Ambiguous rhoticity in Glasgow: Short term exposure promotes perceptual adaptation for experienced and inexperienced listeners

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Background and Research Goals

It is well known that unfamiliar accents are more difficult to understand [e.g. 1, 5], but perceptual flexibility is gained over time [7].

Glaswegian is difficult to understand for speakers of other English dialects [1], so it is an ideal testing ground for the perception of unfamiliar variants.

Most Scottish speech is 'firmly rhotic' [8], i.e. **postvocalic /r/** is pronounced in words like *car* and *bird*.

But working class (WC) speech in Glasgow is displaying a loss of rhoticity [6]. This is known as **derhoticisation.**

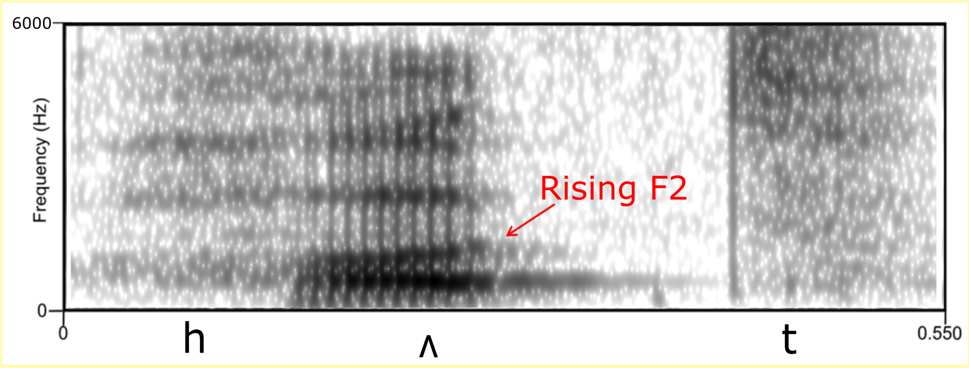


Fig.1 WC *hut*

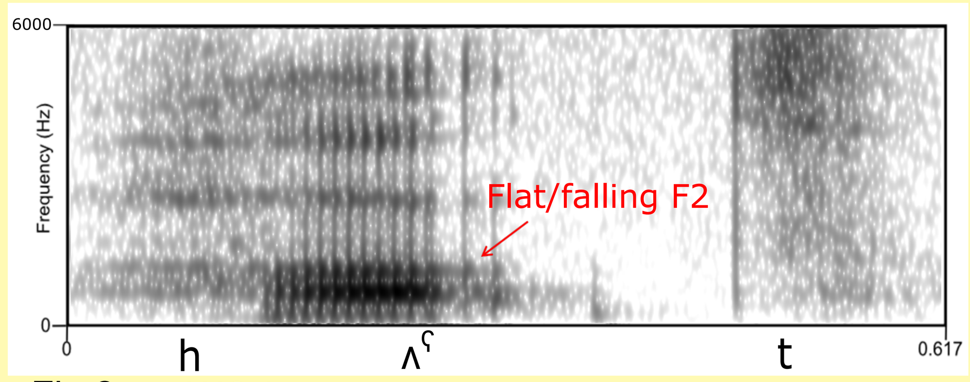


Fig.2 WC *hurt*

Similar places of articulation (pharynx/uvula) in derhoticised /r/ and /ʌ/ vowels causes **perceptual ambiguity** in /CʌC, CʌrC/ environments (e.g. *hut/hurt*).

In a 2AFC task, Lennon (2014) [3] found Glaswegians easily distinguished e.g. *hut/hurt* (Figs.1,2), with listeners in S.E. England performing poorly. English listeners living in Glasgow **hypercorrected**, over-reporting the presence of /r/.

Research questions:

1. Can listeners learn derhoticised /r/ following **exposure** to Glaswegian?
2. How does a listener's **familiarity** with derhoticised /r/ affect this learning?

