

CONNECTED SPEECH PROCESSES: A SOCIOPHONETIC APPROACH

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ABSTRACT

This paper reports results from an electropalatographic study of coarticulatory phenomena in the speech of 2 speakers of Cambridge English. These are alveolar place assimilation and /l/vocalisation, which occur in connected speech (connected speech processes or CSPs). The principal aim of the study was to investigate the articulatory gradualness of these CSPs and to determine the effects of speaking rate and care of articulation on their application. Assimilation is shown to function as a fast speech process, strongly influenced by speech rate, whereas /l/vocalisation is sociolinguistically salient -- its application being more affected by care than by rate.

'fossilised' in the course of linguistic change, leading to morphophonemic alternations which are always discrete. 'Fossilisation' then is the residual effect of coarticulation after the factors conditioning its application in connected speech have disappeared. The transition from processes motivated by 'phonetic' factors such as speaking rate, care of articulation and environment, to morphophonological rules does not seem to have been studied in any great detail from a phonetic point of view (although results from experimental work on phonetic motivation have been applied to the explanation of sound change /4/).

1.2 CSPs as Sociolinguistic Variables

Sociolinguistic studies /5/ provide strong evidence that sound change does not occur uniformly and imperceptibly in a language or speech community. Instead, two forms (older and newer variants) of a sound may co-exist within the community, not randomly, but showing systematic patterning. This patterning is manifested as either i) linguistic differences between groups of speakers (distinguished by sociological criteria like sex, age, class) or between individuals; or ii) style or register-bound variation in an individual's speech or in the speech of a group.

Kerswill /6/ found that the working-class vernacular English of Durham contains a number of CSPs differentiating it from RP. Regressive voicing assimilation ([laɹg mɛr] for like me) and the deletion of the final vowel of into in the phrase into the car are processes not found in RP. Alveolar place assimilation (giving [bɹɹgɹai] for bad guy) on the other hand, does not occur in Durham vernacular though it is widespread in RP. The fact that RP is used by some speakers in Durham while others use a broad 'vernacular' or intermediate variety, suggests the presence of a socially-stratified system as a possible model of variation. Within such a model, the CSPs mentioned function as linguistic variables. In Durham vernacular, some processes seem to be deliberately avoided in formal speech styles as well as being less widespread in middle-class speech, while alveolar place assimilation is a prerequisite of the RP spoken in Durham. One framework for investigating the sociolinguistic salience of CSPs is the extent to which their articulation is discrete or gradual: If a variable with clear social differentiation thought to involve discrete alternation (on the basis of careful auditory analysis) is actually articulatorily

1. INTRODUCTION

1.1 Phonetic and Phonological Description

Both phoneticians and phonologists have been concerned with the description of coarticulatory phenomena -- as phonetically motivated processes and in terms of their description within a phonological theory /1,2/. Connected speech processes (CSPs) have been classified in terms of phonemic and allophonic variation /3/. The former subsumes processes such as assimilation (a segment changes phonemic identity under the influence of an adjacent segment), coalescence (segments combine to form one segment, yet retaining articulatory and auditory features of both) and deletion. Allophonic variation includes feature-spreading, lenition and reduction processes (where segments fail to reach articulatory or auditory targets in production).

This dichotomy however, implies that so-called 'phonemic' CSPs may be discrete or categorical, applying in an on-off fashion. In addition, the fact that some CSPs may result in a segment's coming to resemble phonetically a different phoneme could be viewed as a matter of chance, depending on the phonemic inventory the language happens to have. A further difficulty is related to the problem of discreteness. Some CSPs become phonologised or

gradual (that is, its variants show intermediate articulations), it would be reasonable to conclude that the process was both a linguistic variable and a phonetically-motivated CSP. However, for a CSP in the process of fossilisation to be sociolinguistically salient, one would expect the auditory distinction between its application and its non-application to be more marked than if the CSP was a completely 'natural' coarticulatory process. Consequently, we would expect a tendency towards auditory discreteness while the CSP is still influenced by speaking rate and care of articulation. But the actual articulation may contain elements basic to both segments to differing degrees. The hybrid nature of the gradual articulations contrasts with the discrete auditory percept. We focus on the instrumental investigation of two CSPs in Cambridge English: alveolar place assimilation and /l/vocalisation /7/. We attempt to identify the effects of speaking rate and care, which provide some insight into the nature of the interaction of phonetic and social factors influencing CSPs. Alveolar place assimilation has been identified as a phonetically-conditioned coarticulatory process in RP, and as a socially-stratified variable in the Durham speech community. /l/vocalisation converts postvocalic [t] in prepausal and preconsonantal environments into a nonsyllabic back vocoid [ɫ] or (rounded) [ɫ̥]. It has been identified as a quite recent development in local southern varieties of English /8/ -- treated as an optional process found in rapid casual speech, which may be influenced by non-linguistic factors like style, age and class in Norwich English /9/.

