

Phonetic Conditioning of Word-final Ejective Stops in the Speech of Scottish English Pre-school Children



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Introduction:

On a daily basis, we observe many cases of word-final ejective stops in Scottish Standard English (SSE) spoken in Edinburgh. In this study, we try to link available quantitative child data to general properties of the language.

We explore the systematicity of occurrence of word-final ejective stops found in the speech of pre-school children with the aims to:

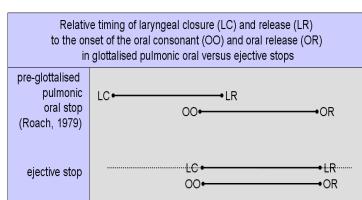
(1) Discuss the phonetic conditioning factors (place of articulation and voicing, prosodic factors)

(2) Relate the children's ejectives to adult input: the issue of glottalisation in British English varieties and occurrence of ejectives in adult speech.

Ejectives and Glottalisation:

Ejective stops are produced with glottal airstream initiated by an upward action of the closed larynx (&glottis), while there is an occlusion in the oral cavity (Laver, 1994) → increased intraoral pressure delimited by glottal and oral closures.

There are occasional notes of ejectives in English in word-final positions (Ladefoged, 1993; Ladefoged & Maddieson, 1996; Chirrey, 1999; Fabricius, 2000), but so far no systematic studies.



Glottal reinforcement:

Roach, 1973, 1979; Wells, 1982; Milroy et al. 1984:

- the glottal closure
- glottal release (LR) before the oral release (OR)
- no social value attached (Wells, 1982)
- in word-final /p t k tʃ/ (Wells, 1982)
- raised larynx (Roach, 1979)
- glottal reinforcement is common in SSE (Wells, 1982; C. Jones (1997); Stuart-Smith, 1999; Chirrey, 1999)

Research Questions:

- (1) What is the incidence of occurrence of ejectives in these child data?
- (2) Does the location of carrier words in the phrase influence the glottal/pulmonic production of the stops?
- (3) Does the voicing of the following consonant (C₂) affect the distribution of ejective and non-ejective stops?
- (4) Does the place of articulation of voiceless C₂ affect the glottal/pulmonic production of the stops?
- (5) Are children's ejectives merely developmental, or derived from the target adult language?

Methodology:

Subjects

7 children aged 3;4 to 4;9

3 recorded 2x longitudinally
(10 cases in total)

All from Middle Class families

Data collected in 2001 to 2004

Materials C₁VC₂- words
(MacArthur CDI, Dale & Fenson, 1996)

C₁ voiceless oral obstruents
C₂ [±voice] and place of articulation /p t k/

C₂= stop -v→ SHEEP FEET
COOK PUT SOUP
C₂= stop +v→ PIG FOOD

Subject	Age	Sex	Residence
C3	3;4 and 3;11	M	Rosyth
C4	3;8 and 4;1	F	Edinburgh
C5	4;0	F	Edinburgh
C6	4;0	F	Edinburgh
C7	4;2 and 4;8	F	Edinburgh
C8	4;2	F	Dunbar
C9	4;10	M	Edinburgh

Elicitation Semi-structured picture naming games

Collected utterances

(N=1133): a mix of single word (N=703) and multi-word utterances (N=430)

Auditory Labelling

- Salient strong ejectives
- Acoustics: lack of glottal friction, strong and short burst
- In case of uncertainty → labelled as non-ejectives

Statistical Analysis

Chi-Square → frequencies of the phonetic labels [ejective, non-ejective] of the word-final stops and their association with:

Phrasal position [initial, medial, final, single word]

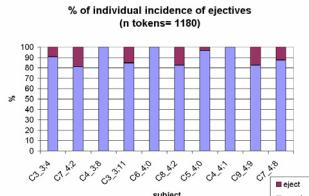
Voicing [-voice, +voice]

Place of articulation [bilabial, alveolar, velar]

Results:

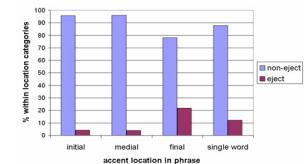
(1) Incidence

- 10% of all word-final stops are ejectives (120 tokens out of 1133)
- 5 of the 7 children produce them
- three longitudinal subjects are coherent in either producing (C3, C7), or not producing them (C4).



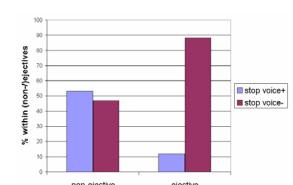
(2) Effect of the position of the target word in phrase [initial, medial, final, single word] on the production of (non-)ejectives

Very highly significant association [$\chi^2 = 24.1$; df=3; p<.0001]
Most ejectives appear in phrase final position and single word utterances.



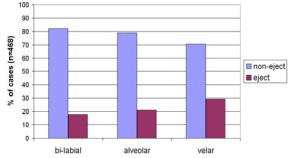
(3) Effect of stop voicing [-voice, +voice] on the production of (non-)ejectives

Very highly significant association [$\chi^2 = 71.5$; df=1; p<.0001]
Most ejectives occurring in [- voice] stops.
Ejectives are not exclusive to the voiceless stops: they also appear in PIG and FOOD (14 cases out of 120)



(4) Effect of place of articulation [bilabial, alveolar, velar] on the production of (non-)ejectives

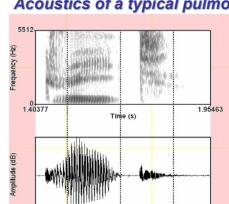
Significant association [$\chi^2=6.1$; df=2; p<.05]
Most ejectives occur in velar stops.
Despite the significance, the joint number of non-dorsal stops is actually higher than of dorsal (58% versus 42%)



(5) Adult Input

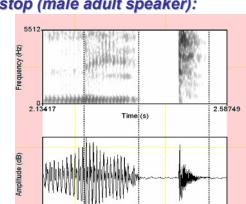
Ongoing research on the Scottish Vowel Length Rule containing word-final stops: 5 male MC Edinburgh residents → 2 out of 5 adults produce ejectives systematically: 15.2% of all stops (n=277) in read speech. Also numerous examples are observed and recorded from spontaneous phone-in and interviews on radio, varied Scottish dialects and registers.

Acoustics of a typical pulmonic and glottalic stop (male adult speaker):



[t] in "GREET":

- Longer release with glottal and oral friction
- Lower amplitude of the stop burst



[t] in "NEAT":

- Shorter release, no glottal friction (oral friction possible)
- Very high amplitude of the stop burst

Summary:

- Word-final ejectives occur systematically in the speech of Scottish English pre-school children from Edinburgh: a substantial 10% in these final stop data are ejective stops.
- Occur in /p t k/ as in glottal reinforcement (Wells, 1982; SSE; Chirrey, 1999; Edinburgh).
- Correlate with phonetic rather than phonological voicelessness (e.g. Giegerich, 1982) Cf. 11.7 % of all ejectives occur in PIG and FOOD tokens.
- Voiceless velar stops in phrase final positions are most likely to be produced with glottal airstream.
- The occurrence of ejectives in child speech is warranted by adult input.
- SSE ejectives can be considered as a distinct type of "glottalisation" in British English varieties, plausibly connected to the SSE tendency to pre-glottalise the word-final stops.
- Ejectives may combine existing articulatory "glottalising" patterns with enhanced perceptually relevant place of articulation information.