**ASPIRATED STOPS IN SCOTS GAEIC**

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**ABSTRACT**

Aspiration is the primary difference between the lenis and fortis stops in Scots Gaelic: postaspiration initially, and preaspiration medially and finally. With faster speech, the postaspirated stops show general shortening, and the preaspirated stops are shortened in the voiceless duration preserving the perceptual salience of the aspiration. The details of the aspiration and the shortening are viewed as controlled, language-specific behaviour.

**INTRODUCTION**

Recent research [1, 2] has emphasised the role of non-automatic, allophonic phonetic activity. This paper presents data on pre- and postaspirated stops in Scots Gaelic at different rates of speech and argues this aspiration is an example of such controlled, subphonemic activity.

In Scots Gaelic [3] the fortis stops /p t k/ have postaspiration [phth kh] in initial position, and preaspiration [p h ˈh k] medially and finally. In the dialects analysed here, preaspiration before /k/ is realised as a velar fricative. The term 'fortis' is used for the phonemes /p t k/ and 'lenis' for the phonemes /b d g/; 'voiceless' and 'voiced' for the phonemes /p t k/ and 'lenis' for the palatal fricative. The term 'fortis' is used dialetically and finally. In the dialects analysed in this paper, the fortis stops /p t k/ have postaspiration [phth kh] in initial position, and preaspiration [p h ˈh k] medially and finally. In the dialects analysed here, preaspiration before /k/ is realised as a velar fricative. The term 'fortis' is used for the phonemes /p t k/ and 'lenis' for the phonemes /b d g/; 'voiceless' and 'voiced' for the phonemes /p t k/ and 'lenis' for the palatal fricative. The term 'fortis' is used.

**Measurements**

Preaspiration (Preasp), Closure Duration (CD), Voiceless Duration (VlessD), and Voice Onset Time (VOT) were measured [20]. VlessD is the entire period of voicelessness including VOT. Figure 1 shows both postaspiration and preaspiration. The waveform is shown with the individual portions labelled. The breathy voice which has been mentioned in some research [17, 19] was only sporadically present and where found has been considered part of the aspiration.

**RESULTS**

**Lenis v. fortis**  
Table 1 compares the lenis and fortis stops. The lenis stops have a voiceless closure followed by a short period of aspiration. The fortis stops have a voiceless closure with longer aspiration, postaspiration initially and preaspiration elsewhere. As expected, the fortis stops often have a longer closure duration than the lenis stops; in two cases, however, the difference is not significant, and in one, the fortis closure is longer. The lenis stops always have a significantly shorter voiceless duration than the fortis stops. The VOT is longer for the fortis stops in initial position, as we would expect; otherwise, it is erratic.

If slow and fast rates of speech are compared (Table 2), the lenis stops show a general shortening in all portions of the consonant, except for FS medial lenis VOT. The fortis stops show a similar general shortening in initial position; in medial and final position, however, the closure duration and VOT are not always significantly different, especially with RM.

**DISCUSSION**

**Lenis Fortis**

Aspiration is the feature which always serves to distinguish fortis and lenis stops: postaspiration initially, and preaspiration medially and finally. Closure duration is not a reliable cue in distinguishing the stops. The total amount of voicelessness

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**Figure 1. Waveform of *tobhta* /tota/ [ˈtʰɔtʰa] 'walls of a house'.**
Table 2. Means of low and fast rates of speech in ms. The means of all slow-fast pairs are significant (p < .05) except for those in bold face. In slow speech, FS paused at the end of the elicited word so that measuring the end of voicelessness was not possible.

<table>
<thead>
<tr>
<th>Initial</th>
<th>N Preasp</th>
<th>CD</th>
<th>VlessD</th>
<th>VOT N Preasp</th>
<th>CD</th>
<th>VlessD</th>
<th>VOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>lenis</td>
<td>35</td>
<td>202</td>
<td>172</td>
<td>27</td>
<td>54</td>
<td>161</td>
<td>186</td>
</tr>
<tr>
<td>slow</td>
<td>45</td>
<td>87</td>
<td>88</td>
<td>22</td>
<td>42</td>
<td>77</td>
<td>95</td>
</tr>
<tr>
<td>fast</td>
<td>36</td>
<td>142</td>
<td>191</td>
<td>77</td>
<td>65</td>
<td>145</td>
<td>243</td>
</tr>
<tr>
<td>foris</td>
<td>39</td>
<td>73</td>
<td>110</td>
<td>53</td>
<td>49</td>
<td>89</td>
<td>162</td>
</tr>
<tr>
<td>slow</td>
<td>38</td>
<td>114</td>
<td>117</td>
<td>47</td>
<td>41</td>
<td>105</td>
<td>119</td>
</tr>
<tr>
<td>fast</td>
<td>17</td>
<td>78</td>
<td>95</td>
<td>36</td>
<td>20</td>
<td>86</td>
<td>97</td>
</tr>
<tr>
<td>Medial</td>
<td>lenis</td>
<td>75</td>
<td>171</td>
<td>66</td>
<td>31</td>
<td>148</td>
<td>74</td>
</tr>
<tr>
<td>slow</td>
<td>39</td>
<td>94</td>
<td>189</td>
<td>28</td>
<td>20</td>
<td>102</td>
<td>65</td>
</tr>
<tr>
<td>Fast</td>
<td>25</td>
<td>181</td>
<td>81</td>
<td>349</td>
<td>36</td>
<td>220</td>
<td>88</td>
</tr>
<tr>
<td>slow</td>
<td>45</td>
<td>107</td>
<td>68</td>
<td>200</td>
<td>18</td>
<td>151</td>
<td>79</td>
</tr>
</tbody>
</table>

is distinctive; however, the aspiration, produced with an open vocal tract, is the most audible and perceptually the most salient part of this voiceless period. The unsystematic variation of VOT in noninitial position is not important since preaspiration serves to distinguish lenis and foris stops in those positions.

Kingston & Diehl [2] have argued that postaspiration in English is a controlled allophonic aspect of production. Their arguments would apply equally well to Scots Gaelic. Further, the argument that preaspiration is also nonautomatic can be made even more strongly, given its rarity in the world.

Rate of speech
In faster speech, in contexts where there is no preaspiration, a general shortening occurs. With the preaspirated stops, all shortening tends to be in the VlessD. The relative stability of the CD at different rates of speech implies that the major adjustments for rate of speech are made during the adjacent pre- and postaspirated periods.

To speak faster, something has to be shortened. This shortening is not necessarily done evenly in all parts of the utterance [18, 21]. In previous work, I have shown that languages use a variety of language-specific strategies to shorten elements in order to talk faster. In Mongolian [22-24], the VlessD for foris stops remains steady at different rates of speech; in French [23], the VOT remains unchanged, but the voiceless portion of the closure is shortened; in Turkish (Rogers, 1994) the foris stops show general shortening. Now, in Scots Gaelic, the stops without preaspiration show general shortening, but the preaspirated stops show a shorter voiceless duration.

These findings are consistent with the position of Docherty [1] and Kingston and Diehl [2] that considerable allophonic variation must be accounted for in the grammar of the language, and not by recourse to automatic processes.

CONCLUSION
Aspiration has been shown to be the primary difference between the lenis and foris stops: postaspiration in initial position, and preaspiration elsewhere. Both types of aspiration are produced by controlled activity at an allophonic level. With an increased rate of speech, a language-specific observation was made that stops with postaspiration show general shortening, and those with preaspiration are shortened in the voiceless duration.

REFERENCES