2. METHOD

Two speakers of Cambridge city English, aged 18 and 22 years, read a set of sentences designed to elicit these CSPs. Since one possible index of sociolinguistic salience would be the extent to which a CSP is applied (both completely and partly) across a range of speaking conditions or 'phonological styles' /10/, the subjects were instructed to read the sentences in four different modes, differentiated on the basis of speech rate and care: 'slowly and carefully', 'at a normal, comfortable speed', 'as fast as possible, but carefully at the same time' and 'as fast as possible'. The sentences contained 17 positions where an alveolar assimilation could occur, and non-assimilating environments as a basis for comparison. The alveolar consonants were /d, n/. There were 10 opportunities for /l/vocalisation, in preconsonantal and prepausal environments:

Assimilating environments:	Control environments:
CB lad passed; bad place	lab passed
Fleetwood Park	
DB red banner	ebb back
DG bad guy; shed got;	Rag guide
EK bad car; good clothes;	Craig couldn't
maid couldn't	
DM orchard management;	Saab motor
retard notion	
NB phone box	handsome boy
screen back	cream back
NM mammade	ham mayonnaise
NK Ron comfort	wrong company

NK Van Causeway
Jason caught

Hang Corner

/l/vocalisation environments: calls from; calls upset; sold; told; well retard; well#; table#; Castle#; Wilson.

A 3-way classification for the analysis of the articulation types, on the electropalatographic (EPG) record was adopted (see Appendix for illustration):
 absence of assimilation/vocalisation: the EPG record shows a complete alveolar closure at some point during the articulation (score = 0);
 partial assimilation/vocalisation: the record shows more lateral and/or alveolar contact than the non-assimilating environment, but no complete alveolar closure at any point during the articulation (score = 1);
 complete assimilation/vocalisation: the record is either identical with the non-assimilating environment; or shows less lateral and/or alveolar contact; /l/vocalisation: the record shows either total absence of lingual contact for vocalisation, or contact characteristic of back vocoids /11, 12/ (score = 2).

Partial assimilation/vocalisation will not be reflected as a uniform pattern of lingual-palatal contact on the EPG record. An individual's record may be marked by idiosyncratic articulatory patterns and asymmetries, and at times obscured by articulatory environment /12/. Thus EPG analysis involves interpretation (abstraction and normalisation) of the lingual-palatal 'plan' of each subject. Partial assimilations include instances of articulatory 'gradualness' as exemplified in the Appendix, but exclude double articulations.

3. RESULTS

3.1 Alveolar Place Assimilation

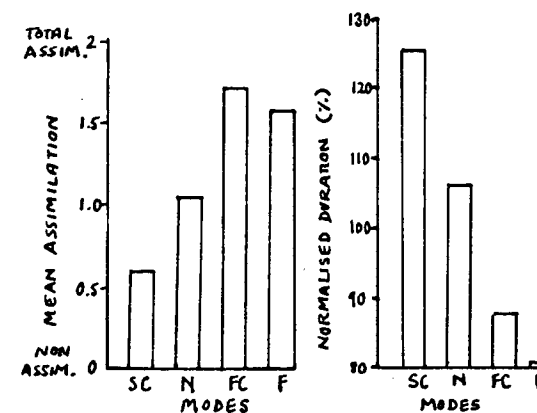
Table 1: Number of occurrences of articulation types across speaking modes (2 speakers):

Reading modes:	slow careful	normal	fast careful	fast
complete assim.	8	16	27	24
partial assim.	6	6	5	7
non-assim.	20	12	2	3

Table 1 shows the number of articulation types for both speakers across the four reading conditions. It shows a large increase in the number of assimilated tokens as the speaking mode becomes faster. This increase occurs at the expense of non-assimilations, the proportion of partial assimilations remaining quite constant across all modes. Consequently, although there is a marked shift overall, from frequent non-assimilation to complete assimilation in faster rates, the application of the process is by no means discrete. This is indicated by the gradual articulations in each mode (which never fall below 14% of the total). Figure 1 shows a comparison of the speakers' mean assimilation scores with their mean speaking rate

(normalised duration for each speaking condition). Speaking rate is expressed as a mean percentage of the normalised duration for each mode.