Experiment

Design

3 Phases: 1. Pretest, 2. Exposure, 3. Posttest

4 Factors: Participant group, Stimulus coda, Test, Exposure condition

Participant group: 3 groups of listeners x 2 exposure conditions

Glasgow	Scottish, living in Glasgow	n=(2x21) 42
Intermediate	English, living in Glasgow*	n=(2x21) 42
Cambridge	English, living in Cambridge	n=(2x22) 44

(*mean residence = 3.1yrs) (mean age of all listeners = 23.3yrs)

Stimulus coda: **VC, VrC** 12 minimal pairs, WC male

Pre/Posttest stimuli:	
VC	**VrC**
bust	*burst*
cud	*curd*
cuss	*curse*
cut	*curt*
fussed	*first*
spun	*spurn*

Exposure stimuli:	
VC	**VrC**
bud	*bird*
bun	*burn*
hut	*hurt*
shut	*shirt*
thud	*third*
tonne	*turn*

Test: Pretest, Posttest

Exposure condition: **Altered, Natural**

Passage (1000wds/6min, 24 targets + 36 distractors) same WC speaker:

*"...He stopped stroking the **mane** on the back of its neck, as he didn't want to be **mean** to it or cause it any **hurt**. Just then, a second donkey came round from behind the **hut**...."*

Altered:

Target words processed using Praat's **source-filter resynthesis**. Three features of vocalic portion manually 'neutralised' within minimal pairs:

- **Vocalic duration** in *hurt* words is longer than in *hut* words, so vocalic portion of *hurt* was manually shortened and *hut* was lengthened to meet at their common midpoint, neutralising the difference.
- **F2** is lower in *hurt* than *hut*; **F3** is higher in *hurt* than *hut* (Figs.1,2), so **F2** & **F3** were manually redrawn half-way towards the minimal pair counterpart (see samples on laptop).

Natural: Resynthesised, no parameters changed.

Procedure

1. Pretest: Two alternative forced choice task (2AFC)

Participants were asked to report what they thought they heard over headphones, out of **2 options** on a computer screen, e.g.:

.... BURST BUST

(96 trials: 24 targets (each x2), 72 distractors)

2. Exposure: Short passage (see left). Listeners were asked to write down the number of animals that were mentioned in the story, in order to maintain their attention.

3. Posttest: another 2AFC, to measure **change from Pretest**. Same stimuli as Pretest but presented in a different randomised order.

Results

Statistical Analysis:

R: Fully saturated *Linear Mixed Effects Models* applied to:

Signal Detection Analysis (d')
Reaction Time (ms)

(lmerTest: step() used to find best fit models)

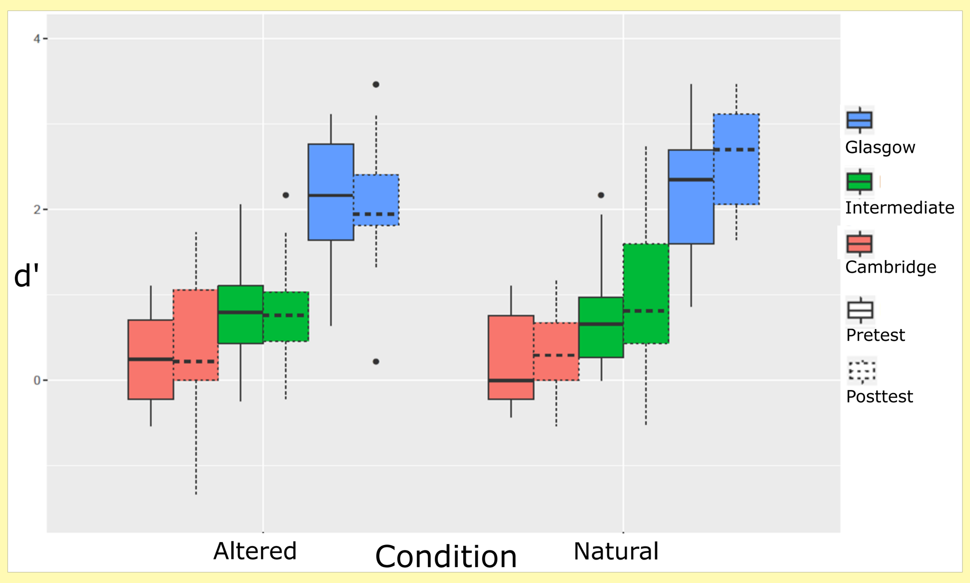
Signal Detection Analysis: [e.g. 4]

d' = sensitivity to differences between minimal pair stimuli.

$$d' = z(H) - z(F)$$

H: hit rate '*burst*' responses divided by '*burst*'+'*bust*' responses, when stimulus=*burst*.

F: false alarm rate '*burst*' resps. divided by '*burst*'+'*bust*' responses, when stimulus=*bust*.

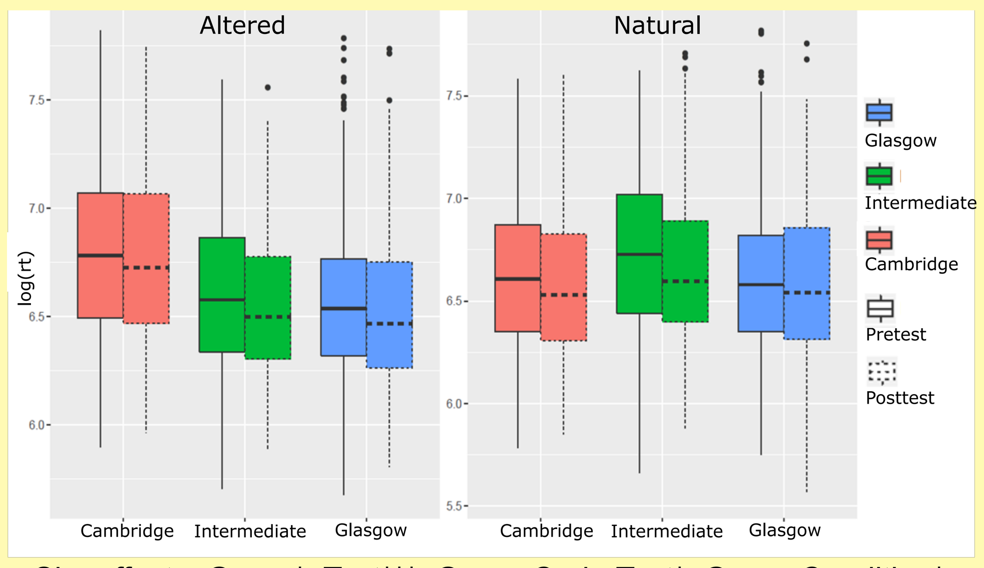


Sig. effect of Group(***) replicates long-term familiarity in Lennon (2014) [3]:

Glasgow: most sensitive to different *hut* and *hurt* stimuli.
Cambridge: poorer ability to distinguish them.
Intermediate: intermediate pattern.

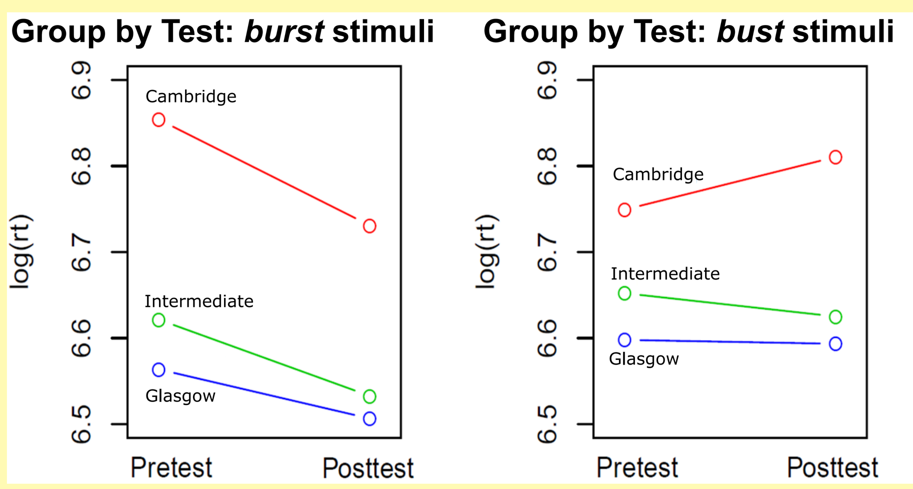
Mean lines show trend for improvement in sensitivity in the Natural Exposure condition, but *not* in the Altered condition.

Reaction Time:

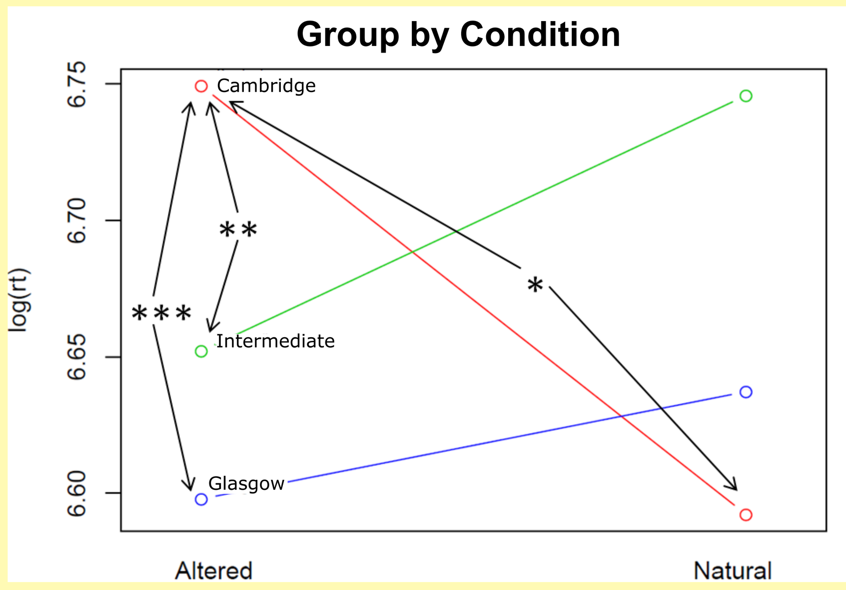


Sig. effects: Group*, Test***, Group:Coda:Test*, Group:Condition*

Interactions:



Less familiar listeners process more slowly, but after exposure all get faster for /r/ words.
Cambridge: slower after exposure for non-/r/ words.



Altered stimuli processed more slowly by less familiar listeners.
Cambridge: process Natural stimuli faster than Altered.

Results Summary:

Signal Detection Analysis: slight increase in sensitivity to difference in stimuli (all listeners).
Reaction Time: slight improvement between Pretest and Posttest.
RT interactions clearly show that Cambridge listeners behave differently than listeners with any level of experience (Glasgow/Intermediate).

Discussion

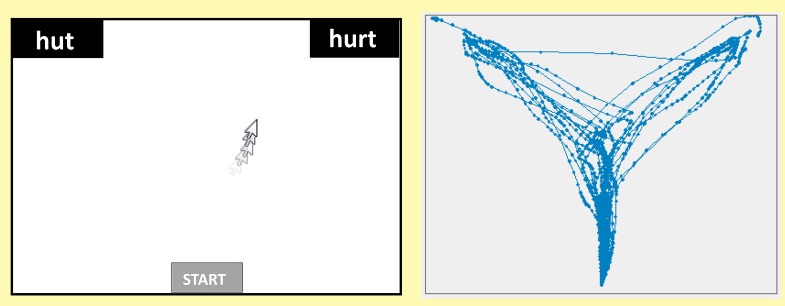
- These results are evidence of an **effect of familiarity** on perception of an unfamiliar dialect. Glasgow listeners are the most sensitive to stimulus difference, replicating Lennon (2014) [3].
- There is only a **small effect of learning** (in all listener groups), but this may be due to the relatively brief exposure to word contrasts in the story. More tokens may yield bigger effects. **(RQ1)**
- The **fine-grained phonetic detail** in this contrast causes **perceptual ambiguity** for all listeners, but affects Cambridge listeners the most. They show **perceptual change** but, as the least experienced group, their learning may be more vulnerable to the experimental conditions here. **(RQ2)**
- The stimuli in this investigation are very natural, and the results clearly demonstrate the difficulty in learning fine phonetic detail with brief exposure.

These results help show how listeners adapt to new linguistic environments.

Further Work

The **time course** of the word appears to be important for identifying the presence of derhoticised variants (compare Figs.1&2, above).

The present stage of this research is a **time course analysis** of perception, mapping listener responses to stimuli in a 2AFC with **mouse-tracking software** [2].



This will allow for analysis of the **online processing** that occurs when listeners perceive derhoticisation.

References

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