged *et al.* (1998).

<sup>187</sup> Bosch & de Jong (1997).

<sup>188</sup> Holmer (1957: 38).

## **7.2. Methodology**

### **7.2.a. Participants**

This analysis has been carried out using recordings of native speakers of six different Gaelic traditional dialects made by the School of Scottish Studies in 1953 (Islay), 1958 (Tiree), 1963 (Strontian), 1970 (Knapdale), and 1974 (Mull and Barra). All speakers were male apart from the one from Barra. The age of the Barra and Mull speakers is unknown, although they were elderly at the time of recording, whilst the others were between 65 and 80 years old. It is unknown whether any of the speakers spent a significant part of their life outwith their native area, which could possibly have affected their use of the dialect. The choice of dialects reflects what is known about the geographical distribution of glottalisation – it occurs mainly in hiatus in Strontian and Barra, but it is also common in consonantal contexts in Tiree, parts of Mull, Islay, and in the southern part of mainland Argyll. These six dialects could also represent other glottalising varieties of Gaelic since the locations in which they are spoken are distributed evenly on the map of the area in which glottalisation has been recorded.<sup>189</sup>

### **7.2.b. Materials**

The duration of each of the six recordings ranges from 4 to 6.5 minutes, except the one of the Islay speaker, which is just over one minute long. They contain spontaneous connected speech of the informants telling traditional stories or talking about local events. Since the original purpose of the recordings was the collection of local lore rather than phonetic research, they were not made in a controlled environment. The original recordings were on a five- or seven-inch reel, as follows: Uher 5” reel (Barra, Mull, Knapdale), Ficord 5” reel (Strontian), Ferrograph 7” reel (Islay), Rep 2 5” reel (Tiree); and were digitised on Otari MX-5050 – IEC equalisation into a SADiE BB2-J. The Barra, Mull, and Strontian recordings were digitised from an EMI copy reel and captured at 24/96. (SR); the Knapdale recording was digitised from an EMI copy reel and captured at 24/96. (SU);<sup>190</sup> the Islay recording was digitised from the original Scotch reel and captured at 24/96. (SR); and the Tiree

---

<sup>189</sup> A notable exception might be the dialects of Kintyre and Arran, but unfortunately, no good quality recordings of these varieties of Gaelic were available.

<sup>190</sup> This tape has been speed-shifted due to a technical problem with the original tape.

recording was digitised from the original MSS reel and captured at 24/96. (SR).<sup>191</sup> The audio files obtained from the School of Scottish Studies were in .wav format.

### 7.2.c. Analysis

The initial analysis of the materials was conducted using Praat.<sup>192</sup> The textgrids were created manually for that purpose since the CLARIN WebMAUS online application does not include an option for force alignment of Gaelic speech recordings. Since a transcription was available for only one of the six recordings (i.e. the one from Islay), the other five were transcribed in the lowest tier in the textgrids. The words in which glottalisation is expected were annotated and segmented, and additional tiers were inserted for coding. Initially, 297 tokens were identified in the recorded materials (see Table 4). Most of these were single words, but a few were represented by short phrases containing a monosyllabic word followed by another word which is either a clitic or has non-initial stress (such as *ghabh e* or *chur a-mach*) since glottalisation can occur over word boundaries in Gaelic (see §4.3). This number does not include the words in which glottalisation normally occurs but which were extremely reduced due to the lack of stress. All 297 tokens were included in the larger part of the analysis. Out of that number, however, 58 tokens (19.5% of the original data) had to be excluded from the parts that involved F0 measurements, leaving 239 tokens (see Table 5). A few of these 58 tokens were excluded because of flawed measurements due to background noise and other types of interference, but for a great majority of them Praat was unable to calculate the pitch values, presumably due to final devoicing, typically occurring at the end of sentences in Gaelic, where most of these tokens were found (Figure 6). As will be shown later, the exclusion of these particular examples appears to have had an important influence on the results of the analysis since almost all these tokens involved strong glottalisation (Figure 7).

	Barra	Strontian	Mull	Tiree	Islay	Knapdale	Total
Consonant	59	3	42	53	27	20	204
Hiatus	23	23	10	23	6	8	93
<b>Total</b>	<b>82</b>	<b>26</b>	<b>52</b>	<b>76</b>	<b>33</b>	<b>28</b>	<b>297</b>

**Table 4:** The number of tokens by dialect and context

<sup>191</sup> The information on the original recordings and digitisation has been provided by the School of Scottish Studies.

<sup>192</sup> Boersma & Weenink (2020).



	Barra	Strontian	Mull	Tiree	Islay	Knapdale	Total
Consonant	46	3	34	48	24	15	170
Hiatus	17	18	7	16	3	8	69
Total	63	21	41	64	27	23	<b>239</b>

**Table 5:** The number of tokens with valid F0 measurements by dialect and context.

Due to the nature of the recorded speech, the tokens used in the analysis were unbalanced. They differed, for example, in the number of syllables, syllabic structure, word class, and their position within sentences, which affected the level of their prominence. The sample structure, however, did make it possible to compare the realisations of glottalisation in a range of different contexts.

A number of parameters were identified by acoustic profiling:<sup>193</sup>

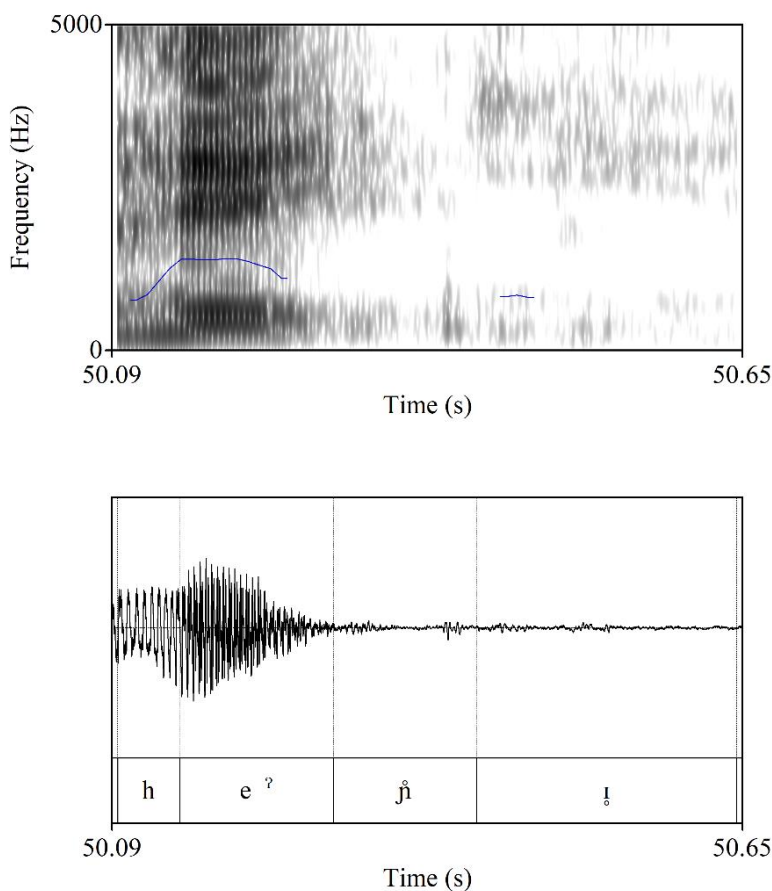
- **Context 1** (consonantal / hiatus) was used to identify the frequency of glottalisation in the two basic environments generally and in particular dialects.
- **Context 2** (stop / fricative / sonorant / approximant / hiatus) was expected to show the possible differences in the frequency of glottalisation in various consonantal environments. This, however, turned out to be impossible due to the small amount of data.
- **Glottalisation** (strong / weak / absent) – this parameter was partially based on auditory perception: glottalisation was coded as ‘strong’ if a period of creaky voice was easily identifiable in the spectrogram and waveform; it was coded as ‘weak’ if a pulse or sudden increase in ‘tenseness’ was identified auditorily, but it was difficult to detect in the spectrogram and waveform.
- **Onset of creaky voice** (vowel 1 / consonant / vowel 2 / absent) was identified where the ‘slowing down’ of the vocal fold vibration was first observable in the spectrograms.
- **Location of creak** (both vowels / vowel 1 / vowel 2 / absent) referred to the presence of creaky voice in one or both of the two vowels. The first vowel was not taken into account if it contained only one or two creaky pulses, in order to enable comparison between this parameter and the onset of glottalisation.
- **Voicing** (full / partial / absent) was considered full if periodicity could be detected in more than 50% of the duration of the consonant (or the closure phase in stops), and partial if it was less than 50%. It was considered absent if there was very little or no periodicity. Partial voicing was also recorded in some hiatus tokens.
- **Stress** (strong / weak / absent) – the degree of stress was determined for a token in relation to the neighbouring words. A token was coded as strongly stressed if it was more prominent than the surrounding words, and as weakly stressed if it was followed by a more prominent word.

<sup>193</sup> Cf. Docherty & Foulkes (1995, 2005).

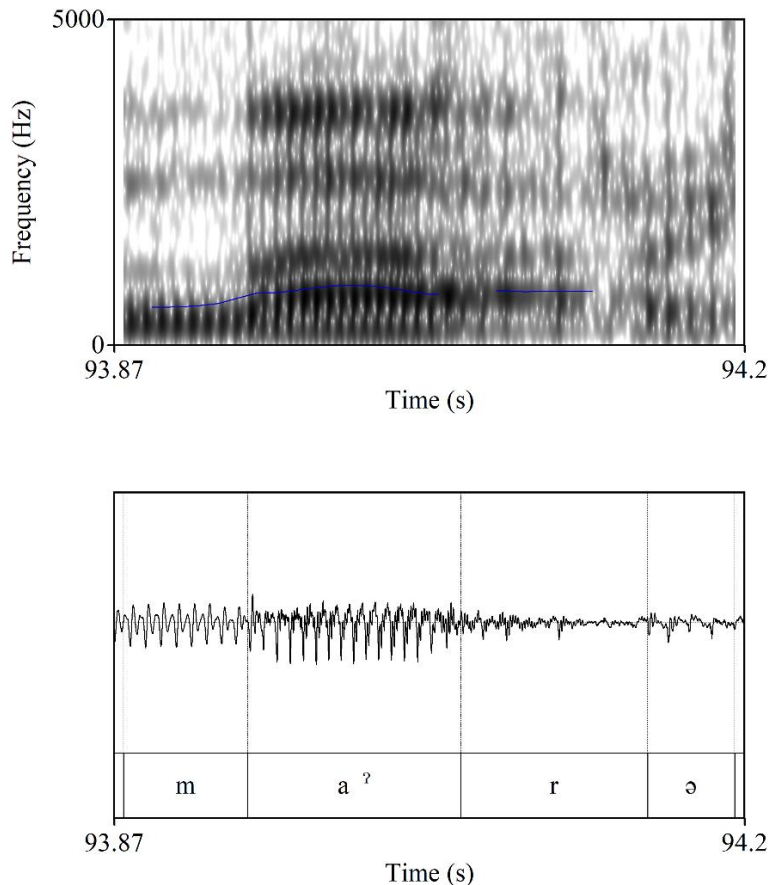
The pitch contour of the token tended to be falling in the former case and rising in the latter. A token was considered unstressed if its prominence resembled that of a proclitic.

The purpose of these parameters in the analysis will be explained in greater detail in the following section on the research results.

The values of each parameter were indicated by corresponding coding labels in different tiers of the textgrids. The codes were extracted using a Praat script (see Appendix 8) which produced a .csv file also containing F0 measurements of the stressed vowel and the following vowel, as well as the difference between the two values. The F0 measurements (in Hz) were taken at the mid point of each vowel.



**Figure 6:** Spectrogram and waveform of the word *theine* (Islay), showing no periodicity following the creaky pulse in the final phase of [e]. This is due to sentence-final devoicing. The blue line indicates the pitch contour terminating in the final phase of the stressed vowel and briefly reappearing early in the initial phase of the second vowel.



**Figure 7:** Spectrogram and waveform of the word *mara* (Strontian) showing creaky pulses starting in the final phase of [a] and persisting through the rest of the word. Praat was unable to measure F0 in the final syllable in this token.

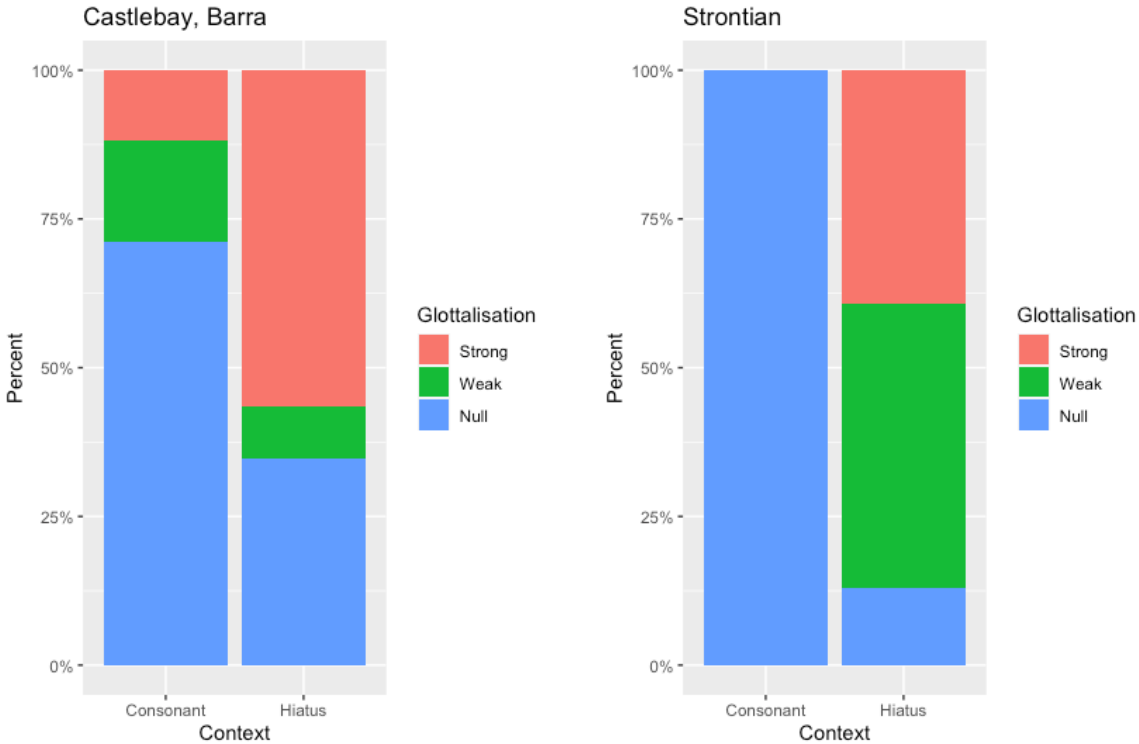
### 7.3. Results

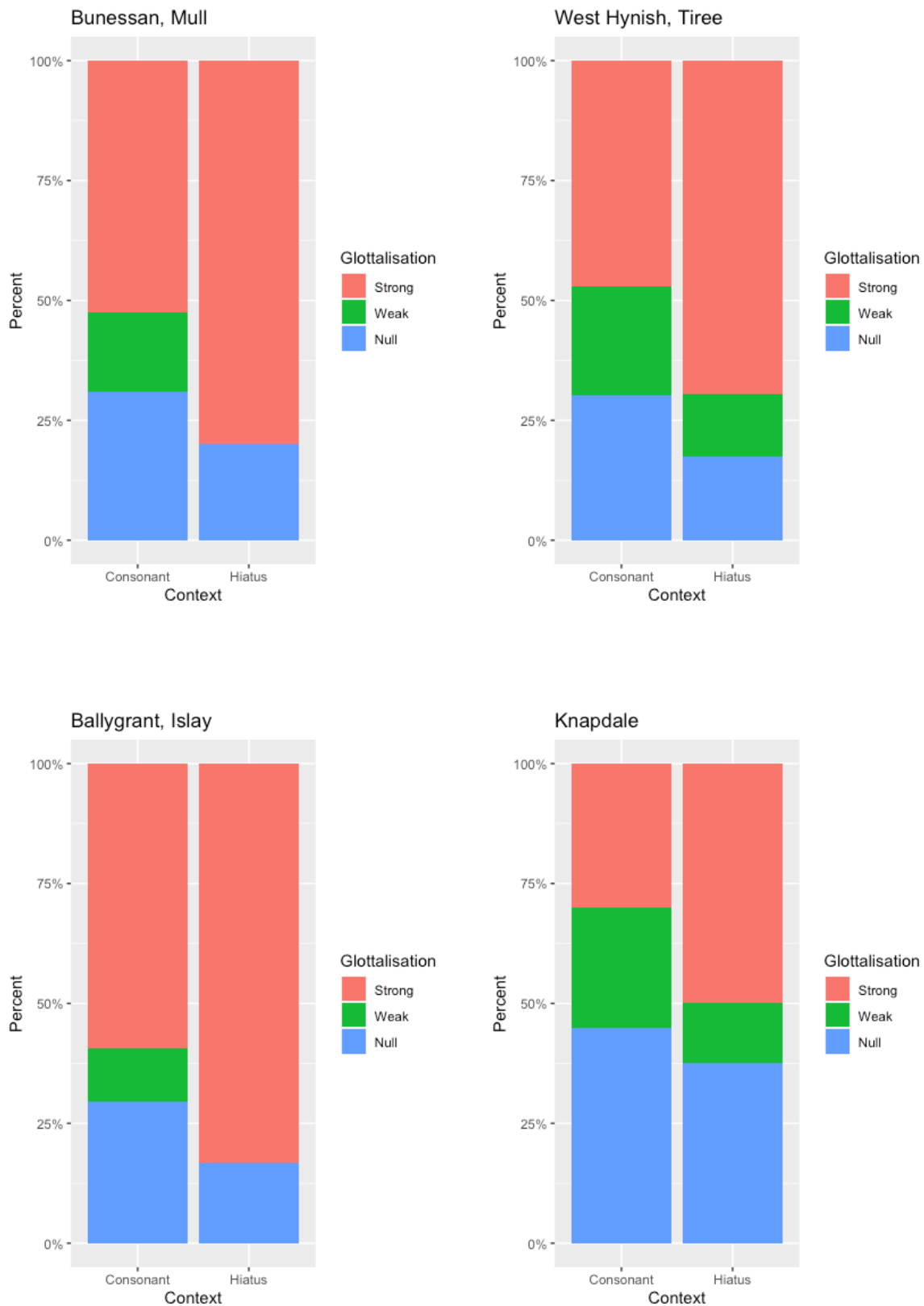
The frequency of glottalisation and its distribution over the two basic environments in each of the six dialects is shown in Table 6. Few tokens of glottalisation in consonantal contexts were recorded in Barra and none in Strontian, whereas it was much more common in the other dialects. Glottalisation was frequent in hiatus in all six dialects. With the exception of consonantal glottalisation in tokens from Barra, these results were expected and correspond to the data obtained from the *SGDS* records although the frequency of glottalisation was lower there for Knapdale and Strontian (pts 50 and 79, Appendix 6, Map 1). The proportion of glottalised tokens according to context in each dialect is shown in Figure 8. The bar charts show that glottalisation was fairly regular in both main contexts in Islay, Mull, and Tiree, and only in hiatus in Strontian. A high percentage of tokens of weak glottalisation characterised the latter dialect, but weak glottalisation was completely absent from hiatus contexts in Islay and Mull. Weak glottalisation was less frequent than strong glottalisation in

each dialect, except with consonants in the Castlebay dialect (Barra), where glottalisation is exceptional in that context.