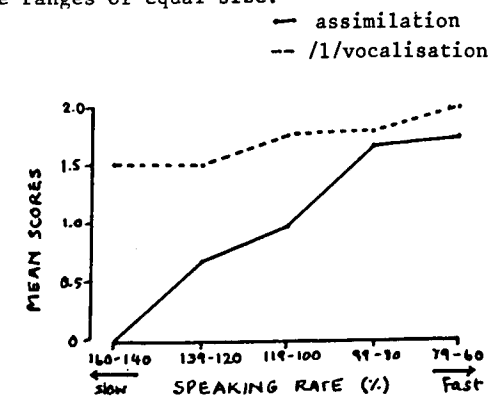
Figure 1: Comparison of normalised durations and mean assimilation scores across speaking modes:



A sharp increase in complete assimilations occurs with a shift to fast speaking modes. According to this profile, the possible effect of care is not separable from that of speaking rate. Indeed, complete assimilations seem to be applied without reference to 'care' of articulation, which might be expected to reduce lenition of the sort involved in this CSP. A possible explanation is that speakers actually paid less attention to articulation in 'fast, careful' mode. Alternatively, (since this condition was tested after 'fast' mode) it is possible that speakers' habituation /10/ to both the test material and the task reduced their attention to their actual speech.

To test whether effects of rate can be distinguished from care of articulation, the duration of each reading of each sentence was measured against assimilation scores. (Because the sentences varied markedly in syllable number, each was measured in ms, then its duration was calculated as a percentage of the mean duration of 4 readings, arriving at a normalised index of duration.) The speaking rate varied considerably, by no means being isomorphic with the speaking conditions in all cases (so some sentences in 'normal' mode are shorter than they are in 'fast' mode). Figure 2 shows mean scores plotted against normalised duration (speaking rate). The solid line indicates the distribution of assimilations across five ranges of equal size.

Figure 2:



Around the mean normalised duration (100.3%) the type of articulation changes dramatically -- from partial assimilations (scores below 1) to close to complete assimilations. This pattern suggests that speaking rate has a direct effect on the degree of assimilation above a certain range. More importantly, actual rate contrasts markedly with the rate speakers intend or identify with the flags 'slow', 'normal' and 'fast'. This suggests that assimilation occurs sporadically at lower rates, but once a certain rate is reached, complete assimilations seem to be applied almost without exception.

3.2 /l/vocalisations

Table 2: Number of occurrences of articulation types across speaking modes (2 speakers):

Reading modes:	slow careful	normal	fast careful	fast
complete voc.	14	15	15	18
partial voc.	5	5	5	1
non-voc.	1	0	0	1

In contrast with the distribution of assimilations across speaking conditions, which appears to be influenced by a speaker's actual rate of utterance, the comparatively low variation in the application of complete vocalisations suggests that speaking rate does not have the same influence on /l/vocalisation. In particular, the frequency of complete vocalisations is consistently high in all 4 modes. This uniformity suggests that vocalisation is a CSP which is becoming phonologised, and is characteristic of a range of speaking conditions including 'phonetic' criteria like rate and care of articulation.

There are some effects of rate and care however. The incidence of partial /l/vocalisations is quite consistent across all modes except the fastest. In this condition, complete vocalisations increase at the expense of partial /l/vocalisations, indicating a possible tendency for speakers to apply vocalisation discretely above a certain speaking rate. This might be interpreted as evidence that rate has a direct influence on the transition from gradual to discrete application of this CSP. However, as indicated in Figure 2 (/l/vocalisation represented by the dotted line), actual speaking rate is not isomorphic with the rate speakers believe they are adhering to as complete vocalisations are by no means correlated with increasing rate. Consequently, some sentences produced in 'fast, careful' mode are actually of shorter duration than those in 'fast as possible' mode. If speakers can be assumed to be paying more 'attention' to speech in terms of care of articulation in 'fast, careful' mode than in 'fast' mode, then it is reasonable to conclude that, with fast speaking rates, care of articulation may reduce the incidence of partial /l/vocalisations.

4. CONCLUSION

The comparison of the scores for /l/vocalisation and alveolar place assimilation provides a partial profile of CSPs with different functions within the same speech community (see /13/ for a detailed analysis and supplementary evidence from an auditory study). These processes contrast in the degree to which they are influenced by phonetic factors like speaking rate and care of articulation. Assimilations apply gradually and not uniformly across a range of speaking conditions. Speaking rate appears to influence the application of complete assimilations, whereas their occurrence is not markedly reduced by shifts to 'careful' modes of speech.

Vocalisation, on the other hand, shows a tendency to occur with a consistently high frequency across all modes. The increase of complete vocalisations in fast modes -- not restricted by the criterion of 'care of articulation' or 'attention to speech' -- indicates that /l/vocalisation is more affected by care than by speaking rate.

These results indicate that alveolar place assimilation functions as a 'fast speech process' directly influenced by phonetic factors, whereas /l/vocalisation seems to be a sociolinguistically salient CSP in the process of fossilisation.

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APPENDIX: Palatograms showing articulation types
 A: degrees of assimilation:

