VOICE QUALITY AND CONSONANTAL WEAKENING: A CASE OF CORRELATION IN *SCOUSE*?

Massimiliano Barbera, Marlen Barth

University of Pisa
m.barbera@ling.unipi.it, marlen_barth@yahoo.com

ABSTRACT

Liverpool English, also known as *Scouse*, presents peculiar characteristics on the segmental as well as on the paralinguistic level, probably linked with the Irish immigration (see [4], [7]). Maybe the most important feature is the lenition of obstruents to affricates or fricatives as a result of a lax voice context. The widespread velarization of all consonantal segments in *Scouse* seems to interact with the phonatory setting, causing a vocal type defined as adenoidal.

Our analysis, based on a corpus of spontaneous speech produced by six native speakers, aims at an acoustic evaluation of the voice quality of *Scouse* through the use of parameters which allow us to classify the phonation types according to the reliable labels (cf. [1], [6]). There seems to be a gender differentiation in relation with the frequency of lenition as far as the vocal characterization of the speakers is concerned.

Keywords: voice quality, scales of energy, lenition, hypo-nasalization**.**

1. INTRODUCTION

The *Scouse* accent is marked mostly at the phonetic and prosodic levels (cf. [3], [4], [5]), but also peripherally involves the lexical and morphosyntactic levels. The most important feature characterizing the consonant system is the lenition of stops. Initially being described as typical of the working class, the consonantal weakening seems to spread out to the speech of higher classes (cf. [7], [8]) and to formerly not affected phonemes.

The *Scouse* voice is often described as "adenoidal" or "nasal", i.e. produced with a partial obstruction in the nasal tract, leading to denasalization. It is important to underline that this voice quality requires an unnatural and hence uneconomical use of the velo-pharyngeal mechanism; in this overall configuration the retraction of the tongue might create a constriction at the epiglotto-pharyngeal level [1] which is in contrast with the definition of the accent as "lax". This seems to be the main reason why a *Scouse* voice is perceived as "ugly" and "unfriendly" by native speakers of English.

As regards the position of the velum during articulation, Laver [6] suggests a neutral scale of velarity according to which the height of the velum varies according to the segment produced. Moreover, the author supposes that in the movement from a neutral velo-pharyngeal setting to a nasal one, at least some segments have to show a lowering of the velum compared to the values of the neutral scale, while a denasalized voice quality requires its raising.

2. EXPERIMENTAL ANALYSIS

The present study was based on the analysis of six adolescent speakers of Liverpool English (three males, three females). The recordings of five of the six speakers were taken from the IViE *corpus*[1], whereas the sixth speaker was recorded in Viareggio (Italy) in August 2004.

The acoustic analysis was carried out in our Laboratory of Phonetics, using the software *Praat* (version 4.3.29).

For each speaker we analyzed six strings of spontaneous speech containing at most three breath groups. In these strings the following parameters were measured, first for the entire breath group and then for single sonorant segments and contiguous vowels:

1. the mean fundamental frequency;
2. the ***Jitter*** (local %), indicating the average absolute difference between consecutive periods, divided by the average period;

[1] ***I**ntonational **V**ariation **i**n **E**nglish*, (2001) by Grabe, E., Post, B., Nolan, F. (*www.phon.ox.ac.uk*).

3. the ***Shimmer*** (local %), i.e. the average absolute difference between the amplitudes of consecutive periods, divided by the average amplitude;
4. the ***HNR*** (dB), the proportional degree of acoustic aperiodicity between the harmonics and the noise.

Nasal consonants are of course the favourite target of denasalization. So, we took them as a first point of reference. Since also the laterals presented spectro-acoustic characteristics very similar to those found for the nasals, we decided to analyze them too. The articulation of these sounds implicates a forward movement of the tongue and hence of the velum and has therefore a velo-pharyngeal and lingual setting comparable to that of the nasals. On the other hand, we omitted the vibrants, for they have a rather strong intrinsic noisy component which may forge the reliability of the above mentioned parameters. We analyzed the vowels since they are affected by coarticulatory effects induced by the contiguous consonantal segments; being phones theoretically lacking aperiodicity, they should show structural alterations connected with the phono-articulatory supra-laryngeal setting rather clearly.

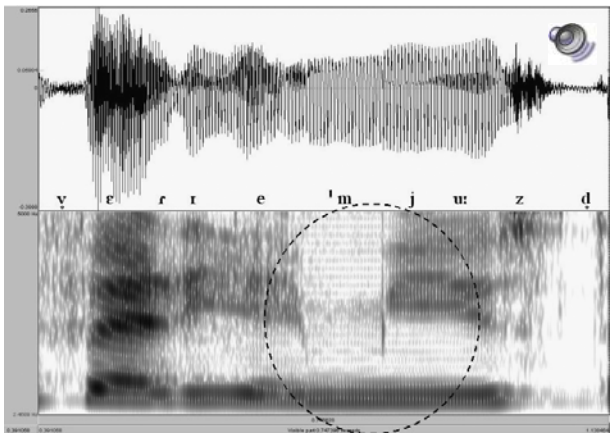
3. THE PHONATORY SETTING

3.1. A peculiar structure

From the very beginning, the acoustic analysis revealed the presence of a peculiar structure with a morphology undoubtedly due to friction noise. The chosen segments (sonorants and vowels) are characterized nearly systematically by a special structure in the spectrogram: fine vertical lines arranged in parallel horizontally indicate the presence of an anomalous resonance.

If we combine the descriptions of the general *Scouse* phonatory setting found in the literature with our observations, it seems to be possible to identify a particular supra-laryngeal setting able to justify the acoustic effect (improperly) defined as nasal as well as the just described evidence from the spectrogram. We could summarize as follows: the velum is in relatively lowered position, thus permitting a limited, but constant air-flow from the nasal cavities due to the only partial obstruction by the velum (a); the signs in the spectrum might hence be attributed to two connected factors: the friction in the velo-pharyngeal tract together with the vibration of the uvula. This last point would give a kind of regularity to the aperiodic structure produced by the friction (b); the nasal segments (but, for the above mentioned reasons, also the contiguous vowels and the lateral phones) are strongly affected by these effects: the velo-pharyngeal constriction seems to reduce the normal nasal resonance (c); as a consequence, the diffused velo-pharyngeal friction can be identified even in the spectrogram (d).

Figure 1: Waveform and spectrogram of the syntagm *very amused*; subject DS (F).



The partial obstruction created by the velum in mid-lowered position together with the uvular vibration – caused by the air-flow coming from the nasal cavities – would hence produce a particular vocal compound qualifiable as **hypo-nasalized** rather than denasalized. In other words, the overall perception is affected by this peculiar trait of nasality, which, however, indicates an anomalous use of the velo-pharyngeal tract as regards the phonatory dynamics and above all for the effects on the really nasal segments.

For this reason, we propose that the *Scouse* voice quality should be interpreted as a special colour, to the formation of which contribute synergically the oral as well as the nasal output.

3.2. Nasal or adenoidal?

The label *nasal voice* is basically linked to the acoustic percept (cf. [6]); in other words, this definition corresponds to the subjective recognition of nasal resonance as characteristic of the speaker's overall colour of voice. In fact, from an articulatory point of view we can identify different velo-pharyngeal dynamics which justify a perceptive output qualifiable as *nasal* or *adenoidal voice*. However, it should be underlined that a really nasal voice has a phonetic correlate of

specific phonatory processes which actually cause an increment of the nasal resonance. On the spectro-acoustic level, this peculiarity is visible most of all in the vowel segments, which, of course, are affected by the effect of articulatory contamination produced by a considerable air-flow through the nose. An adenoidal voice, on the other hand, is by definition denasalized and hence marked by perceptual features caused by a partial obstruction of the nasal cavities; on the whole, the colour is similar to that of speakers with adenoids. Despite this contrasting aetiology, the two mechanisms have been settled on the same definition based mainly on perception, namely *nasalization*.

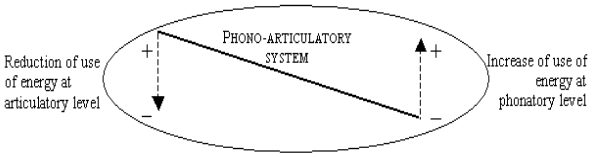
If we consider these premises, the definition of the *Scouse* voice as either *adenoidal* or *nasal* appears inadequate or at least imprecise. First of all, the double denomination does not resolve the basic ambiguity of the actual dynamics underlying this particular voice quality. Moreover, the possibility to distinguish between two phonatory outputs, which are in fact similar, but however not identical, remains vague. As regards the *Scouse* accent, we should presume a reduction of the nasal resonance triggered by a special phono-articulatory mechanism, keeping in mind the energetic balance system of the vocal and verbal production as a whole.

In the light of the analysis carried out and above all because of the spectral morphology found in the subjects' speech, we propose – as already mentioned – the label *hypo-nasalized voice*, which describes in a more adequate manner the actual anomaly (both on the perceptive and the spectro-acoustic level) of the vowels and the sonorant segments. For articulatory contiguity, these sounds activate the velo-pharyngeal friction in the supra-laryngeal tract to a higher degree than a voice quality classifiable as neutral or modal.

Since the *Scouse* voice is normally reported as lax, it is now necessary to conciliate the *lax* articulatory setting with the hypo-nasalization, depending on a phonatory setting undoubtedly definable as *tense voice*. We can suppose that the total energetic expenditure in the phono-articulatory act is subject to an intrinsic balancing according to which to a reduction of the use of energy at the articulatory level corresponds an increment of the use of energy at the laryngeal level (causing instances of *creaky voice*), but above all at the supra-laryngeal level (related to a hyperactivation of the velo-pharyngeal mechanism). In fact, as regards the articulatory output, lenition indicates a reduced use of energy corresponding to an overall relaxed setting of the external articulatory organs; on the other hand, at the phono-articulatory level, the velo-pharyngeal tract and the tongue take an unnatural setting which implicates a higher effort.

Therefore, we could hypothesize that the two parts draw from a total amount of energy available for the systemic process of linguistic production, balancing each other. In other words, according to our hypothesis, there is a limited overall quantity of energy: if the muscular effort (and hence the energetic expenditure) increases in the phase of vocal production and in the first part of the articulatory tract, then force would be subtracted from the actual articulation, rendering the phonological targets less precise and the phonetic outputs weaker.

Figure 2: Energetic balancing in the phono-articulatory system of *Scouse* voice.



4. VOICE QUALITY

From the spectrographic morphology of our speakers' voices emerges a systematic presence of noise, highlighted also by the parameters of aperiodicity (*Jitter, Shimmer, HNR*).

The comparative analysis shows a gap (actually not very strong) between the values for *Jitter*, *Shimmer* and *HNR* measured for the entire string and for the single sonorant segments, since the *Praat* voice report includes all aperiodic segments. The presence, although sporadic, of *creaky voice* contributes to the deviation of the average of these parameters (compared to the standard average).

Table 3: Modal values and average values of hypo-nasalized segments for males (M) and females (F).

subj.	tokens		F0 (Hz)	Jitt (%)	Shim (%)	HNR (dB)
modal values			220 (F) 120 (M)	1,04	3,8	15,4-19,1
F	76	av.	216,3	1,2	8,2	16,6
		σ	23,2	0,5	2,9	4,6
M	86	av.	108	1,6	12,4	11,5
		σ	14,4	0,4	1,5	1,9

The comparison between the values of the indexes of aperiodicity for hypo-nasalized and *creaky* segments shows a different mutual distribution: in particular, the rather high values for *Shimmer* and *HNR* (however close to the normal range) seem to be correlated with the velo-pharyngeal friction, differing from the values for *creaky*/*harsh* voice, all considerably different with reference to those of modal phonation.

Keeping in mind the above made observations, we notice a general relation between the parameters taken into account for the segments defined as hypo-nasalized. The F0 maintains modal values, similar to the average for the breath group; the *Jitter* is slightly higher than normal, thus behaving differently compared to other amodal qualities, especially *creaky voice*. *Shimmer* and *HNR*, on the other hand, are the significant parameters for the effects of hypo-nasalization: high *Shimmer* (both for male and female subjects) and *HNR* values diverging from the modal threshold of about 20 dB, with sensible decrease for the males (indicating a greater distribution of energy in the noisy components of the signal).

At this point, our analysis leads us to formulate a fundamental hypothesis: the aperiodic components of the signal – to which corresponds the peculiar spectrographic structure we highlighted – can be attributed to a strong velo-pharyngeal friction and to the vibration of the uvula, which, being the velum the valve connecting the oral and the nasal tract and thus behaving as vibratile means, would imprint the relative regularity of its movement to the aperiodic structure produced by the friction.

5. CONCLUSION

From a critical review of the literature on the *Scouse* voice quality seem to emerge some inaccuracies. The former descriptions explain in detail the articulatory characteristics of the variety of English spoken in Liverpool, but they do not examine in depth the phonatory dynamics which are the basis of an acoustic perception commonly recognized as peculiar. On the basis of the spectro-acoustic analysis carried out we propose the definition "hypo-nasalized" for the *Scouse* vocal setting due to the convergence of measurements, analysis of the spectrographic morphology and of the perceptible vocal colour. The dominant factor seems to be the strong velo-pharyngeal friction; hence the vocal output is distorted since it is influenced by a constant feature of limited nasal resonance. This feature is understood as characterizing the voice quality, being diffused among the non nasal phones, while the nasal ones undergo a lowering of the nasal resonance due to the partial lowering of the velum.

All things considered, it seems to be possible to observe a gender divergence for the overall definition of the *Scouse* voice quality. Limited to the perceptive level, we can identify a different connotation for the female voice, which uses a high range of frequency and a high volume, denoting the "nasal" effect as salient colour feature. The male one, in contrast, is characterized by a strongly compressed tonal range, an extremely low volume and a colour that indicates perceptive elements definable as "nasal" on an essentially harsh basis.

The basic hypothesis is that the supra-laryngeal phonatory setting, which is expensive in energetic terms, is balanced by the articulatory setting definable as lax. So, the systemic perspective we presented can be referred to as a sort of "energetic scales".

6. REFERENCES

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