Dialect	Context	Glottalisation			
		Strong	Weak	Absent	Total
Barra	Consonant	7	10	42	59
	Hiatus	13	2	8	23
Strontian	Consonant	0	0	3	3
	Hiatus	9	11	3	23
Mull	Consonant	22	7	13	42
	Hiatus	8	0	2	10
Tiree	Consonant	25	12	16	53
	Hiatus	16	3	4	23
Knapdale	Consonant	6	5	9	20
	Hiatus	4	1	3	8
Islay	Consonant	16	3	8	27
	Hiatus	5	0	1	6
Total	Consonant	76	37	91	204
	Hiatus	55	17	21	93

**Table 6:** Frequency of glottalisation by context in each dialect.





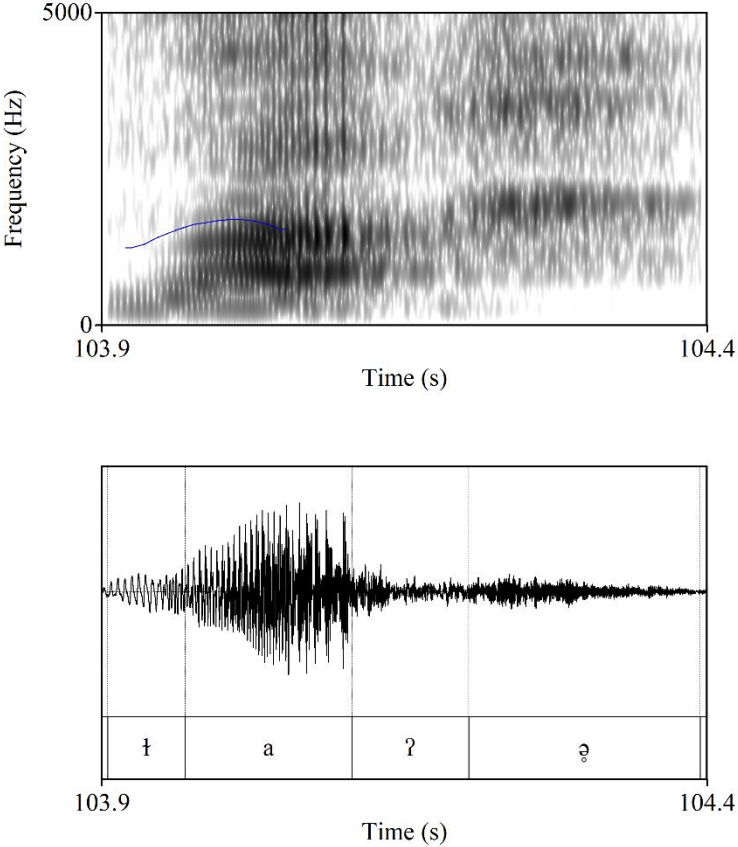
**Figure 8:** Proportion of glottalised tokens in the data from each dialect according to context.

The most common realisation of glottalisation in the studied data was creaky voice. Numerous tokens were also characterised by other types of phonation, such as whisper (Figure 9), but these can be explained as the consequence of sentence-final devoicing, phenomena related to intonation, or extra-

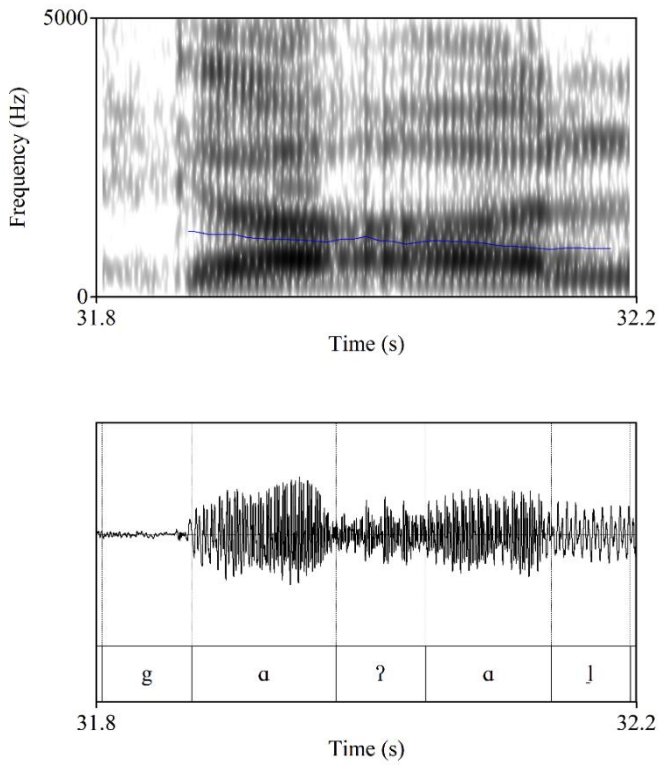
linguistic factors. The onset of creaky voice was detected in the final phase of the stressed vowel in a great majority of tokens (Table 7). This was particularly common in the tokens of hiatus, where a fairly creaky phase, creating the auditory impression of glottal stop, was perceived as belonging to the stressed vowel on closer inspection (Figure 10). The onset of creak rarely followed a phase of low energy, which was also perceived as part of the stressed vowel (Figure 11). With consonants, creak normally started in the final phase of the stressed vowel or in the initial phase of the consonant, creating the impression of glottal stop preceding the consonant (Figure 12).

Context	Onset of creaky voice								
	Vowel 1		Consonant		Vowel 2		Absent		Total
Consonant	95	47%	17	8%	0	0%	92	45%	204
Hiatus	71	76%	n/a		1	1%	21	23%	93

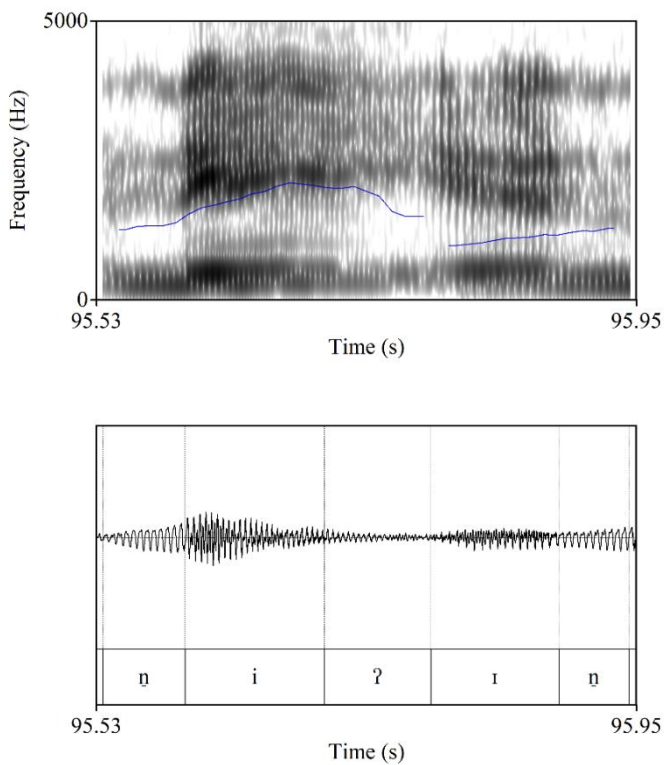
**Table 7:** Location of the onset of creaky voice by context.



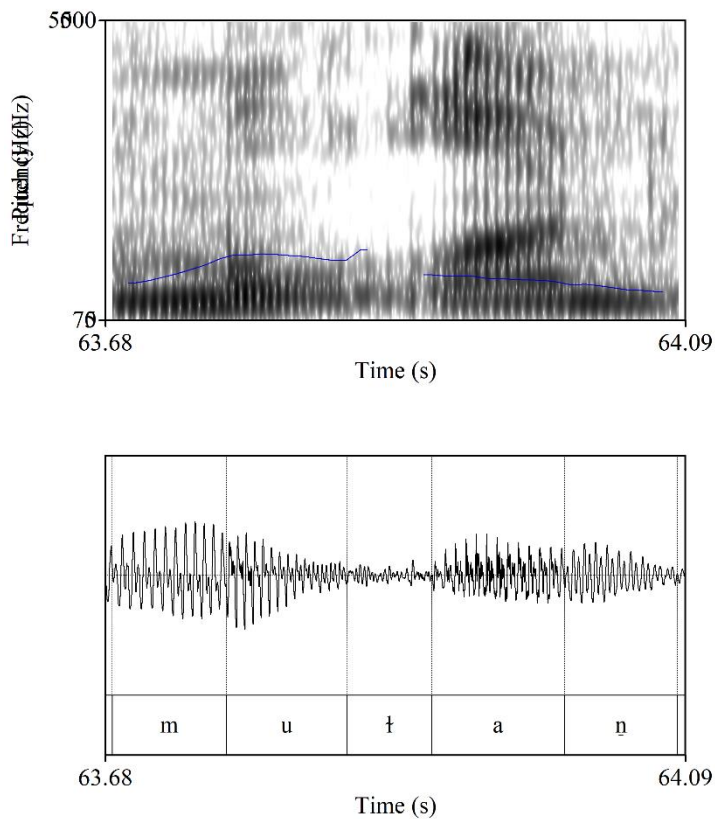
**Figure 9:** Spectrogram and waveform of the word *latha* (Barra) showing creaky phonation in the final phase of the first vowel followed by devoicing and whisper.



**Figure 10:** Spectrogram and waveform of the word *gabhail* (Islay). On careful examination, the phase of creaky voice segmented as [ʔ] was perceived as belonging to the first vowel.



**Figure 11:** Spectrogram and waveform of the word *nighean* (Tiree) showing a decrease of energy due to glottal constriction, followed by creak in the second vowel.



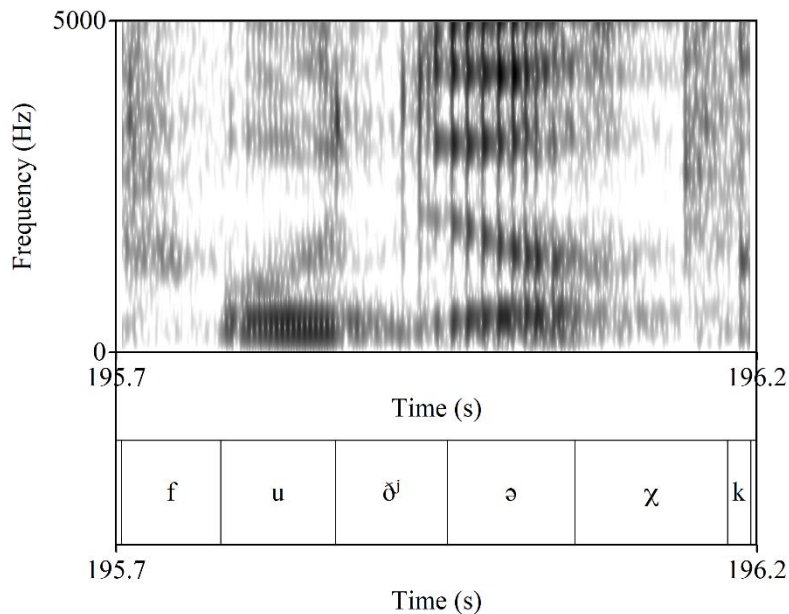
**Figure 12:** Spectrogram and waveform of the word *mulan* (Islay) showing creaky pulses starting in the initial phase of [t] and continuing throughout the following vowel.

After its onset, creaky phonation normally persisted throughout the following vowel in the majority of tokens (Table 8). Where no more than one or two glottal pulses occurred in the stressed vowel, creak was coded as located only in the *second* vowel. This enabled comparison of these tokens with those involving more creak in the stressed vowel, which showed that hiatus glottalisation was characterised by longer periods of creaky phonation in both vowels and very rarely only in the second one. In consonantal contexts, however, very few or no pulses occurred in the stressed vowel in the majority of tokens. Weakly glottalised tokens were also characterised by a delayed onset of creak. The absence of creaky phonation in the second vowel in some tokens was the result of final devoicing. The glottalised tokens coded as not creaky involved only one or two glottal pulses in the stressed vowel (Figure 6). Creaky phonation sometimes occurred where no ‘classical’ glottalisation (resembling a glottal stop) was perceived – this usually started gradually or later on in the second vowel, or was dispersed throughout the word (Figure 13). The same phenomenon was recorded in long vowels and diphthongs (Figure 14).

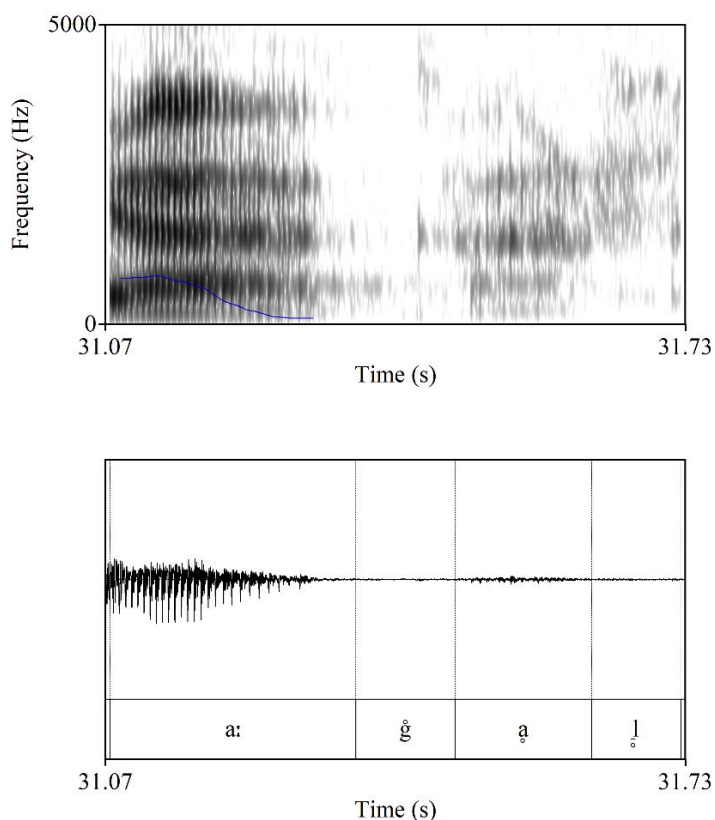


Dialects	Context	Glottalisation	Location of creaky voice							
			All		Vowel 2		Vowel 1		Absent	
Type 1	Consonant	Strong	24	35%	38	55%	1	1%	6	9%
		Weak	3	11%	16	59%	2	7%	6	22%
		Absent	0	0%	0	0%	0	0%	46	100%
	Hiatus	Strong	24	73%	3	9%	4	12%	2	6%
		Weak	3	75%	0	0%	1	25%	0	0%
		Absent	1	10%	0	0%	0	0%	9	90%
Type 2	Consonant	Strong	1	14%	5	72%	1	14%	0	0%
		Weak	3	30%	5	50%	1	10%	1	10%
		Absent	3	7%	14	31%	1	2%	27	60%
	Hiatus	Strong	21	95%	0	0%	1	5%	0	0%
		Weak	9	70%	2	15%	2	15%	0	0%
		Absent	0	0%	1	9%	0	0%	10	91%

**Table 8:** Location of creaky voice by context and degree of glottalisation.



**Figure 13:** Spectrogram of the word *fuireachd* (Barra) realised sentence-finally, showing a period of strong creak starting in the final phase of [ðʲ] without the auditory impression of a glottal stop.

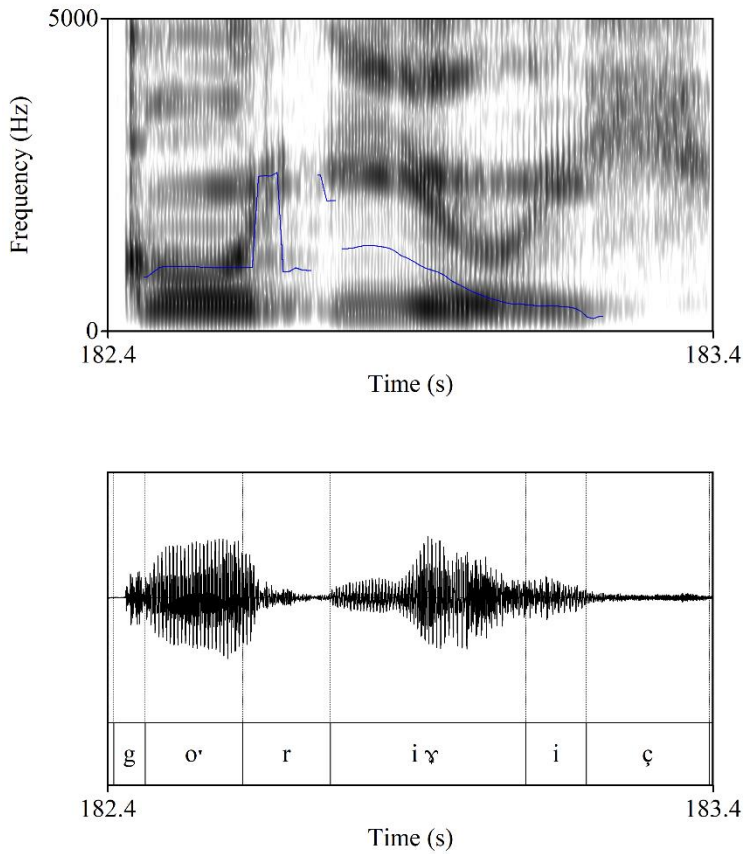


**Figure 14:** Spectrogram and waveform of the word *fhàgail* (Tiree) showing a period of creaky phonation starting in the later phase of [a:]. This does not create the impression of [ʔ].

The presence and degree of glottalisation appear to be related to the intensity of stress. In this analysis, the data was divided into two groups according to the dialect – type 1 dialects included Tiree, Mull, Islay, and Knapdale, and type 2 dialects included Strontian and Barra, where glottalisation is rare or absent in consonantal environments. The purpose of this division was to prevent the bias caused by the large number of unglottalised tokens involving a consonant, which were found in type 2 dialects. The relationship of glottalisation and stress is shown in Table 9. The data shows that glottalisation was far more frequent in fully stressed tokens, whereas it tended to be absent from tokens which were unstressed or weakly stressed. In some tokens, the absence of stress also led to various forms of reduction and hiatus groups were reduced to a single vowel or diphthong (Figure 15).

Dialects	Stress	Glottalisation					
		Strong		Weak		Absent	
Type 1	Strong	95	68%	25	18%	19	14%
	Weak	7	16%	6	14%	31	70%
	Absent	0	0%	0	0%	6	100%
Type 2	Strong	21	60%	9	26%	5	14%
	Weak	1	9%	3	27%	7	64%
	Absent	0	0%	0	0%	0	0%

**Table 9:** Frequency of glottalisation by stress.



**Figure 15:** Spectrogram and waveform of the phrase *gobhair fhiadhaich* (Strontian) showing reduction in the first word, normally realised as [goʔr] in this dialect, when stressed.

Special attention was paid to glottalisation in consonantal contexts in Barra, since it has not been recorded in this dialect in *SGDS*. The data presented in Table 10 shows that glottalisation was not very frequent in this context in Barra, it was mainly perceived as weak, and it only occurred under strong stress. It has to be mentioned that the Barra speaker’s natural voice could be described as considerably creaky, which could have influenced the realisation of these tokens.

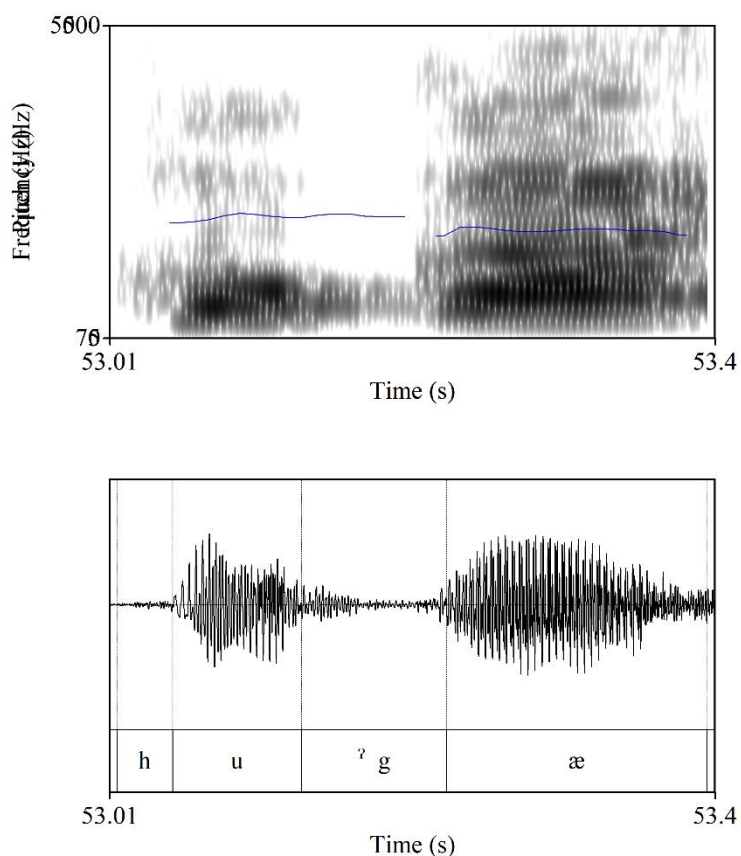
Context	Stress	Glottalisation					
		Strong		Weak		Absent	
Consonant	Strong	7	17%	10	24%	24	59%
	Weak	0	0%	0	0%	17	100%
	Absent	0	0%	0	0%	1	100%
Hiatus	Strong	13	72%	1	6%	4	22%
	Weak	0	0%	1	20%	4	80%
	Absent	0	0%	0	0%	0	0%

**Table 10:** The frequency of glottalisation by stress and context in Castlebay (Barra).

A relationship was found to exist between glottalisation and voicing, as demonstrated by the data presented in Table 11. Glottalisation was almost absent in completely devoiced contexts. In the data from both groups of dialects, but especially from type 1, fully voiced tokens displaying strong glottalisation were more numerous than either partially voiced but strongly glottalised tokens or fully voiced but weakly glottalised tokens. The large number of strongly glottalised tokens with partial voicing can be explained by the fact that creaky voice, which is the most common realisation of glottalisation, affects periodicity often creating the impression of devoicing. The high numbers of (seemingly anomalous) fully voiced but non-glottalised tokens in both groups of dialects can be explained in a similar fashion – voicing is full here due to the absence of creaky voice. It has to be borne in mind that all tokens involve phonologically voiced sounds, the sole exception being unaspirated stops (orthographical *b d g*), in which voicing seems to be redundant. Even they, however, can be fully voiced between vowels (see Figure 16).

Dialects	Voicing	Glottalisation					
		Strong		Weak		Absent	
Type 1	Full	63	47%	21	16%	50	37%
	Partial	35	73%	10	21%	3	6%
	Absent	4	57%	0	0%	3	43%
Type 2	Full	13	33%	12	30%	15	37%
	Partial	10	91%	1	9%	0	0%
	Absent	1	100%	0	0%	0	0%

**Table 11:** Frequency of glottalisation by the degree of voicing.



**Figure 16:** Spectrogram and waveform of the phrase *thug e* (Mull) showing periodicity in the closure phase of [g].

A comparison of stress and voicing (Table 12) revealed that devoicing was considerably more frequent under strong stress than in weakly stressed or unstressed tokens. This tendency might have been caused by glottalisation, i.e. creaky voice, which was also more common under strong stress (cf. Table 13).

Stress	Voicing					
	Full		Partial		Absent	
Strong	139	64%	72	33%	6	3%
Weak	66	90%	6	8%	1	2%
Absent	6	85%	0	0%	1	15%

**Table 12:** The relationship between stress and voicing.

Particular attention was given to the relationship between glottalisation and voicing in unaspirated stops, which have often been described as voiceless (see §4.2.a.α). The analysis showed that these sounds were, in fact, usually realised as voiced stops between vowels, at least in these four dialects. Partial voicing was fairly frequent in strongly glottalised tokens, presumably due to the devoicing effect of creaky phonation. Full voicing was prevalent otherwise. This could be explained as the

consequence of the absence or a lower degree of creak and of the spread of periodicity from the surrounding vowels.

Glottalisation	Voicing					
	Full		Partial		Absent	
Strong	11	52%	10	48%	0	0%
Weak	9	69%	4	31%	0	0%
Absent	7	70%	2	20%	1	10%

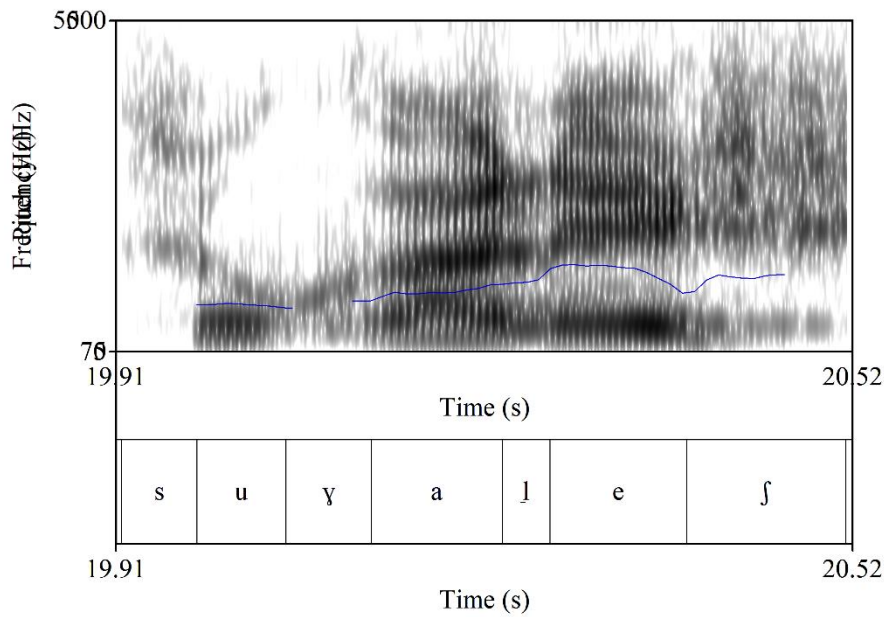
**Table 13:** Voicing in unaspirated stops and glottalisation in type 2 dialects.

Disyllabic sequences beginning with a stressed short syllable are usually characterised by a special pitch contour involving a more or less abrupt pitch drop between the two syllables. It was assumed, therefore, that both creaky phonation and the auditory perception of glottal stop in these contexts might be related somehow to this particular pitch contour.<sup>194</sup> In order to find out whether this is the case and how exactly these two phenomena might be related, a quantitative analysis of F0 transition between the two vowels was carried out. The fundamental frequency was measured at the mid point of each vowel and the difference between the two values was calculated. Since it had been predicted that the degree of pitch drop would depend on the intensity of stress, mean F0 difference values were calculated for different degrees of stress, separately for each dialect (Table 14). As expected, the results showed that the average values were negative in stressed contexts, revealing that considerable pitch drop was likely to occur in strongly stressed tokens. On the other hand, the values were mainly positive in unstressed tokens – often followed by a prosodically more prominent word, which can lead to an increase in F0 (Figure 17).

	Stress		
	Strong	Weak	Absent
Barra	-52	-10.6	14
Strontian	-34.7	-19.1	n/a
Mull	-43.6	-17	7.3
Tiree	-52.4	-16.4	13
Islay	-33.7	-17.7	n/a
Knapdale	-33.8	-14.8	-3

**Table 14:** Mean F0 difference (Hz) by the degree of stress.

<sup>194</sup> This is sometimes referred to as tone 1 or accent 1 in works on northern dialects (see §8).



**Figure 17:** Spectrogram of the phrase 's thug e leis' (Tiree) showing a rising pitch contour in the first (unstressed) part of the phrase and no glottalisation in the word *thug*.

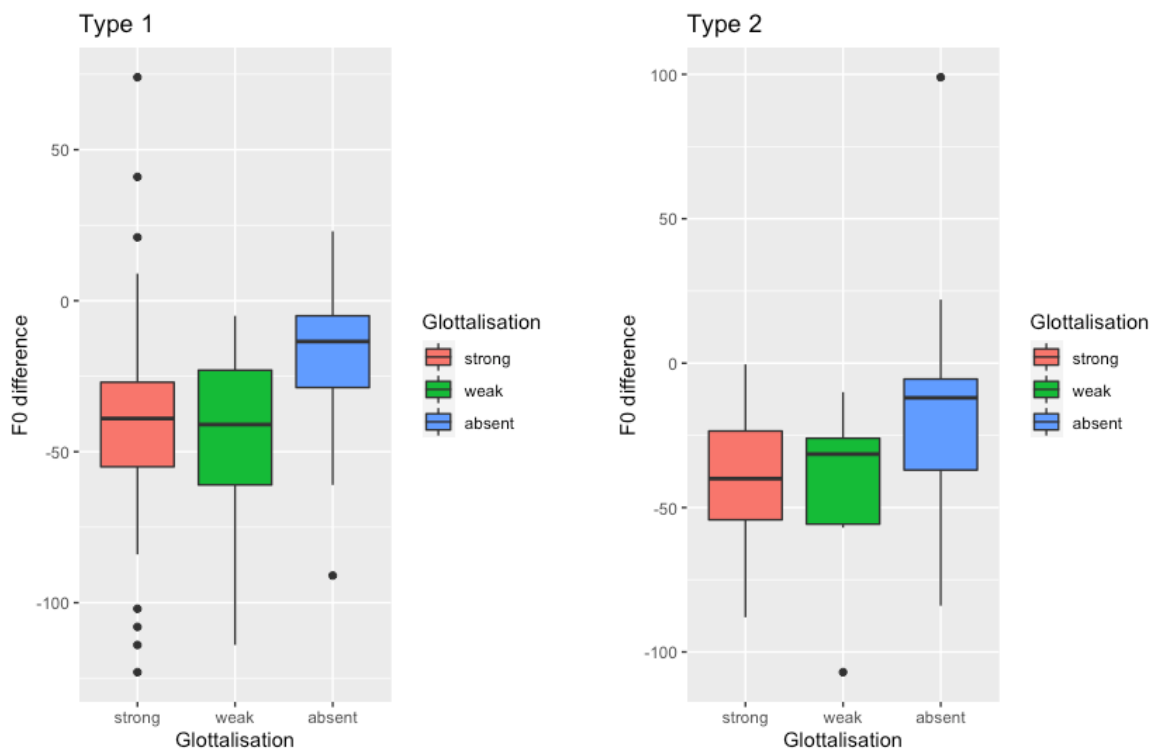
Mean F0 difference values were then calculated for each degree of glottalisation and the results demonstrated that the average F0 decrease was generally more considerable in glottalised tokens (Table 15). The results, however, were somewhat unexpected in that they reflected a more considerable pitch drop in slightly glottalised tokens than in strongly glottalised ones, except in Islay. This anomaly can be explained as the consequence of the exclusion of almost 20% of tokens from the analysis due to failed or flawed F0 measurement – almost all these tokens were strongly glottalised, but they occurred at the end of sentences and were affected by final devoicing (Figures 6 and 9). Since pitch drop is otherwise common in this position in Gaelic, it can be assumed that it would have occurred in these tokens if devoicing had not been complete. Table 16 shows the results for the data from Barra based only on the tokens of hiatus. Figure 18 illustrates the tendency of glottalisation to occur in tokens of a more considerable negative F0 change.

	Glottalisation		
	Strong	Weak	Absent
Barra	-64.1	-73.6	-20.7
Strontian	-34.6	-31.4	-21.2
Mull	-41.7	-57	-13.9
Tiree	-53.1	-54	-14.6
Islay	-34.1	-12	-18.8
Knapdale	-31.3	-37	-21.6

**Table 15:** Mean F0 difference (Hz) by the degree of glottalisation.

	Glottalisation		
	Strong	Weak	Absent
Barra	-44.8	-81.5	-10.3

**Table 16:** Mean F0 difference (Hz) by the degree of glottalisation in tokens of hiatus.



**Figure 18:** Mean F0 difference ratio according to the degree of glottalisation in the two types of dialects.

Finally, mean F0 difference values were calculated for the two groups of dialects, in relation with both glottalisation and the intensity of stress (Table 17). The results showed that an increase in F0 only occurred in unstressed tokens which also lacked glottalisation. Otherwise, negative values dominate in the data and the most considerable difference is observed between the values associated with the absence vs. presence of glottalisation and, in type 1 dialects, between the values related to the difference between weak and strong stress. Like the unstressed tokens, the tokens of weak stress normally preceded a prosodically more prominent word in the recorded speech. The unexpectedly low values for the tokens of strong glottalisation have already been explained.



Dialects	Stress	Glottalisation		
		Strong	Weak	Absent
Type 1	Strong	-41.9	-50.8	-34.2
	Weak	-34	-26.4	-12.8
	Absent	n/a	n/a	7.5
Type 2	Strong	-40.4	-42.1	-15.7
	Weak	-40	-39.7	-14
	Absent	n/a	n/a	n/a

**Table 17:** Mean F0 difference (Hz) by the degree of stress and glottalisation. Only tokens of hiatus were included in the data from the type 2 dialects.

#### 7.4. Discussion

The results of this analysis have shown that glottalisation occurs fairly regularly in Knapdale, Islay, and Tiree both in hiatus and in consonantal contexts, whilst it is much less frequent with consonants in Barra, and limited to hiatus in Strontian. These finds correspond only partially to the data found in the *SGDS* records from the same dialects, where consonantal glottalisation was not recorded in Barra, and the frequency of glottalisation was much lower in Strontian (32% in hiatus) and Knapdale (12% in hiatus, 16% with consonants). Additionally, hiatus glottalisation was indicated by a special symbol [̥] in the *SGDS* materials from Barra although its realisation does not seem to differ from that heard in Islay or Tiree, where the glottal stop symbol was used in *SGDS*.<sup>195</sup>

The most common realisation of glottalisation in Gaelic seems to be creaky phonation. Although it is normally perceived as a distinct segment (glottal stop),<sup>196</sup> Gaelic glottalisation is in fact a fairly extensive period of creak, which can persist into the following vowel, even through an intervening consonant, as also reported by A. Scouller for the Colonsay dialect.<sup>197</sup> Other realisations have been recorded as well, but further research is required to define the particularities of this variation. Creaky phonation tends to start in the final phase of the stressed vowel and to continue throughout the following syllable. The first vowel tends to be creakier in hiatus, although it has to be pointed out that the exact boundary between the two vowels is often difficult to determine: the sequence resembles a prolonged vowel or diphthong interrupted by periods of creaky voice. In consonantal contexts, creak normally begins either in the final phase of the stressed vowel or in the initial phase of the consonant

<sup>195</sup> These materials, however, were not collected by the same fieldworker, which may explain the difference in notation. On the other hand, the realisation and frequency of glottalisation can vary across speakers of the same dialect.

<sup>196</sup> Cf. Holmer (1938; 1857); Jones (2000; 2006); Iosad (2015).

<sup>197</sup> Scouller (2017). Cf. also Morrison (2019: 422).

– this can also be difficult to determine, especially with sonorants. In sentence-final contexts, a few pulses of creaky voice can occur in the stressed vowel, followed by (almost) complete devoicing.

Gaelic glottalisation appears to be related to voicing, stress, and F0 transitions, and these phenomena have also been found to be mutually related. Glottalisation seems to be associated with strong stress, at least partial voicing, and significant F0 decrease. Voicing is normally present in this context even in stops, for which it is phonologically redundant in Gaelic.<sup>198</sup> Stressed vowels are characterised by high pitch in Gaelic, which explains the more considerable F0 decrease following stronger stress. Glottalisation is much less common in unstressed and weakly stressed tokens, characterised by a much less significant drop in pitch or by rising pitch, which can be explained as the consequence of their position before a more prominent word in the phrase. The regular absence of glottalisation in the context of voiceless fricatives can be explained by the cessation of any vocal fold vibration in these environments.<sup>199</sup> Sentence-final devoicing, however, does not block glottalisation, presumably because it begins only after the onset of creaky voice, followed by a sharp drop in F0 leading to voicelessness.

In other words, the abrupt lowering of F0, typical of the transition from a stressed (and high pitched) short vowel to the following vowel, triggers the onset of creaky voice in voiced contexts. The sudden change can create some tension in the vocal folds and also constriction, which is the cause of creak.<sup>200</sup> The initial period of creak, which involves a few stronger pulses is perceived as glottal stop. An exception to this may be the realisation of weak glottalisation in Islay, where a less significant pitch drop has been recorded. A more detailed analysis is required to reach more accurate conclusions.

In long vowels or diphthongs, however, both the intensity of stress and F0 decrease more evenly and even if some creaky voice is present in the final phase of the vowel, the transition is gradual and does not normally create the impression of glottal stop. Similar transitions seem to occur in svarabhakti groups (see §5.3).

## 7.5. Conclusion

The main conclusion is that glottalisation is related to voicing, pitch, and stress in Gaelic, and could be the consequence of the abrupt F0 decrease characteristic of the transition from a stressed short

---

<sup>198</sup> Cf. Morrison (2019). Unaspirated stops are realised as fairly devoiced segments in Lewis dialects, where glottalisation does not occur, see Nance & Stuart-Smith (2013).

<sup>199</sup> This can be expressed by the [+spread glottis] feature in phonological terms. Cf. Morrison (2019: 423).

<sup>200</sup> Cf. the description of the properties of Gaelic hiatus by Bosch (1998: 12-13) as ‘broken tension’, abrupt changes in pitch, and in stress and loudness.

vowel to an unstressed vowel under strong sentence stress. It normally starts in the final phase of the stressed vowel, typically with only a few glottal pulses, and continues through the following syllable (unless the latter is completely devoiced sentence-finally), which creates the auditory impression of glottal stop. This impression is not created by a more even F0 decrease typical of long vowels, even where creaky voice is present.

Differences in the precise realisation of the glottalised period have been noticed: most often it is creaky phonation, but other phenomena can accompany it or occur instead of it. This has not been studied here in detail. The F0 measurements for the Islay data are interesting (unless coincidental) in that they reveal a much less significant pitch drop with weak glottalisation, which could have implications for the phonological status of glottalisation there (see §8). Some phenomena have not been included in this analysis, such as pitch transitions in svarabhakti sequences (especially in dialects such as Islay, see §8); realisation of hiatus after a long vowel or the epenthetic vowel in Barra; less prominent forms of hiatus in various dialects (which also seem to be the outcome of glottal gestures); realisation of voiced stops in these dialects (which can create the auditory impression of geminates); but these will have to be considered in another study.

## 8. Phonological status of glottalisation in Gaelic

The question whether glottalisation is phonetic (i.e. predictable) in Gaelic or it represents a phonemic (distinctive) feature is fairly complex and cannot be discussed here in detail. What follows, therefore, is only a concise overview of this issue. A few phonetic phenomena which have not been analysed in §7 will be mentioned in this section for the sake of clarity. Gaelic glottalisation has been described by various scholars as a prosodic feature corresponding to certain tonal or pitch phenomena characteristic of various northern dialects.<sup>201</sup> Some of these dialects, for example those spoken in Lewis, distinguish between two accents or tones – accent 1, occurring in originally disyllabic groups that (used to) start with a short vowel, such as *bogha* or *ballag*; and accent 2, characteristic of etymological long vowels and svarabhakti groups, as in *bò* or *balg*.<sup>202</sup> The words in which glottalisation occurs in the southern dialects are characterised by accent 1 in the northern varieties.

Gaelic glottalisation has been described as a suprasegmental feature by E. Ternes<sup>203</sup> and A. Scouller.<sup>204</sup> According to Ternes, it is a hiatus marker in some dialects, but he analyses it as a phonemic feature later on in his book on the Applecross dialect.<sup>205</sup> G. Jones also describes glottalisation as phonemic, adducing examples of minimal pairs from Jura: **fi?ax** (fitheach) vs. **fiax** (fiach); **ma?riç** (mairidh) vs. **maricç** (marbhaidh).<sup>206</sup> According to P. Iosad,<sup>207</sup> glottal stop insertion is a phonological process providing a ‘light’ stressed syllable with a mora, i.e. glottal stop is not a hiatus breaker, but it rather belongs to the coda of the preceding syllable. In my opinion, this is somewhat counter-intuitive since a single intervocalic consonant is usually analysed as part of the following syllable or as ambisyllabic.<sup>208</sup> In his recent article,<sup>209</sup> Iosad adopts a ‘metrical’ approach to Gaelic tonal accent: the domain of accentual contrast is a word-final trochaic foot consisting either of one heavy syllable (=long vowel or diphthong) or of two light syllables (=short vowels).<sup>210</sup> Glottalisation is found in the latter context. D. A. Morrison also analyses Gaelic glottalisation within a metrical approach, describing it as the epenthesis of [+constricted glottis] between two syllables

---

<sup>201</sup> Cf. Ternes (1980; 2006); Jones (2006); Scouller (2017); Iosad (2015; 2021); Morrison (2019).

<sup>202</sup> Ternes (1980: 82-83; 2006: 138); Iosad (2015: 34; 2021: 185-86); Morrison (2019: 392). For a phonetic description, see Ladefoged *et al.* (1998) and Nance (2015).

<sup>203</sup> Ternes (2006: 136-39).

<sup>204</sup> Scouller (2017: 257).

<sup>205</sup> Ternes (2006: 100, 136-39).

<sup>206</sup> Jones (2006: 200-01).

<sup>207</sup> Iosad (2015: 34-38).

<sup>208</sup> The same applies to the syllabification of svarabhakti sequences proposed by Borgstrøm (1940).

<sup>209</sup> Iosad (2021).

<sup>210</sup> Iosad (2021: 194-95).

that form a foot and are not separated by a [+spread glottis] consonant (=voiceless fricatives and preaspirated stops), implying that glottalisation is predictable in Gaelic dialects.<sup>211</sup>

Although obvious correspondences exist between glottalisation in the southern Gaelic dialects and the tonal systems of the northern dialects, the two phenomena differ in some respects.<sup>212</sup> The distribution of the two accents is based entirely on the historical (or perhaps phonological) metrical structure of the context in which they occur (see Table 18). Glottalisation, however, is absent if the two vowels are separated by a voiceless fricative or a heterosyllabic consonant cluster: 55 **haχəʔ'** (thachair); **smuɭ'kaχ** (smuilceach); so such words cannot be grouped together with those like 55 **baʔrən** (barran); whereas they all have accent 1 in the northern dialects. Whilst it is not completely clear whether tonal contrast is possible in polysyllabic words in the northern dialects,<sup>213</sup> glottalised sequences can contrast with long vowels or svarabhakti groups in polysyllables, as evident from the examples in Table 19.

Accent 1	Accent 2
<b>l̥a:</b> (latha) < //La.e//	<b>l̥a:n</b> (làn) < //La:n//
<b>áran</b> (aran) < //ara:n//	<b>b̥a:r</b> (bàrr) < //ba:r://
	<b>àram</b> (arm) < //arm//

**Table 18.**

	V <sup>2</sup> V or V <sup>2</sup> CV	V: or VCV
40	<b>kə'ərə</b> (comhartha)	<b>sɔ:χə</b> (is dòcha <sup>215</sup> )
53	<b>n̥i'ɪðərəχg̊</b> (nigheadaireachd)	<b>mi:rəɭtʃ</b> (mìorbhailt)
55	<b>kə'raɡəŋ</b> (corragan <sup>214</sup> )	<b>dɔ:raχə</b> (dorcha)

**Table 19.**

It has been recognised in earlier works that glottalisation interacts in one way or another with such phenomena as epenthesis or syncope (or its various present-day manifestations).<sup>216</sup> These, however, can differ depending on the dialect – especially if the reduction of voiced fricatives, whose results show great dialectal variation, is considered – so the issue of the phonemic status of glottalisation and the afore-mentioned pitch/tone phenomena should probably be tackled by a separate analysis of individual dialects or groups of similar dialects. Broadly speaking, the glottalising dialects could be divided into at least three main types:

<sup>211</sup> Morrison (2019: 423-24).

<sup>212</sup> Cf. Iosad (2021: 188).

<sup>213</sup> See Iosad (2021: 193-95).

<sup>214</sup> *Medìrean*.

<sup>215</sup> *Dòcha*.

<sup>216</sup> Cf. Ternes (2006), Morrison (2019), Iosad (2021).

- the Barra type dialects, characterised by frequent hiatus glottalisation, tonal oppositions, and the type of svarabhakti in which the epenthetic vowel can be a copy of the stressed vowel;<sup>217</sup>
- the Mull type dialects, in which glottalisation occurs both in hiatus and in consonantal contexts, the epenthetic vowel is a copy of the stressed vowel, and there probably are tonal oppositions;
- the Islay type dialects, in which glottalisation also occurs in consonantal environments, the epenthetic vowel is [ə], and there do not seem to exist any tonal oppositions.

Glottalisation is most probably predictable in the Barra type dialects, where it appears to be a concomitant feature of pitch drop typical of the accent 1 contexts (see §7.4). These contexts can vary in detail depending on the dialect and even across speakers so, for example, glottalisation can occur in consonantal environments in the Castlebay (Barra) dialect, although this does not agree with the *SGDS* records.<sup>218</sup> Glottalisation does not normally occur when pitch drop is less prominent or absent due to sentence stress, which explains its inconsistency in these dialects (see §7.3). If the pipe symbol used by K. H. Jackson in his records from Barra represents creaky voice, its occurrence in hiatus after a long or epenthetic vowel can be explained as the consequence of pitch lowering in the final phase of these vowels (cf. Figure 5). Glottalisation is absent from svarabhakti sequences, where pitch drop commences in the second syllable, i.e. after the intervening consonant.<sup>219</sup> In these dialects, the pitch contours (or tones) can be analysed as either phonemic or phonetic: in the latter case, svarabhakti sequences have to be regarded as the realisations of phonologically monosyllabic structures, e.g. *tarbh* /t<sup>h</sup>arv/ = [t<sup>h</sup>arav]. This, however, is less convincing because although the examples such as 30 **v[ar'a]|əg<sup>h</sup>** (mharbhadh) can be explained by intervocalic voiced fricative deletion (cf. 30 **m[ar'a]y** (marbh)), svarabhakti is synchronically unmotivated in words like 30 **[inw]|əs** (Aonghas), **g'[ɛn'ɛ]|əɣ** (gainmheach).<sup>220</sup> The alternations presented in Table 20 are the result of syncope and can be analysed in terms of the syllabic structure of words – glottalisation occurs only if there is hiatus.<sup>221</sup>

---

<sup>217</sup> For the different types of epenthesis, see Ó Baoill (1980).

<sup>218</sup> This claim is based on a comparison of the *SGDS* data and the realisation in audio recordings of native speakers (see Appendix 3).

<sup>219</sup> See Bosch & de Jong (1997: 5-11).

<sup>220</sup> It could be explained by positing an underlying consonant in such words, which would cause epenthesis. This and other related issues are discussed by Iosad (2021: 190).

<sup>221</sup> Cf. Iosad (2015: 37-38; 2012: 195).

	No syncope	Syncope
89	uʔuʔ (ubhal)	u:ʔyn (ùbhlan)
83	l'ɛ'ur' (leabhar)	l'ɛurix'in (leabhraichean)
84	a'uʔ (abhainn)	ʔüiʔiʔ (aibhnean)
79	ʔoʔor (bodhar)	ʔüir'ʔ (buidhre <sup>222</sup> )

**Table 20.**

A similar interpretation applies to the Mull type dialects, if they are characterised by tonal oppositions corresponding to those in Barra. If the bottom ligature which marks svarabhakti groups in the fieldwork records from pts 82 and 83 indicates a special pitch contour, glottalisation could be analysed as a phonetic feature (optionally) accompanying accent 1.<sup>223</sup> Due to the restrictions in the distribution of glottalisation, however, words such as 82 **iuʔar'** (iuchair) would belong to the same accentual class as 82 **piuʔar'** (piuthar) or **duʔe** (duine). If the pitch patterns are taken to be phonetic, svarabhakti groups would have to be analysed as phonologically monosyllabic (as in Barra), which is less convincing because accent 2 is synchronically unmotivated in words such as 82 **ʔaraʔr'** (arbhar), **gɛʔaʔɣ** (gainmheach).<sup>224</sup>

In the southern dialects and in Tìree, pitch drop appears to start earlier in long vowels and svarabhakti groups. It can be accompanied by creaky voice in its final phase, but this is more widely distributed and does not create the auditory impression of a glottal stop (see §7.3). The pitch patterns differ in words such as *falbh* and *balach*, in that pitch drop is gradual in the former and abrupt in the latter, but this seems to be the consequence of the presence or absence of glottalisation.<sup>225</sup> It is interesting that glottalisation has been recorded in Islay in tokens which involved a less considerable F0 decrease, which may imply that glottalisation does not always depend on pitch there (see §7.4). This may mean that glottalisation is phonemic in these dialects, i.e. that it is not (exclusively) the consequence of the articulatory gestures which lead to pitch drop.

Like the pitch contours in the Barra type dialects, glottalisation can still be analysed as a phonetic phenomenon here if svarabhakti groups are interpreted as underlyingly monosyllabic, since glottalisation is blocked by a syllable-final consonant (see 4.2): 53 **ʔaʔɛʔ** (sealladh) vs. **ʔaʔɛʔ** (sealg) /ʔaʔg/. This would also explain the alternations presented in Table 21. In that case, however, a similar

<sup>222</sup> *Nas buidhre.*

<sup>223</sup> The pitch drop symbol was used frequently to indicate hiatus in the records from pt 81, including hiatus following the epenthetic vowel: ʔüiʔiʔ<sup>1</sup>s (Aonghas). However, glottalisation has not been recorded in any context at this survey point.

<sup>224</sup> This would have to be explained as in Barra (see footnote 220), but including an additional contraction rule.

<sup>225</sup> E. P. Hamp indicated svarabhakti groups by the bottom ligature in his records from Tìree, but see his note quoted in footnote 179. The lack of a clear pitch difference between svarabhakti groups and original disyllables in the southern dialects has been noted by fieldworkers in some of their records (see the same footnote).

problem is encountered as in Mull: the unmotivated lack of glottalisation in words such as 55 **m̩r̩ar** (morair) or 40 **s̩r̩as** (soirbheas); but definitely without a special pitch pattern that would differentiate them from words like 40/55 **a̩r̩aŋ** (aran). Cf. also examples like 84 [ara]̩̊r̩ (arbhar). On the other hand, the alternations as in 46 **u̩ʔal** (ubhal) vs. **u̩:lan** (ùbhlan), can be explained as in the other dialects.

	No syncope	Syncope and epenthesis
31	<b>la̩'v̩ar̩tʃ</b> (labhairt)	<b>la̩:v̩ri</b> (labhraidh)
57	<b>s̩e̩'v̩iŋ̩</b> (samhain)	<b>hev̩iŋə</b> (shamhna)
53	<b>b̩a̩'la̩x</b> (alach)	<b>i̩ va̩la̩x̩a̩y</b> (a bhalchaibh <sup>226</sup> )
54	<b>k̩'e̩'n̩a̩x</b> (ceannach)	<b>ç̩e̩n̩a̩x̩ə̩y</b> (cheannchadh <sup>227</sup> )

**Table 21.**

There are indications, however, that glottalisation indeed is phonetic in the southern dialects. It can occur after shortened (phonologically long) vowels or diphthongs: 40 **g̩o̩'ʔo̩** (gaoithe); 46 **la̩ʔan** (lànhan).<sup>228</sup> Cf. also 53 **g̩a̩'la̩ŋ̩ g̩y̩'ç** (gòbhlan-gaoithe),<sup>229</sup> where the glottalisation triggering context is the result of reduction in unstressed position.<sup>230</sup> It occurs with the reflexes of //hr// and //hn// where these are voiced: 40 **k̩e̩'r̩ar** (ceathrar), cf. 84 **k̩'e̩r̩r̩** (see §4.2.a.δ); and with orthographical *p t c* where they seem to have merged with *b d g* in non-initial position: 39/41 **ta̩'ʔi** (tapaidh) (see §4.2.b). Glottalisation has even been recorded in svarabhakti groups in some examples: 54 **su̩'ri** (suirghe); **k̩ə'ʔa̩l̩** (coingheall).<sup>231</sup> The fact that glottalisation can occur in sandhi in these dialects is perhaps the firmest indication of its phonetic nature: 46 **ha̩ h̩o̩'m̩i** (cha shuidh mi); 57 **xa̩'ʔə̩xa̩'riç** (cha do charaich) (see §4.4). If glottalisation is a phonemic feature, these examples have to be explained either by analogy or as dating from a period in which it was still a phonetic process. Regarding sandhi, the monosyllables capable of forming contexts that trigger glottalisation would be classed as inherently glottalised, but this property would normally be realised only when a suitable context arises. The difference between examples such as 84 **s̩ā:u̩x** (sàmhach) vs. **m̩ā:'i̩z** (màthair) might depend on the quality of the neighbouring vowels (see §4.1.b.β).

<sup>226</sup> *A fhearraibh.*

<sup>227</sup> *Cheannachadh* in the standard orthography.

<sup>228</sup> The latter example has also been recorded at pts 66, 67, 70-72, and 82-84.

<sup>229</sup> This has also been attested at pts 40, 55, 57, and 82.

<sup>230</sup> 39 **nas riʔnə** (nas rìghne) probably represents a realisation of the unsyncoated form *nas rìghinne*.

<sup>231</sup> The former example has also been recorded at pts 44, 53, 55, and 57.



## 9. The origin of Gaelic glottalisation

The historical origin of glottalisation in Gaelic is another complex topic which cannot be discussed here in detail. According to certain theories, non-initial unlenited consonants were geminated in Old Gaelic and glottalisation evolved before them as they were shortened, e.g. Old Gaelic *becca* //beg:a// > **be<sup>g</sup>gə**.<sup>232</sup> Interestingly, in his 1938 monograph on Argyll Gaelic, Holmer described orthographical *p t c* and *m* as geminates in the contexts in which glottalisation is usually found: **pət:ax** (bodach), **khom:ə** (coma).<sup>233</sup> Although it is unclear whether this reflects Holmer's perception of glottalisation or it represents one of the possible realisations of these consonants, impressionistically, unaspirated stops following a fully stressed short vowel do appear to be longer than after a long or unstressed vowel in some Gaelic dialects, and to involve some 'glottal tension' in their closure phase.<sup>234</sup> This, however, requires further research. In any case, even if Old Gaelic unlenited consonants were indeed geminates and that played a role in the development of glottalisation, it cannot have been its only source – glottalisation normally also occurs with lenited consonants, which are unlikely to have been geminates in Old Gaelic. According to Ó Maolalaigh,<sup>235</sup> glottalisation may first have evolved as a 'marker of short syllables', predating the rise of epenthesis, which would explain its absence in svarabhakti groups. This would mean that it could be an old and once much more widespread feature of Gaelic.

On the other hand, as demonstrated in §7.3, glottalisation is most consistent in fully stressed words involving an abrupt drop in pitch, which often results in creaky phonation in the following syllable. The combination of the sudden change in frequency and the onset of creak is perceived as glottal stop. If this happens before or during the articulation of a consonant, the glottal pulse occurring in the final phase of the stressed vowel or in the consonant is perceived as glottal stop or a form of laryngeal tension. Pitch drop following stressed short vowels is well-documented in the *SGDS* records from certain survey points, presumably where it was particularly prominent: 40 **fi<sup>l</sup>ix** (fitheach<sup>236</sup>); 68 **.ri<sup>l</sup>i<sup>l</sup>ɛŋ** (ri Iain); and especially in those from pt 81: **l'e<sup>l</sup>is** (leigheas); **a<sup>l</sup>ɔŋ** (abhainn); **g'u<sup>l</sup>əs** (giuthas); where E. Hamp noted possible glottalisation in the second syllable of a few words, such as **l'i<sup>l</sup>ɔy**

---

<sup>232</sup> Cf. a similar explanation of Gaelic preaspiration in Ó Baoill (1980).

<sup>233</sup> Holmer (1938: 68-70).

<sup>234</sup> Laryngeal tension as part of the realisation of geminates has been reported, for example, for Japanese. See Kawahara (2015: 68).

<sup>235</sup> Ó Maolalaigh (2014).

<sup>236</sup> Page 8 of the questionnaire, next to the word *fiù*.

(leaghadh), presumably indicating creaky voice caused by a drop in F0 to a lower level.<sup>237</sup> Cf. also 83 **k̠ʰ** **ɛx** (coimheach), where glottalisation was strong enough to create the impression of glottal stop. When pitch drop is gradual, as in long vowels or svarabhakti groups, glottalisation that may occur in their final phase is not perceived as glottal stop except sometimes in hiatus, especially (it seems) if the surrounding vowels differ in quality (see §4.1.b.β). Glottalisation is blocked by voiceless segments, since the [+spread glottis] feature which characterises them in Gaelic is incompatible with glottal constriction (see §4.1).

The tonal opposition found in the northern dialects arose by contraction of hiatus groups and by epenthesis, whereby the difference between the pitch contours typical of earlier long vowels and disyllabic groups became contrastive.<sup>238</sup> In the southern dialects, glottalisation was a concomitant feature of the pitch contour corresponding to accent 1 in the north, so hiatus sequences have not been contracted. It could have developed before or after epenthesis, as long as there still existed a difference in pitch contour. Due to the presence of glottalisation, however, the relevance of the pitch opposition may have diminished, as seems to have happened in Islay, and this opposition may even have become redundant in these dialects, resulting in the phonemicity of glottalisation. This, however, requires further research.

---

<sup>237</sup> Cf. the note on page 21 (pt 81): **ɾ̠ʰiʰift̠ʰ** (a-rithis) ‘slight ? on 2<sup>nd</sup> i. 2 sylls.’; page 24: **f̠iuʰiʰj̠** (feadhainn) ‘i slightly ?’; **l̠ʰiʰoʰy** (leaghadh) ‘or perhaps l̠ʰiʰuʰiʰy (2 sylls)’.

<sup>238</sup> Ternes (2006: 132-33). It is unclear whether this development was influenced in any way by a medieval Scandinavian dialect. See Iosad (2015: 48-50).

## Conclusion

Glottalisation is present in the dialects spoken in the islands south of Eriskay and Skye, and in the mainland dialects south of Loch Ailort and Loch Eil, especially along the western seaboard.

The pipe symbol indicating hiatus in the published *SGDS* lists probably represents glottalisation in the materials from Barra, and pitch drop in various mainland dialects. This reflects the difference in its use by different fieldworkers.

The most widespread phonological context in which glottalisation is realised is hiatus following a stressed short vowel. In Tiree, Coll, parts of Mull, and the areas south and east of that, it also occurs if a phonetically voiced consonant or tautosyllabic consonant cluster intervenes, but not before the epenthetic vowel. Glottalisation can be realised across word boundaries. Another context is hiatus following a stressed long vowel or the epenthetic vowel, where glottalisation has been recorded in a few dialects. In some southern dialects, glottalisation has also been recorded in the context of historical aspirated stops, which appear to have merged with unaspirated stops there.

The *SGDS* records reveal seemingly dialectal differences in the frequency of glottalisation in one or more contexts, but these may in fact reflect differences between individual speakers.

Phonetically, glottalisation is most commonly realised in Gaelic as creaky phonation which begins in the final phase of the stressed vowel or in the initial phase of the consonant, and continues throughout the following vowel, unless the latter is devoiced sentence-finally. It appears to be the consequence of strong stress, accompanied by abrupt pitch drop characteristic of this phonetic environment. It only occurs in voiced contexts. The absence of perceived glottalisation in long vowels or in svarabhakti groups can be explained by the gradual decrease of F<sub>0</sub> in these contexts.

The phonological status of glottalisation may differ in various dialects. It appears to be predictable in most dialects where a difference exists between the pitch contours of (1) long vowels and svarabhakti groups and (2) original disyllabic sequences, including hiatus. This opposition does not seem to exist in the southern dialects, such as those of Islay, where glottalisation may have become a distinctive feature. This, however, requires further phonetic research.

The historical origin of glottalisation in Gaelic can be explained by its present-day phonetic causes. It evolved as a concomitant feature of abrupt F<sub>0</sub> decrease and might have become phonemic in some dialects due to the possible loss of the pitch opposition between the original disyllabic sequences and svarabhakti groups. In case this opposition has never existed in such dialects, it has to be assumed that glottalisation evolved there before epenthesis.

## Bibliography

- Boersma, P. & Weenink, D. 2020. Praat: Doing phonetics by computer [computer program]. Version 6.1.23.
- Borgstrøm, C. Hj. 1937. 'The Gaelic of Barra in the Outer Hebrides', *Norsk Tidsskrift for Sprogvidenskap* 7, 71-242.
- Borgstrøm, C. Hj. 1940. *The Dialects of the Outer Hebrides* (Oslo).
- Borgstrøm, C. Hj. 1941. *The Dialects of Skye and Ross-shire* (Oslo).
- Bosch, A. 1998. 'The Syllable in Scottish Gaelic Dialect Studies', *Scottish Gaelic Studies* 18, 1-22.
- Bosch, A. & de Jong, K. 1997. 'The prosody of Barra Gaelic epenthetic vowels', *Studies in the Linguistic Sciences* 27/1, 1-15.
- Davidson, L. 2018. 'Phonation and laryngeal specification in American English voiceless obstruents', *Journal of International Phonetic Association* 48/3, 331-56.
- Davidson, L. 2011. 'Characteristics of stop releases in American English spontaneous speech', *Speech Communication* 53/8, 1042-58.
- Davidson, L. 2020. 'The versatility of creaky phonation: Segmental, prosodic, and sociolinguistic uses in the world's languages', *WIREs Cognitive Science*, e1547.
- Dilworth, A. 1972. *Mainland Dialects of Scottish Gaelic* (Fort Augustus).
- Docherty, G. J. & Foulkes, P. 1995. 'Acoustic profiling of glottal and glottalised variants of English stops', in *Proceedings of the XIIIth ICPhS* 1, ed. by K. Elenius & P. Branderud (Stockholm), 350-53.
- Docherty, G. J. & Foulkes, P. 1999. 'Sociophonetic variation in "glottals" in Newcastle English', in *Proceedings of the 14<sup>th</sup> International Congress of Phonetic Sciences*, ed. by J. J. Ohala (Berkeley), 1037-40.
- Docherty, G. J. & Foulkes, P. 2005. 'Glottal Variants of /t/ in the Tyneside Variety of English', in *A Figure of Speech*, ed. by W. J. Hardcastle & J. Mackenzie Beck (New York), 173-200.
- Dorian, N. C. 1978. *East Sutherland Gaelic* (Dublin).
- eDIL = *An Electronic Dictionary of the Irish Language*, based on the Contributions to a Dictionary of the Irish Language (Dublin: Royal Irish Academy, 1913-1976) (www.dil.ie 2019).

- Eska, J. F. 2018. 'Laryngeal Realism and the prehistory of Celtic', *Transactions of the Philological Society* 116, 320-31.
- Eska, J. F. 2019. 'Laryngeal Realism and early Insular Celtic orthography', *North American Journal of Celtic Studies* 3/1, 1-17.
- Fischer-Jørgensen, E. 1989. 'Phonetic Analysis of the Stød in Standard Danish', *Phonetica* 46: 1-59.
- Gordeeva, O. B. & Scobbie, J. M. 2011. 'Laryngeal Variation in the Scottish English Voice Contrast: Glottalisation, Ejectivisation and Aspiration', *CASL Research Centre Working Paper WP 19*.
- Gordeeva, O. B. & Scobbie, J. M. 2013. 'A phonetically versatile contrast: Pulmonic and glottalic voicelessness in Scottish English obstruents and voice quality', *Journal of the International Phonetic Association* 43/3, 249-71.
- Grann, S. 1985. 'Some Distinguishing Features of the Gaelic of Islay', *Scottish Language* 4, 19-31.
- Grann, S. 2000. *The Gaelic of Islay: A Comparative Study* (Aberdeen).
- Grønnum, N. & Basbøll, H. 2001. 'Consonant Length, Stød and Morae in Standard Danish', *Phonetica* 58, 230-53.
- Grønnum, N., Vazquez-Larruscaín, M. & Basbøll, H. 2013. 'Danish Stød: Laryngealization or Tone', *Phonetica* 70, 66-92.
- Holmer, N. M. 1938. *Studies on Argyllshire Gaelic* (Uppsala & Leipzig).
- Holmer, N. M. 1957. *The Gaelic of Arran* (Dublin).
- Holmer, N. M. 1962. *The Gaelic of Kintyre* (Dublin).
- Iosad, P. 2015. "'Pitch accent" and prosodic structure in Scottish Gaelic: Reassessing the role of contact', in *New trends in Nordic and general linguistics*, ed. by M. Hilpert, J. O. Östman, C. Mertzluff, M. Rießler & J. Duke (Berlin), 28-54.
- Iosad, P. 2016. 'Prosodic structure and suprasegmental features: Short-vowel stød in Danish', *Journal of Comparative Germanic Linguistics* 19/3, 221-68.
- Iosad, P. 2021. 'The phonology of Gaelic tonal accent', in *Cànan & cultar / Language & culture, Rannsachadh na Gàidhlig* 10, ed. by W. McLeod, A. Gunderloch & R. Dunbar (Aberdeen), 185-203.

- Jones, G. 2000. 'Beagan mu'n stad ghlotasach ann an Gàidhlig ceann a deas Earraghàidheil', *Scottish Language Studies* 20, 201-11.
- Jones, G. 2006. 'Cunntas air an Stad Ghlotasach ann an Gàidhlig Ceann a Deas Earra Ghàidheal', in *Cànan & Cultar / Language & Culture, Rannsachadh na Gàidhlig* 3, ed. by W. McLeod, J. E. Fraser & A. Gunderloch (Edinburgh), 193-202.
- Kawahara, S. 2015. 'The phonetics of sokuon, or geminate obstruents', in *Handbook of Japanese Phonetics and Phonology*, ed. by H. Kubozono (Boston), 43-78.
- Keating, P., Garellek, M. & Kreiman, J. 2015. 'Acoustic properties of different kinds of creaky voice', in *Proceedings of the 18<sup>th</sup> International Congress of Phonetic Sciences*, ed. by The Scottish Consortium for ICPhS 2015 (Glasgow).
- Ladefoged, P., Ladefoged, J., Turk, A., Hind, K. & Skilton, St. J. 1998. 'Phonetic Structures of Scottish Gaelic', *Journal of the International Phonetic Association* 28, 1-41.
- LASID = Wagner, H. & Ó Baoill, C. 1969. *Linguistic Atlas and Survey of Irish Dialects* (Dublin).
- Laver, J. 1994. *Principles of phonetics* (Cambridge).
- Macaulay, R. K. S. 1977. *Language, Social Class and Education: A Glasgow Study* (Edinburgh).
- McCarthy, O. & Stuart-Smith, J. 2013. 'Ejectives in Scottish English: A social perspective', *Journal of the International Phonetic Association* 43/3, 273-98.
- Milroy, J., Milroy, L., Hartley, S. & Walshaw, D. 1994. 'Glottal stops and Tyneside glottalisation: Competing patterns of variation and change in British English', *Language Variation and Change* 6, 327-57.
- Morrison, D. A. 2019. 'Metrical structure in Scottish Gaelic: tonal accent, glottalisation and overlength', *Phonology* 36/3, 391-432.
- Nance, C. 2015. 'Intonational variation and change in Scottish Gaelic', *Lingua* 160, 1-19.
- Nance, C. & Stuart-Smith, J. 2013. 'Pre-aspiration and post-aspiration in Scottish Gaelic stop consonants', *Journal of the International Phonetic Association* 43/2, 129-52.
- Ó Baoill, D. P. 1980. 'Preaspiration, Epenthesis and Vowel Lengthening – Interrelated and of similar origin?', *Celtica* 13, 79-108.
- Oftedal, M. 1956. *The Gaelic of Leurbost, Isle of Lewis* (Oslo).
- Ó Maolalaigh, R. 2003. 'Processes in Nasalization and Related Issues', *Ériu* 53, 109-32.

- Ó Maolalaigh, R. 2006. ‘Coibhneas idir consan (*dh / gh*) agus guta i stair na Gaeilge’, in *Aistí ar an Nua-Ghaeilge in ómós do Bhreandán Ó Buachalla*, ed. by A. Doyle & S. Ní Laoire (Baile Átha Cliath), 41-78.
- Ó Maolalaigh, R. 2010. ‘The Sound of Silence: Some Structural Observations on Preaspiration in Scottish Gaelic’, in *Bile ós Chrannaibh: A Festschrift for William Gillies*, ed. by W. McLeod, A. Burnyeat, D. U. Stiùbhart, T. O. Clancy & R. Ó Maolalaigh (Ceann Drochaid), 365-404.
- Ó Maolalaigh, R. 2014. ‘Glottal and related features in the Gaelic languages’, *8<sup>th</sup> Celtic Linguistic Conference*, University of Edinburgh, 6-7 June 2014 (lecture notes).
- Ó Murchú, M. 1985. ‘Varia viii: Devoicing and Preaspiration in Varieties of Scots Gaelic’, *Ériu* 36, 195-98.
- Penney, J., Cox, F. & Szakay, A. 2020. ‘Glottalisation, coda voicing, and phrase position in Australian English’, *The Journal of the Acoustical Society of America* 148/5, 3232-45.
- Roach, P. J. 1973. ‘Glottalisation of English /p/, /t/, /k/ and /tʃ/ – a re-examination’, *Journal of the International Phonetic Association* 3, 10-21.
- Scouller, A. MacNeill. 2017. *The Gaelic dialect of Colonsay*, Doctoral thesis, University of Edinburgh.
- Seyfarth, S. & Garellek, M. 2020. ‘Physical and phonological causes of coda /t/ glottalisation in the mainstream American English of central Ohio’, *Laboratory Phonology: Journal of the Association for Laboratory Phonology* 11/1, 1-33.
- SGDS I-V = Ó Dochartaigh, C. 1994-1997. *Survey of the Gaelic Dialects of Scotland, Vol. 1-5* (Dublin).
- Shuken, C. R. 1979. ‘Aspiration in Scottish Gaelic stop consonants’, in *Current Issues in the Phonetic Sciences*, ed. by H. Hollien & P. Hollien (Amsterdam), 451-58.
- Shuken, C. R. 1980. *An instrumental investigation of some Scottish Gaelic consonants*, Doctoral thesis, University of Edinburgh.
- Stuart-Smith, J. 1999a. ‘Glottals Past and Present: A Study of T-glottalling in Glaswegian’, *Leeds Studies in English* 30, 181-204.
- Stuart-Smith, J. 1999b. ‘Glasgow: Accent and voice quality’, in *Urban voices: Accent studies in the British Isles*, ed. by P. Foulkes & G. Docherty (London), 203-22.

- Ternes, E. 1980. 'Scottish Gaelic phonemics viewed in a typological perspective', *Lingua* 52, 73-88.
- Ternes, E. 2006. *The Phonemic Analysis of Scottish Gaelic: Based on the Dialect of Applecross, Ross-shire* (Dublin).
- Watson, S. 1996. 'Hiatus-filling /h/ in Irish and Scottish Gaelic dialects', *Scottish Gaelic Studies* 17, 376-82.
- Wells, J. C. 1982. *Accents of English 1-3* (Cambridge).
- Wentworth, R. G. 2005. *Rannsachadh air Fòn-eòlas Dualchainnt Ghàidhlig Gheàrrloch, Siorrachd Rois* (Dublin). <<https://www.dias.ie/wp-content/uploads/2011/04/gearrloch.pdf>>



## Appendix 1: Modifications to the symbolisation used in the *SGDS* materials and other sources

- the voiced velar fricative symbol **ʒ** has been replaced by **ɣ**;
- the central high vowel symbol **ɰ** has been replaced by **u**;
- most superposed and all postposed shift signs used with vowels (e.g. **á** or **a·**) have been replaced with their subscript equivalents (**a<sub>̣</sub>**, **ạ**);
- in diphthongs, nasality is indicated separately above each symbol (e.g. **ãũ**) instead of a single tilde extending over both symbols;
- subscript wedge (**◌̘**) indicating devoicing has been replaced by a subscript ring (**◌̣**); or by a superposed ring with **g ŋ ɲ**;
- various palatalisation symbols have been replaced by a prime (**'**);
- various aspiration symbols have been replaced by superscript **h**;
- bottom ligature indicating diphthongs and svarabhakti groups has been replaced by subscript brackets (e.g. **[au]**, **[ana]**);
- the pitch drop symbol (**◌̚**) has been replaced by a superscript downwards arrow (**◌̩**);
- syllabicity is indicated by an understroke (**◌̣**) instead of a subscript ring;
- superscript glottal stop has been replaced by a superscript apostrophe (e.g. **ṛ'**);
- the hyphen (-) has been replaced by the pipe (|) and vice versa in part of Anthony Dilworth's materials, except in §3.

**Appendix 2: Primary sources – SGDS fieldwork notes and fair copies<sup>239</sup>**

Survey point	Informant	Place of residence (and upbringing)	Place of upbringing
14	Angus MacDonald	Old Kilpatrick, Dunbartonshire	St Kilda
15	Donald MacQueen	Clydebank	St Kilda
16	Lachlan MacDonald	Fort William	St Kilda
<b>19</b>	Lachlan MacDonald	Sollas, North Uist	
<b>23</b>	Miss Christine MacKay	West Gerinish, South Uist	
<b>27</b>	Michael Mackinnon	Eoligarry, Barra	Bruernish
<b>28</b>	Niall Gillies & Miss Mary Gillies	Garrygall, Castlebay, Barra	
<b>29</b>	Niall Sinclair	Leideag, Castlebay, Barra	
<b>30</b>	Miss Annie Johnson	The Glen, Castlebay, Barra	
31	John McBride	Shannochie Farm, Arran	
32	John Robertson,	Haycocks, Kilpatrick, Arran	
33	Willie Currie	Laggmore, Machrie, Arran	
34	John MacLeod	Brodick, Arran	Pirnmill
35	Mrs Sillars (née Kerr)	Daisybank, Shiskine, Arran	Catacol
35*	Callum Robertson	North Newton, Arran	
36	Neil MacDougall	Carradale, Kintyre	
37 <sup>240</sup>	Neil MacDougall	Carradale, Kintyre	
38	John Taylor	Muasdale, Kintyre	Crubisdale
38*	Geo. Thomson	Muasdale, Kintyre	
39	Dugald McFater,	Campbeltown, Kintyre	Killean/Kilmory
40	Peter MacCallum & Marian MacCallum	Ardminish, Gigha	
41	Miss Sarah McPhail & Miss Catherine McPhail	Achavallaich, Clachan, Kintyre	Portachoillan
42	John Campbell	Tarbert, Kintyre	
43	Sandy MacArthur	Achachoish, Knapdale, Mid-Argyll	Balure
44	Neil MacArthur,	South Knapdale, Mid-Argyll	Drumdrishaig
45	Mrs Mary Buchan Simpson	Glendaruel, Cowal	Duiletter
45*	John Black	Tighnabruaich, Cowal	Kilfinan
46	Miss Harriet Crawford	Stuckreoch, Strathlachlan, Cowal	
47	Donald Munro	Furnace, West Loch Fyne, Mid-Argyll	Auchindrain
48	Donald Turner & Mrs Isabella Turner	Minard, West Loch Fyne, Mid-Argyll	
49	Duncan Campbell	Kilmartin, Mid-Argyll	Duntroon/Crinan
50	James MacKellar	Tayvallich, North Knapdale, Mid-Argyll	Arinafad Beg
51	Donald MacKechnie	Inverlussa, Jura	
Lu*	Peter MacDougall	Toberonochy, Luing	
52	Malcolm MacArthur	Craighouse, Jura	Ardfarnal
52*	Ann Buie	Craighouse, Jura	Oban/Craighouse
52**	Donald MacDougall	Craighouse, Jura	
53	Esther MacDougall	Port Askaig, Islay	Heather Houses
53*	Donald MacDougall	Port Askaig, Islay	Caol Ila
54	Duncan Heads	Port Ellen, Islay	
55	Alexander MacKinnon	Bowmore, Islay	
<b>56</b>	Alastair Ferguson	Cultroon, Rhinns, Islay	Carn Tormisdale
57	Miss Annabella MacNeill	Tigh na Mara, Colonsay	Lower Kilchattan
58	Mrs Margaret MacCallum	Craignish, Mid-Argyll	Loch Beag
59	William Dewar	Ellanbeich, Easdale	
60	Duncan MacIntyre	Kilmore, Oban, South Lorn	
61	Duncan Macdougall	Culrioch, Kilchrenan, South Lorn	Portsonachan
62	Mrs Margaret Whyte	Inverlochy, Dalmally, South Lorn	
63	Ian Black	Stronmilchan, Dalmally, South Lorn	

<sup>239</sup> The numbers written in bold refer to the survey points for which the original fieldwork materials were unavailable (§0.1). The asterisk indicates the survey points at which the unpublished materials have been collected (§0.2).

<sup>240</sup> The same informant was interviewed at pts 36 and 37 by different fieldworkers (see *SGDS I*, 85).

64	Mrs MacLarty	Ichrachan, Taynuilt, South Lorn	
65	Miss Catriona Campbell	Achadacallen, Taynuilt, South Lorn	Taynuilt
66	Miss Lizzie Campbell	Black Crofts, Loch Etive, Benderloch	
67	Miss MacLucas	Kiel, Benderloch	
68	Duncan Black	Achnacroish, Lismore	Achanuaran Farm
69	Sam MacColl	Port Appin, Appin	
70	Mrs. R. MacColl	Portnacrois, Appin	
71	Robert MacDonald	Tigh Phuirt, Glencoe, Appin	
72	John MacDonald	Ballachulish, Appin	
73	Ewan MacDonald	Moy, Laggan, Upper Badenoch	
74	Donald MacDonald	Bohuntin, Roybridge, Lochaber	
74*	Archie MacInnes	Achluachrach, Roybridge, Lochaber	Morar
75	John MacDonald	High Bridge, Spean Bridge, Lochaber	
76	Davis Cameron	Muirshearlich, Banavie, Lochaber	
77	Mr John Stewart	Kinlocheil, Lochaber	
78	Miss Kate Boyd	Garvan, Locheilside, Ardgour	
79	Donald MacPherson	Strontian, Sunart and Ardnamurchan	
80	Mrs Dolly MacDonald	Lochaline, Morvern	
81	Dugald MacArthur	Rowantree, Achnacraig, Mull	Ardachoir
82	Miss Jean Gibson	Knockan, Bunessan, Mull	
82*	Calum MacDonald	Uisken, Bunessan, Mull	
82**	Calum Maclean	Achnacraig, Mull	Carsaig
83	Mrs Mary MacColl	Torloisk, Mull	Burg Farm
83*	Archibald MacFadyen	Gribun, Mull	
84	Lachlan Macdonald	Balemartine, Tiree	
85	John Mackinnon	Arinagour, Coll	Sorisdale/Oban
85*	John MacFadyen	Arinagour, Coll	
86	Mrs Mary Mason	Achnacriche, Bunavullin, Morvern	
87	Donald Campbell	Glenborrodale, Sunart and Ardnamurchan	
88	Mrs Mary MacDonald	Kilchoan, Sunart and Ardnamurchan	
89	Ailean Cameron	Kentra, Acharacle, Sunart and Ardnamurchan	
90*	Cap. Angus MacDonald	Kinlochmoidart	Langall
91	Peter MacQueen	Ardmore, Arisaig	Borrodale
92	Donald MacDonald	Bunacaimb, Arisaig	
93	Mr. Angus MacDonald	Morar Village, Morar	
94	D. Ferguson	Kildonan, Eigg	
94*	Hugh Mackinnon	Muck	
95	Mrs MacLean	Canna	
95*	John MacLeod	Sanday, Canna	
96	Roddie MacRae	Kingie, Glenquoich, Knoydart	Kinloch Hourn
97	John Sinclair	Arnisdale, Knoydart	
98	John Chisholm	Galltair, Glenelg	
99	Duncan MacRae	Leacachan, Letterfearn, Glenshiel	
100	John MacRae	Ault a' Chruinn, Glenshiel	
101	Alec Fraser	Inverinate, Kintail	
102	Alec MacKenzie	Carn Du, Dornie, Kintail	
103	Miss Gordon	Duirinish, Lochalsh	
116	Duncan MacKay	Lochcarron, Wester Ross	
167	Miss Jessie Gray	Invermoriston, NW Inverness-shire	Achnaconeran
167*	Miss MacDonald	Invermoriston, NW Inverness-shire	
168	Peter Fraser	Culnacarn, Glenmoriston	Dalcreichart
169	Mrs Catherine Frazer	Inverfarigaig, NE Inverness-shire	Trinloist
170	Thomas Frazer	Bailebeg, NE Inverness-shire	Trinloist
171	Mrs. MacDonald	Fort Augustus, NW Inverness-shire	
172	Mrs. Jessie Macaskill	Easter Mandally, Invergarry, NW Inverness-shire	
188	Mrs Bella Millin	Laggan Bridge, Upper Badenoch	Drumgask

**Appendix 3:** Primary sources – audio recordings obtained from the School of Scottish Studies  
Sound Archives (published on *Tobar an Dualchais*: [www.tobarandualchais.co.uk](http://www.tobarandualchais.co.uk))

ID number	Contributor	Area	Title	Fieldworker
1963 SA1953.074	Archie Cameron (1873) 468	Inversanda, Ardgour, Argyllshire	Naidheachd air feadhainn a ghoid mart	Calum Iain Maclean
2467 SA1954.056	Donald MacEachen 4410	Back of Keppoch, Arisaig & Moidart, Inverness-shire	Naidheachd bho na mairbh.	Calum Iain Maclean
2845 SA1955.160	Murdo John Maclean 235	Achiltibuie, Lochbroom, Ross & Cromarty	Clann Mhurchaidh Riabhaich...	Calum Iain Maclean
3797 SA1953.010.B1	Lachlan MacLeod (1881-1973) 30	Bruernish, Barra, Barra, Inverness- shire	An gobha a chaidh a dhiùltadh aig doras Nèimh agus doras ifrinn.	Calum Iain Maclean
5320 SA1953.134.A12	Dugald Smith 239	Ballygrant, Islay, Killarrow & Kilmenny, Argyllshire	Cleas aig mèirlich air fear nach reiceadh feur nuair a bha...	Calum Iain Maclean
5900 SA1953.077.B3	Duncan Campbell 1228	Easdale, Kilbrandon & Kilchatton, Argyllshire	Rud os-nàdarra a thachair dhan fhiosraiche.	Calum Iain Maclean
19801 SA1962.006	Kate Gillies (1891- 1979) 3135	Caolis, Vatersay, Barra	An teaghlach à Pabaigh a fhuair gibht na mnatha- glùine.	Elizabeth Sinclair
21266 SA1964.077	Nan MacKinnon (1903-1982) 1864	Vatersay, Barra, Inverness-shire	Bean-sìthe a’ bruidhinn ri fear a bha a’ buain muraìn.	Anne Ross
21370 SA1964.077	Nan MacKinnon (1903-1982) 1864	Vatersay, Barra, Inverness-shire	Fear a chunnaic sithichean air an oidhche.	Anne Ross
28715 SA1954.052	William MacDonald (1880- 1959) 4286	Arisaig, Arisaig & Moidart, Inverness- shire	Mac na Banntraich, an caman, is na fuamhairean.	Calum Iain Maclean
29906 SA1954.038	Donald MacEachen 4410	Back of Keppoch, Arisaig & Moidart, Inverness-shire	’S Fhada Bhuam Fhìn Bonn Beinn Eadarra.	Calum Iain Maclean
31765 SA1958.002.6	Donald Sinclair (1885-1975) 829	West Hynish, Tiree, Tiree, Argyllshire	Oisean an dèidh na Fèinne: mar a dh’fhalbh Oisean, am fear...	Hamish Henderson
34417 SA1959.059	Duncan Macintyre (1891-1966) 4887	Kilmore, Kilmore & Kilbride, Argyllshire	Naidheachd mun dà-shealladh.	Calum Iain Maclean
36100 SA1959.092	Duncan Macintyre (1891-1966) 4887	Kilmore, Kilmore & Kilbride, Argyllshire	Ulaidh a dh’adhbharaich murt mic.	Calum Iain Maclean
36102 SA1958.092	Duncan Macintyre (1891-1966) 4887	Kilmore, Kilmore & Kilbride, Argyllshire	Ainm-aite: Carn Ailpein.	Calum Iain Maclean
36132 SA1958.094	Angus Cameron 5004	Newton, Ardnamurchan, Argyllshire	Am balach a chroch robair.	Calum Iain Maclean

37245 SA1963.025	Alasdair Cameron 4165	Strontian, Ardnamurchan, Argyllshire	Sgeulachd mu dheidhinn Shomhairle Mhòir a' sabaid an aghaidh...	Dr John MacInnes
37248 SA1963.025	Alasdair Cameron 4165	Strontian, Ardnamurchan, Argyllshire	Donnchadh Bàn agus a mhiann adharc gobhar fhaighinn airson...	Dr John MacInnes
39703 SA1958.085	Christina Bell (1892-1974) 5330	Taynuilt, Ardchattan & Muckairn, Argyllshire	Chuidich MacCaluim croitear sa chùirt agus bha suipeir mhòr...	Calum Iain Maclean
39707 SA1958.085	Sandy Livingstone (1886-1961) 5002	Glencoe, Lismore & Appin, Argyllshire	Fiosrachadh mun Bheothachan Mholach, sinnsear an fhiosraiche...	Calum Iain Maclean
39710 SA1958.085	Hugh MacKenzie 5008	Benderloch, Ardchattan & Muckairn, Argyllshire	Shàbhail Caimbeulach Loch nan Eala an seirbheiseach aige...	Calum Iain Maclean
42204 SA1974.100	Mrs Mary MacKinnon 7161	Castlebay, Barra, Barra, Inverness- shire	An Codaidh agus am bodach Èirisgeach.	Mary MacDonald Dr Emily Lyle
42205 SA1974.100	Mrs Mary MacKinnon 7161	Castlebay, Barra, Barra, Inverness- shire	An Codaidh ag iarraidh iasg air an iasgair Èirisgeach.	Mary MacDonald Dr Emily Lyle
42206 SA1974.100	Mrs Mary MacKinnon 7161	Castlebay, Barra, Barra, Inverness- shire	An Codaidh agus an Sgoilear Bàn.	Mary MacDonald Dr Emily Lyle
43322 SA1965.128	John Robertson (1871) 5654	Shiskine, Arran, Kilmory, Bute & Arran	Boireannach anns an sgìre aig an robh an droch-shùil.	Dr John MacInnes
44227 SA1964.006	Hugh MacKinnon (?-1972) 5679	Cleadale, Eigg, Small Isles, Inverness-shire	Mar a fhuair a' Ghobhar Ghlas a minn air ais nuair a dh'ith...	Donald Archie MacDonald
45450 SA1965.123	Duncan Ferguson (?-1981) 5736	Sandavore, Eigg, Small Isles, Inverness-shire	Beachdan ionadail air mort Eige.	Donald Archie MacDonald
46208 SA1974.114	John Campbell 5658	Bunessan, Mull, Kilfinichen & Kilvickeon, Argyllshire	Naidheachd mu theaghlach a chuireadh as an taigh leis an...	Eric R. Cregeen Rev. Donald W. MacKenzie
48365 SA1972.076	Sandy MacPhee (1892-1973) 5914	Inverie, Glenelg, Inverness-shire	Fiosrachadh mu shabaid aig tiodhlacaidhean.	Alan J. Bruford Donald Archie MacDonald
48864 SA1969.174	Charles Cameron (1896-1970) 5946	Spean Bridge, Kilmonivaig, Inverness-shire	Grunn naidheachdan ceangailte ri Alasdair Bàn a' Bhòcain	Dr. John MacInnes
55358 SA1970.361	Sandy Campbell (1895-1971) 5938	Knapdale, North Knapdale, Argyllshire	Sgeulachd mu chreach.	Donald Archie MacDonald Eric R. Cregeen
56642 SA1972.077	Alexander MacDougall (1905- 1988) 6469	Morar, Glenelg, Inverness-shire	Fear a' dannsadh ann an sìthean fad bliadhna.	Donald Archie MacDonald Alan J. Bruford

58141 SA1954.136	Donald Kennedy 6552	Eilean Shona, Arisaig & Moidart, Argyllshire	Na Caimbeulaich 's Clann Iain ann an Àird nam Murchan.	Calum Iain Maclean
66215 SA1980.028	Kenneth Chisholm 6915	Letterfearn, Glenshiel, Ross & Cromarty	Donnchadh Mòr: an duine làidir.	Donald Archie MacDonald Ian Fraser Alan J. Bruford
69898 SA1972.013	Duncan Matheson (1929-2010) 1851	Camusluinie, Kintail, Ross & Cromarty	Mar a fhuair an Naomh Faolan comas leighis.	Donald Archie MacDonald Ian Fraser
101027 SA1971.022	John Shaw (1909) 4153 Norman MacDonald (1912- 1988) 6061	Craighouse, Jura, Argyllshire Ardfin, Jura, Argyllshire	Naidheachdan beaga agus fiosrachadh à Diùra	John MacLean Morag MacLeod

**Appendix 4:** The *SGDS* survey points by fieldworker<sup>241</sup>

Fieldworker	Survey points
Anthony Dilworth	66, 67, 69, 70, 71, 72, 73, 74, 76, 77, 78, 79, 80, 86, 88, 89, 91, 92, 93, 94, 95, <b>96, 97, 98, 99, 100, 101, 102, 103, 116</b> , 167, <b>168</b> , 171, 172, 188
Kenneth H. Jackson	<b>19, 28, 29, 30, 75</b>
Fred MacAulay	14, 15, <sup>242</sup> 31, 32, 33, 34, 35, 37, 39, 41, 42, 44, 45, 46, 47, 48, 49, 50, 58, 60, 62, 65, <b>169, 170</b>
Terence McCaughey	<b>27</b> , 43, 61, 63, 64, <b>87, 90</b>
Eric P. Hamp	16, 40, 51, 52, 53, 54, 55, <b>56</b> , <sup>243</sup> 57, 59, 68, 81, 82, 83, 84, 85
Derick S. Thompson	36, 38 <sup>244</sup>

**Appendix 5:** Transcription of non-initial unaspirated stops in the *SGDS* materials<sup>245</sup>

Fieldworker	Word-internal position	Word-final position
Anthony Dilworth	p t k – ɖʒ / ɖʃ / tʃ	p t k – tʃ
Kenneth H. Jackson	ɸ ɖ ɡ̊ – ɖʒ / p t k – tʃ	ɸ ɖ ɡ̊ – ɖʒ / p t k – tʃ <sup>246</sup>
Fred MacAulay	ɸ ɖ ɡ̊ – ɖʒ	p t k – tʃ
Terence McCaughey	ɸ ɖ ɡ̊ – ɖʒ	p t k – ɖʒ
Eric P. Hamp	ɸ ɖ ɡ̊ – ɖʒ	ɸ ɖ ɡ̊ – ɖʒ / ɖʃ

<sup>241</sup> The numbers written in bold refer to the survey points for which only the fair copies of the materials were available.

<sup>242</sup> The recordings from pts 14 and 15 were transcribed by KHJ.

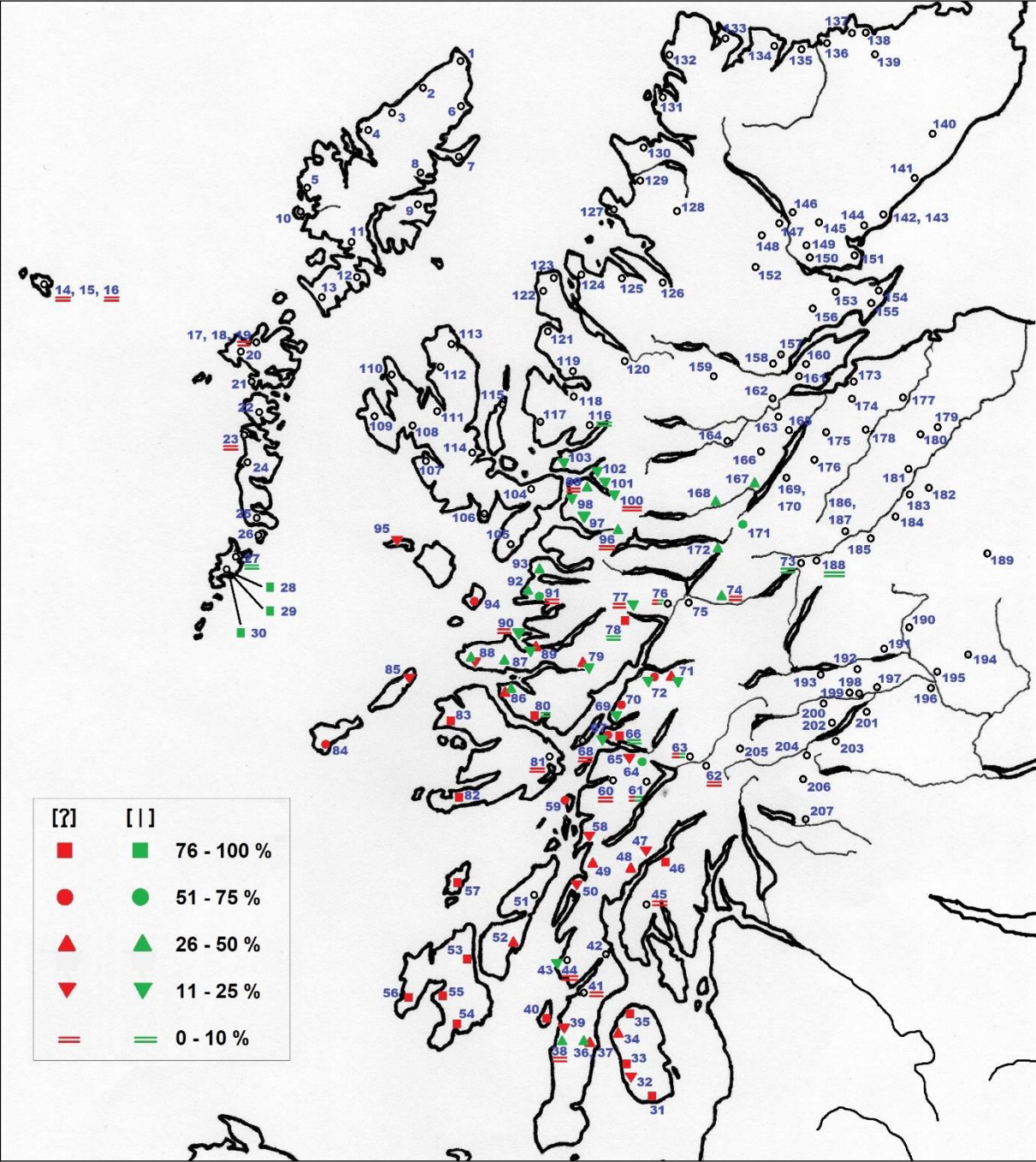
<sup>243</sup> The recordings from pt 56 were transcribed by KHJ.

<sup>244</sup> The recordings from both survey points were transcribed by AD.

<sup>245</sup> This refers primarily to unaspirated stops following a short stressed vowel. The affricates have been included here since they are realisations of palatalised dental stops.

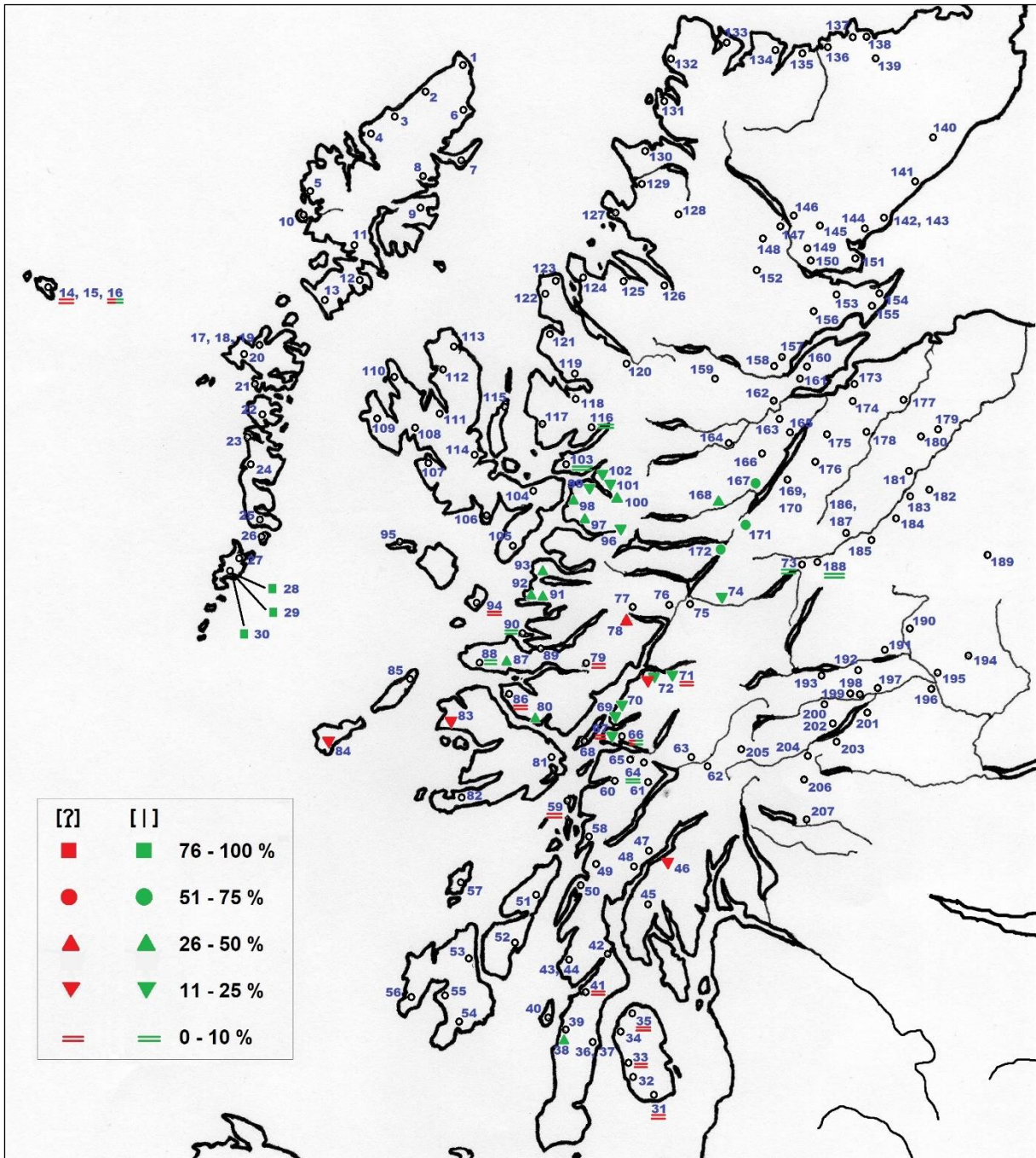
<sup>246</sup> The symbols ɸ ɖ ɡ̊ are common in all positions in the records from pt 75. Both sets are used in all positions in the materials from pts 28-30, with p t k dominating word-finally.

Appendix 6: Maps

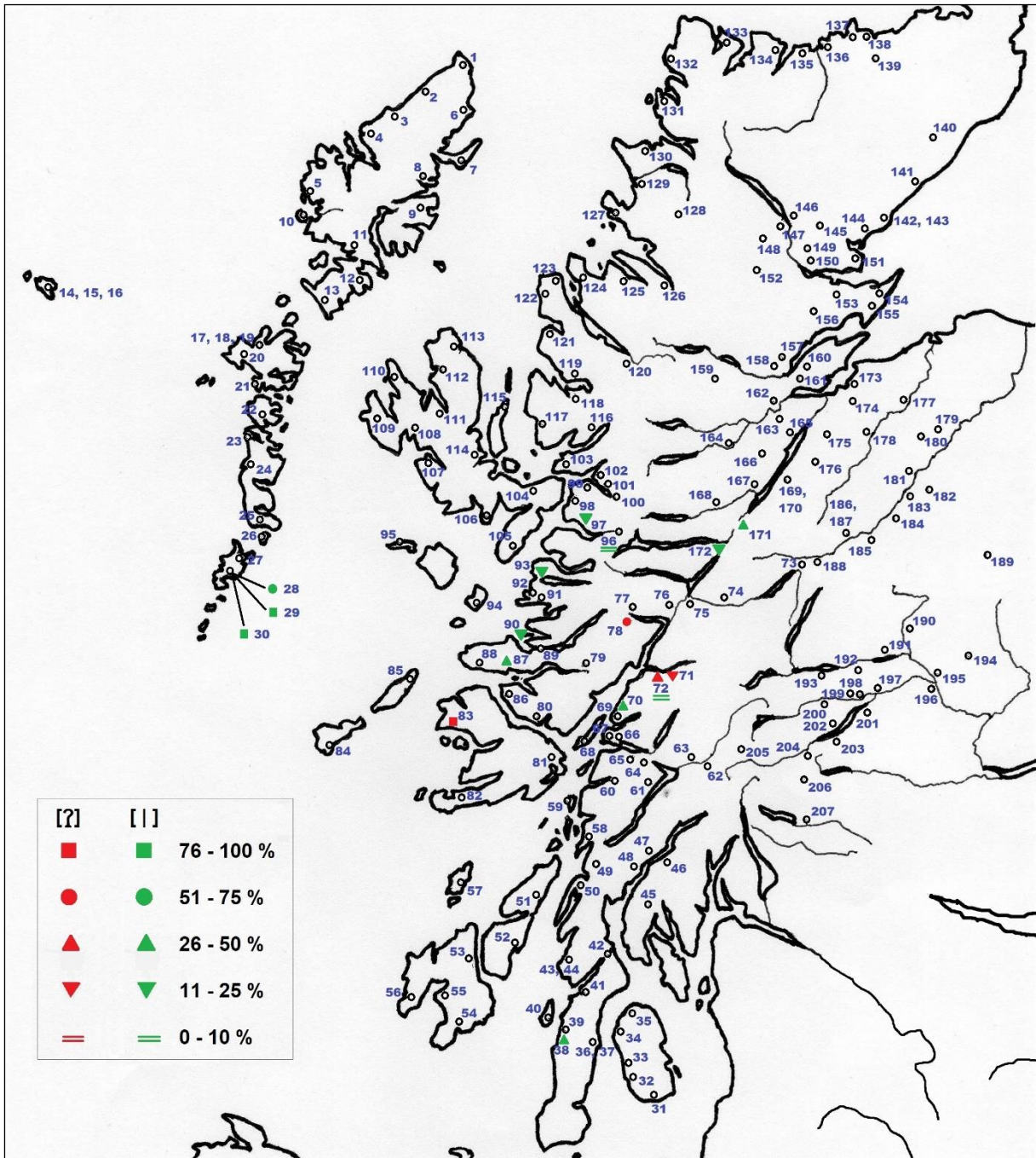


Map 1: Hiatus glottalisation following a stressed short vowel.

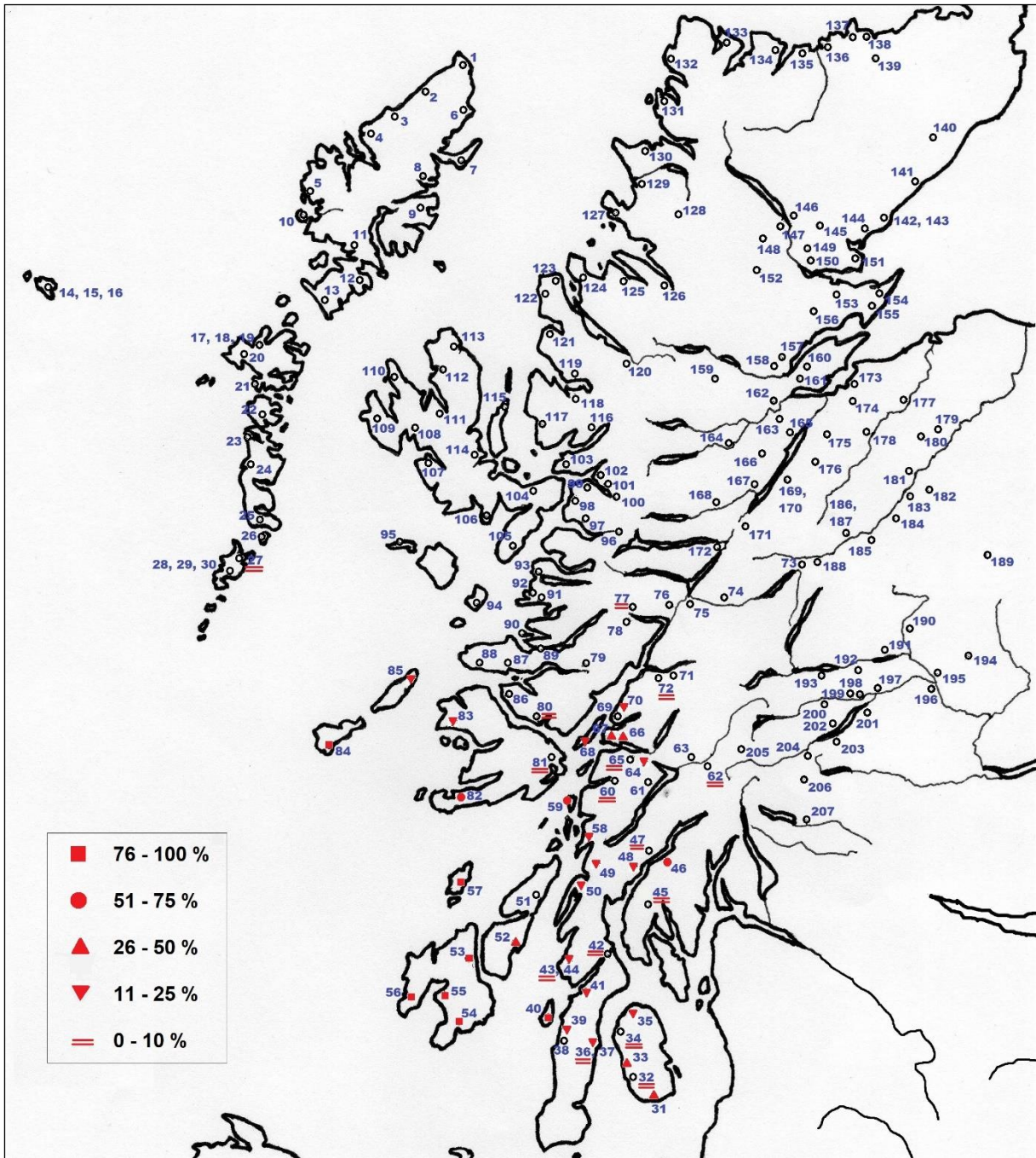




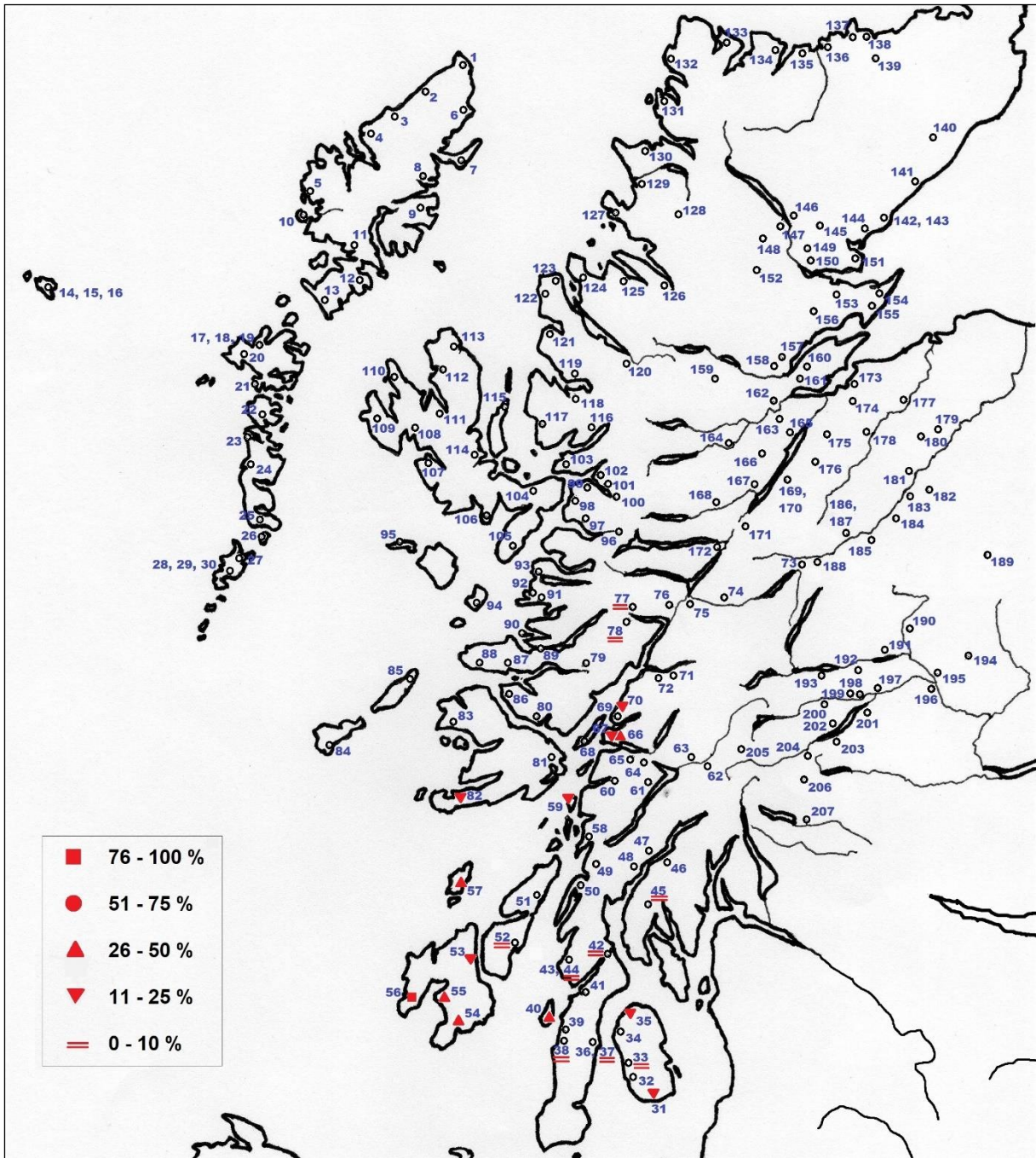
Map 2: Hiatus glottalisation following a stressed long vowel.



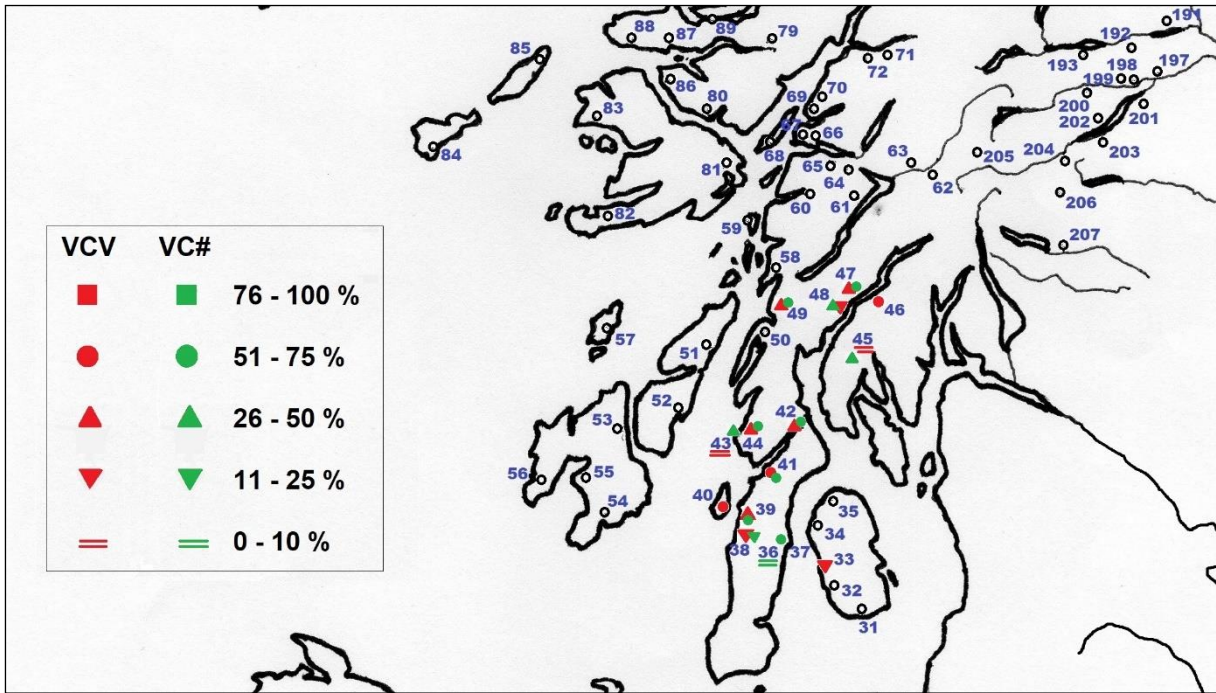
Map 3: Hiatus glottalisation following the epenthetic vowel.



**Map 4:** Glottalisation in the context of word-internal voiced consonants.



Map 5: Glottalisation in the context of word-final voiced consonants.



**Map 6:** Glottalisation in the context of voiceless (aspirated) stops.

**Appendix 7: Glottalisation in the *SGDS* records – statistics**

**Table A: Hiatus glottalisation following a short vowel**

Survey point	All examples of hiatus	Glottalised (ʔ)	Percentage	Hiatus (l)	Percentage
14		7		0	
16		2		3	
19	67	1	1	0	
23	70	4	6	0	
27	72	0		4	6
28	70	0		61	87
29	70	0		53	76
30	72	0		63	88
31	93	80	86	0	
32	85	20	24	0	
33	91	79	87	0	
34	93	24	26	0	
35	81	72	89	0	
36	82	23	28	25	30
37	93	30	32		
38	80	7	9	34	43
39	90	18	20	0	
40	68	65	96	0	
41	99	9	9	0	
42	86	0		0	
43	91	0		13	14
44	95	1	1	0	
45	89	2	2	0	
46	99	85	86	0	
47	64	8	13	0	
48	100	29	29	0	
49	109	35	32	0	
50	113	13	12	0	
51	94	0		0	
52	71	33	46	0	
52*	33	25	76	0	
53	95	93	98	0	
54	97	95	98	0	
55	87	85	98	0	
56	64	61	95	0	
57	103	101	98	0	
58	64	10	16	0	
59	108	68	63	0	
60	65	4	6	0	
61	88	1	1	2	2
62	64	1	2	0	
63	89	1	1	1	1
64	100	0		69	69

65	66	7	11	0	
66	96	77	80	3	3
67	91	65	71	11	12
68	102	2	2	0	
69	95	0		16	17
70	89	50	56	5	6
71	108	54	50	18	17
72	104	75	72	12	12
73	96	0		10	10
74	99	1	1	37	37
76	91	5	5	8	9
77	95	1	1	13	14
78	97	80	82	6	6
79	105	34	32	12	11
80	101	85	84	8	8
81	100	3	3	0	
82	96	84	88	0	
83	112	96	86	0	
84	99	51	52	0	
85	95	12	13	0	
86	98	32	33	26	27
87	67	0		22	33
88	110	12	11	51	46
89	97	28	29	16	16
90	71	1	1	12	17
90*	105	14	13	47	45
91	91	9	10	53	58
92	68	0		34	50
93	99	0		43	43
94	109	68	62	0	
94*	108	69	64	0	
95	102	24	24	0	
96	68	3	4	30	44
97	68	0		14	21
98	64	0		12	19
99	66	1	2	17	26
100	64	1	2	14	22
101	63	0		8	13
102	67	0		12	18
103	66	0		9	14
116	67	0		5	7
167	81	0		34	42
167*	79	0		34	43
168	60	0		18	30
171	88	0		47	53
172	99	0		49	49
188	84	0		5	6

**Table B:** Hiatus glottalisation following a long vowel

Survey point	Hiatus (all)	Glottalised (?)	Percentage	Hiatus (l)	Percentage
14		1			
16		1		1	
28	11	0		11	100
29	11	0		10	91
30	11	0		10	91
31	5	2	40	0	
33	6	2	33	0	
35	7	3	43	0	
38	4	0		2	50
41	8	1	13	0	
46	12	2	17	0	
59	13	1	8		
64	13			1	8
66	15	1	7	1	7
67	13	1	8	3	23
69	14	0		3	21
70	11	1	9	2	18
71	12	1	8	2	17
72	13	2	15	2	15
73	11	0		1	9
74	14	0		3	21
74*	15	0		2	13
78	13	5	38	0	
79	10	1	10	0	
80	10	0		3	30
83	15	2	13	0	
84	16	4	25	0	
86	12	1	8	0	
87	11	0		4	36
88	11	0		1	9
90	11	0		1	9
90*	11	1	9	0	
91	10	0		4	40
92	8	0		3	38
93	12	0		4	33
94	15	1	7	0	
94*	15	1	7	0	
96	11	0		2	18
97	10	0		3	30
98	11	0		3	27
99	9	0		2	22
100	7	0		3	43
101	10	0		2	20
102	10	0		2	20
103	11	0		1	9



116	11	0		1	9
167	12	0		9	75
167*	13	0		8	62
168	11	0		4	36
171	10	0		7	70
172	9	0		7	78
188	10	0		1	10

**Table C:** Hiatus glottalisation following the epenthetic vowel

Survey point	Hiatus (all)	Glottalised (?)	Percentage	Hiatus (!)	Percentage
28	8	0		6	75
29	10	0		9	90
30	11	0		11	100
38	2	0		1	50
70	2	0		1	50
71	9	1	11	0	
72	10	3	30	1	10
78	6	4	67	0	
83	10	9	90	0	
87	10	0		4	40
90	9	0		1	11
93	9	0		1	11
96	10	0		1	10
97	11	0		2	18
167*	2	0		1	50
171	4	0		2	50
172	4	0		1	25

**Table D:** Glottalisation in consonantal contexts

Survey point	All	Glottalised	Percentage
27		2	
31	156	66	42
32	148	3	2
33	150	48	32
34	135	8	6
35	145	31	21
36	144	2	1
37	172	21	12
38	135	0	0
39	161	39	24
40	134	124	93
41	168	35	21

42	145	1	1
43	144	11	8
44	144	17	12
45	137	13	9
46	153	105	69
47	81	5	6
48	144	26	18
49	154	26	17
50	166	27	16
51	162	0	
51*	28	16	57
52	131	66	50
52*	51	40	78
53	161	153	95
54	159	151	95
55	157	146	93
56	88	85	97
57	189	178	94
58	81	9	11
59	163	86	53
60	91	2	2
61	138	0	
62	81	2	2
63	139	0	
64	134	29	22
65		5	
66	153	52	34
67	154	60	39
68	159	22	14
69	144	0	
70	137	20	15
71	160	0	
72	137	1	1
77	11	2	
78	21	13	
80	105	11	10
81	166	1	1
82	187	131	70
82*	12	12	
83	159	29	18
84	174	147	84
85	173	39	23
85*	15	2	

**Table E:** Glottalisation in consonantal contexts (%)

Survey point	Voiced stops	Voiced fricatives	Unlenited sonorants	Lenited sonorants
31	34	47	42	46
32	4	0	4	0
33	10	57	27	43
34	0	0	4	13
35	20	20	16	28
36	0	0	0	4
37	26	0	13	8
38	0	0	0	0
39	3	21	26	36
40	92	77	95	95
41	50	14	15	12
42	4	0	0	0
43	3	0	16	2
44	6	0	11	16
45	13	0	6	12
46	32	80	76	79
47	0	0	75	29
48	16	0	26	13
49	26	0	18	11
50	31	17	16	8
51	0	0	0	0
52	88	0	64	33
52*	84	0	76	73
53	100	78	98	92
54	100	67	95	95
55	97	86	98	87
56	95	0	93	100
57	100	84	93	94
58	29	0	6	3
59	63	25	47	53
60	6	0	3	0
61	0	0	0	0
62	[2]			
63	0	0	0	0
64	24	0	20	24
65	[4]		[1]	
66	83	0	18	18
67	58	17	25	42
68	37	0	4	11
69	0	0	0	0
70	56	0	0	0
71	0	0	0	0
72	3	0	0	0
77	[2]			
78	[10]			[3]

80	38	0	6	2
81	0	0	2	0
82	67	22	77	72
83	8	0	34	0
84	86	50	82	33
85	5	0	28	0

**Table F:** Glottalisation in the context of word-final voiced/unaspirated stops

Survey point	All	Glottalised	Percentage
31	18	2	11
32	18	0	
33	18	1	6
34	18	0	
35	18	3	17
36	19	0	
37	24	2	8
38	18	3	6
39	25	0	
40	14	6	43
41	27	0	
42	22	1	5
43	22	0	
44	25	2	8
45	19	1	5
46	18	0	
48	23	0	
49	27	0	
50	27	0	
51	26	0	
52	20	2	10
53	25	3	12
54	34	13	38
55	27	8	30
56	10	9	90
57	32	9	28
58	10	0	
59	26	3	12
60	10	0	
61	23	0	
62	10	0	
63	20	0	
64	20	0	
65	0	0	
66	31	12	39
67	29	4	14

68	32	0	
69	32	0	
70	28	5	18
71	35	0	
72	31	0	
73	0	0	
74	1	0	
75	0	0	
76	1	0	
77	3	2	67
78	3	2	67
79	1	0	
80	15	0	
81	27	0	
82	30	4	13
83	27	0	
84	28	0	
85	26	0	

**Table G:** Glottalisation in the context of word-internal voiceless stops

Survey point	All	Glottalised	Percentage
33	9	1	11
36	6	0	0
37	7	0	0
38	9	1	11
39	14	5	36
40	10	7	70
41	15	11	73
42	11	3	27
43	10	1	10
44	9	3	33
45	12	1	8
46	9	5	56
47	2	1	50
48	11	2	18
49	10	3	30

**Table H:** Glottalisation in the context of word-final voiceless stops

Survey point	All	Glottalised	Percentage
36	12	1	8
37	11	6	55
38	12	3	25

39	10	9	90
40	9	0	
41	12	11	92
42	12	12	100
43	9	3	33
44	13	12	92
45	12	5	42
46	12	7	58
47	8	5	63
48	13	5	38
49	9	5	56

## Appendix 8: Praat script used in the phonetic analysis – to extract phonetic measurements and coding labels from the annotated textgrids

```
### JSS edited 14 Sept 21; Joe Pearce 2021 - script to measure f0 in intervals preceding and following non-blank intervals on a different tier, adapted from a script by Katherine Crosswhite
###

###Description of this script (Katherine Crosswhite)
## This script measures f0 and the first three formants at the midpoint of the vowel, and appends the
## results to a text file. It will be called "formant-log.txt", and will be written to the same
## directory holding your sound files.
## To run this script, you will have to have a bunch of sound files with accompanying text grids. The
## locations of vowels to be measured must be marked in tier 1 of the textgrid. Anything with a non-null
## label in that tier will be logged.
## JSS edited further so that all coding in tiers 1-7 are also extracted.
###End of description

## Specify the directory containing your sound files in the next line:

## Now we will do some prep work to get your log file ready. The first thing I usually do is
## make sure that I delete any pre-existing variant of the log:

filedelete f0-log.csv

## Now I'm going to make a variable called "header_row$", then write that variable to the log file:

header_row$ = "Filename, Sound, Context1, Context2, Glottal, Onset, Creak, Voicing, Stress, Word, Sound_start,
Sound_end, F0_prev_vowel, F0_following_vowel, F0_difference" + newline$
header_row$ > f0-log.csv

## The next three lines are a form that will pop up when the script is run, allowing the
## user to specify which tiers to use

form Enter which tiers to look at and measure
  integer Look_at_tier 1
  integer context2_tier 2
  integer glottal_tier 3
  integer onset_tier 4
  integer creak_tier 5
  integer voicing_tier 6
  integer stress_tier 7
  integer Measure_tier 8
```

```

endform

## Now we make a list of all the sound files in the directory we're using, and put the number of
## filenames into the variable "number_of_files":

Create Strings as file list... list *.wav
number_files = Get number of strings

# Then we set up a "for" loop that will iterate once for every file in the list:

for j from 1 to number_files

    # Query the file-list to get the first filename from it, then read that file in:

    select Strings list
    current_token$ = Get string... 'j'
    Read from file... 'current_token$'

    # Here we make a variable called "object_name$" that will be equal to the filename minus the ".wav" extension:

    object_name$ = selected$ ("Sound")

    # Now we'll re-select the sound object, and do a pitch analysis:

    select Sound 'object_name$'
    To Pitch... 0.01 75 600

    # Now we get the corresponding TextGrid and read it in:

    Read from file... 'object_name$.TextGrid

    # Now we query the TextGrid to get find out how many intervals there are in tier 1, storing
    # that number in a variable called "number_of_intervals". This is used to set up a for loop
    # that will be used to go through each of the intervals and measure it (if its label is non-null).

    select TextGrid 'object_name$'
    number_of_intervals = Get number of intervals... look_at_tier
    for b from 1 to number_of_intervals
        select TextGrid 'object_name$'
        interval_label$ = Get label of interval... look_at_tier b
        if interval_label$ <> ""
            int_start = Get starting point: look_at_tier, b

```



```

int_end = Get end point: look_at_tier, b
int_measure = Get interval at time: measure_tier, int_start
sound_label$ = Get label of interval: measure_tier, int_measure
context2_label$ = Get label of interval: context2_tier, b
glottal_label$ = Get label of interval: glottal_tier, b
onset_label$ = Get label of interval: onset_tier, b
creak_label$ = Get label of interval: creak_tier, b
voicing_label$ = Get label of interval: voicing_tier, b
stress_label$ = Get label of interval: stress_tier, b

word_tier = measure_tier + 1
int_word = Get interval at time: word_tier, int_start
word_label$ = Get label of interval: word_tier, int_word

prev_num = int_measure - 1
follow_num = int_measure + 1

prev_start = Get starting point... measure_tier prev_num
prev_end = Get end point... measure_tier prev_num

prevmidpoint = prev_start + ((prev_end - prev_start) / 2)

follow_start = Get starting point... measure_tier follow_num
follow_end = Get end point... measure_tier follow_num

followmidpoint = follow_start + ((follow_end - follow_start) / 2)

select Pitch 'object_name$'
prev_f_zero = Get value at time: prevmidpoint, "Hertz", "Linear"
follow_f_zero = Get value at time: followmidpoint, "Hertz", "Linear"

difference = follow_f_zero - prev_f_zero

sep$ = ","

#header_row$ = "Filename, Sound, Context1, Context2, Glottal, Onset, Creak, Voicing, Stress, Word, Sound_start,
Sound_end, F0_prev_vowel, F0_following_vowel, F0_difference" + newline$

fileappend f0-log.csv 'object_name$"sep$' 'sound_label$' 'sep$"interval_label$' 'sep$' 'context2_label$' 'sep$'
'glottal_label$' 'sep$' 'onset_label$' 'sep$' 'creak_label$' 'sep$' 'voicing_label$' 'sep$' 'stress_label$'
'sep$"word_label$"sep$"int_start:3"sep$"int_end:3"sep$"prev_f_zero:0"sep$"follow_f_zero:0"sep$"difference:0"new
line$'

```

```
endif
endfor

# By this point, we have gone through all the intervals for the current sound object and
# textgrid, and written all the appropriate values to our log file. We are now ready to go on to
# the next file, so we close can get rid of any objects we no longer need, and end our for loop

select all
minus Strings list
Remove
endfor

# And at the end, a little bit of clean up and a message to let you know that it's all done.

select all
Remove
clearinfo
print All files have been processed.

## written by Katherine Crosswhite
## crosswhi@ling.rochester.edu
## adapted by Joe Pearce
```